

# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL



## ROTARY GEAR PUMPS

MODELS
GMC SERIES PUMPS

**THE GORMAN-RUPP COMPANY MANSFIELD, OHIO**

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## INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp Rotary Gear Pump. This manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp Rotary Gear pump. **Read this manual** carefully to learn how to safely install, operate and repair your pump. Failure to do so could result in personal injury or damage to the pump.

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 provide detailed instructions and precautions for each specific application or for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner, installer and/or maintenance personnel to ensure that applications and/or maintenance procedures not addressed in this manual are performed only after establishing that neither personal safety nor pump integrity are compromised by such applications or procedures.

In addition to this manual, a separate **Parts List** is shipped with the pump. Refer to the Parts List when ordering parts.

If your pump is furnished with a drive unit, refer to the drive unit manufacturer's installation and operation instructions in the literature accompanying the pump.

These pumps can transfer a wide range of light, medium, and heavy viscosity liquids, depending on design and components. **Some models are not recommended for use with water; others when fitted with specific options, may be used with water; consult the factory.**

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

**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

## 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.

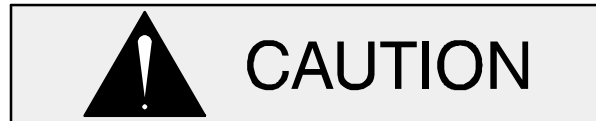
The following are used to alert personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



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



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



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

#### **NOTE**

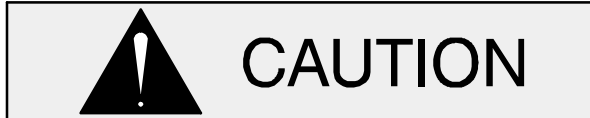
*Instructions to aid in installation, operation, and maintenance or which clarify a procedure.*

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## SAFETY – SECTION A

This information is specific to Gorman-Rupp GMC Series Rotary Gear Pumps. **It applies throughout this manual and any manual or literature accompanying the pump.**

In addition to this manual, see the separate literature covering the drive unit used to operate this pump.



Pumps and related equipment must be installed and operated according to all national, local and industry standards.



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 provide detailed instructions and precautions for each specific application or for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner, installer and/or maintenance personnel to ensure that applications and/or maintenance procedures not addressed in this manual are performed only after establishing that neither personal safety nor pump integrity are compromised by such applications or procedures.



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.



The standard version of this pump is designed to handle a wide range of light, medium, and heavy viscosity liquid, depending on design and components, and a range of temperatures when fitted with different seals. Do not apply at higher temperatures that the seal will handle. Do not attempt to pump liquids which may damage the pump or endanger personnel as a result of pump failure; consult the factory for chemical compatibility.



If the pump and motor are furnished mounted on a base, make certain that all lifting devices have adequate capacity. If chains or cables are used in lifting, make certain that they are positioned so as not to damage components, and so that the load will be balanced.



After the pump has been installed, make certain that the pump and all piping or hose connections are secure before operation. Loose connections can result in damage to the equipment and serious injury to personnel.



Never operate the pump without a pressure relief valve installed on the pump or in the discharge piping. Make certain that pump-mounted pressure relief

valves are installed with their adjusting ends toward the suction port. If bi-rotational operation is required, a pressure relief device must be provided for both directions of flow. Operation without a pressure relief valve or with an improperly installed relief valve could cause the pump to explode, resulting in serious injury or death to personnel.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Lock out incoming power to the drive unit to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Close the discharge and suction valve (if used).



An overheated pump can cause severe burns and injury. If overheating occurs:

1. Stop the pump immediately.

2. Allow the pump to completely cool.
3. Refer to the instructions in this manual before restarting the pump.



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 completely cool before servicing.



This pump may be used to handle liquids which may cause serious illness or injury through direct exposure or emitted fumes. Wear protective clothing, such as rubber gloves, face mask and rubber apron, as necessary, before disconnecting or servicing the pump or piping.

## INSTALLATION – SECTION B

Review all SAFETY information in Section A.

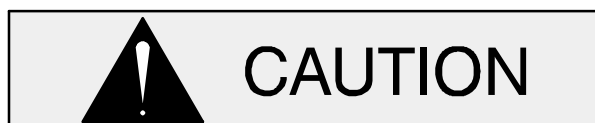


Pumps and related equipment must be installed and operated according to all national, local and industry standards.

Since pump installations are seldom identical, this section is intended only to summarize general recommendations and practices required to inspect, position, and arrange the pump and piping. If there are any questions concerning your specific installation, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Most of the information applies to a flooded suction installation where liquid is supplied under pressure.

If the pump is positioned above the liquid in a static lift installation, information such as mounting, piping configuration and priming must be tailored to specific conditions.



These pumps are not recommended for use with water. Some models when fitted with specific options may be used with water; consult the factory.

### PUMP MODEL DESIGNATION

Following is a description of the model numbering system for Gorman-Rupp rotary gear pumps. Rotary gear pump model numbers include design style, port size, hydraulic size and construction code.

### Typical Pump Model

<b>GHS</b>	<b>1 1/2</b>	<b>GF</b>	<b>32</b>
⏟	⏟	⏟	⏟
<b>Design Style</b>	<b>Port Size</b>	<b>Hydraulic Size</b>	<b>Construction Code</b>

**Design Style:** Gorman-Rupp rotary gear pumps are available in five basic designs:

- GMC – Medium Duty – Compact
- GMS – Medium Duty
- GHC – Heavy Duty – Compact
- GHS – Heavy Duty
- GHA – Abrasive Duty

**Port Size:** Gorman-Rupp rotary gear pumps are available in port sizes from 1 to 6 inches, depending on the design style. Consult your Gorman-Rupp distributor or the factory for additional sizes.

**Hydraulic Size:** The first letter in the hydraulic size is a rotor diameter code. The second letter indicates tooth length.

**Construction Code:** Construction Codes for Gorman-Rupp rotary gear pumps are as follows:

Code	Description
3	Iron w/Mechanical Seal(s)
4	Iron w/Packing or Lip Seal(s)
9	316 SST w/Mechanical Seal(s)
10	316 SST w/Packing or Lip Seal(s)
32	Steel w/Mechanical Seal(s)
38	Steel w/Packing or Lip Seal(s)

**Theoretical Displacement:** Table B-1 indicates theoretical displacement values for each hydraulic size.

### NOTE

*Actual capacities and recommended shaft speeds vary according to application. Consult your Gorman-Rupp distributor or the factory for additional information.*



**Table B-1. Theoretical Displacement**

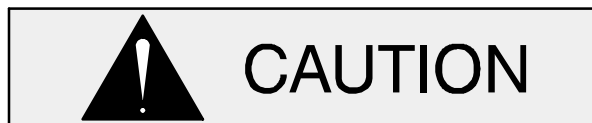
Hydraulic Size	Theoretical Displacement Per Revolution	
	Gallons	Centimeters <sup>3</sup>
DC	0.00568	21.486
DE	0.00704	26.646
GC	0.00967	36.619
GF	0.01405	53.186
GH	0.01915	72.479
GJ	0.02317	87.700
JG	0.03579	135.49
JJ	0.05159	195.28
JL	0.07078	267.94
JP	0.10078	381.48
NK	0.10665	403.71
NM	0.14173	536.51
NP	0.17681	669.31
RM	0.24030	909.65
RP	0.29979	1134.8
RR	0.35927	1360.0
RS	0.41876	1585.1
SR	0.65752	2489.0
SU	1.10240	4173.2
TU	1.91280	7240.7

**PREINSTALLATION INSPECTION**

The pump assembly was inspected and tested before shipment from the factory. Before installation, check for damage which may have occurred during shipment. Check as follows:

- a. Inspect the pump assembly for cracks, dents, damaged threads, and other obvious damage.
- b. Check for loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at the mating surfaces.
- c. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated.

**STORAGE**



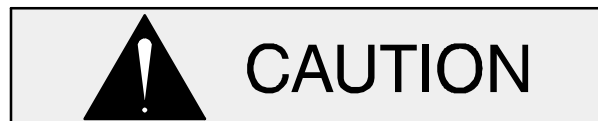
Due to the extreme close machining tolerances within rotary gear pumps, proper

storage before installation is essential to prevent damage to the pump.

If the pump will not be immediately installed, follow these procedures or damage to the pump will occur.

- a. **Do not** flush the pump. Ensure that the port plugs shipped with the pump remain in place until piping is installed to help prevent dust or other foreign objects from entering the pump.
- b. Pumps that will not be installed for an extended period should be stored indoors if possible. The factory-installed port plugs will **not** ensure protection from excessive humidity, splash water or rain. In very humid or wet conditions, install air-tight plugs in the ports and fill the pump completely with a lubricating preservative liquid that is compatible with the liquid to be pumped.
- c. Pumps stored outdoors **must be fully preserved** as described above, **completely covered** with plastic or other water-tight material, and the covering anchored to ensure that it will not be blown off.

**Flushing**



Clean piping is essential because of close-tolerance moving parts in this pump. Flush all dirt, grit, weld beads or scale from the suction piping before installing the pump. Damage to the pump because of debris in the suction line is not covered by the pump warranty.

Before shipment, the pump may have been tested using a petroleum-based preservative. If flushing is required, do not do so until just before installation; the test oil protects close-tolerance pump parts from corrosion.



