

**INSTALLATION, OPERATION,  
AND MAINTENANCE MANUAL**  
WITH PARTS LIST



**10 SERIES PUMP**

MODEL
<b>13A9-B</b>

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

[www.grpumps.com](http://www.grpumps.com)

**GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA** Printed in U.S.A.

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**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: \_\_\_\_\_

# TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>PAGE I – 1</b>
<b>SAFETY  SECTION A</b> .....	<b>PAGE A – 1</b>
<b>INSTALLATION – SECTION B</b> .....	<b>PAGE B – 1</b>
Pump Dimensions .....	PAGE B – 1
PREINSTALLATION INSPECTION .....	PAGE B – 1
POSITIONING PUMP .....	PAGE B – 2
Lifting .....	PAGE B – 2
Mounting .....	PAGE B – 2
Clearance .....	PAGE B – 2
SUCTION AND DISCHARGE PIPING .....	PAGE B – 2
Materials .....	PAGE B – 2
Line Configuration .....	PAGE B – 2
Connections to Pump .....	PAGE B – 2
Gauges .....	PAGE B – 3
SUCTION LINES .....	PAGE B – 3
Fittings .....	PAGE B – 3
Strainers .....	PAGE B – 3
Sealing .....	PAGE B – 3
Suction Lines In Sumps .....	PAGE B – 3
Suction Line Positioning .....	PAGE B – 3
DISCHARGE LINES .....	PAGE B – 4
Siphoning .....	PAGE B – 4
Valves .....	PAGE B – 4
Bypass Lines .....	PAGE B – 4
AUTOMATIC AIR RELEASE VALVE .....	PAGE B – 5
Theory of Operation .....	PAGE B – 5
Air Release Valve Installation .....	PAGE B – 6
ALIGNMENT .....	PAGE B – 7
Coupled Drives .....	PAGE B – 8
V  Belt Drives .....	PAGE B – 8
<b>OPERATION – SECTION C</b> .....	<b>PAGE C – 1</b>
PRIMING .....	PAGE C – 1
STARTING .....	PAGE C – 1
Rotation .....	PAGE C – 1
OPERATION .....	PAGE C – 2
Lines With a Bypass .....	PAGE C – 2
Lines Without a Bypass .....	PAGE C – 2
Leakage .....	PAGE C – 2
Liquid Temperature And Overheating .....	PAGE C – 2
Strainer Check .....	PAGE C – 2
Pump Vacuum Check .....	PAGE C – 2
STOPPING .....	PAGE C – 3
Cold Weather Preservation .....	PAGE C – 3
BEARING TEMPERATURE CHECK .....	PAGE C – 3
<b>TROUBLESHOOTING – SECTION D</b> .....	<b>PAGE D – 1</b>

**TABLE OF CONTENTS**  
**(continued)**

<b>PUMP MAINTENANCE AND REPAIR</b>  <b>SECTION E</b> .....	<b>PAGE E – 1</b>
STANDARD PERFORMANCE CURVE .....	PAGE E – 1
PARTS LIST:	
Pump Model .....	PAGE E – 3
PUMP AND SEAL DISASSEMBLY AND REASSEMBLY .....	PAGE E – 4
Suction Check Valve Removal and Disassembly .....	PAGE E – 4
Back Cover Removal .....	PAGE E – 4
Pump Casing Removal .....	PAGE E – 4
Impeller Removal .....	PAGE E – 4
Seal Removal and Disassembly .....	PAGE E – 5
Shaft and Bearing Removal and Disassembly .....	PAGE E – 5
Shaft and Bearing Reassembly and Installation .....	PAGE E – 6
Seal Reassembly and Installation .....	PAGE E – 7
Impeller Installation And Adjustment .....	PAGE E – 8
Pump Casing Installation .....	PAGE E – 9
Back Cover Installation .....	PAGE E – 9
Suction Check Valve Installation .....	PAGE E – 9
Final Pump Assembly .....	PAGE E – 10
LUBRICATION .....	PAGE E – 10
Seal Assembly .....	PAGE E – 10
Bearings .....	PAGE E – 10
Power Source .....	PAGE E – 10

## INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp pump. **Read this manual** carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump.

This pump is a 10 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is designed for handling corrosive liquids containing specified entrained solids, residues and slurries. The basic material of construction for wetted parts is type 316 stainless steel.

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.

For information or technical assistance on the power source, contact the power source manufacturer's local dealer or representative.

If there are any questions regarding the pump or its application 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**  
**Phone: (419) 755-1011**  
 or:  
**Gorman-Rupp of Canada Limited**  
**70 Burwell Road**  
**St. Thomas, Ontario N5P 3R7**  
**Phone: (519) 631-2870**

The following are used to alert maintenance 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.*

## SAFETY - SECTION A

This information applies to 10 Series basic pumps. Gorman-Rupp has no control over or particular knowledge of the power source which will be used. Refer to the manual accompanying the power source before attempting to begin operation.

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



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. 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 before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is designed to handle corrosive liquids containing specified entrained solids, residues and slurries. Do not attempt to pump volatile or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.



Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Suction and discharge hoses and piping must be removed from the pump before lifting. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.



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



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.

**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!**

Overheating may produce dangerous fumes. Use extreme caution when venting the pump, or when removing covers, plates, plugs, or fittings.

**WARNING!**

Overheated pumps can cause severe burns and injuries. 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 before opening any covers, plates, gauges, or plugs.
5. Vent the pump slowly and cautiously.
6. Refer to instructions in this manual before restarting the pump.

**WARNING!**

This pump is designed to pump materials which could 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 disassembling the pump or piping.

**WARNING!**

Do not operate the pump without shields and/or guards in place over the drive shafts, belts, and/or couplings, or other rotating parts. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.

**WARNING!**

Never run this pump backwards. Be certain that rotation is correct before fully engaging the pump.

**CAUTION**

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

## INSTALLATION – SECTION B

### Review all SAFETY information in Section A.

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

Most of the information pertains to a standard **static lift** application where the pump is positioned above the free level of liquid to be pumped.

If installed in a **flooded suction application** where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the

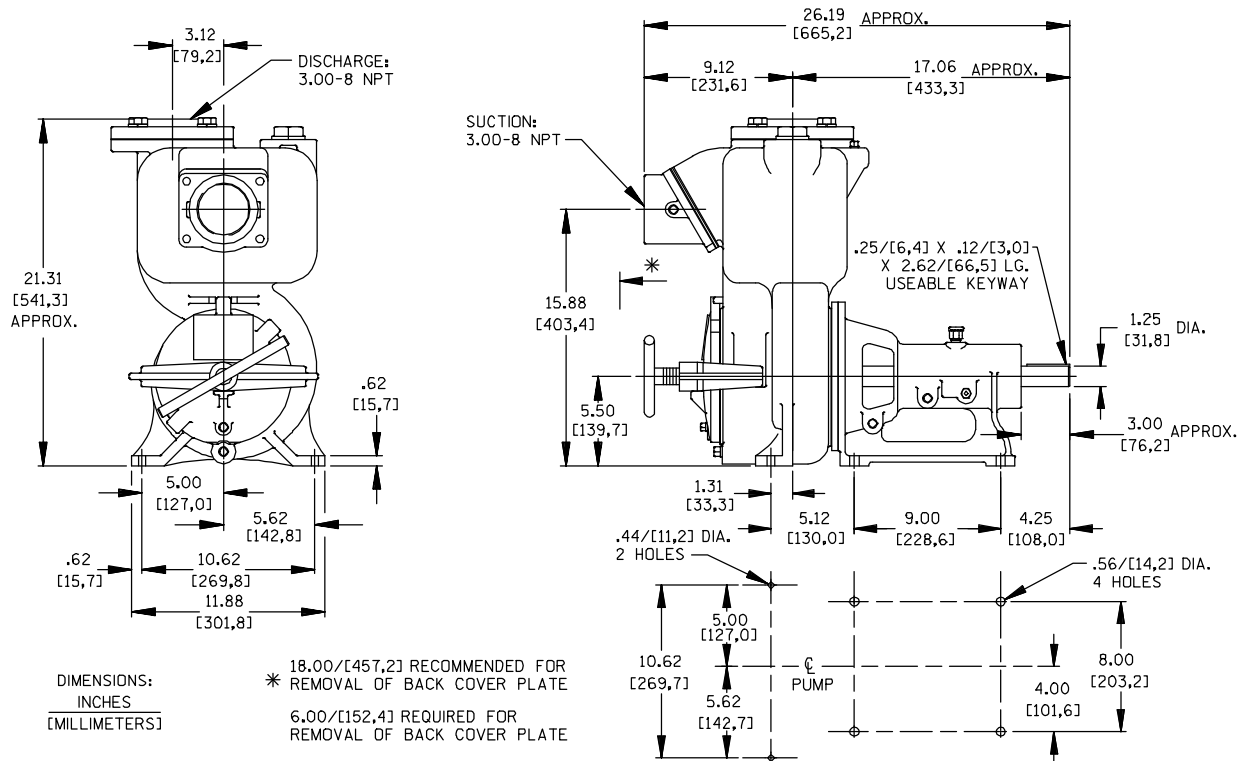
specific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to 50% of the maximum permissible operating pressure as shown on the pump performance curve (see Section E, Page 1).

