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INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

60 SERIES PUMP

MODEL

610M20B–B

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
www.gormanrupp.com
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA Printed in U.S.A.

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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 Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is a 60 Series, straight centrifugal model with an enclosed impeller. The pump is designed for pumping liquids that contain large entrained solids. The basic material of construction for wetted parts is gray iron, with a ductile iron impeller and wear rings. Be sure the liquid being pumped is compatible with these materials.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for every aspect of each specific application. Therefore, it is the responsibility of the owner/installer of the pump to ensure that applications not addressed in this manual are performed **only** after establishing that neither operator safety nor pump integrity are compromised by the installation. Pumps and related equipment **must** be installed and operated according to all national, local and industry standards.

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 write:

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

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

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:

DANGER!

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

WARNING!

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

CAUTION

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

NOTE

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

SAFETY – SECTION A

This information applies to 60 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 the power source or take other precautions to ensure that the pump will remain inoperative.**
3. **Allow the pump to completely cool if overheated.**
4. **Check the temperature before opening any covers, plates, or plugs.**
5. **Close the suction and discharge valves.**
6. **Vent the pump slowly and cautiously.**
7. **Drain the pump.**

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

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

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

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

Do not operate the pump against a closed discharge valve for long periods of time. This could bring the liquid to a boil, build pressure, and cause the pump casing to rupture or explode.

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.

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 1 for the approximate physical dimensions of this pump and engine.

OUTLINE DRAWING

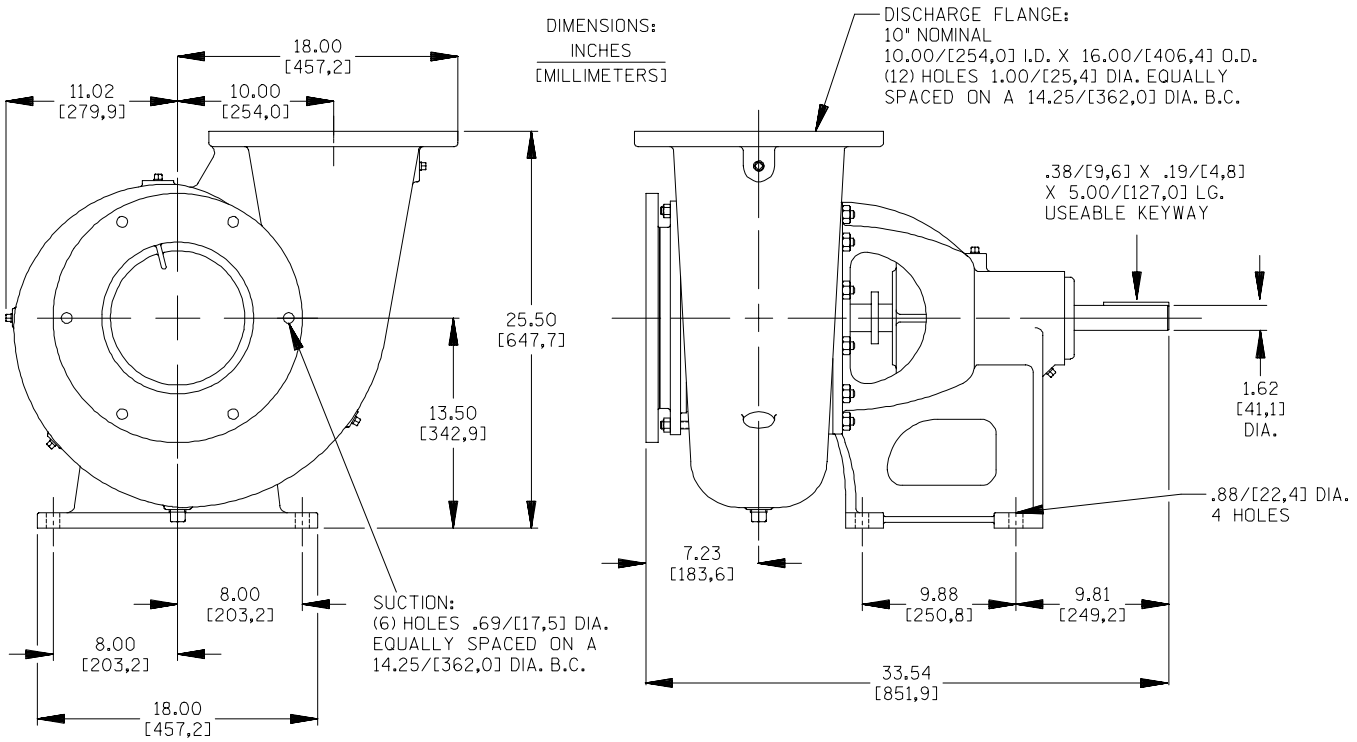


Figure 1. Pump Model 610M20B–B

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 and engine 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.

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

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.

CAUTION

The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

WARNING!

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

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.

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 mini-

mum 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 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 airtight 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 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).

