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INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

SUPER T SERIES® PUMPS

MODELS

T3A60S–E5 1P T3A60S–E5 3P
T3A60S–E15 3P

INCLUDING /WW

GORMAN-RUPP PUMPS

www.grpumps.com

Printed in U.S.A.

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

Valid serial number and e-mail address required.

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: _____

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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.

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 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

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

HAZARD AND INSTRUCTION DEFINITIONS

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

Before attempting to open or service the pump:

1. **Familiarize yourself with this manual.**
2. **Disconnect the incoming power to the motor and lock it out 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 liquids containing entrained solids or slurries. Do not attempt to pump volatile, corrosive, or flammable materials 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 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.

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.

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

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

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.

WARNING!

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.

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.

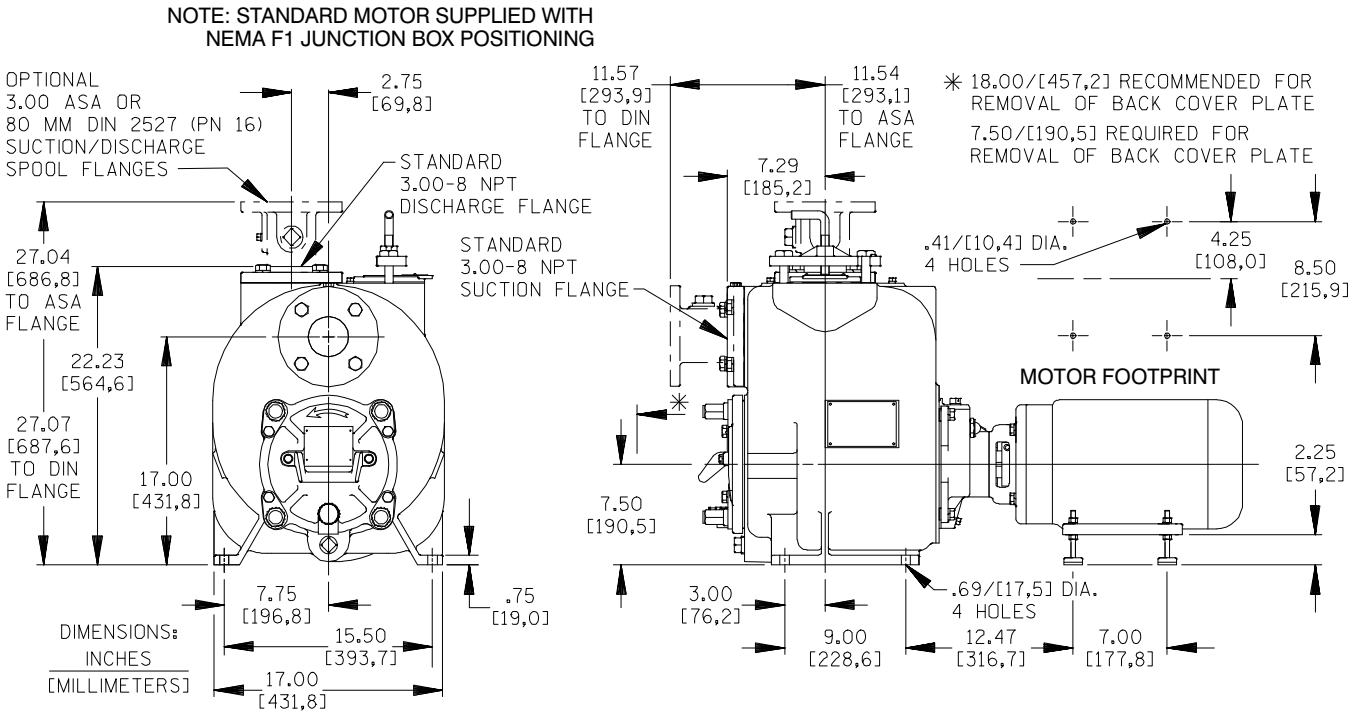
If installed in a **flooded suction application** where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the specific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to **50%** of the maximum permissible operating pressure as shown on the pump performance curve.

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

Pump Dimensions

See Figures 1 and 2 for the approximate physical dimensions of this pump.