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

### Pump Dimensions

See Figure B-1 for the approximate physical dimensions of this pump.

### OUTLINE DRAWING



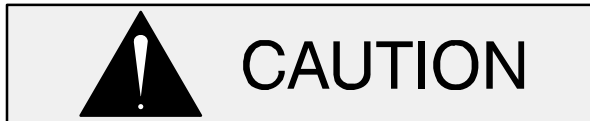
**Figure B-1. Pump Model 13A9-B**



## PREINSTALLATION INSPECTION

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

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



Only operate this pump in the direction indicated by the arrow on the pump body and on the accompanying decal. Otherwise, the impeller could become loosened from the shaft and seriously damage the pump.

- d. Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- e. If the pump has been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

## POSITIONING PUMP

### Lifting



**Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Suction and discharge hoses and piping must be removed from the pump before lifting. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.**

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.

### Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation.

The pump may have to be supported or shimmed to provide for level operation or to eliminate vibration.

### Clearance

It is recommended that **18 inches (457 mm)** of clearance be provided in front of the back cover to permit removal of the cover and easy access to the pump interior. A **minimum** clearance of **6 inches (152,4 mm)** must be maintained to permit removal of the cover.

## SUCTION AND DISCHARGE PIPING

Pump performance is adversely effected by increased suction lift, discharge elevation, and friction losses. See the performance curve on Page E-1 to be sure your overall application allows pump to operate within the safe operation range.

### Materials

Either pipe or hose maybe used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

### Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

### Connections to Pump

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

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

### Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches (457,2 mm) from the suction and discharge ports and install the lines.

Installation closer to the pump may result in erratic readings.

## SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

### Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

### Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 1-1/2 inch (38,1 mm) diameter spherical solids.

### Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an air-tight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

**Suction Lines In Sumps**

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to 1-1/2 times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance 1-1/2 times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency

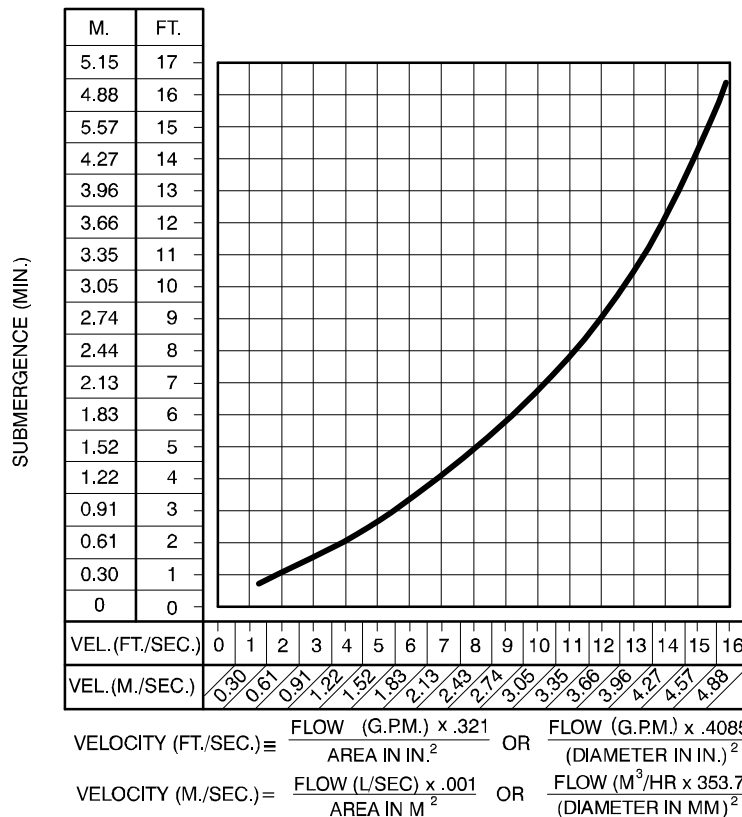
of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least 3 times the diameter of the suction pipe.

**Suction Line Positioning**

The depth of submergence of the suction line is critical to efficient pump operation. Figure B-2 shows recommended minimum submergence vs. velocity.

**NOTE**

*The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).*



**Figure B-2. Recommended Minimum Suction Line Submergence vs. Velocity**

## DISCHARGE LINES

### Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

### Valves

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

A check valve in the discharge line is normally recommended, but it is not necessary in low discharge head applications.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

### Bypass Lines

Self-priming pumps are not air compressors. During the priming cycle, air from the suction line must be vented to atmosphere on the discharge side. If the discharge line is open, this air will be vented through the discharge. However, if a check valve has been installed in the discharge line, the discharge side of the pump must be opened to atmospheric pressure through a bypass line installed between the pump discharge and the check valve. A self-priming centrifugal pump **will not prime** if there is sufficient static liquid head to hold the discharge check valve closed.

## NOTE

*The bypass line should be sized so that it does not affect pump discharge capacity; however, the bypass line should be at least 1 inch (25,4 mm) in diameter to minimize the chance of plugging.*

In **low discharge head applications** (less than 30 feet (9,1 m)), it is recommended that the bypass line be run back to the wet well, and located 6 inches below the water level or cut-off point of the low level pump. In some installations, this bypass outline may be terminated with a six-to-eight foot (1,8 to 2,4 m) length of 1-1/4 inch (31,8 mm) I.D. **smooth-bore** hose; air and liquid vented during the priming process will then agitate the hose and break up any solids, grease, or other substances likely to cause clogging.



A bypass line that is returned to a wet well must be secured against being drawn into the pump suction inlet.

It is also recommended that pipe unions be installed at each 90° elbow in a bypass line to ease disassembly and maintenance.

In **high discharge head applications** (more than 30 feet (9,1 m)), an excessive amount of liquid may be bypassed and forced back to the wet well under the full working pressure of the pump; this will reduce overall pumping efficiency. **Therefore, it is recommended that a Gorman-Rupp Automatic Air Release Valve be installed in the bypass line.**

Gorman-Rupp Automatic Air Release Valves are reliable, and require minimum maintenance. See **Automatic Air Release Valves** in this section for installation and theory of operation of the Automatic Air Release Valve. Consult your Gorman-Rupp distributor, or contact the Gorman-Rupp Company for selection of an Automatic Air Release Valve to fit your application.



Except in certain specific applications (to prevent flooding during service of an auto-

matic air release valve in a below-ground lift station), if a manual shut-off valve is installed **anywhere** in a bypass line, it **must** be a full-opening, **ball-type** valve to prevent plugging by solids.



**A manual shut-off valve should not be installed in any bypass line. A manual shut-off valve may inadvertently be left closed during operation. A pump which has lost prime may continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. Personnel could be severely injured.**

**Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely cools, drain the liquid from the pump by removing the casing drain plug. Use caution when re-**

**moving the plug to prevent injury to personnel from hot liquid.**

## **AUTOMATIC AIR RELEASE VALVE**

When properly installed, a Gorman-Rupp Automatic Air Release Valve will permit air to escape through the bypass line and then close automatically when the pump is fully primed and pumping at full capacity.