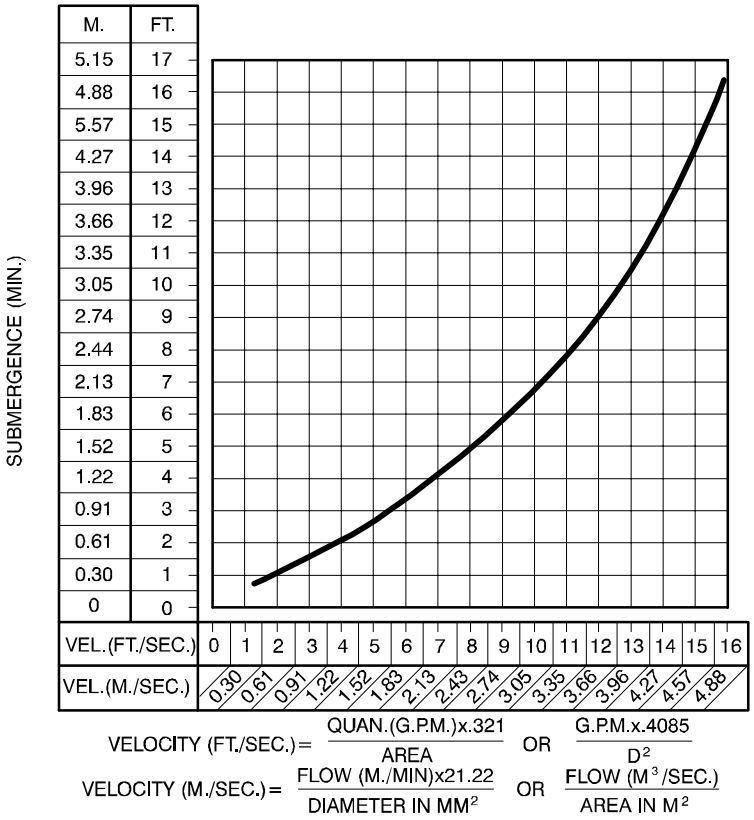


Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity

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.

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.

CAUTION

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

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.

WARNING!

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

CAUTION

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 degrees. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 3A).

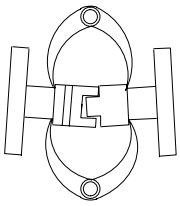


Figure 3A. Aligning Spider-Type Couplings

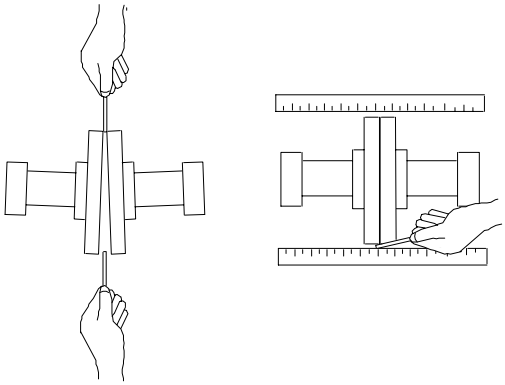


Figure 3B. Aligning Non-Spider Type Couplings

Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90 degrees. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 3B).

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 3C). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.

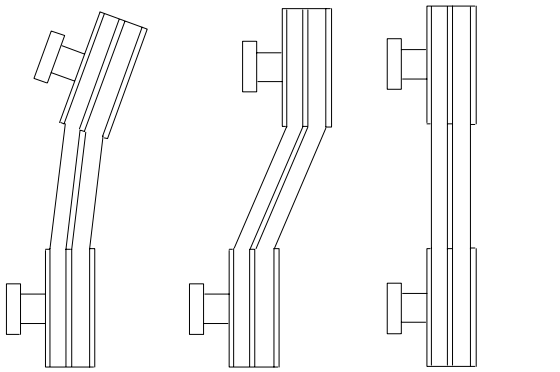


Figure 3C. Alignment of V-Belt Driven Pumps

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.

DANGER!

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.

OPERATION – SECTION C

Review all SAFETY information in Section A.

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

WARNING!

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

CAUTION

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 is not a self-priming pump, so an external priming device must be used if the pump is installed on a **suction lift**. A foot valve may be installed at the end of the suction pipe to maintain the prime; however, this may adversely affect pump performance due to friction loss. Many standard centrifugal models are equipped with a hand-operated vacuum pump, exhaust primer, or ejector for this purpose. If a priming device was not furnished with the pump, it may be ordered from the factory as an option.

Before attempting to operate the priming device, close the discharge throttling valve. (Installation of a spring-loaded check valve is also recommended to facilitate priming.) Once the pump is fully primed, close the valve between the priming device and pump to preserve the prime. Start the pump and open the discharge valve slowly to fill the discharge line.

CAUTION

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.

Hand Primers

Hand-operated primers are usually mounted on the pump and, when operated, draw air out of the suction line and pump casing. To prime a pump with a hand vacuum pump, open the cock on the pump priming line. Operate the hand pump until liquid flows out of the check valve on the bottom of the primer pump. Once the pump is primed, close the valve located between the primer and the pump so that the prime will not be lost.

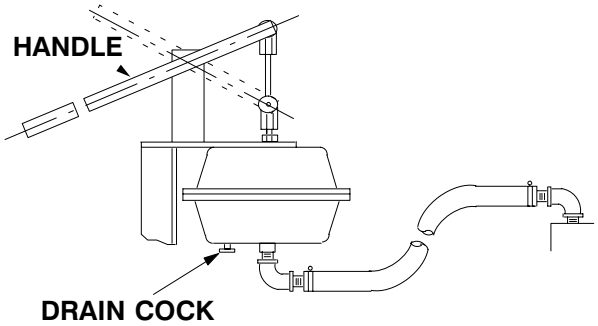


Figure 1. Hand Primer Assembly

STARTING

Consult the operations manual furnished with the power source.

OPERATION

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 cool before servicing it. Refill the pump casing with cool liquid.

DANGER!

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 cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury to personnel from hot liquid.

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

Since this pump does not have a suction check valve, the discharge line must be fitted with a check valve if a pump vacuum reading is to be taken.

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 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.

On engine driven pumps, reduce the throttle speed slowly and allow the engine to idle briefly before stopping.