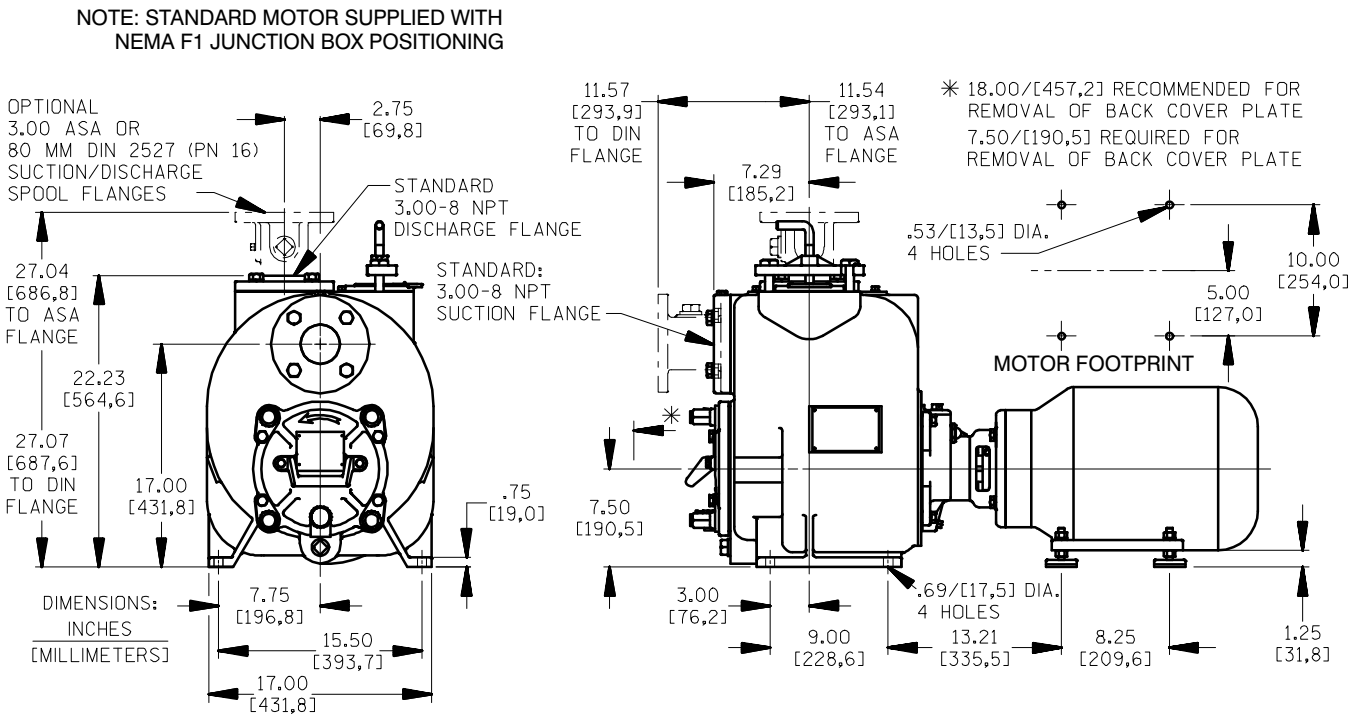
OUTLINE DRAWING



NOTE: OPTIONAL ASA OR DIN STANDARD SUCTION & DISCHARGE SPOOL FLANGES AVAILABLE

Figure 1. Pump Models T3A60S—E5 1P And T3A60S—E5 3P, Including /WW Models

OUTLINE DRAWING



NOTE: OPTIONAL ASA OR DIN STANDARD SUCTION & DISCHARGE SPOOL FLANGES AVAILABLE

Figure 2. Pump Models T3A60S—E15 3P, Including /WW Models

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 motor 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 warnings and cautions contained in this manual or affixed to the pump, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates counterclockwise when facing the impeller.

CAUTION

Only operate this pump in the direction indicated by the arrow on the pump body and on the accompanying decal. Refer to **ROTATION** in **OPERATION**, Section C.

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 and motor have 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.

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.

POSITIONING PUMP

WARNING!

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.

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.

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 casing is equipped with mounting foot holes and the motor is equipped with adjustable leveling feet. When mounting the pump, secure the casing feet to the base and then extend the motor mounting feet to the surface of the base to support the motor and eliminate vibration. **Do not** over-extend the mounting feet; over-extension of the mounting feet can cause distortion of the motor shaft and/or shaft extension, resulting in damage to the pump and/or motor. When the mounting feet are fully extended to the surface of the base, lock the mounting feet in place with the mounting feet jam nuts.

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 **7-1/2 inches (191 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 and operating range shown 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 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 2—1/2-inch (63,5 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 dis-

tance 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 3 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).

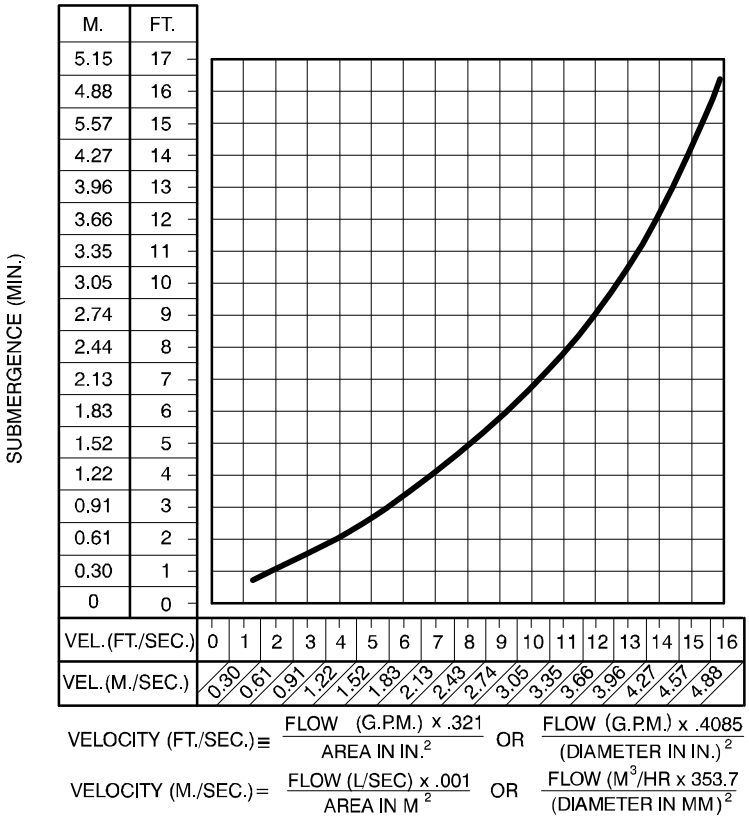


Figure 3. Recommended Minimum Suction Line Submergence vs. Velocity

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.

CAUTION

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 in diameter to minimize the chance of plugging.

In **low discharge head applications** (less than 30 feet or 9 meters), 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 line may be terminated with a six-to-eight foot length of 1 1/4 inch 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), 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 VALVE** 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.

If the installation involves a flooded suction such as a below-ground lift station, a pipe union and manual shut-off valve may be installed in the bleed line to allow service of the valve without shutting down the station, and to eliminate the possibility of flooding. If a manual shut-off valve is installed **anywhere** in the air release piping, it **must** be a full-opening **ball type** valve to prevent plugging by solids.

If a manual shut-off valve is installed in a bypass line, <u>it must not be left closed during operation</u>. A closed manual shut-off valve may cause a pump which has lost prime to continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. <u>Personnel could be severely injured.</u>

<u>Allow an over-heated pump to completely cool before servicing.</u> <u>Do not</u> 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. <u>After the pump completely cools</u>, 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.

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.

WARNING!

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 4). The inlet opening in the Air Release Valve is equipped with standard 1-inch NPT pipe threads.