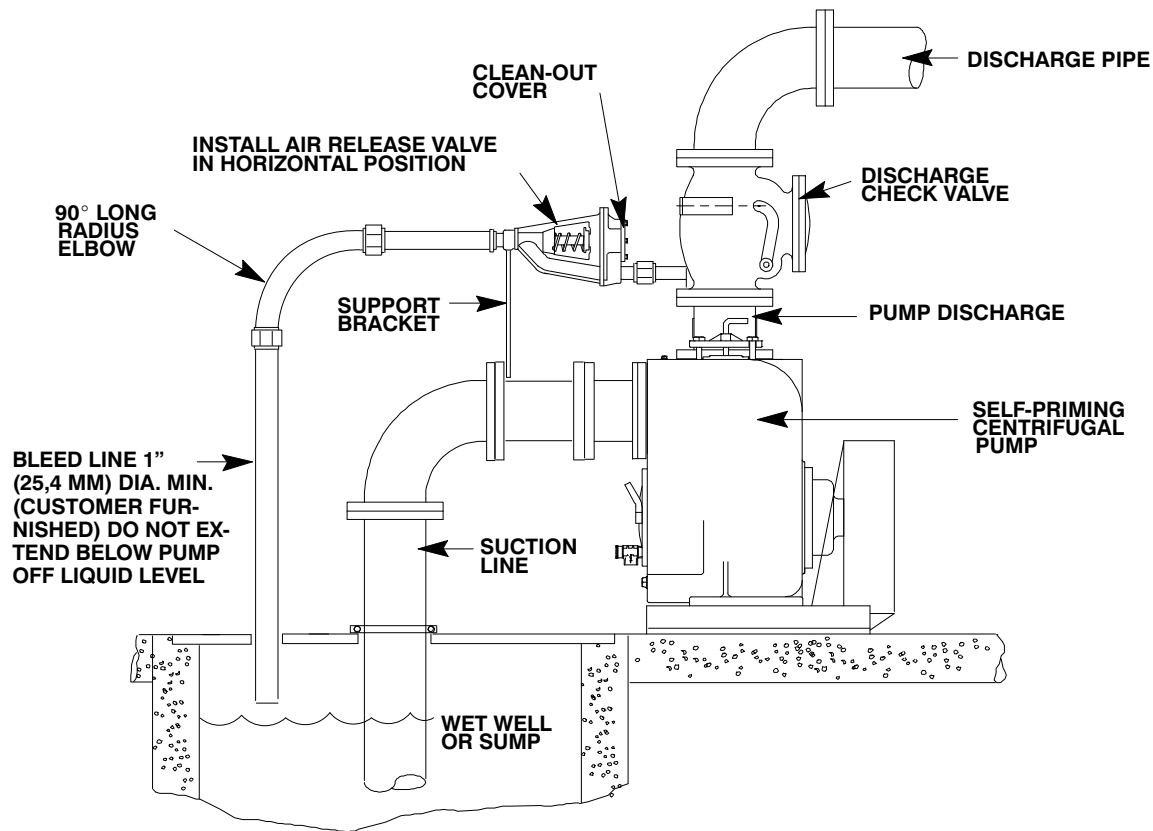


**Some leakage (1 to 5 gallons [3.8 to 19 liters] per minute) will occur when the valve is fully closed. Be sure the bypass line is directed back to the wet well or tank to prevent hazardous spills.**

Consult the manual accompanying the Air Release Valve for additional information on valve installation and performance.

### **Air Release Valve Installation**

The Automatic Air Release Valve must be independently mounted in a horizontal position between the pump discharge port and the inlet side of the discharge check valve (see Figure 3). The inlet opening in the Air Release Valve is equipped with standard 1-inch NPT pipe threads.



**Figure 3. Typical Automatic Air Release Valve Installation**

Connect the valve outlet to a bleed line which slopes back to the wet well or sump. The bleed line must be the same size as the outlet opening or larger, depending on which Air Release Valve is being used. If **pipng** is used for the bleed line, avoid the use of elbows whenever possible.

#### NOTE

*For multiple pump installations, it is recommended that each Air Release Valve be fitted with an independent bleeder line directed back to the wet well. If multiple Air Release Valves are installed in a system, **do not** direct bleeder lines to a common manifold pipe. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about installation of an Automatic Air Release Valve for your specific application.*

#### ALIGNMENT

The alignment of the pump and its power source is

critical for trouble-free mechanical operation. In either a flexible coupling or V-belt driven system, the driver and pump must be mounted so that their shafts are aligned with and parallel to each other. It is imperative that alignment be checked after the pump and piping are installed, and before operation.

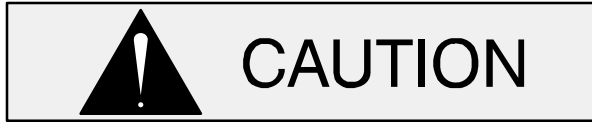
#### NOTE

*Check **Rotation**, Section C, before final alignment of the pump.*

When mounted at the Gorman-Rupp factory, driver and pump are aligned before shipment. Misalignment will occur in transit and handling. Pumps **must** be checked and realigned before operation. Before checking alignment, tighten the foundation bolts. The pump casing feet and/or pedestal feet, and the driver mounting bolts should also be tightly secured.



**When checking alignment, disconnect the power source to ensure that the pump will remain inoperative.**

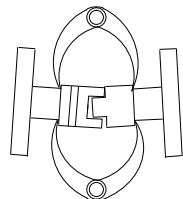


Adjusting the alignment in one direction may alter the alignment in another direction. Check each procedure after altering alignment.

**Coupled Drives**

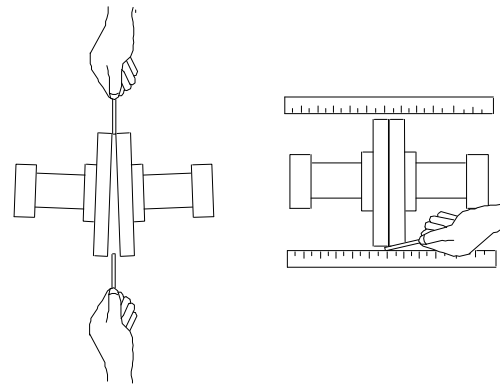
When using couplings, the axis of the power source must be aligned to the axis of the pump shaft in both the horizontal and vertical planes. Most couplings require a specific gap or clearance between the driving and the driven shafts. Refer to the coupling manufacturer's service literature.

Align spider insert type couplings by using calipers to measure the dimensions on the circumference of the outer ends of the coupling hub every 90°. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 4A).



**Figure 4A. Alignment of V-Belt Driven Pumps**

Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 4B).

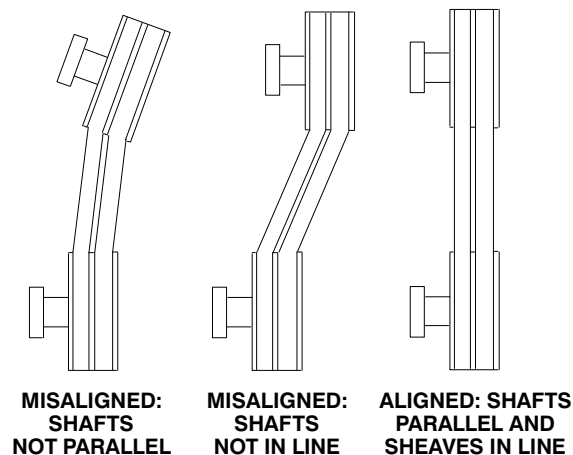


**Figure 4B. Alignment of V-Belt Driven Pumps**

Check parallel adjustment by laying a straightedge across both coupling rims at the top, bottom, and side. When the straightedge rests evenly on both halves of the coupling, the coupling is in horizontal parallel alignment. If the coupling is misaligned, use a feeler gauge between the coupling and the straightedge to measure the amount of misalignment.

**V-Belt Drives**

When using V-belt drives, the power source and the pump must be parallel. Use a straightedge along the sides of the pulleys to ensure that the pulleys are properly aligned (see Figure 4C). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.



**Figure 4C. Alignment of V-Belt Driven Pumps**

Tighten the belts in accordance with the belt manufacturer's instructions. If the belts are too loose, they will slip; if the belts are too tight, there will be

excessive power loss and possible bearing failure. Select pulleys that will match the proper speed ratio; overspeeding the pump may damage both pump and power source.