CAUTION

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 to ensure that the pump will remain inoperative.

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.

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.

TROUBLESHOOTING — SECTION D

Review all SAFETY information in Section A.

WARNING!

Before attempting to open or service the pump:

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

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See **INSTALLATION**.
	Strainer clogged.	Check strainer and clean if necessary.
	Suction check valve or foot valve clogged or binding.	Clean valve.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Pump speed too high.	Check driver output.
	Impeller or other wearing parts worn or damaged.	Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.
	Strainer clogged.	Check strainer and clean if necessary.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Pump speed too slow.	Check driver output; consult the operation manual.
	Impeller clogged.	Free impeller of debris.
	Suction lift too high.	Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Discharge head too high.	Install bypass line.
	Suction intake not submerged at proper level or sump too small.	Check installation and correct submergence as needed.
PUMP REQUIRES TOO MUCH POWER	Pump speed too high.	Check driver output.
	Discharge head too low.	Adjust discharge valve.
	Liquid solution too thick.	Dilute if possible.
PUMP CLOGS FREQUENTLY	Discharge flow too slow.	Open discharge valve fully to increase flow rate, and run driver at maximum governed speed.
	Suction check valve or foot valve clogged or binding.	Clean valve.
EXCESSIVE NOISE	Cavitation in pump.	Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.
	Pumping entrained air.	Locate and eliminate source of air bubble.
	Pump or drive not securely mounted.	Secure mounting hardware.
	Impeller clogged or damaged.	Clean out debris; replace damaged parts.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.	Check bearing temperature regularly to monitor any increase.
	Low or incorrect lubricant.	Check for proper type and level of lubricant.
	Suction and discharge lines not properly supported.	Check piping installation for proper support.
	Drive misaligned.	Align drive properly.

PREVENTIVE MAINTENANCE

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

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

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

Preventive Maintenance Schedule

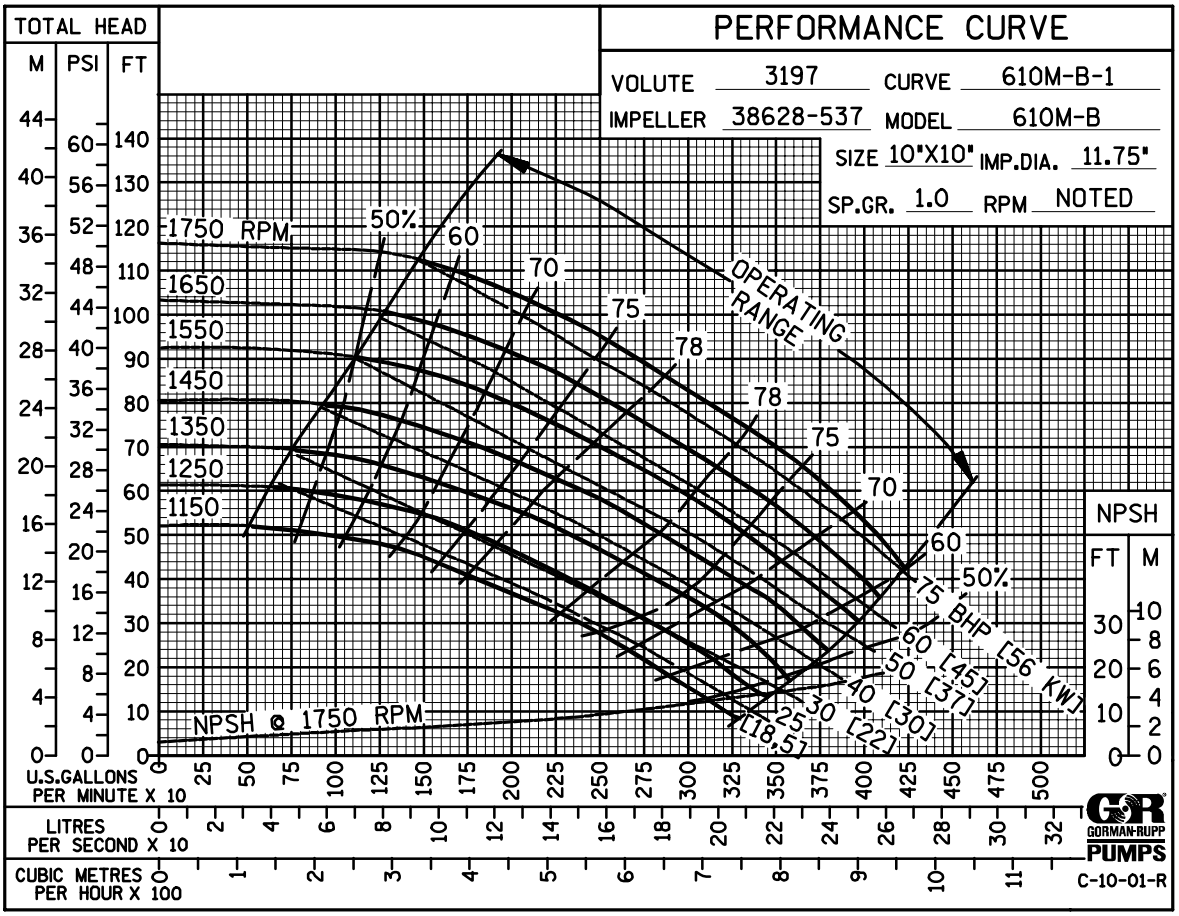
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)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

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

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

PUMP MAINTENANCE AND REPAIR - SECTION E

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



✳ STANDARD PERFORMANCES FOR PUMP MODEL 610M20B—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 difference due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

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 performance or part numbers.