**Most cleaning solvents are toxic and**

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

To flush the pump, use an approved solvent compatible with the liquid being pumped. **Make certain that the solvent will not attack pump components, particularly seals and gaskets.**

### PUMP INSTALLATION

Pump dimensions are shown in the separate Pump Specification Bulletin.



**Never operate the pump without a pressure relief valve installed on the pump or in the discharge piping. Make certain that pump-mounted pressure relief valves are installed with their adjusting ends toward the suction port. If bi-rotational operation is required, a pressure relief device must be provided for both directions of flow. Operation without a pressure relief valve or with an improperly installed relief valve could cause the pump to explode, resulting in serious injury or death to personnel.**

#### Lifting

Remove suction and discharge hose and piping before attempting to lift the pump. Use lifting equipment with a capacity of at least five times the total weight of the equipment being lifted.

#### Positioning The Pump

Locate the pump as close as possible to the liquid being pumped. Locating the pump below the liquid source will help self-priming and reduce the possibility of cavitation.

#### Mounting

The pump may be shipped alone, mounted on a base, or with pump and motor mounted on a base.

Install the pump and motor on a base before mounting the base on a foundation.

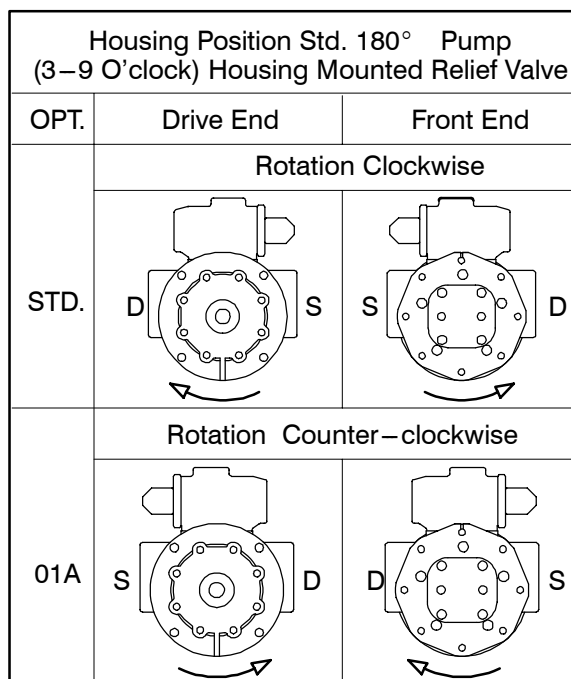
Mount the base on a foundation that will provide permanent, rigid support for the pump, and will be heavy enough to absorb any vibration, strain or shock.

#### Piping

Before establishing suction and discharge lines, determine pump port positions and rotation. Figure B-1 shows typical port positions for the standard 180° housing; if you have selected a 90° housing port option, your port positions will be different.

Begin piping layout at the pump, and work toward the source of supply and the point of discharge.

Either hose or rigid pipe may be used to make connections. If rigid piping is used, install expansion joints to protect the pump from vibration and thermal expansion in the piping. Do not use expansion joints or flexible connectors to adjust misaligned piping.



**Figure B-1. Typical Port Positions & Rotation**

The discharge and suction lines must be independently supported to avoid vibration and strain on the pump. For maximum pumping capacity, keep the lines as short and straight as possible. EI-

bows and fittings used in the lines increase friction losses; minimize their use. Reducers used in suction lines should be the eccentric type installed with the flat part uppermost to avoid creating air pockets.

Before tightening a connection or flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

### Strainers

Because of the close-tolerance moving parts of this pump, it is recommended that a strainer be installed in the suction line. The strainer should be large enough to prevent excessive vacuum, and capable of operating under high vacuum without collapsing. The net open area of the strainer screen depends on liquid viscosity and desired flow rate; in any case, the sum of the area of all the holes in the screen should be three to five times the area of the suction pipe.

### Gauges

To monitor operation and assist in troubleshooting, a vacuum gauge and a pressure gauge should be installed on the pump.

### Sealing

Even a slight leak will affect priming, head, and capacity, especially in a suction lift application. Seal all piping joints, valves and gauges with pipe dope or teflon tape. The sealing material should be compatible with the liquid being pumped.

### Valves

To avoid air pockets, install piping valves with the stem horizontal.

To prevent leakage during shutdown, install a shut-off valve in the discharge line, particularly on a flooded suction application. Shutoff valves are not recommended for suction lines.

It is **not** recommended that a foot valve be installed at the end of the suction line. If desired to install a foot valve, consult the factory.

When handling very hot or cold liquids, install a pressure relief valve in any part of the system that can be valved off or isolated; this will protect piping against damage from liquid thermal expansion or contraction from temperature changes during shutdown.

## ALIGNMENT



**Make certain that power to the drive unit is disconnected before attempting to connect the pump drive; otherwise, personal injury may result.**

### NOTE

See **ROTATION** in Section C before mounting the pump on the base.

Because this pump is designed to be driven by a close-coupled motor, it is imperative that the user make certain that the motor drive shaft is parallel and concentric with the rotor/shaft assembly.

## ELECTRICAL CONNECTIONS

Before connecting the motor to the incoming power, check that the electrical service available matches the pump motor requirements stamped on the motor nameplate.



**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.**



**Do not install and operate a non-explosion proof motor in an explosive atmosphere. Install, connect, and operate the motor in accordance with The National Electric Code and all local codes.**

**If there is a conflict between the instructions in the manual accompanying the unit and The National Electric Code or the applicable local code, The National or local code shall take precedence.**

## OPERATION – SECTION C

Review all **SAFETY** information in Section A.

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

### PUMP OPERATION



**Pressure relief valves are designed to operate as safety devices and should never be used to regulate liquid flow. Otherwise, the pump or piping may explode and cause personal injury or death.**

### PRE-OPERATION

Make certain that all instructions in **INSTALLATION**, Section B have been carried out.



The standard version of the pump is designed to handle a wide range of light, medium, and heavy viscosity liquids, depending on design and components. Do not install the pump in a service with higher liquid temperatures than what it was designed; otherwise, pump components and operation may be affected. For temperature range consult The Gorman-Rupp Company.

#### Before Starting The Pump



**Never operate the pump against a closed suction or discharge valve. The pump will overheat, and may rupture or explode, causing personal injury or death.**

Open all valves in the suction and discharge lines, and close all drain valves.

Consult the drive manufacturer’s operating manual before attempting to start the drive.

In a suction lift, fill the pump housing with liquid to seal clearances and to lubricate.

#### Checking Pump Rotation

Correct rotation of your pump is shown on the pump serial plate or direction arrow plate.



In applications with a single direction of flow and a single pump-mounted pressure relief valve, make certain that the drive unit turns the pump in the correct direction of rotation. Otherwise, the pump-mounted pressure relief valve will not function.

Follow the drive unit manufacturer’s instructions, jog the pump motor **briefly**, and check rotation.

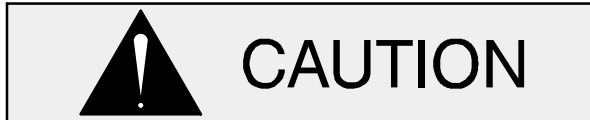


Gorman-Rupp rotary gear pumps are bi-directional; however, the pumps are manufactured to rotate in one specific direction. If rotation is to be changed, the pressure relief valve must be re-installed with the cap pointing toward the suction port. Additionally, if the discharge pressure is greater than the shaft seal rating (consult your Gorman-Rupp distributor), the pressure relief plugs in the back of the housing must be switched (see **Housing Assembly** under **PUMP REASSEMBLY**, Section E).

If a 3-phase motor is being used and rotation is incorrect, have a qualified electrician interchange any two of the 3-phase wires to change the direction of rotation. If a 1-phase motor is being used and rotation is incorrect, consult the motor manufacturer’s literature.

## STARTING

Start the drive unit as indicated in the manufacturer's instructions and observe the suction and discharge gauges. If the pump does not deliver liquid within one minute, stop the drive unit. **Do not** operate the pump more than one minute without liquid in it; dry operation will damage or destroy the pump.



Although this pump is self-priming, never operate it dry. Dry operation could cause galling, seizing, damage to the seal or excessive wear of rotating parts.

Review the previous steps outlined in **PRE-OPERATION** and review **TROUBLESHOOTING**, Section D. If everything appears normal, add liquid to the pump housing to assist priming and start the driver again.

If the pump does not deliver liquid within two minutes, stop the pump; it may be necessary to vent the discharge line until liquid begins to flow.

If the pump still does not deliver after consulting **TROUBLESHOOTING** and venting the discharge line, contact your local Gorman-Rupp Rotary Gear Distributor or the factory.

## OPERATION

### NOTE

*If the pump malfunctions or does not meet operating specifications, refer to **TROUBLESHOOTING** – Section D.*

A change in operating noise when liquid first enters the pump is normal. After the pump is fully operational, monitor it for any unusual noises or vibration; if either occurs, shut the pump down immediately.

### Liquid Temperature

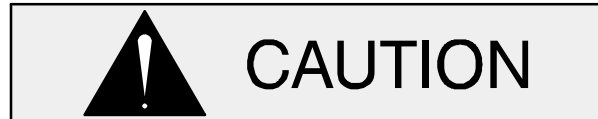
Do not install the pump in a service with higher liquid temperatures than what it was designed. Intro-

ducing hot liquid into a cold pump will expand parts unevenly, causing excessive wear, pump failure, and operation may be affected. This thermal shock can be reduced by gradually heating the liquid being introduced into the pump. If it is not possible to heat the liquid, use heat tape and/or insulation to heat the pump.