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

## V-BELT TENSIONING

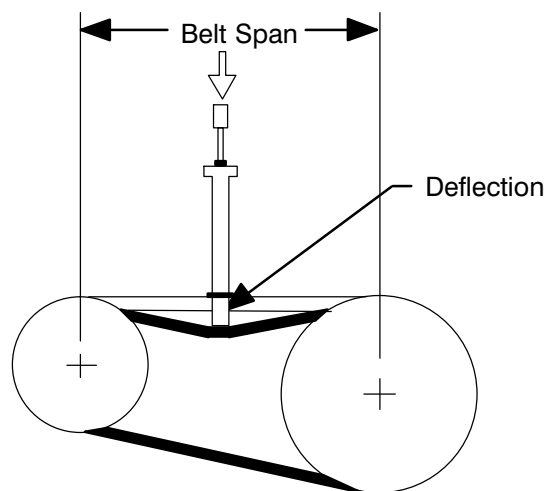
### General Rules of Tensioning

For new V-belts, check the tension after 5, 20 and 50 hours of operation and re-tension as required (see the following procedure for measuring belt tension). Thereafter, check and re-tension if required monthly or at 500 hour intervals, whichever comes first.

Ideal V-belt tension is the **lowest** tension at which the belt will not slip under peak load conditions. Do not over-tension V-belts. Over-tensioning will shorten both V-belt and bearing life. Under-tensioning will cause belt slippage. Always keep belts free from dirt, grease, oil and other foreign material which may cause slippage.

### Tension Measurement

Correct v-belt tension can be achieved using a V-belt tension tester and Table 1 or 2. Use the tables to find the V-belt size (cross-section), the smallest sheave diameter, the belt type for your application. The corresponding deflection force required for new or used belts is shown opposite the RPM range of the pump.



**Figure 5. Belt Tension Measurement**

The ratio of deflection to belt span is 1:64 for both ASA and metric units. Therefore, a belt with a span of 64 inches would require a deflection of 1 inch at the force shown on the Tables for your particular application.

For example, if the span as measured in Figure 5 is 32 inches (813 mm), the V-belt cross-section is C, the smallest sheave diameter is 8 inches, the pump speed is 1250 RPM, and the belts are uncogged Yy-T type, then 11.5 lbs. of force on the tensioner should show 1/2-inch (12,7 mm) of deflection.

A tension tester is available as an option from Gorman-Rupp (P/N 29513—001). Other tension testers are available from your local belt/sheave distributor, and work on a similar principal.

To use the Gorman-Rupp tensioner, measure the belt span as shown in Figure 5. Position the bottom of the large O-ring on the span scale of the tensioner at the measured belt span. Set the small O-ring on the deflection force scale to zero.

Place the tension tester squarely on the belt at the center of the belt span. Apply force on the plunger, perpendicular to the belt span, until the bottom of the large O-ring is even with the top of the next belt, or with the bottom of a straight edge laid across the sheaves.

Read the force applied from the bottom of the small O-ring on the deflection force scale. Compare this force with the value shown in Table 1 or 2 and adjust the tension accordingly. Note that the **tension for new belts is higher than that for used belts** to allow for expected belt stretching. **Do not** over-tension used belts to the higher deflection forces shown for new belts.



**Table 1. Sheave Diameter (Inches)  
Deflection Force (Lbs.)**

Cross Section	Smallest Sheave Diameter Range	R.P.M. Range	Belt Deflection Force			
			Uncogged Hy-T Belts & Uncogged Hy-T Torque Team		Cogged Torque-Flex & Machined Edge torque Team Belts	
			Used Belt	New Belt	Used Belt	New Belt
A,AX	3.0 - 3.6	1000-2500 2501-4000	3.7 2.8	5.5 4.2	4.1 3.4	6.1 5.0
	3.8 - 4.8	1000-2500 2501-4000	4.5 3.8	6.8 5.7	5.0 4.3	7.4 6.4
	5.0 - 7.0	1000-2500 2501-4000	5.4 4.7	8.0 7.0	5.7 5.1	9.4 7.4
B,BX	3.4 - 4.2	860-2500 2501-4000			4.9 4.2	7.2 6.2
	4.4 - 5.6	860-2500 2501-4000	5.3 4.5	7.9 6.7	7.1 7.1	10.5 9.1
	5.8 - 8.6	860-2500 2501-4000	6.3 6.0	9.4 8.9	8.5 7.3	12.6 10.9
C,CX	7.0 - 9.0	500-1740 1741-3000	11.5 9.4	17.0 13.8	14.7 11.9	21.8 17.5
	9.5 - 16.0	500-1740 1741-3000	14.1 12.5	21.0 18.5	15.9 14.6	23.5 21.6
D	12.0 - 16.0	200-850 851-1500	11.5 9.4	17.0 13.8	14.7 11.9	21.8 17.5
	18.0 - 20.0	200-850 851-1500	30.4 25.6	45.2 38.0		
3V, 3VX	2.2 - 2.4	1000-2500 2501-4000			3.3 2.9	4.9 4.3
	2.65 - 3.65	1000-2500 2501-4000	3.6 3.0	5.1 4.4	4.2 3.8	6.2 5.6
	4.12 - 6.90	1000-2500 2501-4000	4.9 4.4	7.3 6.6	5.3 4.9	7.9 7.3
5V, 5VX	4.4 - 6.7	500-1749 1750-3000 3001-4000			10.2 8.8 5.6	15.2 13.2 8.5
	7.1 - 10.9	500-1740 1741-3000	12.7 11.2	18.9 16.7	14.8 13.7	22.1 20.1
	11.8 - 16.0	500-1740 1741-3000	15.5 14.6	23.4 21.8	17.1 16.8	25.5 25.0
8V	12.5 - 17.0	200-850 851-1500	33.0 26.8	49.3 39.9		
	18.0 - 22.4	200-850 851-1500	39.6 35.3	59.2 52.7		

**Table 2. Sheave Diameter (Millimeters)  
Deflection Force (KG.)**

Cross Section	Smallest Sheave Diameter Range	R.P.M. Range	Belt Deflection Force			
			Uncogged Hy-T Belts & Uncogged Hy-T Torque Team		Cogged Torque-Flex & Machined Edge torque Team Belts	
			Used Belt	New Belt	Used Belt	New Belt
A,AX	75 - 90	1000-2500 2501-4000	1.7 1.3	2.5 1.9	1.9 1.5	2.8 2.3
	91 - 120	1000-2500 2501-4000	2.0 1.7	3.1 2.6	2.3 2.0	3.4 2.9
	125 - 175	1000-2500 2501-4000	2.4 2.1	3.6 3.2	2.6 2.3	4.3 3.4
B,BX	85 - 105	860-2500 2501-4000			2.2 1.9	3.3 2.8
	106 - 140	860-2500 2501-4000	2.4 2.0	3.6 3.0	3.2 3.2	4.8 4.1
	141 - 220	860-2500 2501-4000	2.9 2.7	4.3 4.0	3.9 3.3	5.7 4.9
C,CX	175 - 230	500-1740 1741-3000	5.2 4.3	7.7 6.3	6.7 5.4	9.9 7.9
	231 - 400	500-1740 1741-3000	6.4 5.7	9.5 8.4	7.2 6.6	10.7 9.8
D	305 - 400	200-850 851-1500	11.3 9.6	16.8 14.2		
	401 - 510	200-850 851-1500	13.8 11.6	20.5 17.2		
3V, 3VX	55 - 60	1000-2500 2501-4000			1.5 1.3	2.2 2.0
	61 - 90	1000-2500 2501-4000	1.6 1.4	2.3 2.0	1.9 1.7	2.8 2.5
	91 - 175	1000-2500 2501-4000	2.2 2.0	3.3 3.0	2.4 2.2	3.6 3.3
5V, 5VX	110 - 170	500-1749 1750-3000 3001-4000			4.6 4.0 2.5	6.9 6.0 3.9
	171 - 1275	500-1740 1741-3000	5.8 5.1	8.6 7.6	6.7 6.2	10.0 9.1
	276 - 400	500-1740 1741-3000	7.0 6.6	10.6 9.9	7.8 7.6	11.6 11.3
8V	315 - 430	200-850 851-1500	15.0 12.2	22.4 18.1		
	431 - 570	200-850 851-1500	18.0 16.0	26.8 23.9		

## OPERATION – SECTION C

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

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



This pump is designed to handle **corrosive liquids containing specified entrained solids, residues and slurries. Do not attempt to pump volatile, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.**



Pump speed and operating condition points must be within the continuous performance range shown on the curve (see Section E, Page 1).