CAUTION

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

SECTION DRAWING

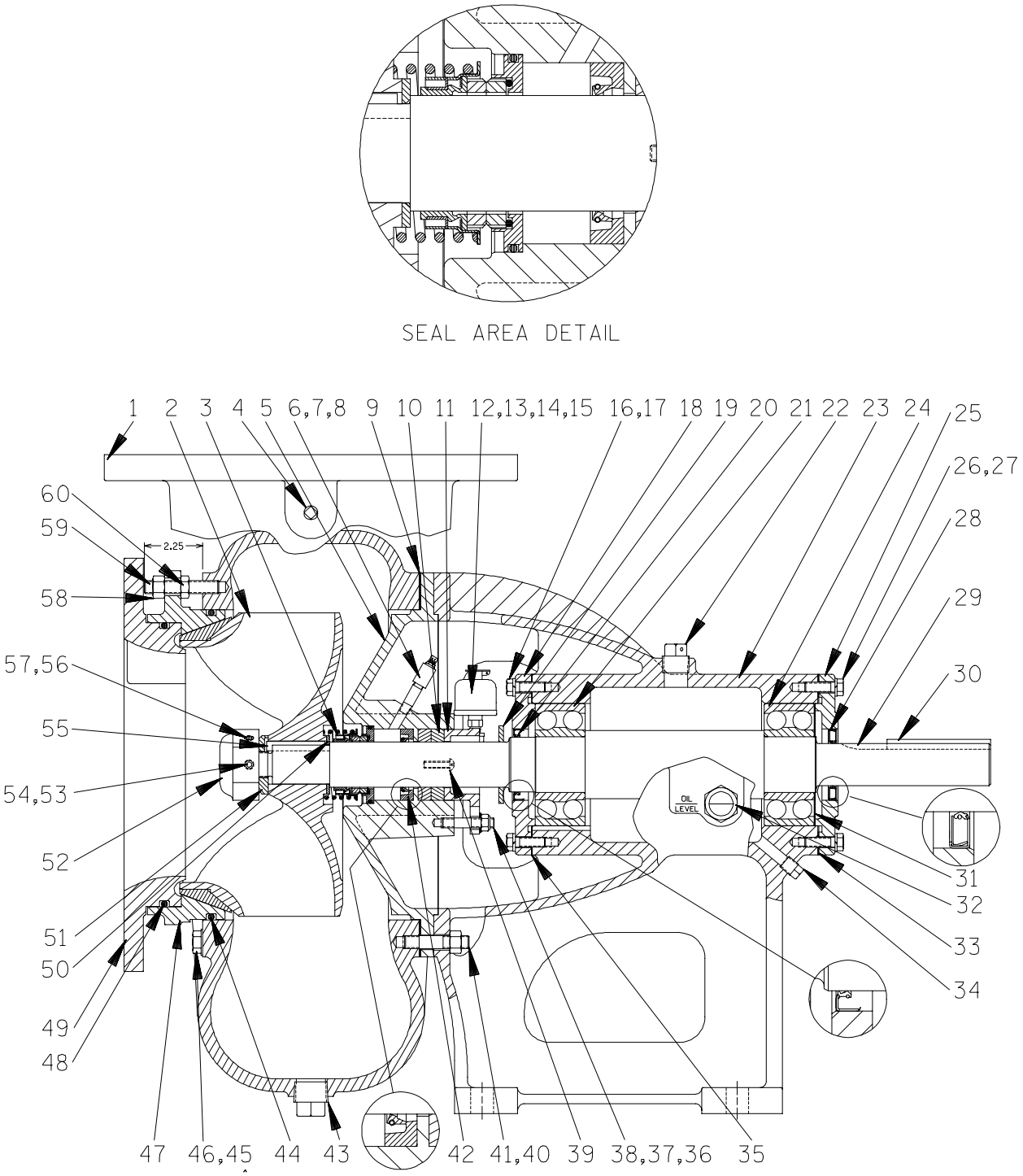


Figure 1. Pump Assembly 610M20B—B

PARTS LIST
Pump Assembly 610M20B−B
(From S/N 699260 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
1		PUMP CASING	3197	10010	1
2	✳	IMPELLER ASSEMBLY	46151−011	24110	1
		−WEAR RING	12741	11030	1
3	✳	SEAL ASSY	12461A	−−−	1
4		PIPE PLUG	P04	15079	1
5		SEAL PLATE	38276−003	10010	1
6		PIPE NIPPLE	T0206	15079	1
7		PIPE COUPLING	AE02	15079	1
8		VENTED PIPE PLUG	S2162	−−−	1
9	✳	PUMP CASING GSKT	3200G	18000	1
10		PACKING SET	PPO830	22110	1
11		SPLIT GLAND	3238A	10010	1
12		BOTTLE OILER	S1933	−−−	1
13		PIPE ELBOW	R02	11999	1
14		PIPE NIPPLE	T0206	15079	1
15		STREET ELBOW	AGS02	11999	1
16		HEX HD CAPSCREW	B0605	15991	6
17		LOCKWASHER	J06	15991	6
18		BEARING CAP	38322−420	10010	1
19		SLINGER RING	3209	19120	1
20	✳	OIL SEAL	25258−718	−−−	1
21	✳	INBOARD BALL BEARING	S1033	−−−	1
22		VENTED PIPE PLUG	38649−009	15079	1
23		PEDESTAL BODY	38257−521	10010	1
24	✳	OUTBRD BALL BEARING	S1033	−−−	1
25		BEARING CAP	38322−420	10010	1
26		HEX HD CAPSCREW	B0605	15991	6
27		LOCKWASHER	J06	15991	6
28	✳	OIL SEAL	S268	−−−	1
29	✳	IMPELLER SHAFT	38516−618	1706H	1
30	✳	SHAFT KEY	N0616	15990	1
31	✳	BEARING SHIM SET	48261−035	−−−	1
32		SIGHT GAGE	S1471	−−−	2
33	✳	BEARING CAP GSKT	38683−447	18000	1
34		PIPE PLUG	P04	15079	1
35	✳	BEARING CAP GSKT	38683−447	18000	1
36		STUD	C0608	15991	2
37		DEFORM LOCK NUT	DD06	15991	2
38		CLIP	3218	15991	2
39		RD HD MACHINE SCREW	X0404	15991	2
40		STUD	C0810	15991	12
41		HEX NUT	D08	15991	12
42	✳	OIL SEAL	25217−571	−−−	1
43		PIPE PLUG	P16	10009	5
44	✳	O-RING	S1865	−−−	1
45		FLAT WASHER	K08	18040	8
46		HEX HD CAPSCREW	B0803	15991	8
47	✳	IMPELLER WEAR RING	12743	11030	1
48	✳	O-RING	S1990	−−−	1
49		SUCTION HEAD	12744	11030	1
50		WASHER	7143A	15990	1
51	✳	IMPELLER WASHER	31171−010	15030	1
52	✳	IMPELLER NUT	4190A	10090	1
53		INSERT	31111−003	23050	1
54		ALLEN HEAD SETSCREW	GA0601−1/4	17090	2
55	✳	IMPELLER KEY	N0609−1/2	15990	1
56		INSERT	31111−003	23050	1
57		ALLEN HEAD SETSCREW	GA0601−1/4	17090	2
58		HEX NUT	D08	15991	4
59		STUD	12746	15010	4
60		JAM NUT	AT08	15991	4
NOT SHOWN:					
		DRIVE SCREW	BM#04−03	17000	4
		NAME PLATE	2613C	13990	1
		ROTATION DECAL	2613M	−−−	1
		LUBE DECAL	38816−079	−−−	1
		SUCTION STICKER	6588AG	−−−	1
		DISCHARGE STICKER	6588BJ	−−−	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

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.

WARNING!

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power source to ensure that the pump will remain inoperative.**
3. **Allow the pump to completely cool if overheated.**
4. **Check the temperature 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.**

Suction Plate And Wear Ring Removal

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

Disconnect the suction and discharge piping. Install an “S” hook in one of the mounting holes in the suction plate (49) and support the suction plate (49) using a suitable hoist and sling. Using a pair of pry bars, carefully pry the suction plate out of the bore of the wear ring (47). Inspect the suction plate O-ring ring (48) and replace it as required.

Disengage the hex nuts (58) securing the wear ring (47) to the pump casing (1).

NOTE