High temperature bushings as well as optional jackets which may be used to heat or cool the pump are available options for many models.

### Overheating

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



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 completely cool before cooling.

### Checking Gauges

Monitor vacuum and pressure gauge readings to ensure that the pump is operating within normal range and delivering full flow.

### Strainer Check

If a strainer has been installed in the suction line, monitor vacuum gauge readings to detect blockage. Check the strainer if flow rate begins to drop.



**Never introduce air or steam pressure into the pump housing to remove a blockage. This could result in personal injury or damage to the equipment. If**

**backflushing is absolutely necessary, limit liquid pressure input to 50% of the maximum permissible operating pressure shown in the pump performance data.**

### Leakage

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

If your pump is equipped with a packing seal, the packing is lubricated by the liquid being pumped. Some leakage around the packing seal is normal. Packing pumps **must leak slightly** to cool and lubricate the shaft and to allow the shaft to turn freely.

Wait until the pump has run long enough to reach its normal operating temperature to adjust the gland nuts. Adjust the nuts only tight enough to reduce excessive leakage.

### PRESSURE RELIEF VALVE ADJUSTMENT

Some pumps are not provided with a pressure relief valve. A pressure relief valve must be installed on the pump or in the discharge piping to ensure safe operation. Otherwise, the pump may be damaged and personnel injured.



If operating at high temperatures, allow the pump to completely cool before attempting any adjustments.

### Cracking Pressure

Cracking pressure is the pressure at which the pressure relief valve first begins to open and by-

pass fluid. The nominal cracking pressure of the relief valve provided with this pump is set at the factory and is indicated on the tag attached to the relief valve.

If the nominal cracking pressure set at the factory must be changed, see Table E-2 and instructions in **Section E - MAINTENANCE AND REPAIR.**

### Complete By-pass Pressure

Complete by-pass pressure is the maximum pressure the pump will see when all the pumped fluid is being by-passed through the pressure relief valve. This pressure will vary depending on the cracking pressure setting, liquid viscosity, and pump speed (pump capacity).

To determine the complete by-pass pressure, refer to the pump performance chart or consult the factory.



**Do not remove the adjusting screw jam nut; with the jam nut removed the relief valve spring(s) can be compressed too far for the valve to open. If the valve does not open, excessive pressure can develop, causing damage to the pump and possible injury to personnel.**

### STOPPING

If the pump will be out of service for an extended length of time, particularly when handling non-lubricating liquids, drain the system and flush the pump and piping with an oil-based preservative to protect close-tolerance pump parts.

When handling liquids that solidify when at rest (tar, glue, etc.), flush the pump and piping with an approved solvent compatible with the pump components and the liquids being pumped.

## TROUBLESHOOTING – SECTION D

Review all **SAFETY** information in Section A.



**Before attempting to open or service the pump:**

1. **Familiarize yourself with this manual.**
2. **Allow the pump to completely cool if overheated.**
3. **Check the temperature before opening any covers, plates, or plugs.**
4. **Close the suction and discharge valves.**
5. **Drain the pump.**

### TROUBLESHOOTING WITH GAUGES

Most pump or system malfunctions can be detected by installing vacuum suction and discharge pressure gauges. Read the gauges and refer to the following information for interpretation of the gauge readings. For additional troubleshooting procedures, see the **TROUBLESHOOTING CHART**.

#### Vacuum Gauges

##### HIGH READING

Suction valve closed, suction line blocked, foot valve jammed, strainer blocked.  
Liquid too viscous.  
Lift too high.  
Suction line undersized.

##### LOW READING

Air leak in suction line.  
End of suction line not submerged.  
Pump parts worn or defective.  
Pump needs priming.

##### ERRATIC READING

Liquid overheated, vaporizing.  
Liquid entering intermittently, suction air leak, end of suction line not submerged.  
Vibration from cavitation, misalignment, damaged parts.

#### Pressure Gauges

##### HIGH READING

Liquid too viscous.  
Discharge line undersized or too long.  
Discharge valve partially closed.  
Strainer blocked.  
Relief valve pressure set too high.  
Thermal changes in liquid.

##### LOW READING

Relief valve pressure set too low.  
Internal valve not seating properly.  
Pump bypass partially open.  
End clearance too great.  
Pump parts worn or defective.

##### ERRATIC READING

Cavitation.  
Liquid entering intermittently, suction air leak, end of suction line not submerged.  
Drive misalignment causing vibration.



## TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME OR LOSES PRIME	<p>Air leak in suction line; end of suction line not submerged; foot valve blocked or jammed; insufficient liquid in sump or tank.</p> <p>Suction strainer clogged.</p> <p>Shaft seal leaking; gaskets, O-rings worn.</p> <p>Leaking relief valve.</p> <p>Suction lift too high.</p> <p>Pump "starving" or liquid vaporizing in suction line.</p> <p>Pump rotation incorrect.</p> <p>Pump speed too slow.</p> <p>Housing dry.</p>	<p>Check and correct as required.</p> <p>Check strainer.</p> <p>Check vacuum gauge; disassemble pump and replace faulty parts.</p> <p>Disassemble and repair.</p> <p>See <b>INSTALLATION, SECTION B</b> and check piping.</p> <p>Increase suction pipe size or reduce length; position pump below liquid level.</p> <p>See <b>OPERATION, SECTION C</b> and check rotation.</p> <p>Check driver speed.</p> <p>Add liquid to housing, see <b>OPERATION, SECTION C</b>.</p>
PUMP DOES NOT DELIVER RATED DISCHARGE OR CAPACITY	<p>Air leak in suction line; end of suction line not submerged; foot valve blocked or jammed; insufficient liquid in sump or tank.</p> <p>Shaft seal leaking; gaskets, O-rings worn.</p> <p>Relief valve pressure set too low.</p> <p>Suction or discharge lines blocked; suction or discharge valves closed.</p> <p>Pump speed too slow.</p> <p>Pump "starving" or liquid vaporizing in suction line.</p> <p>Rotating parts worn or damaged; improper end clearance.</p>	<p>Check and correct as required.</p> <p>Check vacuum gauge; disassemble pump and replace faulty parts.</p> <p>Readjust.</p> <p>Check strainer, valves and piping.</p> <p>Check driver speed; check belts/couplings.</p> <p>Increase suction pipe size or reduce length; position pump below liquid level.</p> <p>Replace defective parts; see <b>SETTING END CLEARANCE</b> in <b>Maintenance And Repair, Section E</b>.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Insufficient end clearances.</p> <p>Pump speed too high.</p> <p>Internal parts worn.</p> <p>Discharge line undersized and/or too long.</p>	<p>Readjust clearance; see <b>SETTING END CLEARANCE</b> in <b>Maintenance and Repair, Section E</b>.</p> <p>Reduce driver output.</p> <p>Disassemble pump and inspect.</p> <p>Increase size, decrease length.</p>

## TROUBLESHOOTING CHART (Cont.)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP RE-QUIRES TOO MUCH POWER (Cont.)	<p>Pump and/or drive mounting not secure; drive misaligned.</p> <p>Power source undersized.</p> <p>Liquid in pump solidified.</p> <p>Insufficient internal clearances.</p>	<p>Tighten mounting hardware; realign drive.</p> <p>Check power requirements for application; resize as required.</p> <p>Clear or heat.</p> <p>Consult factory.</p>
EXCESSIVE NOISE OR VIBRATION	<p>Pump and/or piping not secure; drive misaligned.</p> <p>Pumping entrained air.</p> <p>Pump "starving" or liquid vaporizing in suction line.</p> <p>Relief valve chatter.</p> <p>Rotating parts worn or damaged; improper end clearance.</p> <p>Pump operating outside designed operating range.</p> <p>Lubrication required.</p>	<p>Anchor base or piping, realign drive.</p> <p>Check liquid level.</p> <p>Increase suction pipe size or reduce length; position pump below liquid level.</p> <p>Increase pressure setting.</p> <p>Replace defective parts; check end clearance.</p> <p>Check discharge head and flow; adjust as required to meet performance specifications.</p> <p>Add lubricant, as needed.</p>
EXCESSIVE WEAR	<p>Corrosive liquid.</p> <p>Abrasive liquid.</p> <p>Exceeding operating limits.</p> <p>Insufficient end clearance.</p> <p>Pump running dry.</p> <p>Pump and/or drive mounting not secure; drive misaligned; piping incorrectly installed.</p> <p>Insufficient lubrication.</p>	<p>Check local distributor or factory for parts compatibility with liquid; check liquid for contamination.</p> <p>Consult factory.</p> <p>Check performance data in <b>Pump Specifications Bulletin</b>.</p> <p>See <b>SETTING END CLEARANCE</b> in <b>Maintenance And Repair, Section E</b>.</p> <p>Add liquid to prime (<b>See Operation, Section C</b>); check liquid flow.</p> <p>Tighten mounting hardware; realign drive; check piping.</p> <p>Add lubrication and maintain at proper level.</p>

## 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 rotary gear 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. The appearance of wearing parts should be documented at each inspection for later comparison. Also, if records indicate that a certain part (such as the seal) fails at the same duty cycle, this part can be checked and replaced before failure occurs.