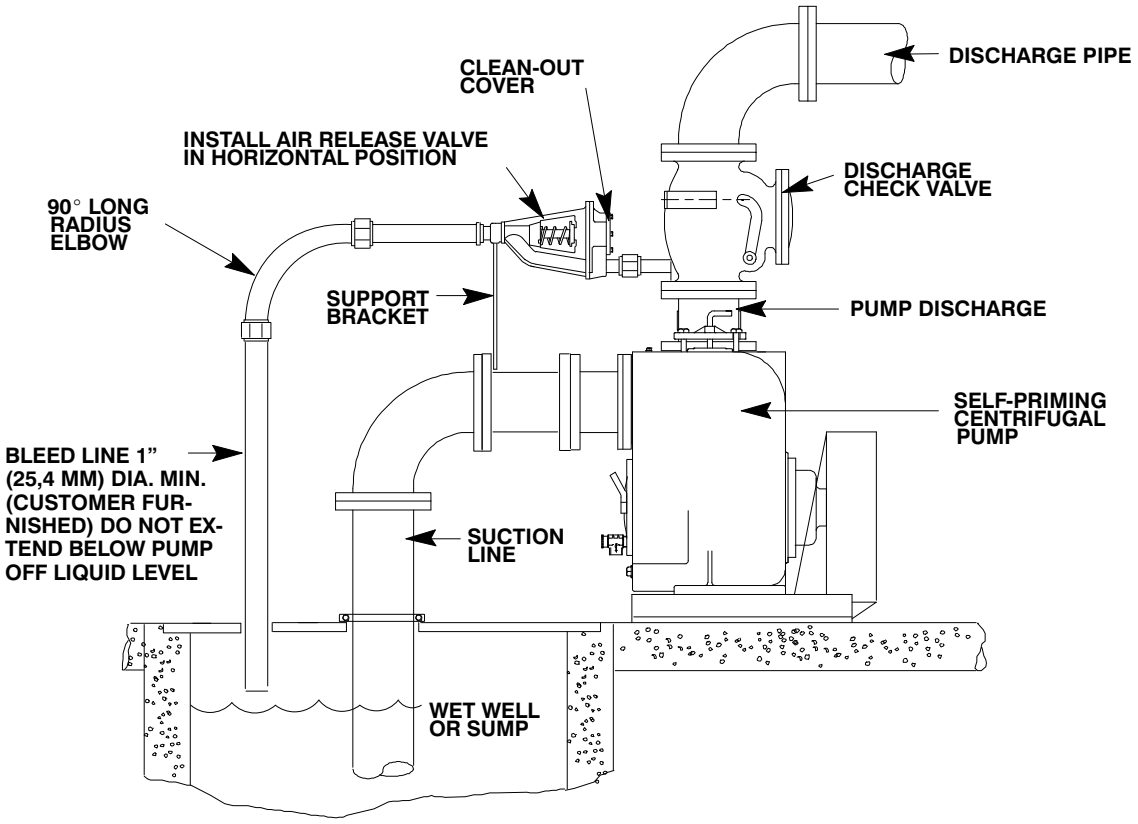


Figure 4. Typical Automatic Air Release Valve Installation

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 **piping** 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.*

ELECTRICAL CONNECTIONS

This pump is driven by an electric motor. Check that the electrical service available matches the motor requirements stamped on the motor nameplate before connecting the motor to the incoming power.

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 motor wiring diagram or the literature supplied with the motor for specific instructions.

WARNING!

The electrical power used to operate the pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections.

WARNING!

Do not install and operate a non-explosion proof motor in an explosive atmosphere. Install, connect, and operate the motor in accordance with The National Electrical Code and all local codes. If there is a conflict between the instructions in the manual accompanying the unit and The National Electrical Code or the applicable local code, The national or local code shall take precedence.

Refer to the following motor data before making electrical connections.

MODEL	VOLTAGE	PHASE	HP	Hz	RPM	START
T3A60S—E5 1P	115/230	1	5	60	1200	Capacitor
T3A60S—E5 3P	230/460	3	5	60	1200	Capacitor
T3A60S—E15 3P	230/460	3	15	60	1200	Capacitor

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 liquids containing entrained solids and slurries. 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 conditions must be within the performance range shown on page E-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.

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.

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.

WARNING!

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 motor.

Rotation

The correct direction of pump rotation is counterclockwise when facing the impeller. The pump could be damaged and performance adversely affected by incorrect rotation. If pump performance is not within the specified limits (see the curve on page E-1), check the direction of motor rotation before further troubleshooting.

Briefly apply power to the motor while observing the direction of shaft rotation through the “window” in the side of the intermediate.

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

If a Gorman-Rupp Automatic Air Release Valve has been installed, the valve will automatically open to allow the pump to prime, and automatically close after priming is complete (see **INSTALLATION** for Air Release Valve operation).

If the bypass line is open, air from the suction line will be discharged through the bypass line back to the wet well during the priming cycle. 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.

WARNING!

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

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 completely 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.

As a safeguard against rupture or explosion due to heat, this pump is equipped with a pressure relief valve which will open if vapor pressure within the pump casing reaches a critical point. If overheating does occur, stop the pump immediately and allow it to cool before servicing it. **Approach any overheated pump cautiously**. It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump casing overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

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.

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.

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 incoming power to the motor and lock it out to ensure that the pump will remain inoperative.

WARNING!

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

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 temperature 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 **MAINTENANCE AND REPAIR**). 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. **Disconnect the incoming power to the motor and lock it out 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	Not enough liquid in casing.	Add liquid to casing. See **PRIMING**.
	Suction check valve contaminated or damaged.	Clean or replace check valve.
	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.
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.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Strainer clogged.	Check strainer and clean if necessary.
	Suction intake not submerged at proper level or sump too small.	Check installation and correct submergence as needed.
	Impeller or other wearing parts worn or damaged.	Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.
	Impeller clogged.	Free impeller of debris.
	Pump speed too slow.	Check driver output; check belts or couplings for slippage.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See **INSTALLATION**.
	Pump running backwards.	Check direction of rotation and correct by interchanging any two motor leads at control box. (See **Pump Rotation**, Section C).
	Low or incorrect voltage.	Measure control box voltage, both when pump is running and when shut off.
	No voltage at line side of circuit breaker.	Check power source for blown fuse, open circuit breaker or control box, broken lead, or loose connection.
PUMP REQUIRES TOO MUCH POWER	Motor shaft or bearings defective.	Disassemble pump and check motor and bearings.
	Discharge head too low.	Adjust discharge valve.
	Liquid solution too thick.	Dilute if possible.
	Bearing(s) frozen.	Disassemble pump and check bearing(s).
PUMP CLOGS FREQUENTLY	Liquid solution too thick.	Dilute if possible.
	Discharge flow too slow.	Open discharge valve fully to increase flow rate, and run power source at maximum governed speed.
	Suction check valve or foot valve clogged or binding.	Clean valve.