No provisions are made for supporting the wear ring during removal or installation. The studs (59) are of sufficeint length to allow the wear ring to be removed from the pump casing bore and still be supported on the studs. However, use caution when removing the wear ring as described in the following step in order to prevent the wear ring from being dropped or damaged.

Using a pair of pry bars, carefully pry the wear ring out of the pump casing bore. Inspect wear ring for excessive wear or scoring and replace it as required. Inspect the O-ring (44) and replace it as required.

If no further disassembly is required, see **Suction Plate and Wear Ring Installation**.

Pump Casing Removal

WARNING!

Use lifting and moving equipment in

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

If the impeller (2) is to be removed, the impeller nut (52) should be loosened before removing the pump casing. Immobilize the impeller by inserting a wood block through the pump discharge and into the impeller vanes. Remove the inserts (53) and loosen the setscrews (54). Remove the impeller nut and washer (51). Remove the wood block from the pump discharge.

Support the pump casing using a suitable hoist and sling. Remove the hardware (41) securing the pump casing to the pedestal (23).

Pull the pump casing straight away from the pedestal to prevent binding on the impeller. Remove the casing gasket (9) and clean the mating surfaces.

Impeller Removal

There are no provisions for draining all of the oil from the seal cavity. To limit the amount of spillage when removing the impeller and seal (3), first remove the bottle oiler (12) and piping (13, 14 and 15) from the seal plate (5). The remaining oil will escape when the seal is removed. Be sure to have shop rags or other absorbent materials available to clean up any spills.

The impeller is secured to the shaft by the shaft key (55) Use a gear puller to remove the impeller from the shaft. Retain the shaft key.

Inspect the impeller and its integral wear ring for excessive wear or scoring.

Proper impeller wear ring replacement requires dynamic balancing of the impeller assembly after the wear ring is welded to the impeller. Failure to properly install the wear ring and balance the impeller assembly can result in premature shaft, seal or bearing failure, or other damage to the pump.

To replace the wear ring, grind off the four weld spots securing the wear ring to the impeller. **Use caution** not to damage the impeller. Pry or carefully grind the wear ring off the impeller.

Seal Removal

This pump is designed with three seals; a primary mechanical seal (3) located directly behind the impeller, a secondary oil seal (42) in the middle of the seal plate (5), and packing (10) at the back of the seal plate. If the liquid being pumped leaks through the packing, all three seals should be replaced immediately. It is recommended that all three seals be replaced whenever the primary seal (2) requires replacement.

Remove the seal washer (50) and spring. Slide the rotating portion of the seal off the shaft. As the seal is removed, the remaining seal lubricating oil will escape from the seal plate. Be sure to have shop rags or other absorbent materials available to clean up any spills.