### PRIMING

Install the pump and piping as described in **INSTALLATION**. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).

This pump is self-priming, but the pump should never be operated unless there is liquid in the pump casing.



Never operate this pump unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime and reprime as necessary.



**After filling the pump casing, reinstall and tighten the fill plug. Do not attempt to operate the pump unless all connecting piping is securely installed. Otherwise, liquid in the pump forced out under pressure could cause injury to personnel.**

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump.

### STARTING

Consult the operations manual furnished with the power source.

#### Rotation

The correct direction of pump rotation is indicated by an arrow on the pump body or accompanying decals. If the pump is operated in the wrong direction, the impeller could become loosened from the shaft and seriously damage the pump.



The pump must operate in the direction indicated by the arrow on the pump, or accompanying decals. Reverse rotation could loosen the impeller and seriously damage the pump.

Consult the operating manual furnished with the pump power source before attempting to start the power source.

If an electric motor is used to drive the pump, remove V-belts, couplings, or otherwise disconnect the pump from the motor before checking motor rotation. Operate the motor independently while observing the direction of the motor shaft, or cooling fan.

If rotation is incorrect on a three-phase motor, have a qualified electrician interchange any two of the three phase wires to change direction. If rotation is incorrect on a single-phase motor, consult the literature supplied with the motor for specific instructions.

## OPERATION

### Lines With a Bypass

Close the discharge throttling valve (if so equipped) so that the pump will not have to prime against the weight of the liquid in the discharge line. Air from the suction line will be discharged through the bypass line back to the wet well during the priming cycle. When the pump is fully primed and liquid is flowing steadily from the bypass line, open the discharge throttling valve. Liquid will then continue to circulate through the bypass line while the pump is in operation.

### Lines Without a Bypass

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pressure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

### 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 pump efficiency.

### Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 160° F (71° C). Do not apply it at a higher operating temperature.

Overheating can occur if operated with the 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 it. Refill the pump casing with cool liquid.



**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.**

### Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

**Never** introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, **liquid pressure** must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve (see Section E, Page 1).

### Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads.

Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches (508,0 mm) or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

## STOPPING

Never halt the flow of liquid suddenly. If the liquid being pumped is stopped abruptly, damaging shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

After stopping the pump, disconnect the power source or lock it out to ensure that the pump will remain inoperative.

## BEARING TEMPERATURE CHECK

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160°F (71°C) are considered

normal for bearings, and they can operate safely to at least 180°F (82°C).

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION** in Section E). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

## Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts. If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining solids by flushing with a hose.

## 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. 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 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	<p>Not enough liquid in casing.</p> <p>Suction check valve contaminated or damaged.</p> <p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Leaking or worn seal or pump gasket.</p> <p>Suction lift or discharge head too high.</p> <p>Strainer clogged.</p>	<p>Add liquid to casing. See <b>PRIMING</b>.</p> <p>Clean or replace check valve.</p> <p>Correct leak.</p> <p>Replace suction hose.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p> <p>Check piping installation and install bypass line if needed. See <b>INSTALLATION</b>.</p> <p>Check strainer and clean if necessary.</p>
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	<p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Suction intake not submerged at proper level or sump too small.</p> <p>Impeller or other wearing parts worn or damaged.</p>	<p>Correct leak.</p> <p>Replace suction hose.</p> <p>Check installation and correct submergence as needed.</p> <p>Replace worn or damaged parts.</p> <p>Check that impeller is properly centered and rotates freely.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Leaking or worn seal or pump gasket.  Impeller clogged.  Pump speed too slow.  Pump running backwards.  Suction lift or discharge head too high.	Check pump vacuum. Replace leaking or worn seal or gasket.  Free impeller of debris.  Check driver output; check belts or couplings for slippage.  Check direction of rotation and correct by interchanging any two motor leads at control box. (See <b>Pump Rotation</b> , Section C).  Check piping installation and install bypass line if needed. See <b>INSTALLATION</b> .
PUMP REQUIRES TOO MUCH POWER	Pump speed too high.  Discharge head too low.  Liquid solution too thick.	Check driver output check that sheaves or couplings are correctly sized.  Adjust discharge valve.  Dilute if possible.
PUMP CLOGS FREQUENTLY	Discharge flow too slow.  Suction check valve or foot valve clogged or binding.	Open discharge valve fully to increase flow rate, and run power source at maximum governed speed.  Clean valve.
EXCESSIVE NOISE	Cavitation in pump.  Pumping entrained air.  Pump or drive not securely mounted.  Impeller clogged or damaged.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.  Locate and eliminate source of air bubble.  Secure mounting hardware.  Clean out debris; replace damaged parts.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.  Low or incorrect lubricant.  Suction and discharge lines not properly supported.  Drive misaligned.	Check bearing temperature regularly to monitor any increase.  Check for proper type and level of lubricant.  Check piping installation for proper support.  Align drive properly.

### PREVENTIVE MAINTENANCE

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

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so

equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

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

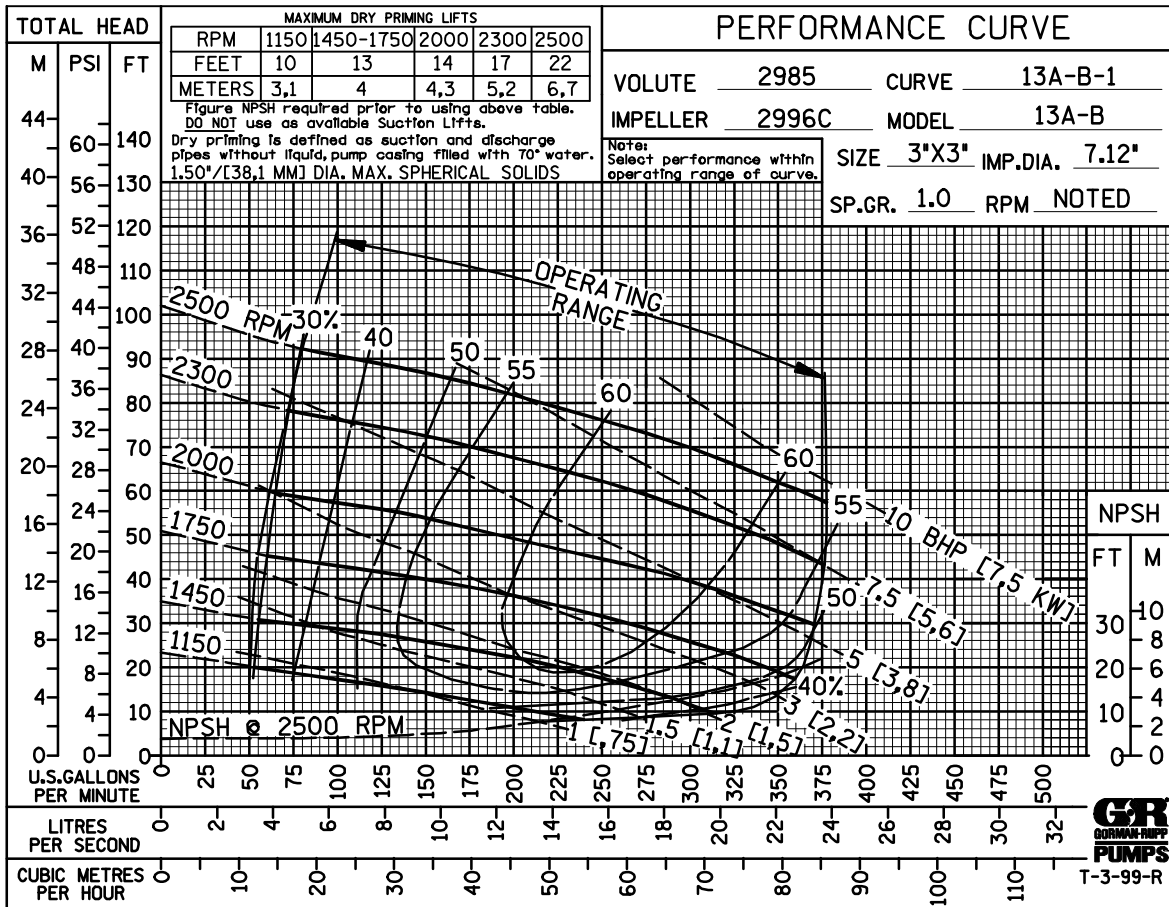
<b>Preventive Maintenance Schedule</b>					
<b>Item</b>	<b>Service Interval*</b>				
	<b>Daily</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Semi-Annually</b>	<b>Annually</b>
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed,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

**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 E

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



**\* STANDARD PERFORMANCE FOR PUMP MODEL 13A9-B**

\* Based on 70°F (21°C) clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

Contact the Gorman-Rupp Company to verify performance or part numbers.