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

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

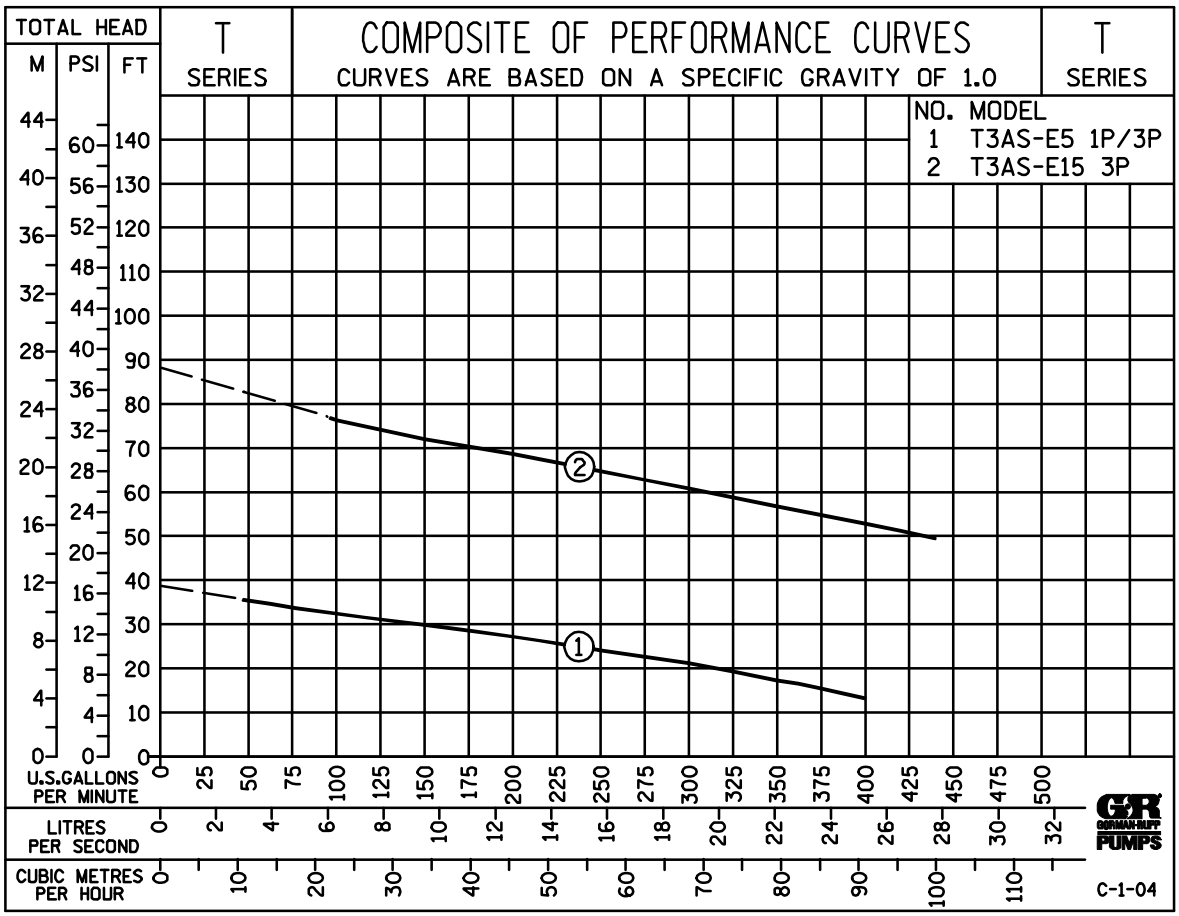
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		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 PERFORMANCE FOR PUMP MODELS T3A60S-E5 1P, T3A60S-E5 3P AND T3A60S–E15 3P, INCLUDING /WW MODELS

✳ 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.

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.