Because of the tight tolerances within your rotary gear pump, wear between rotating parts is normal and expected. For new applications, a first inspection at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at regular intervals of 2000 hours. Critical applications should be inspected more frequently.

Check the thrust washer (medium duty models), idler bushing, idler pin, idler assembly, shaft bushing and rotor/shaft assembly at each inspection. Wear patterns should be uniform, without evidence of deep or irregular grooves.

For packing pumps, periodic adjustment of the packing is required to keep leakage to a minimum (see the adjustment procedure described under **Leakage in Operation, Section C**). Do not over-tighten. Replace the packing if leakage cannot be reduced by a slight adjustment.

If the pump is equipped with a backhead bearing (heavy duty models), inspect for free rotation of the shaft and rotor, and excessive endplay or radial movement of the shaft, which could indicate bearing wear. Remove the rotor adjusting sleeve assembly and inspect the bearing for damaged seals. Replacing the bearing at the first indication of a problem can extend the life of the pump and save considerable expense later to replace major components that can be damaged if the bearing is allowed to fail.

After extended service, adjustment of the clearance between the rotor and the head will normally improve performance (see the adjustment procedure in **Maintenance And Repair, Section E**).

If the pump is to be removed from service for repair, be sure to protect the internal components from rusting while the pump is disassembled and after reassembly if not immediately placed back into service.

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## MAINTENANCE AND REPAIR – SECTION E

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.

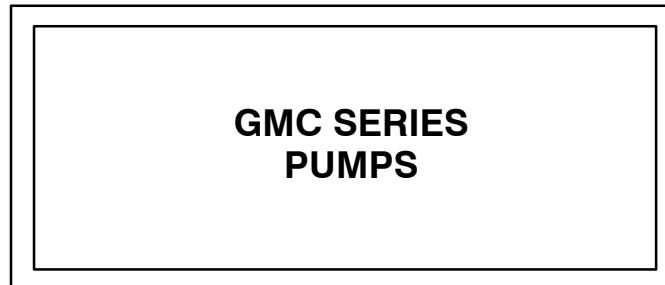
### Pump Model

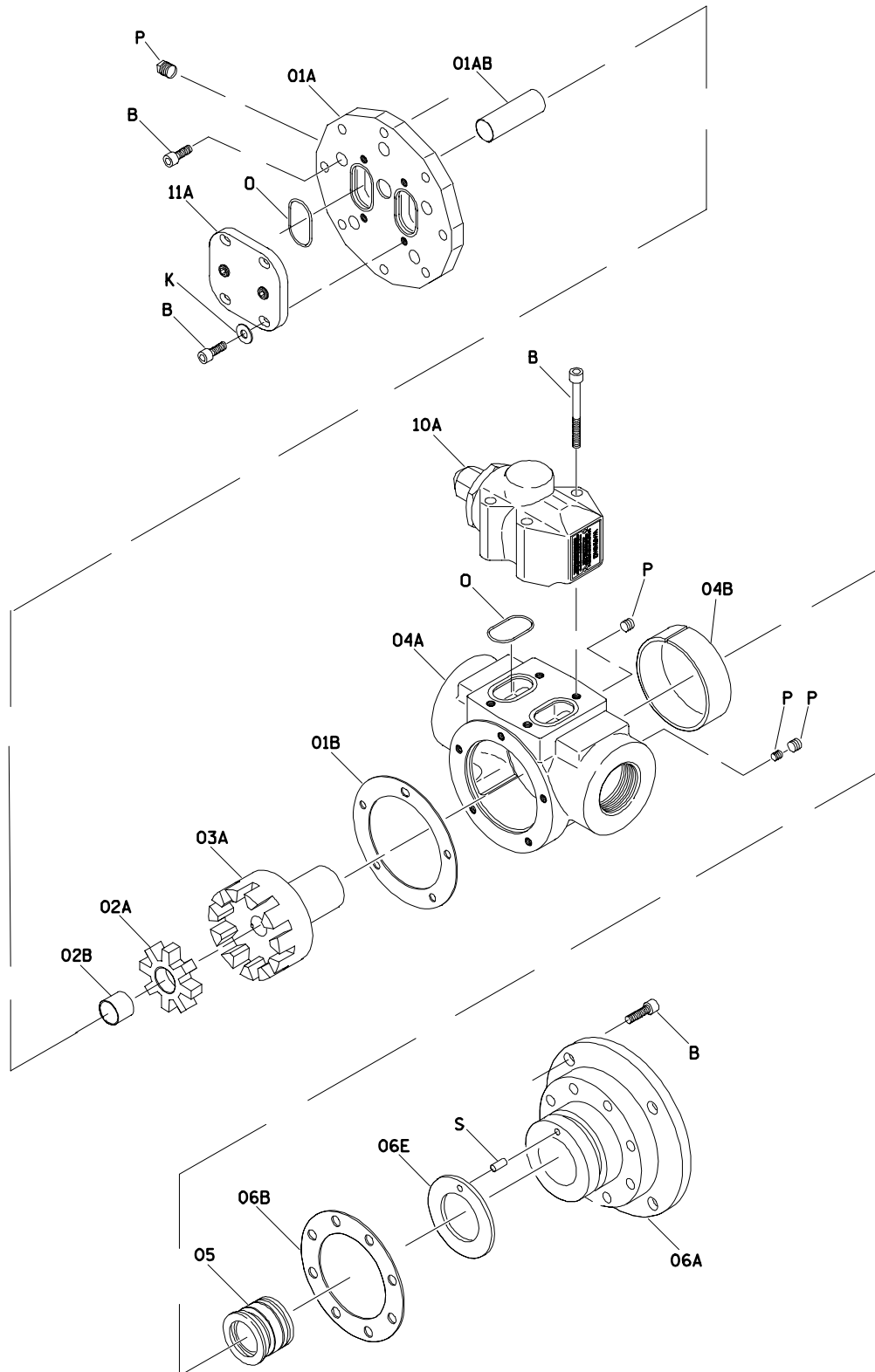
Your pump model number and serial number are shown on the **Parts List**, furnished as a separate document with this manual.

Below the pump model number on the **Parts List**, is a grouping of several alpha-numeric codes. This code identifies the optional features of the pump. **Be sure** to include this grouping, along with the model number and serial number, when ordering parts.

The sectional views cover disassembly and reassembly for the pump models shown below. Refer to the **Parts List** for your specific pump model.

**The Following Pumps Are Covered By This Manual.**





Shown: Standard Model With 180° Ports and Housing-Mounted Relief Valve. Also Available With 90° Ports, BackHead Adaptor, and Head-Mounted Relief Valve. A Coverplate Kit Replaces Either Relief Valve When Not Used.

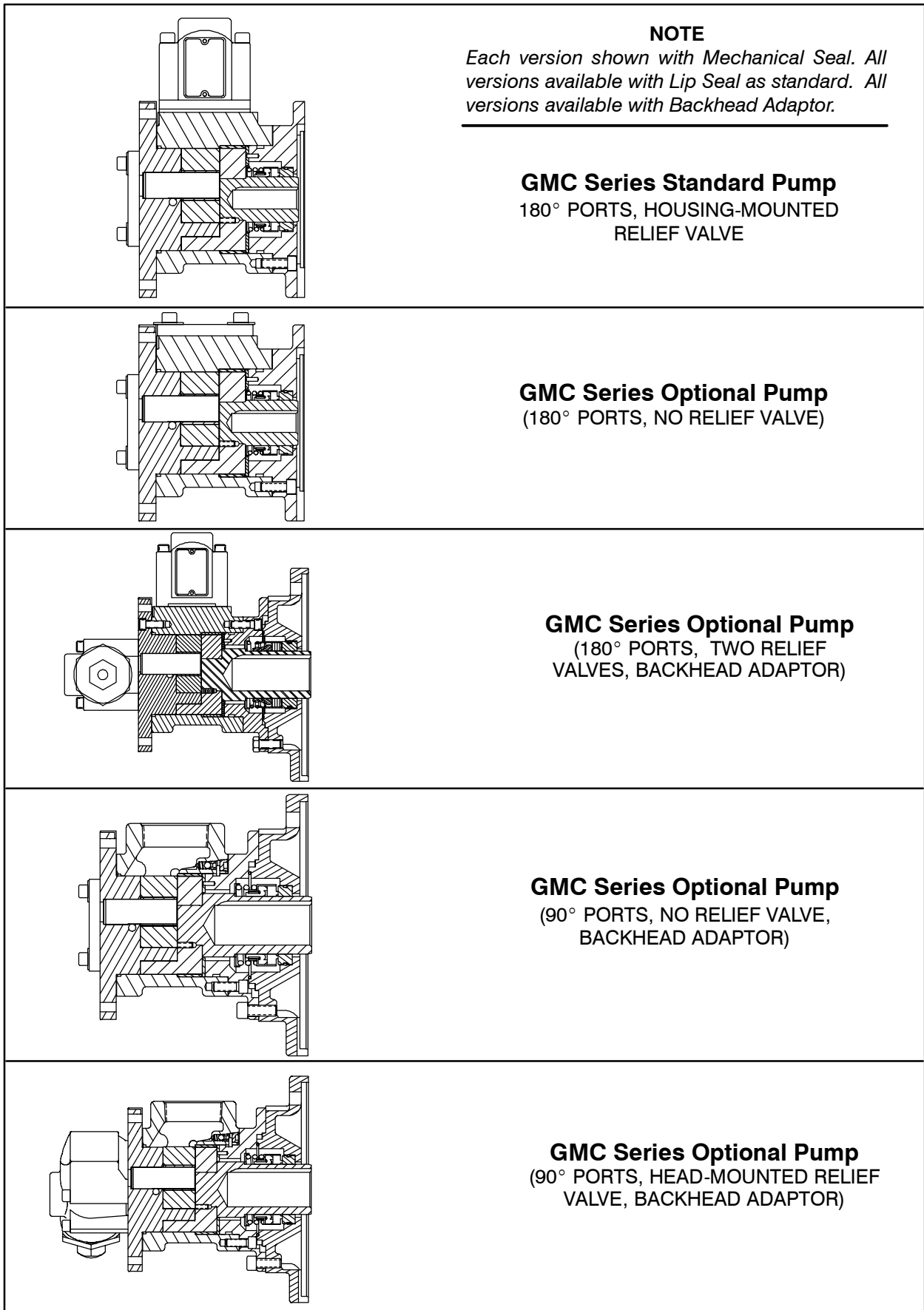
**NOTE:** Refer to **Seal Appendix, Section F** for details of the seal assembly and related components.