Pump speed and operating condition points must be within the continuous performance range shown on the curve.

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model.



SECTION DRAWING

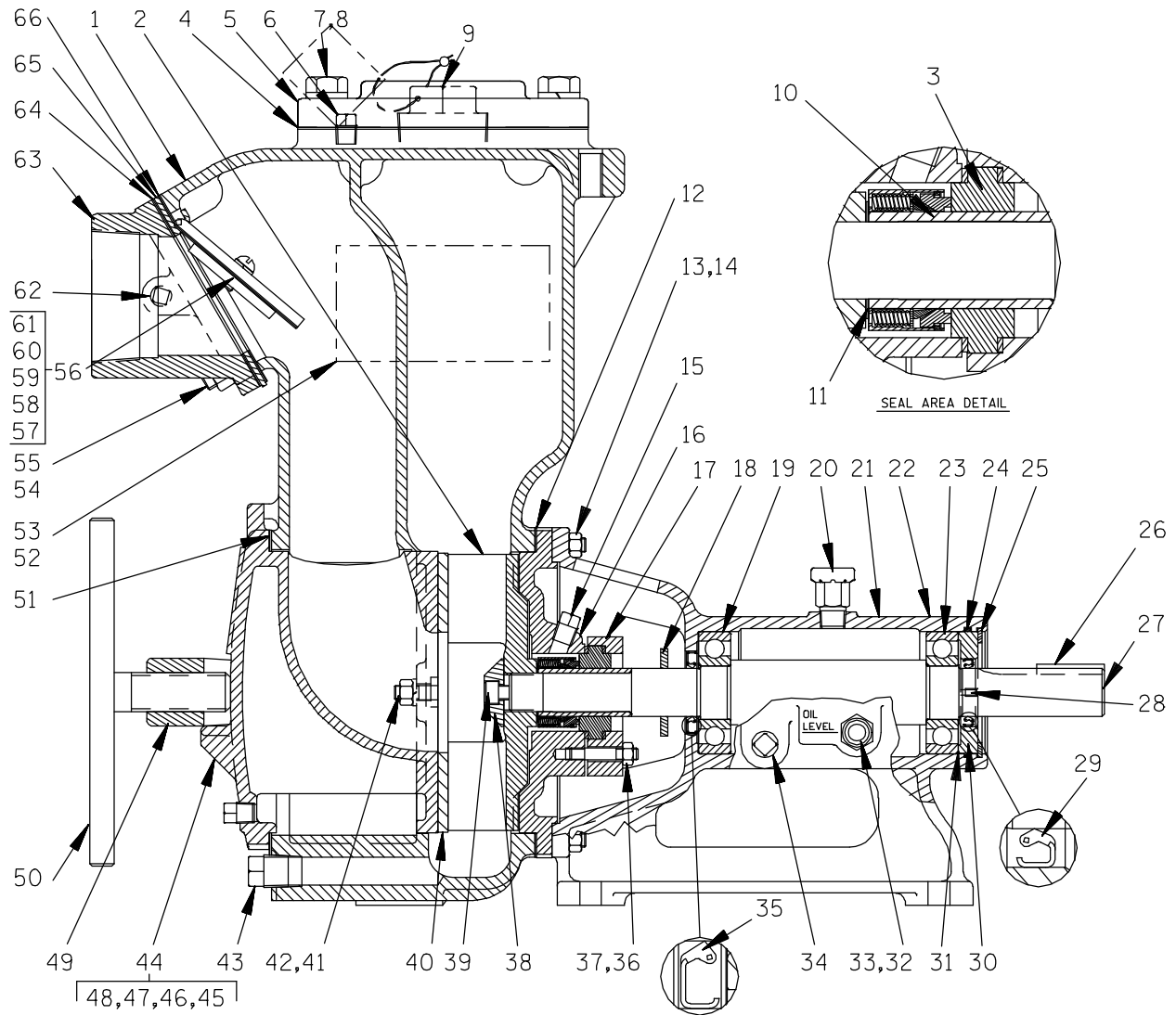


Figure 1. Pump Model 13A9-B

**PARTS LIST**  
**Pump Model 13A9-B**  
 (From S/N 733170 Up)

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify part numbers.

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	SEE NOTE BELOW			42	LOCKWASHER	J06	17090	2
2 *	IMPELLER	2996C	17070	1	43	CASING DRAIN PLUG	P08	17090	1
3 *	SEAL ASSEMBLY	25271-750	----	1	44	COVER PLATE ASSY	42111-922	----	1
4 *	DISCH FLANGE GSKT	1674GC	19410	1	45	-WARNING PLATE	2613EV	17090	1
5	DISCHARGE FLANGE	1753A	17070	1	46	-DRIVE SCREW	BM#04-03	17000	4
6	ACCESSORY PLUG	P04	17090	1	47	-COVER PLATE	NOT AVAILABLE		1
7	HEX HD CAPSCREW	B1007	17090	4	48	-DRAIN PLUG	P04	17090	1
8	LOCKWASHER	J10	17090	4	49	COVER CLAMP BAR	2987	11010	1
9	FILL PLUG ASSEMBLY	48271-098	----	1	50	COVER CLAMP SCREW	2536	24000	1
10 *	SHAFT SLEEVE	5129	1706H	1	51 *	COVER PLATE GSKT	2985GA	19410	1
11	IMPELLER SHIM SET	2X	17090	REF	52	NAME PLATE	38818-023	17010	1
12 *	CASING GSKT SET	3GD	19410	REF	53	DRIVE SCREW	BM#04-03	17000	4
13	STUD	C0607	17090	8	54	STUD	C0808	17090	4
14	HEX NUT	D06	17090	8	55	HEX NUT	D08	17090	4
15	ACCESSORY PLUG	P04	17090	1	56	CHECK VALVE ASSY	9845C	----	1
16	SEAL PLATE	11004	17070	1	57 *	-CHECK VALVE GSKT	9843G	19540	1
17	SEAL CLAMP	11005	17070	1	58	-VALVE WEIGHT	9843	17190	1
18	SLINGER RING	3272	19410	1	59	-VALVE WEIGHT	9844	17090	1
19 *	BALL BEARING	23275-008	----	1	60	-RD HD MACH SCREW	X0503	17090	1
20	PEDESTAL AIR VENT	S1703	----	1	61	-LOCKWASHER	J05	17090	1
21	PEDESTAL	3114B	10010	1	62	PIPE PLUG	P04	17090	1
22	ROTATION DECAL	2613M	----	1	63	SUCTION FLANGE	2943	17070	1
23 *	BALL BEARING	23275-008	----	1	64 *	CHECK VALVE GSKT	9842G	19410	1
24 *	BRG RETAINER O-RING	25152-235	----	1	65	CHECK VALVE SEAT	9842	17190	1
25	BRG RETAINING RING	S247	----	1	66 *	CHECK VALVE GSKT	9842G	19410	1
26 *	SHAFT KEY	N0407	15990	1	NOT SHOWN:				
27 *	IMPELLER SHAFT	38514-549	1706H	1		INSTRUCTION LABEL	2613DK	----	1
28	ALLEN HD SETSCREW	GA#10-01S	15990	2		LUBE DECAL	38818-079	----	1
29 *	OIL SEAL	25227-303	----	1		SUCTION STICKER	6588AG	----	1
30	BEARING RETAINER	38322-521	26000	1		PRIMING STICKER	6588AH	----	1
31 *	BEARING SHIM SET	48261-009	----	1		DISCHARGE STICKER	6588BJ	----	1
32	OIL LEVEL SIGHT GAUGE	26714-011	----	1		G-R DECAL	GR-03	----	1
33	PIPE PLUG	P06	17090	1	OPTIONAL:				
34	PEDESTAL DRAIN PLUG	P06	17090	1	CASING HEATER:				
35 *	OIL SEAL	25227-311	----	1		-120V	47811-044	----	1
36	STUD	C0507	17090	2		-240V	47811-045	----	1
37	HEX NUT	D05	17090	2	HI TEMP SHUT-DOWN KITS:				
38 *	IMPELLER WASHER	10474	17090	1		-145° F	48313-186	----	1
39 *	IMPELLER CAPSCREW	DM0603	17090	1		-130° F	48313-256	----	1
40 *	WEAR PLATE ASSY	2634C	17090	1		-120° F	48313-257	----	1
41	HEX NUT	D06	17090	2					