ILLUSTRATION

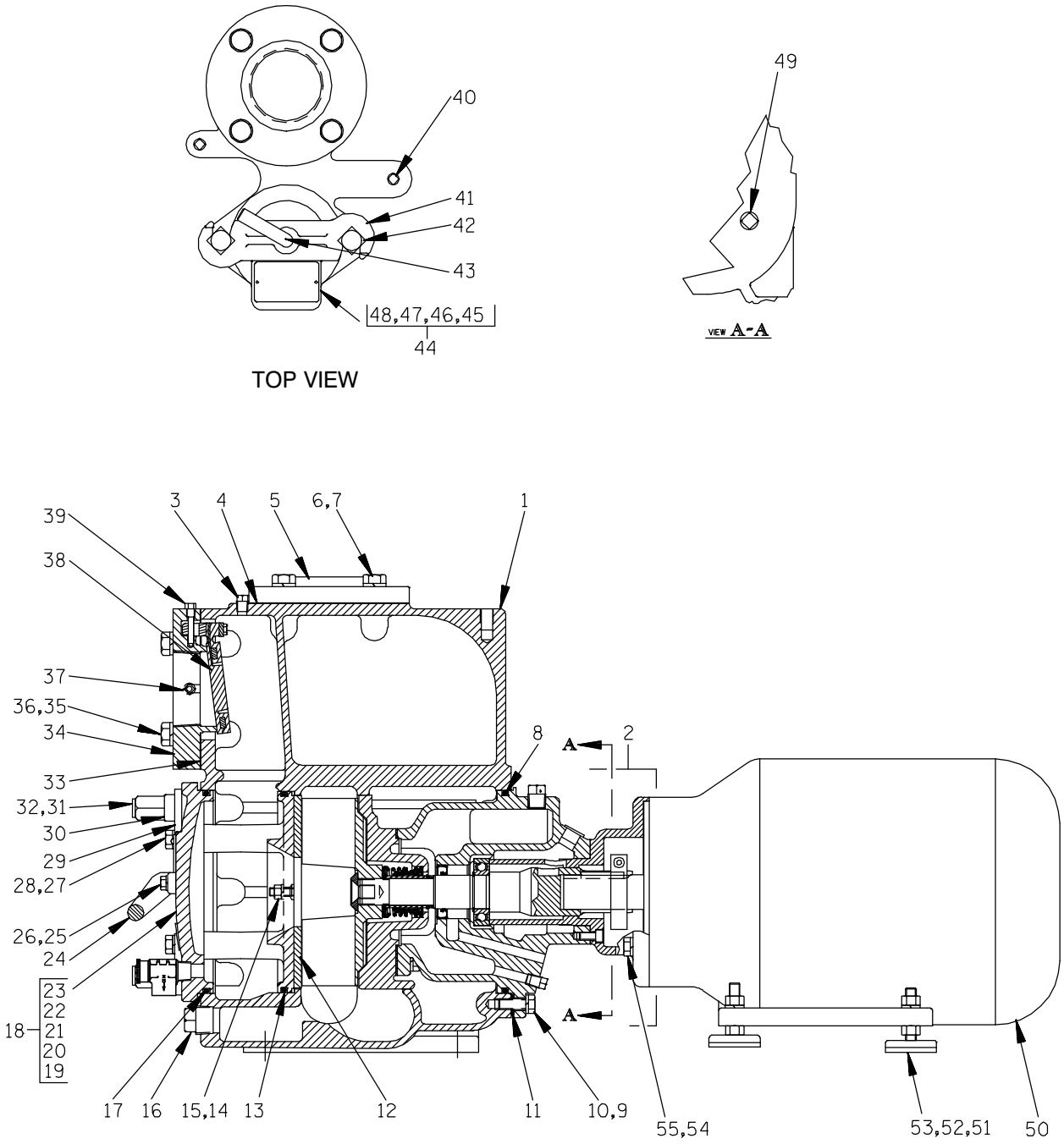


Figure 1. Pump Models T3A60S—E5 1P, T3A60S—E5 3P And T3A60S—E15 3P, Including /WW

PARTS LIST

Pump Models T3A60S−E5 1P, T3A60S−E5 3P And T3A60S−E15 3P, Including /WW

(From S/N 1279883 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	SEE NOTE BELOW		
2	REPAIR ROTATING ASSY			
	−5 HP MODELS	44163−382	−−−	1
	−5 HP (/WW MODELS)	44163−420	−−−	1
	−15 HP MODEL	44163−384	−−−	1
	−15 HP (/WW MODEL)	44163−419	−−−	1
☞ 3	PIPE PLUG	P04	15079	1
4 ◗	DISCH FLANGE GASKET	25113−033	−−−	1
5 ◗	DISCH FLANGE	1753A	10010	1
6 ◗	HEX HD CAPSCREW	B1007	15991	4
7 ◗	LOCKWASHER	J10	15991	4
8	BEARING HSG O-RING	S1748	−−−	1
9	HEX HD CAPSCREW	B0805−1/2	15991	4
10	LOCKWASHER	J08	15991	4
11 ✳	ROT ASSY ADJ SHIMS	13130−3	17040	8
12 ✳	WEAR PLATE ASSY	11407A	15990	1
13 ✳	BACK COVER O-RING	25152−446	−−−	1
14	HEX NUT	D06	15991	2
15	LOCKWASHER	J06	15991	2
16	PIPE PLUG	P16	10009	1
17 ✳	BACK COVER O-RING	S1748	−−−	1
18	BACK CVR PLATE ASSY	42111−801	−−−	1
19	−BACK COVER PLATE	NOT AVAILABLE		
20	−WARNING PLATE	2613EV	13990	1
21	−DRIVE SCREW	BM#04−03	17000	4
22	−PRESS RELIEF VALVE	26662−005	−−−	1
23	−WARNING DECAL	38816−302	−−−	1
24	COVER PLATE HANDLE	12354	13010	1
25	HEX HD CAPSCREW	B0604	15991	2
26	LOCKWASHER	J06	15991	2
27	HEX HD CAPSCREW	B0804−1/2	15991	4
28	LOCKWASHER	J08	15991	4
29	LOCKING COLLAR	38115−551	15001	4
30	ADJUSTING SCREW	31871−070	1500G	4
31	BACK COVER NUT	31871−073	15000	4
☞32	STUD	C1213	15991	4
33 ✳	SUCT FLANGE GASKET	11412G	19370	1
34	SUCTION FLANGE			
	−/WW MODELS ONLY	11412A	10010	1
	−ALL OTHER MODELS	11412	10010	1
35	HEX HD CAPSCREW			
	−/WW MODELS ONLY	B1007	15991	4
	−ALL OTHER MODELS	B1009	15991	4
36	LOCKWASHER	J10	15991	4
37	PIPE PLUG	P04	15079	1
38 ✳	FLAP VALVE ASSY	46411−060	−−−	1
39	CHECK VALVE PIN	11557A	17010	1
☞40	PIPE PLUG	P04	15079	1
41	CLAMP BAR	38111−004	11010	1
☞42	MACHINE BOLT	A1014	15991	2
43	CLAMP BAR	31912−009	15000	1
44	FILL COVER PLATE ASSY	42111−344	−−−	1
45	−FILL COVER PLATE	NOT AVAILABLE		
46	−WARNING PLATE	38816−097	13990	1
47	−DRIVE SCREW	BM#04−03	17000	2
48 ✳	−FILL COVER GASKET	50G	19210	1
☞49	PIPE PLUG	P08	15079	1
50	MOTOR			
	−5 HP 1P MODELS	28257−301	−−−	1
	−5 HP 3P MODELS	28257−542	−−−	1
	−15 HP 3P MODELS	28261−512	−−−	1
51	LEVELER			
	−5HP MODELS	22813−011	−−−	4
	−15HP MODELS	22813−012	−−−	4
52	HEX NUT			
	−5 HP MODELS	D06	15991	8
	−15 HP MODELS	D08	15991	8
53	LOCKWASHER			
	−5 HP MODELS	J06	15991	4
	−15 HP MODELS	J08	15991	4
54	HEX HD CAPSCREW	B0806	15991	4
55	LOCKWASHER	J08	15991	4
NOT SHOWN:				
	WARNING DECAL	2613FE	−−−	1
	ROTATION DECAL	2613M	−−−	1
	NAME PLATE	38818−040	13990	1
	DRIVE SCREW	BM#04−03	17000	4
	LUBE DECAL	38817−087	−−−	1
	SUCTION DECAL	6588AG	−−−	1
	PRIMING STICKER	6588AH	−−−	1
	DISCHARGE DECAL	6588BJ	−−−	1
	SUPER T DECAL	38812−089	−−−	1
	G-R DECAL	GR−03	−−−	1
	INSTRUCTION TAG	38817−023	−−−	1
	INSTRUCTION TAG	38817−011	−−−	1
	WARNING DECAL	2613FF	−−−	1
OPTIONAL:				
	▶SELF CLEANING			
	WEAR PLATE	46451−765	24150	1
	DISASSEMBLY TOOL	48711−020	−−−	1
	AIR RELEASE VALVES:			
	−25# COMP SRPING	GRP33−07	−−−	1
	−10# COMP SPRING	GRP33−07A	−−−	1
	−80# COMP SPRING	GRP33−07B	−−−	1
	CASING HEATERS:			
	−120 VOLT	47811−006	−−−	1
	−240 VOLT	47811−007	−−−	1
	HI TEMP SHUT-DOWN KITS:			
	−145° F	48313−186	−−−	1
	−130° F	48313−256	−−−	1
	−120° F	48313−257	−−−	1
	HI TEMP SHUT-DOWN THERMOSTAT KIT:			
	−145° F	48313−172	−−−	1
	SEWAGE SLUDGE RELIEF VALVE	46431−628	−−−	1
	G-R HARD IRON PARTS:			
	−IMPELLER	11406	1102H	1
	−SEAL PLATE	11837D	1102H	1
	−WEAR PLATE	46451−337	24160	1
	FLAP VALVES:			
	−NEO SOLID CENTER	46411−043	−−−	1
	−VITON SOLID CENTER	46411−086	−−−	1
	−VITON BLOW-OUT CNTR	46411−074	−−−	1
	SUCT/DISCH SPOOL FLANGE KITS:			
	−3" ASA	48213−040	−−−	1
	−80 MM METRIC	48213−076	−−−	1