**Figure E-1. Typical GMC Pump Models**

## PARTS KEY FOR FIGURE E-1

Note: Item numbers cross reference to specific part numbers on the separate **Parts List**.

ITEM NO.	PART NAME	ITEM NO.	PART NAME
01	HEAD KIT	08	FOOT BRACKET KIT
01A	–HEAD ASSEMBLY	08A	–FOOT BRACKET
01AA	–HEAD	B	–CAPSCREW
01AB	–IDLER PIN	D	–NUT
P	–PIPE PLUG		
01B	–GASKET	10	RELIEF VALVE KIT
B	–CAPSCREW	10A	–RELIEF VALVE ASSEMBLY
		10AA	–VALVE BODY
02	IDLER ASSEMBLY	10AB	–WARNING PLATE
02A	–IDLER	BM	–DRIVE SCREW
02B	–BUSHING	B	–CAPSCREW
		O	–O-RING
03A	ROTOR/SHAFT ASSY		NOT SHOWN:
04	HOUSING ASSEMBLY	11	HEAD COVERPLATE KIT
04A	–HOUSING	11A	–COVERPLATE ASSEMBLY
04B	–HOUSING BUSHING	11AA	–COVERPLATE
P	–PIPE PLUG	11AC	–WARNING PLATE
		BM	–DRIVE SCREW
05	SEAL ASSEMBLY (SEE SECTION F)	P	–PIPE PLUG
		K	–WASHER
06	BACKHEAD KIT	B	–CAPSCREW
06A	–BACKHEAD ASSEMBLY	O	–O-RING
06B	–GASKET		
B	–SOCKET HD CAPSCREW	12	NAMEPLATE KIT
06E	–THRUST WASHER	12A	–NAMEPLATE
S	–BACKHEAD PIN	BM	–DRIVE SCREW



**Figure E-2. Assembled GMC Pump Models**

## PUMP DISASSEMBLY AND REASSEMBLY

Review all SAFETY information in Section A.

Follow the instructions on all tags, labels 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, unless otherwise specified, are keyed to the sectional view (see Figure E-1) and the accompanying parts list. Refer to the separate parts list accompanying your pump for part numbers.

In the following text, minor headings are followed by a number in parenthesis. This number represents the assembly for the item being discussed as identified in Figure E-1.

Before attempting to service the pump, disconnect the power source to ensure that it will remain inoperative. Remove the hardware securing the pump to the power source, and separate the power source and pump assembly. Retain all connection parts such as shaft keys, etc.

Close all valves in the suction and discharge lines. Disconnect the suction and discharge hose/piping.

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



**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 provide detailed instructions and precautions for each specific application or for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner, installer**

and/or maintenance personnel to ensure that applications and/or maintenance procedures not addressed in this manual are performed only after establishing that neither personal safety nor pump integrity are compromised by such applications or procedures.



**Do not attempt to service the pump unless all power to the power source has been disconnected; otherwise, serious personal injury or death could result.**

### PUMP DISASSEMBLY



**This pump may be used to handle liquids which may cause serious illness or injury through direct exposure or emitted fumes. Wear protective clothing, such as rubber gloves, face mask and rubber apron, as necessary, before disconnecting or servicing the pump or piping.**



Use caution when handling the idler (02A) and the rotor shaft assembly (03A). These parts have sharp edges which will grow sharper with use.

In the instructions which follow the **FRONT** is the head assembly end of the pump and the **REAR** is the drive (or backhead) end of the pump.

### NOTE

*It is strongly recommended that gaskets and O-rings be replaced whenever the pump is reassembled.*

### Preparing for Disassembly

The pump should be removed from the system piping and drained for servicing. Close all valves in the



suction and discharge lines to isolate the pump. Position drain pans and/or absorbant material under and around the pump suction and discharge ports. Disconnect the suction and discharge hose/piping.

Remove the hardware securing the pump to the power source and separate the power source and pump assembly. Retain all connection parts such as shaft keys, etc.

Use a hoist and sling with sufficient capacity to position the pump in a suitably sized drain pan or surround the pump with absorbant material. Some pumps are equipped with drain plugs in the head and backhead. Remove the plug(s) and drain the pump before proceeding with disassembly.

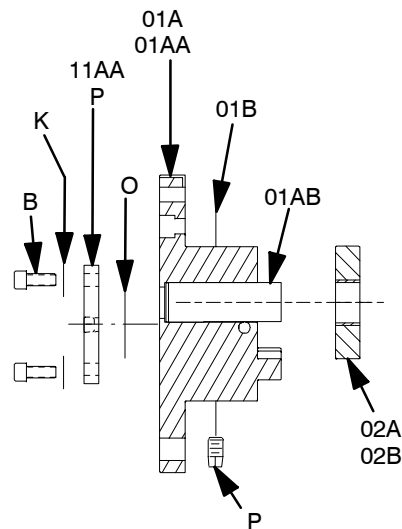
**Pressure Relief Valve (10)**

If the pump is equipped with a pressure relief valve (10A), it can be mounted on either the head assembly (01A) or the housing assembly (04). Some models are equipped with one of each. Take note as to the direction in which the relief valve is mounted. To remove either style, remove the capscrews (B) securing the relief valve to the pump. The O-rings (O) may remain in the head (01A) or in the housing (04A). Remove and discard the O-rings. For relief valve maintenance, see **RELIEF VALVE DISASSEMBLY** followed by **RELIEF VALVE REASSEMBLY** at the end of this section.

**Coverplate Kit (11)**

(Figure E-1 And E-3)

The coverplate kit may be mounted on either the head assembly or the housing assembly. Removal is the same for either.

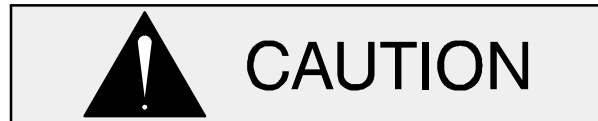


**Figure E-3. Head Coverplate Kit, Head Kit And Idler Disassembly**

Remove the hardware (B and K) securing the coverplate (11AA) to the head (01AA) or housing (04A). The O-rings (O) may remain in the head or housing. Remove and discard the O-rings.

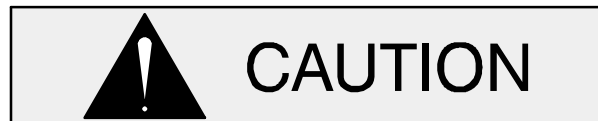
**Head/Idler Kit (01 and 02)**

(Figure E-1 and E-3)



Use caution to prevent the idler assembly from dropping off the idler pin; the idler may be damaged if it falls on a hard surface.

Disengage the hardware (B) and pull the head assembly (01A) from the housing assembly (04A, Figure E-1). Take care not to let the idler assembly (02) slide off the idler pin (01AB). Remove and discard the gasket (01B). Remove the check pipe plug (P) from the suction side of the head (01AA).



Use caution when handling the idler (02A) and the rotor shaft assembly (03A). These parts have sharp edges which will grow sharper with use.

**NOTE**

*The idler bushing (02B) may be damaged during*

removal. Do not remove the idler bushing unless replacement is required.

Remove the assembled idler (02) and bushing (02B) from the head assembly. Inspect the idler bushing for excessive wear or scoring. If replacement is required, use an arbor (or hydraulic) press and a suitably sized dowel to remove the idler bushing (02B) from the idler (02A).

To remove the idler pin (01AB), lay the head assembly (01A) on an arbor (or hydraulic) press with the idler pin (01AB) facing down and remove the idler pin (01AB) from the head (01AA).

### Backhead Kit Removal (06)

(Figures E-1 and E-2)

#### NOTE

Part or all of the seal assembly (5) will be removed with the backhead. If your pump is fitted with an optional adaptor (Figure E-2), the seal parts will be removed with the adaptor. Remove the backhead (or adaptor) as follows, check the **Parts List** furnished with your pump to identify the seal, then refer to **Seal Appendix, Section F** for removal of the seal and related components.

Remove the hardware and separate the backhead (or adaptor) from the motor.