\* INDICATES PARTS RECOMMENDED FOR STOCK

☞ INCLUDED WITH 46471-509 ---- 1  
 REPAIR PUMP CASING ASSY

## 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 view (see Figure E–1) and the accompanying parts list.

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.

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

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



**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 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.**



**Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Suction and discharge hoses and piping must be removed from the pump before lifting. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.**

### Suction Check Valve Removal and Disassembly

Before attempting to service the pump, remove the pump casing drain plug (43) and drain the pump. Clean and reinstall the drain plug.

To service the suction check valve assembly (56), remove the suction piping. Remove the nuts (55) securing the suction flange (63), check valve gaskets (64 and 66), check valve seat (65) and check valve assembly (56) to the pump casing (1). Separate the check valve assembly from the check valve seat.

Inspect the check valve parts for wear or damage. If replacement is required, remove the hardware (60 and 61), and separate the check valve gasket (57) and weights (58 and 59).

If no further disassembly is required, see **Suction Check Valve Installation**.

### Back Cover Removal

The wear plate (40) is easily accessible and may be serviced by removing the back cover assembly (44). Loosen the clamp bar screw (50) and remove the clamp bar (49). Pull the back cover and wear plate from the pump casing. Remove the back cover gasket (51). Clean the mating surfaces of the back cover plate and pump casing.

Inspect the wear plate and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (41 and 42) securing it to the back cover.

If no further disassembly is required, see **Back Cover Installation**.

### Pump Casing Removal

To service the impeller or seal assembly, disconnect the discharge piping. Remove the hardware securing the pump to the base.

Remove the nuts (14), and separate the pump casing and gasket set (12) from the seal plate (16) and pedestal (21). Tie and tag any leveling shims used under the pump mounting feet to ease reassembly.

Clean the mating surfaces of the seal plate and pump casing. Tie and tag the gaskets, or measure and record their thickness for ease of reassembly.

### Impeller Removal

Disconnect the power source.

Immobilize the impeller by wedging a block wood between the vanes. If removed, install the shaft key (26). Install a lathe dog on the drive end of the shaft (27) with the “V” notch positioned over the shaft keyway.

With the impeller rotation still blocked, strike the lathe dog sharply in a counterclockwise direction (when facing the drive end of the shaft). The impeller may also be loosened by using 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) as shown in Figure 2.

**Use caution** not to damage the shaft or keyway. When the impeller breaks loose, remove the lathe dog and wood block and unscrew the impeller from the shaft.

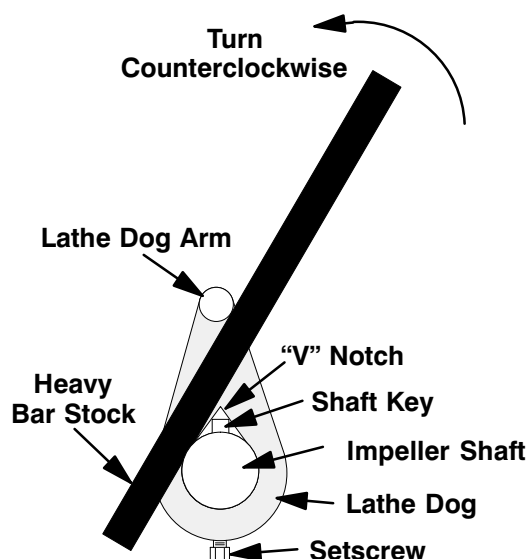


Figure 2. Loosening Impeller

Inspect the impeller and replace it if cracked or badly worn. Slide the impeller adjusting shims (11) off the impeller shaft. Tie and tag the shims or measure and record their thickness for ease of reassembly.

### Seal Removal and Disassembly

Slide the shaft sleeve (10) and rotating portion of the seal off the shaft as a single unit. Measure and record the distance from the impeller end of the sleeve to the end of the seal retainer, or use a felt-tip marker to scribe a line on the sleeve at this location. Loosen the setscrews securing the retainer to the sleeve and slide the rotating portion of the seal off the sleeve.

Slide the seal plate and stationary seal components off the shaft as a single unit. Place the seal plate on a flat surface with the impeller side down. Remove the nuts (37) and separate the seal clamp (17) and stationary portion of the seal from the seal plate.

If no further disassembly is required, see **Seal Reassembly and Installation**.

### Shaft and Bearing Removal and Disassembly

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



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

Remove the pedestal drain plug (34) and drain the bearing lubricant. Clean and reinstall the drain plug.

Remove the slinger ring (18). Remove the pedestal mounting hardware from the base. Tie and tag any shims used under the mounting feet for leveling.

Using snap ring pliers, remove the bearing retaining ring (25) from the pedestal bore. Remove the bearing shim set (31); tie and tag the shims or measure and record their thickness for ease of reassembly.

Remove the setscrews (28) from the bearing retainer (30) and install two machine screws (#10—32 X 1—inch long, not supplied). Pry the retainer from the pedestal bore using a pair of screwdrivers against the heads of the machine screws. **Do not** use the machine screws to jack against the ball bearing. Remove the machine screws and reinstall the setscrews.

Press the oil seal (29) from the bearing retainer, and remove the bearing retainer O-ring (24).

Place a block of wood against the impeller end of the shaft (30) and tap the shaft and assembled bearings (19 and 23) from the pedestal. **Be careful** not to damage the shaft.

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



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

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



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

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



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

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

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

If bearing replacement is required, use a bearing puller or an arbor (or hydraulic) press to remove the bearings from the shaft.

Press the inboard oil seal (35) from the pedestal bore.

#### **Shaft and Bearing Reassembly and Installation**

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



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

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.

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.



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

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

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

position the bearings on the shaft until fully seated against the shaft shoulders.



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.

Position the inboard oil seal (35) in the pedestal (22) with the lip positioned as shown in Figure E-1. Press the oil seal into the pedestal until the face is **just flush** with the machined surface in the housing.

Slide the shaft (27) and assembled bearings (19 and 23) into the pedestal until the inboard bearing seats against the pedestal bore. **Be careful** not to damage the oil seal lip.



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 soft grease on the O-ring and the O-ring groove. Replace the bearing retainer O-ring (24).

Press the outboard oil seal (29) into the bearing retainer (30) with the lip positioned as shown in Figure E-1. Press the bearing retainer into the pedestal until it seats against the bearing. **Be careful** not to damage the oil seal lip on the shaft keyway. Be sure the setscrews (28) are fully screwed into the bearing retainer, and that they are positioned horizontally inline.

Install the same thickness of bearing adjusting shim (31) as previously removed, and secure them with the bearing retaining ring (26). Check the shaft endplay.

#### NOTE

*Shaft endplay should be between .002 and .010 inch (0,05 to 0,25 mm). Add or remove bearing adjusting shims to achieve the correct endplay.*

Install the slinger ring (18) on the shaft.

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

### Seal Reassembly and Installation

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



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

Inspect the impeller shaft for damage. Small scratches or nicks may be removed with a fine file or emery cloth. If excessive wear exists, the shaft will have to be replaced.