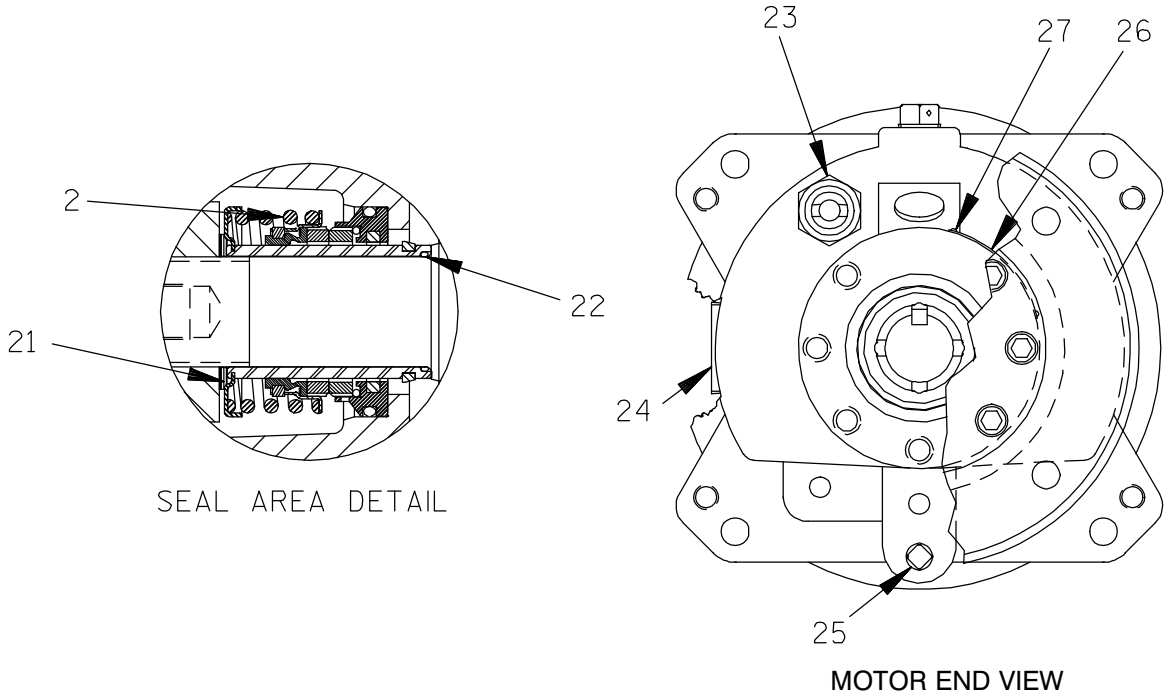
✳ INDICATES PARTS RECOMMENDED FOR STOCK

◗ NOT USED ON /WW MODELS

▶FOR PUMP RETRO-FITTING, BACK COVER OPENING MUST BE 3.66 INCH DIAMETER - CONSULT FACTORY FOR DETAILS.