To ease removal of the remaining seal components, it is recommended that the seal plate be removed. Loosen, but do not remove, the lock nuts (37) securing the halves of the split gland (11). Remove the machine screws (39) and slide the seal plate and remaining seal components off the shaft as a unit.

Position the seal plate on a flat surface with the impeller side down. Remove the lock nuts (37), clips (38) and both halves of the split gland. Use a suitable tool to remove the packing rings from the back of the seal plate.

Reposition the seal plate with the impeller side up. Pull the stationary seal seat and O-ring out of the seal plate bore.

Use a suitable tool to pry the oil seal (42) out of the seal plate.

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

Shaft and Bearing Removal and Disassembly

Remove the hardware securing the pedestal to the base. Use a suitable hoist and sling to move the pedestal assembly to a clean work area.

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.

CAUTION

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

Before disassembling the pedestal, remove the pedestal drain plug (34) and drain the oil from the pedestal. Clean and reinstall the pipe plug.

Disengage the hardware (26 and 27) and remove the outboard bearing cap (25), gasket (33), shims (31) and oil seal (28). Clean the mating surfaces. Press the oil seal from the bearing cap.

Remove the slinger ring (19). Disengage the hardware (16 and 17) and remove the inboard bearing cap (18), gasket (35) and oil seal (20). Clean the mating surfaces. Press the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft (29) and tap the shaft and assembled bearings (21 and 24) out of the pedestal.

After removing the shaft and bearings, clean and inspect the bearings **in place** as described in **Bearing Cleaning and Inspection**.

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 to remove the inboard and outboard bearings from the shaft.

Bearing Cleaning and Inspection

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

WARNING!

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

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

CAUTION

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

Rotate the bearings by hand to check for roughness or binding. Inspect the bearing balls (or rollers) on open-type bearings. If rotation is rough or the balls or rollers are discolored, replace the bearings.

Shaft and Bearing Reassembly and Installation

Inspect the shaft for distortion, nicks or scratches, or damaged keyways. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

CAUTION

To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is

strongly recommended that the bearings be replaced **any** time the shaft and bearings are removed.

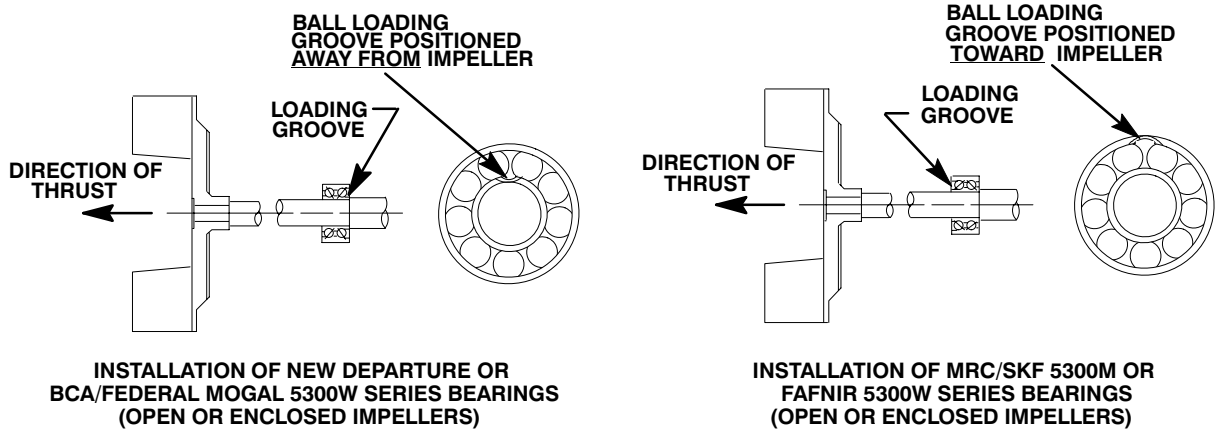


Figure 2. Bearing Installation

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.

CAUTION

Use caution when handling hot bearings to prevent burns.

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 against the shaft shoulders. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

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

NOTE

Position the inboard bearing (21) on the shaft as shown in Figure 2.

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

CAUTION

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

Position the oil seal (20) in the bearing cap (18) with the lip positioned as shown in Figure 1. Press the oil seal into the bearing cap until it it just flush with the inside of the chamfer on the face of the bearing cap.

Install the bearing cap gasket (20) and secure the bearing cap to the pedestal (23) with the hardware (16 and 17).

Slide the shaft and assembled bearings into the pedestal until the inboard bearing seats against the inboard bearing cap. Use caution not to roll or cut the lip of the oil seal during installation.

CAUTION

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

Press the outboard oil seal (28) into the bearing cap (25) with the lip positioned as shown in Figure 1. Install the bearing cap gasket (33) and shims (31). Secure the bearing cap to the pedestal with the hardware (26 and 27). Use caution not to cut or roll the lip of the oil seal during installation.

NOTE

Shaft endplay should be between .002 and .010 inch (0,05 and 0,25 mm). Add or subtract shims to establish the correct endplay.

Install the slinger ring (19) on the impeller shaft.

Use a suitable hoist and sling to position the pedestal assembly on the base. Secure the pedestal to the base using the previously removed hardware.

Lubricate the pedestal as indicated in **LUBRICATION**.

Seal Reassembly and Installation

(Figures 1 and 3)

Clean the bore of the seal plate (35) and shaft (25) with a cloth soaked in fresh cleaning solvent.

WARNING!

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

Lay the seal plate on a flat surface with the impeller side down. Press the oil seal (33) into the seal plate with the lip positioned as shown in Figure 1.