If the pump is fitted with an optional adaptor (see Figure E-2), remove the hardware securing the adaptor to the backhead. Carefully slide the adaptor off the rotor/shaft assembly. Remove and discard the gasket.

If the pump is not fitted with an adaptor, remove the screws (B) securing the backhead assembly (06A) to the housing assembly (04). Carefully slide the backhead out of the housing.

Remove and discard the gasket (06B) or O-ring (O) and the thrust washer (06E).

If replacement is required, pull the pin (S) from the backhead.

### Rotor/Shaft Removal (03A)

Slide the rotor/shaft assembly (03A) out of the housing (04A). If your pump is equipped with a mechanical seal, the rotating portion of the seal assembly (05) will remain on the shaft. Refer to **Seal Appendix, Section F**, for seal replacement.

Due to close machine tolerances and assembly practices, the rotor/shaft is available only as an assembly. Further disassembly is not required.

### Seal Removal (05)

The seal assembly (05) is available in a variety of configurations. Check the **Parts List** furnished with your pump to identify the seal, then refer to **Seal Appendix, Section F**, for removal of the seal and related components.

### Housing Assembly (04)

#### NOTE

The housing bushing (04B) may be damaged during removal. Do not remove the housing bushing unless replacement is required.

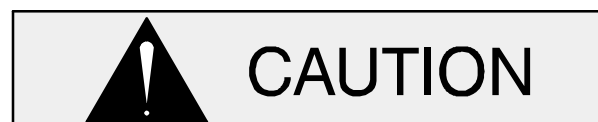
Use an arbor (or hydraulic) press and a suitably sized dowel to remove the housing bushing.

#### NOTE

Seal cavity pressure relief is accomplished using two plugs (P) in the back side of the housing. Removal of the pins is not required unless the direction of pump rotation is to be changed.

If pump rotation is to be changed, remove the socket head pipe plugs (P) from the housing. The hole adjacent to the discharge port will have a small pipe plug under the larger, outer pipe plug. This plug must be removed to change rotation.

### PUMP REASSEMBLY



Use caution when handling the idler (02A) and the rotor shaft assembly (03A). These parts have sharp edges which will grow sharper with use.

## Cleaning and Inspection



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

Clean and inspect the pump parts (except the seal assembly) with a cloth soaked in fresh cleaning solvent. Inspect all parts for excessive wear or for any nicks or burrs. Remove nicks or burrs using emery cloth or a fine file. Replace any parts that are badly worn or damaged.

Clean and inspect the seal assembly as indicated in the appropriate section of the **Seal Appendix, Section F**.

## Bushing Preparation

When replacing bushings, lightly oil the O.D. of the replacement bushing before installation.



**Be very careful** when installing graphite bushings. Graphite is extremely brittle and will crack if improperly installed. Use a press to install the bushing with one continuous motion until the bushing is fully seated. Stopping in mid-stroke will cause the bushing to crack. After installation, check the bushing for cracks.

### NOTE

*When installing **high temperature graphite bushings**, heat the part that receives the bushing to 500°F and place the bushing in a freezer for at least one hour. This will allow easy installation without breakage and provide a tight shrink fit after cooling.*

## Housing Assembly (04)

Clean and inspect the housing (04A) with a cloth soaked in fresh cleaning solvent. Replace it if badly worn or damaged.



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

When installing a replacement bushing, position the housing on the bed of an arbor (or hydraulic) press with the drive end facing up. Press the bushing into the housing until fully seated against the bore shoulder.



If the housing plugs (P) were removed in order to change the direction of pump rotation, the smaller diameter plug **must** be installed in the hole adjacent to the discharge port of the housing. Otherwise, over-pressurization of the seal cavity could result in premature seal failure.

If the socket head pipe plugs (P) in the back side of the housing were removed, install the smaller diameter plug in the hole adjacent to the discharge port, and install one of the larger diameter pipe plugs over the smaller one. Install the second large pipe plug in the other hole in the back of the housing adjacent to the suction port.

## Rotor/Shaft Assembly (03A)

Inspect the rotor/shaft assembly (03A) for excessive wear, scoring or scratches along the shaft sealing surface. If replacement is required, the shaft and rotor must be replaced as an assembly. Small scratches can be dressed with a fine file or emery cloth. Replace the rotor/shaft assembly or any other parts if wear or damage is extensive.

### NOTE

*Part or all of the seal assembly (5) must be installed*

on the rotor/shaft assembly before installing the assembly. Check the **Parts List** furnished with your pump to identify the seal, refer to **Seal Appendix, Section F** for seal installation, then proceed as follows.

Carefully slide the rotor/shaft assembly and seal into the housing and backhead. **Use caution** not to scratch the I.D. of the bushing (04B).

### Head/Idler Kit (01 and 02)

#### (Figures E-1 and E-3)

If the idler pin (01AB) was removed, apply “Loctite PST No. 565” pipe sealant with teflon (or equivalent compound) to the O.D. of the replacement idler pin and the I.D. of the idler pin bore in the head (01AA). Position the pin in the head with the chamfered side toward the head and the milled flat side facing the crescent. (If the pin is stepped, position it with the large chamfered end toward the head.) Use an arbor (or hydraulic) press to press the pin into the head until it bottoms out.

#### NOTE

When properly installed, the pin will be positioned 0.010 inch below the surface of the crescent.

Lightly oil the I.D. of the idler (02A), and use an arbor (or hydraulic) press to install the idler bushing (02B) in the idler. The bushing should be centered at both ends of the idler.

Place the head (01A) on a flat surface. Lightly oil the idler bushing (02B) and pin (01AB); install the idler assembly (02) on the pin. Spin the idler to make certain that it moves freely on the pin.

See **SETTING END CLEARANCE** and calculate the number and thickness of gaskets (01B) required for your application and hydraulic pump size. Position the gasket(s) against the head, and slide the head into the housing assembly. Rotate the head assembly (01A) until the groove in the head matches the groove in the housing. Secure the head to the housing with the capscrews (B).

### Coverplate Kit (11)

#### (Figures E-1 and E-3)

The coverplate kit may be mounted on either the head assembly or the housing assembly. Installation is the same for either.

Lightly lubricate the O-ring (O) with oil and install it in the housing (04A). Secure the coverplate (11AA) with the hardware (BD). Be sure that the warning plate (11AC) is attached to the coverplate (11AA).

### Seal Installation (05)

The seal assembly (05) is available in a variety of configurations. Check the **Parts List** furnished with your pump to identify the seal, then refer to **Seal Appendix, Section F**, for installation of the seal and related components.

### Backhead Kit (06)

#### (Figures E-1 and E-4)

#### NOTE

Part or all of the seal assembly (5) must be installed before installing the backhead. If your pump is fitted with an optional adaptor (Figure E-2, Versions 3, 4 and 5), the seal parts must be installed in the adaptor. Check the **Parts List** furnished with your pump to identify the seal, refer to **Seal Appendix, Section F** for installation of the seal and related components, then proceed as follows.

If removed, install the backhead pin (S) in the backhead (06A) until it bottoms out. Install a new gasket (06B) on the backhead (06A).

Apply a small amount of “Parker-O-Lube” lubricant or equivalent compound on the light metallic side of the thrust washer (06E) to hold it in place. Install the thrust washer over the backhead pin with the dark Teflon™ side facing out. Remove any excess lubricant.

Carefully position the backhead assembly against the housing with the drain slot in the backhead toward the bottom of the pump. Secure the backhead assembly to the housing with the capscrews (B).

If the pump is fitted with a backhead adaptor, install the gasket (06K) and carefully position the adaptor

(06L) against the backhead. Secure the adaptor to the backhead with the previously removed capscrews.

### SETTING END CLEARANCE

(Figures E-1 and E-5)

The end clearance between the head (01AA) and the face of the rotor (03A) should be checked and adjusted as required as part of a regular preventive maintenance schedule, when performance drops or the pump is disassembled.

#### NOTE

The end clearance is established **without** the head gasket set (01B) in place.

Slide the head assembly into the housing assembly. Rotate the head (01AA) until the groove in the head matches the groove in the housing. Secure the head to the housing with the capscrews (B). The head **must** be drawn completely tight against the housing to establish the correct end clearance.

Use a feeler gauge to measure the clearance between the front of the housing assembly and the back of the head as shown in Figure E-4.

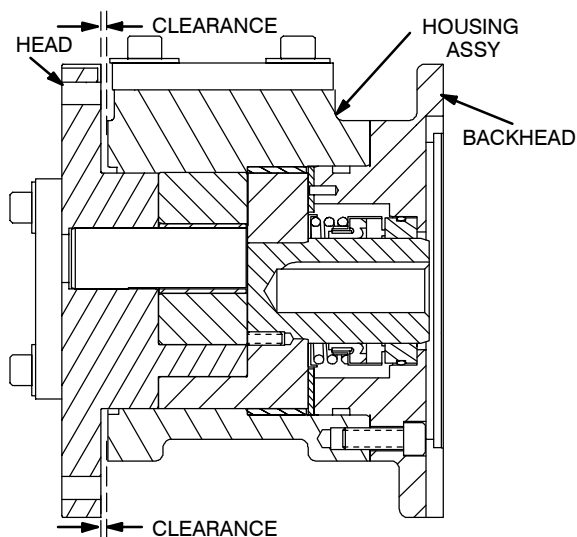


Figure E-4. End Clearance Adjustment

See Table E-1 to determine the gasket(s) (01B) required for your rotor trim. Remove the head from the housing assembly and install the gasket(s).