☞INCLUDED WITH REPAIR PUMP CASING ASSY	46472−720	−−−	1

ILLUSTRATION



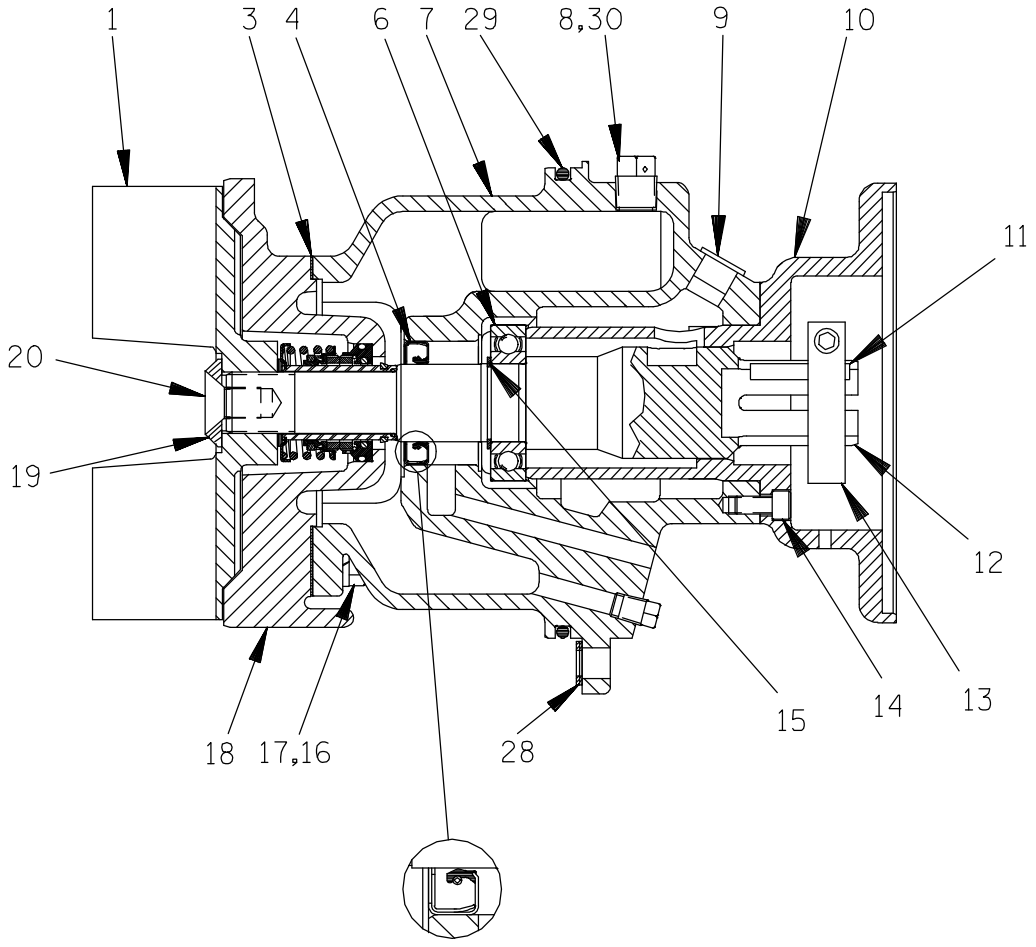


Figure 2. Repair Rotating Assemblies

PARTS LIST
Repair Rotating Assemblies

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1	✳	IMPELLER	11406	11010	1
2	✳	CARTRIDGE SEAL ASSY	46513–151	–––	1
3	✳	SEAL PLATE GASKET	10959G	20000	1
4	✳	OIL SEAL	S1352	–––	1
5		NOT USED			
6	✳	BALL BEARING	23257–013	–––	1
7		BEARING HOUSING	38251–421	10000	1
8		VENTED PLUG	4823A	15079	1
9		PLASTIC CLOSURE	25151–042	–––	1
10		RETAINER FLANGE	38545–502	10000	1
		5 HP MODELS ONLY			
11	✳	KEY	N0508	15990	1
12		ADAPTOR SHAFT	38513–805	16040	1
13		LOCKING COLLAR	24118–033	–––	1
		15 HP MODELS ONLY			
11	✳	KEY	N0607	15990	1
12		ADAPTOR SHAFT	38513–806	16040	1
13		LOCKING COLLAR	24118–034	–––	1
		ALL MODELS			
14		SOC HD CAPSCREW	BD0603	15990	7
15		SNAP RING	S244	–––	1
16		HEX HD CAPSCREW	B0805	15991	4
17		LOCKWASHER	J08	15991	4
18		SEAL PLATE	11837D	10010	1
19	✳	IMPELLER WASHER	31167–029	16000	1
20	✳	IMPELLER CAPSCREW	F1004S	1500G	1
21	✳	IMP ADJ SHIM SET	37J	17090	REF
22	✳	SHAFT SLEEVE O-RING	25154–022	–––	REF
23		SIGHT GUAGE	S1471	–––	1
24		SOC HD PIPE PLUG	PC20	10009	1
25		PIPE PLUG	P04	15079	1
26		SERIAL NUMBER PLATE	2613GG	13990	1
27		DRIVE SCREW	BM#04–03	17000	2
28		ROT ASSY SHIMS	13130–3	17040	8
29		BEARING HSG O-RING	S1748	–––	1
30		SHIPPING PLUG	11495B	15079	2
NOT SHOWN:					
		ROTATION DECAL	2613M	–––	1
		INSTRUCTION TAG	6588U	–––	1
		ILUBRICATION DECAL	38817–087	–––	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 views (see Figures 1 and 2) and the accompanying parts lists.

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.

Many service functions may be performed by draining the pump and removing the back cover assembly. If major repair is required, the piping and/or power source must be disconnected. The following instructions assume complete disassembly is required.

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

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

WARNING!

Before attempting to open or service the pump:

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

WARNING!

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.

Back Cover And Wear Plate Removal

(Figure 1)

The wear plate (12) is easily accessible and may be serviced by removing the back cover assembly (18). Before attempting to service the pump, remove the pump casing drain plug (16) and drain the pump. Clean and reinstall the drain plug.

Remove the back cover nuts (31) and pry the back cover and assembled wear plate from the pump casing (1).

NOTE

An alternate method of removing the back cover from the pump casing is to remove the back cover nuts (31) and two diagonally opposing locking collars (30). Install two 1/2−16 UNC−2B x 2 inch long screws in the tapped holes in the back cover and use them to press the back cover out of the pump casing.

Inspect the wear plate, and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (14 and 15).

Inspect the back cover O-rings (13 and 17) and replace it if damaged or worn.

Suction Check Valve Removal

(Figure 1)

If the check valve assembly (38) is to be serviced, remove the check valve pin (39), reach through the back cover opening and pull the complete assembly from the suction flange (34).