Since the mechanical seal is the primary seal in the pump, special consideration should be given to ensure proper installation.

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. 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 bellows and stationary seat O-rings 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).

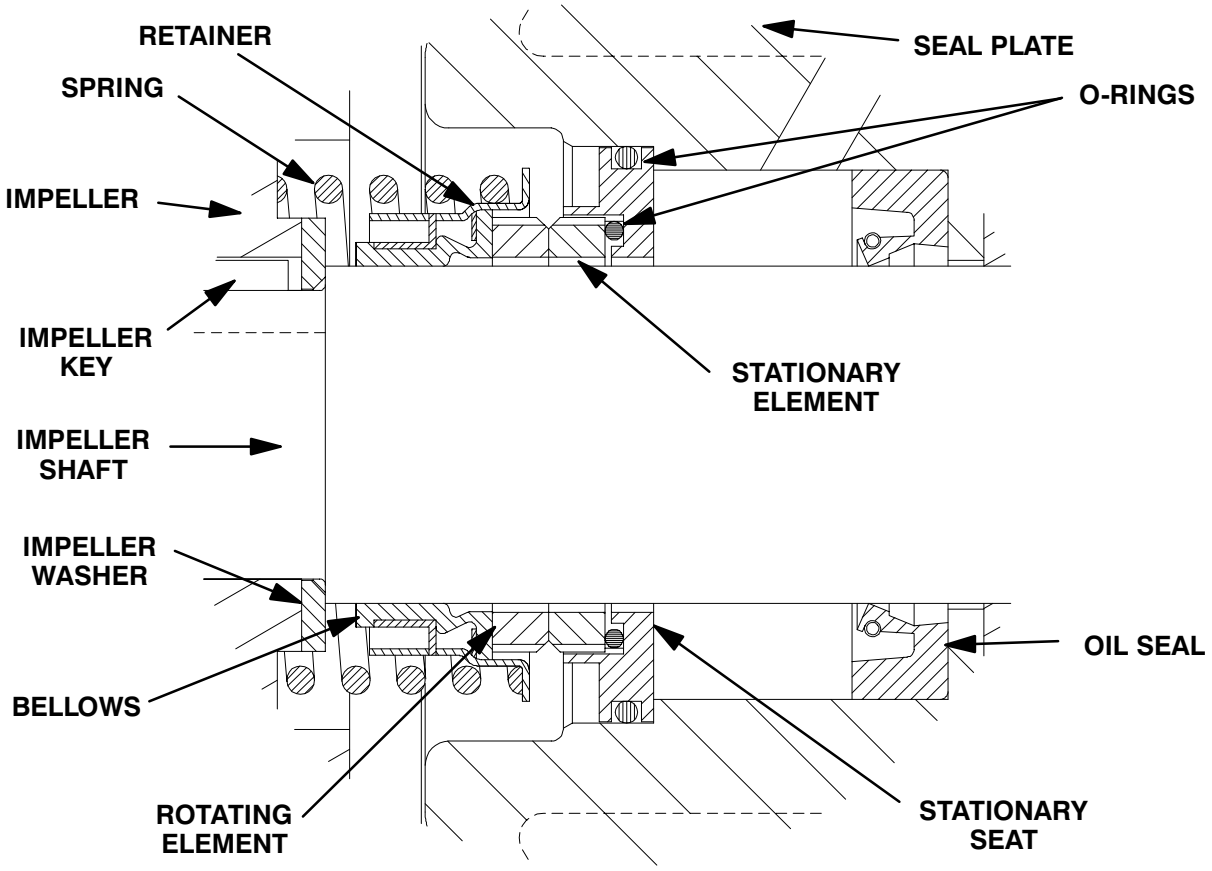


Figure 3. 12461A Seal Assembly

CAUTION

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

Position the seal plate with the impeller side up and press the oil seal (42) in the seal plate (5) with the lip positioned as shown in Figure 1.

Lubricate the stationary seat O-ring with water or light oil, and press the stationary subassembly (consisting of the stationary seat, O-rings and stationary element) into the front of the seal plate until it seats squarely against the bore shoulder.

Position the seal plate and stationary seat over the shaft and secure it to the pedestal with the machine screws (39). **Be careful** not to damage the stationary element on the shaft keyway.

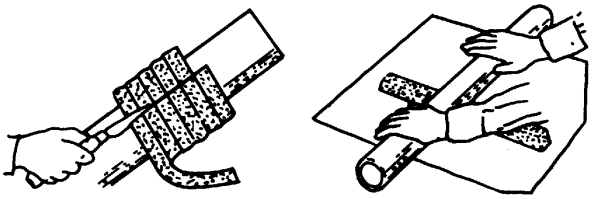
Lubricate the shaft in the area of the seal, and slide the rotating portion of the seal (consisting of the bellows, retainer and rotating element) onto the shaft until the seal faces contact.

Install the seal spring and washer (50).

Install new packing rings (10) in the back of the seal plate seal plate as follows.

NOTE

It is recommended that replacement rings pre-cut to the correct width and length, and packaged in a set be ordered from the Gorman-Rupp Company or your Gorman-Rupp distributor. However, if bulk commercial packing will be used in the unit, prepare and install the packing in accordance with the steps outlined below in order to ensure that the packing will form a tight seal.