Reinstall the head on the housing assembly (04) and secure with the capscrews (B).

#### NOTE

The gasket set (01B) includes (2) 0.006 inch gaskets and (1) 0.015 inch gasket and will accommodate all standard clearances. If additional clearance is required, order two kits.

Feeler Gauge Reading	Std & 35B Rotor Trims	35C & 35E Rotor Trims	35D Rotor Trim
0.000-0.002	(1) 0.006	(2) 0.006	(1) 0.015
0.003-0.006	(2) 0.006	(1) 0.015	(1) 0.015 (1) 0.006
0.007-0.010	(1) 0.015	(1) 0.015 (1) 0.006	(1) 0.015 (2) 0.006
0.011-0.014	(1) 0.006 (1) 0.015	(2) 0.006 (1) 0.015	(2) 0.015
0.015-0.018	(2) 0.006 (1) 0.015	(2) 0.015	(1) 0.006 (2) 0.015
0.019-0.023	(2) 0.015	(1) 0.006 (2) 0.015	(2) 0.006 (2) 0.015

Notes:  
Consult Pump Parts List For Rotor Trim Code.  
For Rotor Trim Codes Not Listed or for Special Applications,  
Consult Your Local Gorman-Rupp Distributor or the Factory.

Table E-1. End Clearance Gaskets

### RELIEF VALVE DISASSEMBLY

(Figure E-5)

#### NOTE

If the relief valve is low pressure, it will have one internal spring (10AE). If the relief valve is high pressure, it will have two internal springs (10AE and 10AF).

Unscrew the cap (10AN) from the bonnet (10AK) and remove the gasket (10AP). Back off the adjustment capscrew (10AM) to relieve pressure on the spring(s) (10AE and/or 10AF).

Unscrew the bonnet from the valve body (10AA). Remove the valve (10AD) and spring(s) (10AE and/or 10AF). The spring guide (10AH) is an O-ring fit in the bonnet. Remove and discard the O-rings.

If the warning plate (10AB) must be replaced, remove the drive screws (BM), and remove the plate.

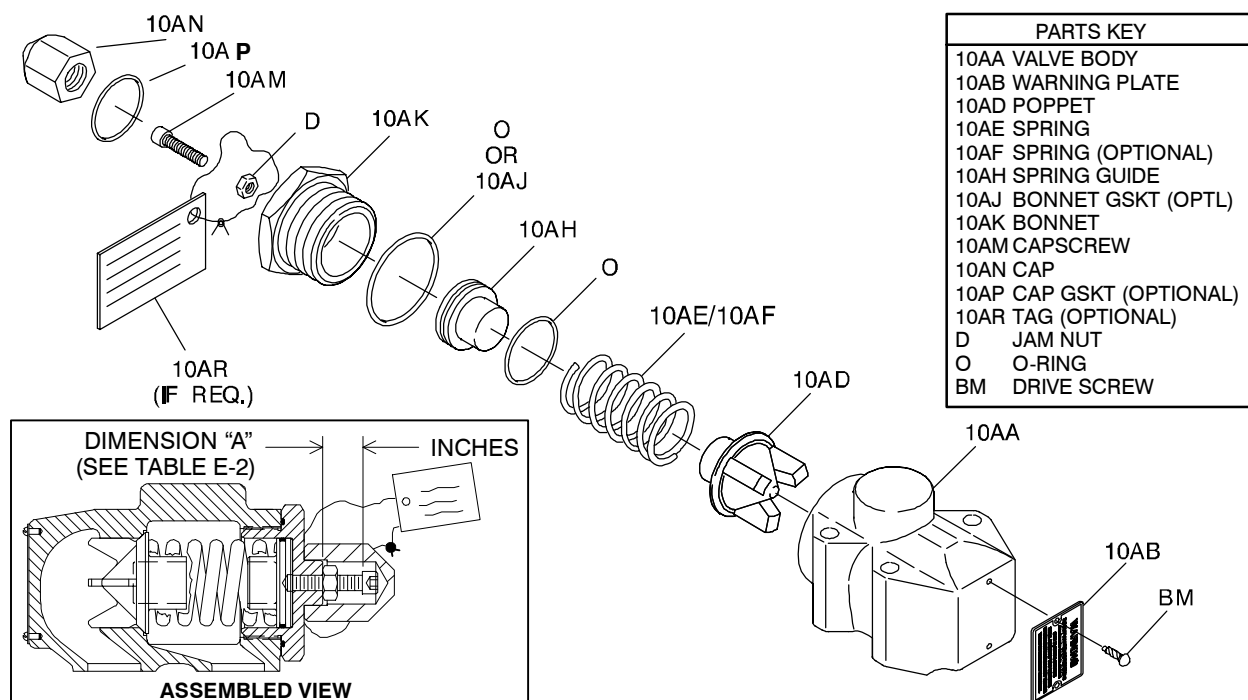


Figure E-5. Pressure Relief Valve Assembly

**RELIEF VALVE REASSEMBLY**

(Figure E-5)



**Do not return the pump to service without the warning plate (10AB) installed. Failure to observe the warning on the plate could result in destruction of the pump, and injury or death to personnel.**

Inspect the components for wear, grooves, or other damage that might cause leakage. If any components are worn, replace the defective parts.

If removed, attach the warning plate (10AB) to the valve body (10AA) using the drive screws (BM).

If used, lightly oil the O-ring (O) and install it in the groove on the bonnet (10AK).

Lightly oil the O-ring (O) and install it in the groove on the spring guide (10AH). Start the large end of the spring guide into the bonnet (10AK), and push the guide in until it bottoms out.

Insert the valve (10AD), finned end first, into the valve body (10AA). Install the spring(s) (10AE and/or 10AF). Make certain that the spring (10AE) fits **over** the spring guide (10AH), and the optional spring (10AF) fits **into** the guide, and thread the bonnet into the valve body.

Install the jam nut (D) on the adjustment capscrew (10AM), and thread the capscrew into the bonnet until the desired height "A" is reached. See Table E-2 and adjust the capscrew (10AM) to the proper "A" dimension for desired cracking pressure.



**Never operate the pump without the adjusting screw jam nut in place. Otherwise, the relief valve spring(s) can be compressed too far for the valve to open. If the valve does not open, excessive pressure can develop, causing damage to the pump and possible injury to personnel.**

Refer to the separate Parts List accompanying your pump, and determine the specific hydraulic size (D, G, etc.).

PUMP HYDRAULIC SIZE	SINGLE SPRING OPTION CODE	APPROX. CRACKING PRESSURE (PSI)	"A" DIMENSION (FIGURE E-5)	DOUBLE SPRING OPTION CODE	APPROX. CRACKING PRESSURE (PSI)	"A" DIMENSION (FIGURE E-5)
DC, DE GC, GF GH, GJ	STD			25A		
		50 MIN.	.60 FULLY OUT		100	.60 FULLY OUT
	25D	75 *	.47	25E	125	.51
		100	.33		150 *	.42
	25G	130 MAX.	.16 SCREW FULLY IN	25H	175	.33
					200	.23
				225	.16 SCREW FULLY IN	

**Table E-2. Cracking (Valve Opening) Settings (\* Denotes Factory Setting)**

After adjustment, tighten the jam nut (D) flush against the bonnet.

Place the optional warning tag (10AR) between the bonnet and the cap (10AN). Install the cap, and tighten until fully seated against the bonnet.