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 (10), 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 shaft sleeve (10) 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 3).

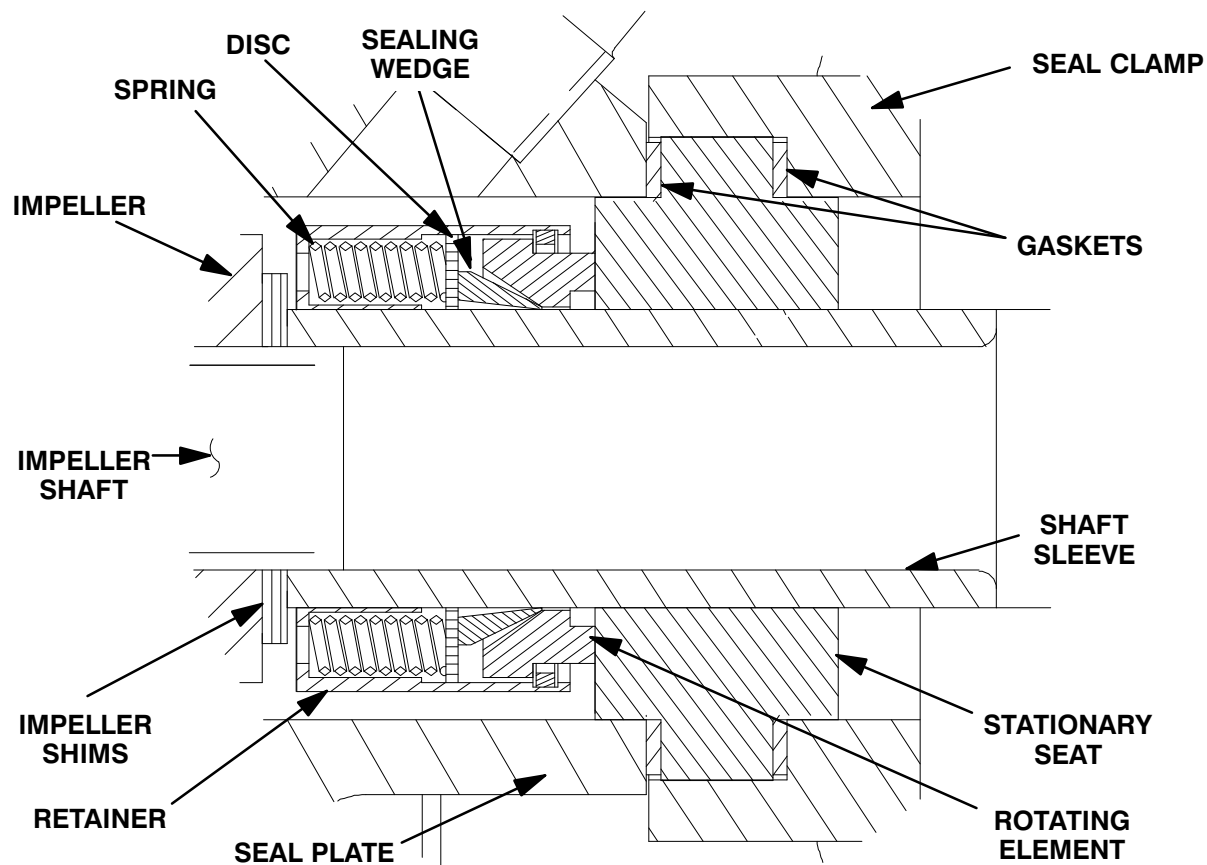
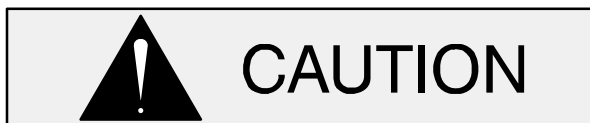


Figure 3. Seal Assembly



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

Position the seal plate (16) on a flat surface with the impeller side down. Assemble the stationary seat and gaskets in the seal clamp (17) with the white gasket toward the seal cavity side of the stationary seat. Secure the seal cap and stationary seal components to the seal plate with the nuts (37).

Slide the seal plate over the shaft until fully seated against the pedestal (21). **Be careful** not to damage the seal stationary seat on the shaft threads.

Align the pipe plug (15) with the pedestal opening and temporarily secure the seal plate to the pedestal using two capscrews and nuts (3/8-16 UNC X 1 1/2 inch long, not supplied).

Slide the rotating portion of the seal onto the lubricated shaft sleeve to the dimension (or scribed line) noted during disassembly. Secure the stationary portion of the seal to the sleeve by tightening the setscrews in the seal retainer.

Slide the sleeve and rotating portion of the seal onto the shaft until the seal elements contact.

#### Impeller Installation and Adjustment

Inspect the impeller, and replace it if cracked or badly worn. Install the same thickness of impeller shims (11) as previously removed, and screw the impeller onto the shaft until tight.

A clearance of .020 to .040 inch (0,51 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 shims until this clearance is reached.

#### NOTE

*Be sure the seal plate is tight against the pedestal while measuring this clearance.*



## Pump Casing Installation

Remove the hardware temporarily securing the seal plate to the pedestal. Install the same thickness of pump casing gaskets (12) as previously removed and secure the pump casing (1) to the seal plate (16) and pedestal (21) with the nuts (14). **Do not** fully tighten the nuts at this time.

### NOTE

*The back cover assembly must be in place to adjust the impeller face clearance.*

A clearance of .010 to .020 inch (0,25 to 0,50 mm) between the impeller and the wear plate (40) is also recommended for maximum pump efficiency. Set this clearance by adding or removing gaskets in the pump casing gasket set (12) until the impeller scrapes against the wear plate when the shaft is turned by hand. After the impeller scrapes, add approximately .010 inch (0,25 mm) of gaskets.

After the face clearance has been set, tighten the nuts (14) securing the pump casing to the pedestal.

## Back Cover Installation

If the wear plate (40) was removed for replacement, secure it to the cover plate (44) using the attaching hardware (41 and 42) at this time. The wear plate must be concentric to prevent binding when the back cover is installed.

Clean any scales or debris from the contacting surfaces on the pump casing that might prevent a good seal with the back cover. Replace the back cover gasket (51) and slide the back cover assembly into the pump casing. Be sure the wear plate does not bind against the impeller.

### NOTE

*To ease future disassembly, apply a film of grease or 'Never-Seez' on the back cover shoulder, or any surface that contacts the pump casing. This action will reduce rust and scale build-up.*

Secure the back cover assembly by installing the clamp bar (49) and tightening the clamp bar screw (50). **Do not** over-tighten the clamp bar screw; it

should be just tight enough to seal the back cover shoulder.

## Suction Check Valve Installation

Inspect the check valve components and replace as required. Subassemble the check valve weights (58 and 59) and check valve gasket (57) using the attaching hardware (60 and 61).

Position the check valve assembly (56) on the tabs on the check valve seat (65) with the large weight toward the inside of the pump casing. Install the inner check valve gasket (66) on the studs (54).

Position the check valve assembly and seat in the suction port. Install the outer check valve gasket (64) and suction flange (63). Secure the complete assembly with the nuts (55). Check the operation of the check valve to ensure proper seating and free movement.

## Final Pump Assembly

Secure the pump to the base with the previously removed hardware. Connect the power source. Be sure to reinstall any leveling shims used under the pump mounting feet.

**Be sure** the pump and power source are securely mounted to the base.

Install the suction and discharge lines and open all valves. Make certain that all piping connections are tight, properly supported and secure. Open all the valves in the suction and discharge lines.

**Be sure** the pump and power source have been properly lubricated, see **LUBRICATION**.

Remove the fill plug assembly (9) and fill the pump casing with clean liquid. Reinstall the fill plug and tighten it.

Refer to **OPERATION**, Section C, before putting the pump back into service.

## LUBRICATION

### Bearings

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (34) and maintain it at the middle of the gauge. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (20). **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

Under normal conditions, drain the pedestal once each year and refill with clean oil to the middle of the sight gauge. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the bearing lubri-

cant 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.

### Seal Assembly

The seal assembly is lubricated by the medium being pumped. No additional lubrication is required.

### Power Source

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

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