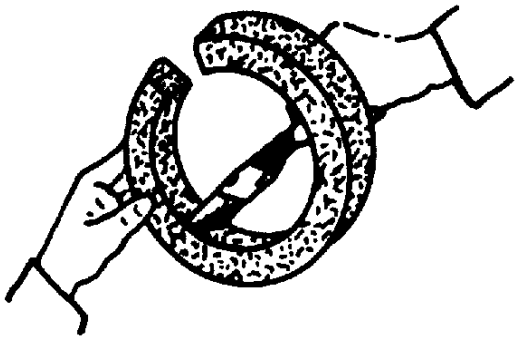


Step 1: Determine how much bulk packing will be required to fill the packing cavity, and wrap it around a rod of the same diameter as the shaft. With the packing wrapped around the rod, cut through each turn as shown.

If the cut rings are too thick and will not fit in the packing cavity, place each turn on a clean piece of paper and use a length of pipe, as you would a rolling pin, to roll the ring until the thickness has been reduced. **Never** attempt to flatten a packing ring with a hammer.

Step 2: It is critical that the ends of the cut packing rings meet in a tight parallel fit to ensure proper sealing. Check this fit; it should be correct if the packing was cut while wrapped around a rod, but if the packing was cut while laid out straight, the ends will meet at an angle. **Never** install a packing ring with an angled gap; pressure on adjacent packing rings will cause them to work into the gap and prevent the angled ring from closing properly around the shaft.

Some channel-type packing with a lead core may require a slight gap between packing ring ends to allow for expansion. Consult the packing manufacturer's installation instructions and follow his recommendations.



Step 3: Lubricate all metallic packings (foil type, lead core, etc.) with the lubricant recommended by the packing manufacturer. In general, swabbing the inside diameter of this type packing with SAE No. 30 non-detergent oil provides sufficient lubrication.

Dip the new packing in non-detergent oil before installation. Push each packing ring into the seal plate and compress it using a blunt ended sleeve the same diameter as the split gland and a mallet. Each successive layer must be compressed and rotated by 90° to prevent excessive leakage. Add enough packing to fill the seal plate to within 3/8 inch of the end.

Install the bottle oiler and piping (12, 13, 14 and 15) in the seal plate and lubricate the primary seal (3) as indicated in **LUBRICATION** after the impeller and remaining pump components are installed.

Impeller Installation

CAUTION

Proper replacement of the impeller wear ring requires dynamic balancing the impeller assembly after the wear ring is welded to the impeller. Failure to properly install the wear ring and balance the impeller assembly can result in premature shaft, seal or bearing failure, or other damage to the pump.

Inspect the impeller, and replace it if cracked or badly worn. If the impeller wear ring was removed, chill the impeller by refrigeration and use an induction heater or oven to heat the new wear ring. Slide

the wear ring onto the impeller until fully seated against the shoulder and allow it to cool.

CAUTION

The wear ring **must** seat squarely on the impeller; otherwise binding and/or excessive wear will occur. Use caution when handling hot parts to prevent burns.

Spot weld the wear ring to the impeller at four places, equally spaced at the vanes. After welding, dynamically balance the impeller assembly per plane 0.2—0.3 oz./in. (5.7—8.5 g./in.).

Install the key (55) in the keyway so the end of the key projects no more than 1/8—inch (3,2 mm) beyond the end of the shaft with the key positioned as far toward the seal as possible.

Press the impeller assembly onto the shaft until fully seated. Install the impeller washer (55) so it seats over the projecting end of the shaft key.

Apply “Never-Seez” or equivalent compound to the shaft threads and screw the impeller nut onto the shaft. Immobilize the impeller, and torque the nut to 200 ft. lbs. (27,6 m. kg.)

Torque the setscrews (53) to 18 ft. lbs. (216 in. lbs. or 2,49 m. kg.) Reinstall the inserts (53).

Pump Casing Installation

Install the casing gasket (9) over the pump casing studs (40). Use a suitable hoist and sling to position the casing over the impeller and slide the studs through the seal plate and pedestal mounting holes.

Secure the casing with the nuts (41).

Suction Plate And Wear Ring Installation

Install a new O-ring (44) in the groove in the wear ring (47) and lubricate it with light grease.

Screw the jam nuts (60) onto the studs (59) until they seat against the pump casing. Position the wear ring on the studs. Install the nuts (58) on the studs. Tighten the nuts evenly in an alternating pattern until the wear ring seats against the impeller. Unscrew the nuts (60) until they seat against wear ring. Unscrew each nut 1/2 to 3/4 turn more in an alternating pattern.

The clearance between the wear ring and the impeller wear ring should be approximately 0.015 inch (0,38 mm). Measure this clearance and use the jam nuts (60) and locking nuts (58) to move the wear ring to achieve the proper clearance. When the correct clearance has been achieved, secure the wear ring by tightening both the locking nuts and jam nuts against the wear ring.

Install the suction head O-ring (49) in the groove in the suction head and coat it with light grease. Position the suction head in the wear ring bore and use a soft-faced mallet to tap it into the wear ring until fully seated.

Rotate the impeller shaft by hand to check for scraping or binding and correct any before putting the pump back into service.

LUBRICATION

Seal Assembly

Fill the bottle oiler (12) with SAE No. 30 non-detergent oil. Check the oil level regularly and refill as required.

Bearings

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauges (32) and maintain it at the midpoint of the gauges. When lubrication is required, remove the vented plug (22) and add SAE No. 30 non-detergent oil through the opening. Clean and reinstall the vented plug. **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

NOTE

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

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

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

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

Power Source

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

For U.S. and International Warranty Information,
Please Visit www.grpumps.com/warranty
or call:
U.S.: 419—755—1280
International: +1—419—755—1352

For Canadian Warranty Information,
Please Visit www.grcanada.com/warranty
or call:
519—631—2870

THE GORMAN-RUPP COMPANY ● MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED ● ST. THOMAS, ONTARIO, CANADA