**Relief Valve (10) Installation**

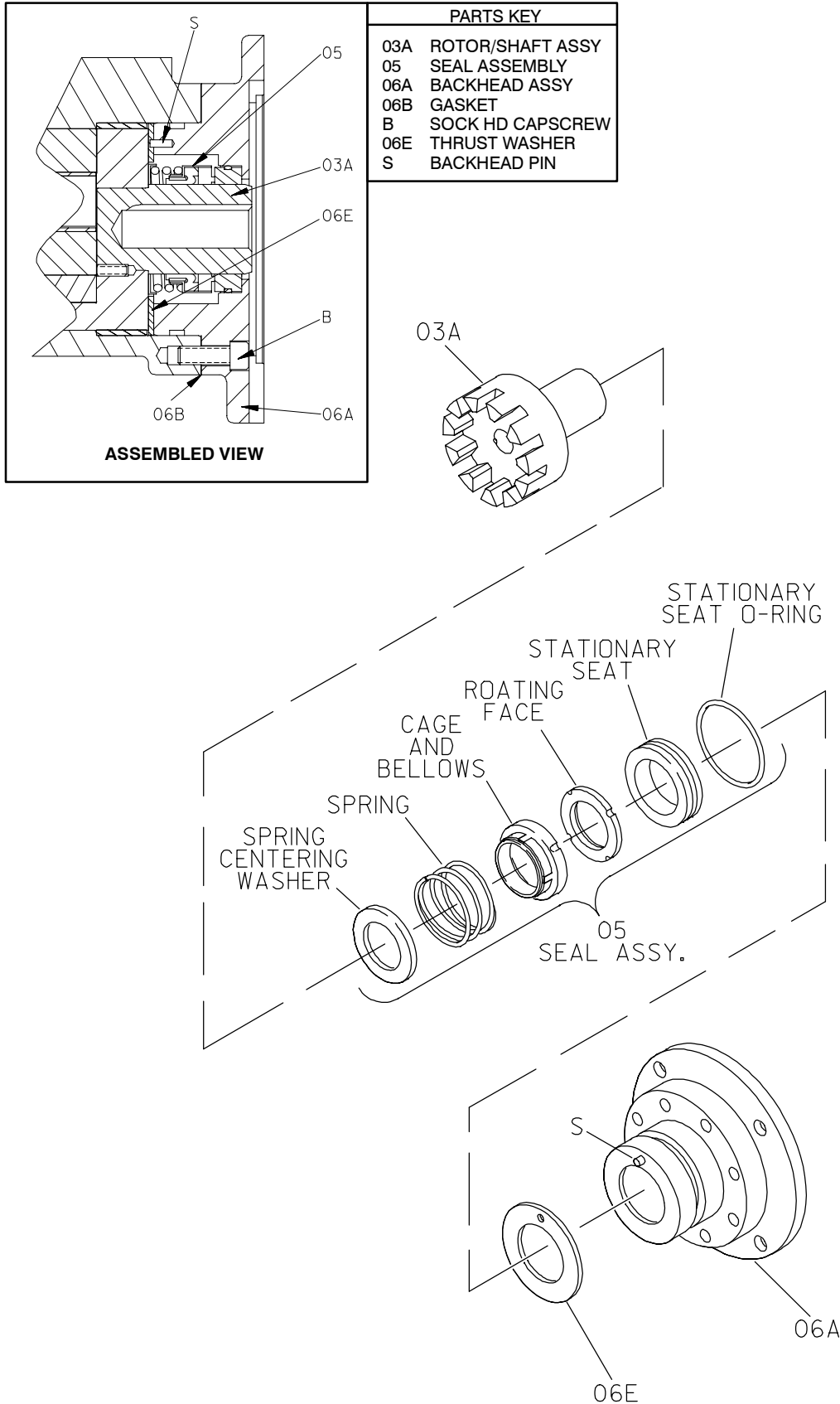
Lubricate and install the O-ring(s) (O) on the housing assembly (04A) or the head assembly (01A). Secure the relief valve (10A) with the capscrews (B).



**Do not return the pump to service without the warning plate (10AB) installed. Failure to observe the warning on the plate could result in destruction of the pump, and injury or death to personnel.**

If the warning plate (10AB) has been removed, secure it with the drive screws (BM).

**SEAL APPENDIX – SECTION F**



**Figure F-1. Standard Type 21 And Optional 60A And 61J Mechanical Seals**



## Seal Removal

(Figures E-1 and F-1)

See **PUMP DISASSEMBLY** and disassemble the pump up to and including the **Backhead Kit (06)**. As the backhead is removed from the housing (04), the stationary element will remain inside the backhead. Remove the seal stationary element and O-ring from the backhead (06A).

With the head kit (01), idler assembly (02), and backhead kit (06) removed, push the rotor/shaft assembly (03A) toward the head end of the pump and remove it from the housing.

Lightly oil the shaft and remove the rotating portion of the seal from the rotor/shaft assembly.

Continue as required with **PUMP DISASSEMBLY**.

## Seal Installation

(Figures E-1 and F-1)

See **PUMP REASSEMBLY**, and reassemble the pump up to the backhead kit (06).

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 flame, sparks, and excessive heat. 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.



Seal components **must** be kept clean. Handle seal parts with extreme caution to prevent damage. Use care not to contaminate the precision-finished faces; even fingerprints on the faces can shorten seal life. If necessary to clean the faces, use a clean cloth and wipe in a circular pattern.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. If any components are worn, replace the complete seal; **never mix old and new seal parts**.

If a replacement seal is being used, unwrap the mechanical seal components. Check that the seal faces are clean, undamaged and free of any foreign matter. Set aside and cover the seal stationary element and O-ring; they will not be used until the backhead kit (06) is installed.

Lubricate the stationary element O-ring and install it in the groove in the backhead.

Position the stationary element in the backhead (06) with the sealing face up. Cover the sealing face with a clean tissue and use thumb pressure to press the stationary element into the backhead until fully seated.

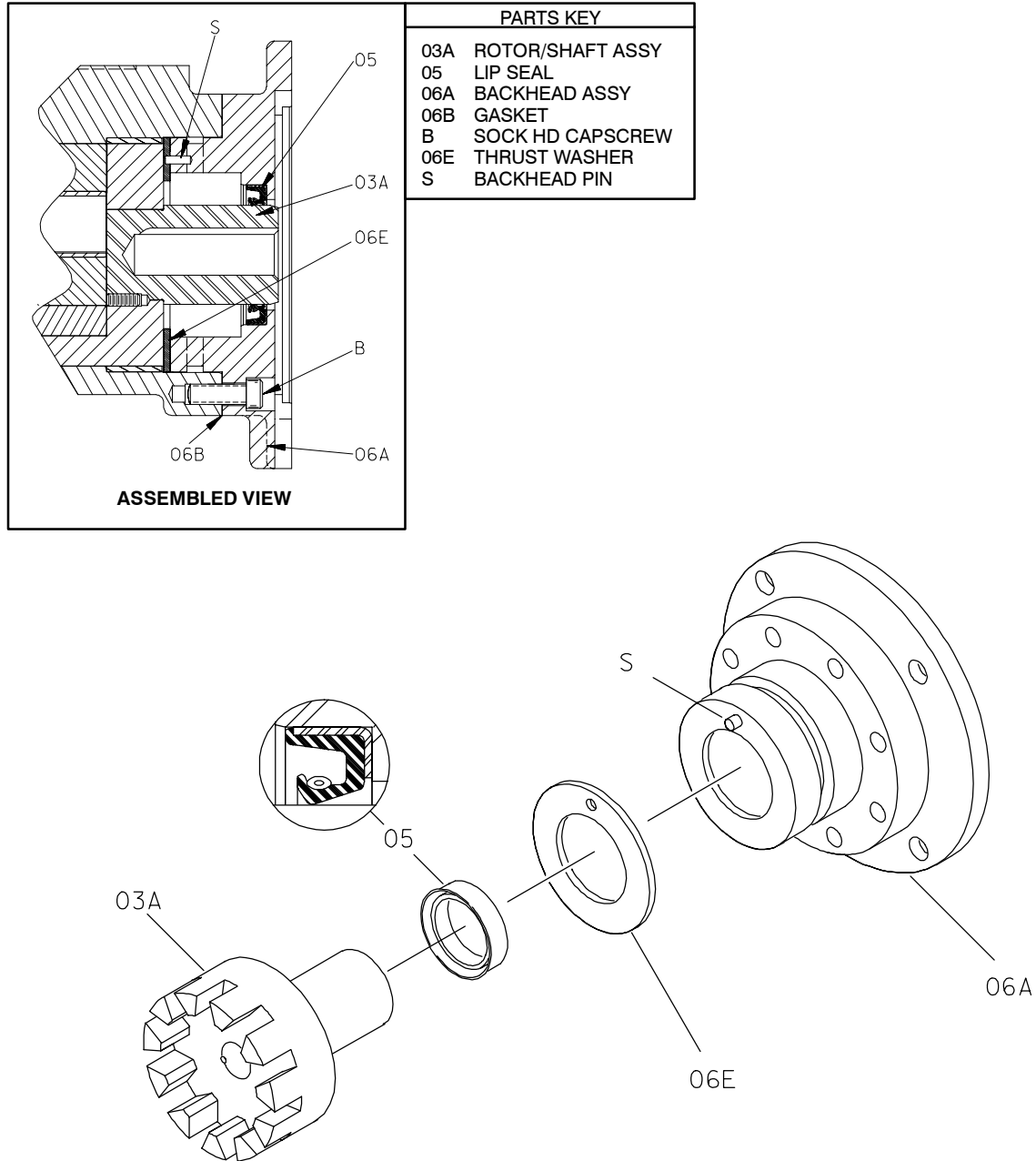
Install the backhead as described in **Pump Reassembly, Section E**

Lightly oil the shaft of the rotor/shaft assembly (03A). Slide the spring centering washer and spring onto the shaft until fully seated against the back of the rotor. Position the rotating portion of the seal on the shaft with the sealing face toward the drive end of the shaft. Place a clean tissue over the sealing face of this rotating subassembly and slide it onto the shaft until the seal retainer seats squarely against the spring.

Slide the assembled rotor/shaft and rotating portion of the seal into the housing until fully seated.

Proceed with **Pump Reassembly, Section E**.

**SEAL APPENDIX – SECTION F**



**Figure F-2. Standard Lip (And Optional 65A And 65C) Seal**

## Seal Removal

(Figures E-1 and F-2)

See **PUMP DISASSEMBLY** and disassemble the pump up to and including the **Backhead Kit (06)**. Remove the backhead from the housing (04). The lip seal will remain inside the backhead. Press or pry the lip seal out of the backhead (06A).

Continue as required with **PUMP DISASSEMBLY**.

## Seal Installation

(Figures E-1 and F-2)

See **PUMP REASSEMBLY**, and reassemble the pump up to the backhead kit (06).

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 flame, sparks, and excessive heat. Read and follow all precautions printed on solvent containers.**

Position the backhead on the bed of an arbor (or hydraulic) press with the drive end down. Lubricate the lip seal with grease and press it into the backhead bore with the lip positioned as shown in Figure F-2 until fully seated.

Proceed with **Pump Reassembly, Section E**.

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