NOTE

Further disassembly of the check valve is not required since it must be replaced as a complete unit. Individual parts are not sold separately.

Rotating Assembly Removal

(Figure 2)

The rotating assembly may be serviced without disconnecting the suction or discharge piping; however, the motor must be removed to provide clearance. To remove the motor, loosen the shaft collar (13). Remove the hardware (54 and 55, Figure 1) and pull the motor straight away from the pump. Remove the shaft collar.

The impeller (1) should be loosened while the rotating assembly is still secured to the pump casing. Before loosening the impeller, remove the seal cavity drain plug (25) and drain the seal lubricant. This will prevent the oil in the seal cavity from escaping when the impeller is loosened. Clean and reinstall the seal cavity drain plug.

Immobilize the impeller by wedging a block wood between the vanes and the pump casing, and remove the impeller capscrew and washer (19 and 20). Remove the wood block.

Disengage the hardware (9 and 10, Figure 1) and retain the rotating assembly shims (11, Figure 1). Tie and tag the rotating assembly shims for ease of reassembly.

Install four 1/2−13 UNC−2B x 2−1/2 inch long capscrews (not supplied) in the tapped holes in the bearing housing. Use these jacking screws to remove the rotating assembly from the pump casing. Remove the jacking screws and move the rotating assembly to a clean area for further disassembly.

Grind a 30° angle on the end of a piece of 1/2" square steel bar stock as shown in Figure 3. Remove the plastic closure (9). Rotate the impeller shaft until the slot in the shaft is visible through the hole for the plastic closure. Immobilize the shaft by inserting the bar through the hole for the plastic closure and into the slot in the shaft as shown in Figure 3.

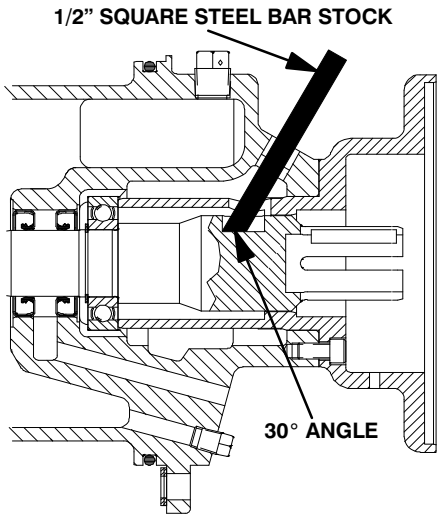


Figure 3. Immobilizing Impeller Shaft

With the shaft immobilized, use a soft-faced mallet to strike the impeller sharply in a counterclockwise direction (when facing the impeller) until the impeller breaks loose from the shaft. **Use caution** not to damage the impeller vanes. When the impeller breaks loose, remove the steel bar used to immobilize the shaft.

Remove the bearing housing O-ring (29).

Impeller Removal

(Figure 2)

With the rotating assembly removed from the pump casing, unscrew the impeller from the shaft. Use caution when unscrewing the impeller; tension on the shaft seal spring will be released as the impeller is removed. Inspect the impeller and replace it if cracked or badly worn.

Remove the impeller adjusting shims (21); tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal

(Figure 2)

Slide the integral shaft sleeve and rotating portion of the seal off the shaft as a unit.

Use a pair of stiff wires with hooked ends to pull the stationary element and seat out of the seal plate.

An alternate method of removing the stationary seal components is to remove the hardware (16 and 17) and separate the seal plate (18) and gasket (3) from the bearing housing (7). Position the seal plate on a flat surface with the impeller side down. Use a wooden dowel or other suitable tool to press on the back side of the stationary seat until the seat, O-rings, and stationary element can be removed.

Remove the shaft sleeve O-ring (22).

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

Shaft and Bearing Removal and Disassembly

(Figure 2)

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

CAUTION

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

Remove the socket head capscrews (14) and pull the retainer flange (10) out of the bearing housing (7). Place a block of wood against the impeller end of the shaft (12) and tap the shaft and bearing (6) out of the bearing housing.

Press the oil seal (4) out of the bearing housing.

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

CAUTION

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

Clean the bearing housing, shaft and all component parts (except the bearing) 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 bearing thoroughly in **fresh** cleaning solvent. Dry the bearing with filtered compressed air and coat with light oil.

Rotate the bearing by hand to check for roughness or binding. If rotation is rough, replace the bearing.

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

If bearing replacement is required, remove the bearing retaining ring (15), and use a bearing puller to remove the bearing from the shaft.

Shaft and Bearing Reassembly and Installation

(Figure 2)

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

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.

CAUTION

This bearing is permanently sealed and requires no additional lubrication except a coating of light oil on the external surface to ease reassembly. This surface must be kept free of all dirt and foreign material. Failure to do so could damage the bearings or the mating surface.

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

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

After the bearing has been installed and allowed to cool, check to ensure that it has not moved in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearing.

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

CAUTION

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

Secure the bearing on the shaft with the bearing retaining ring (15).

Lubricate the lip seal area of the shaft and slide the shaft and assembled bearing into the bearing housing until the bearing seats against the bearing housing bore.

CAUTION

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

Position the oil seal (4) in the bearing housing bore with the lip positioned as shown in Figure 2. Press the oil seal into the housing until the face is **just flush** with the machined surface on the housing.

NOTE

The O.D. of the oil seal is coated to prevent corro-

sion. Some of this coating may be shaved off during installation. Check for and remove any coating shavings before continuing shaft and bearing assembly.

Slide the retainer flange (10) into the bearing housing and align the mounting holes in the flange with the holes in the bearing housing. Secure the flange to the bearing housing with the socket head capscrews (14).

Lubricate the bearing housing as indicated in **LUBRICATION**.

Seal Installation

(Figures 2, 4, 5 and 6)

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 seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the stationary seat bore in the seal plate for dirt, nicks and burrs, and remove any that exist. The stationary seat bore **must** be completely clean before installing the seal.

CAUTION

A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

To ease installation of the seal, lubricate the shaft sleeve O-ring and the external stationary seat O-ring with a very **small** amount of light lubricating oil. See Figure 4 for seal part identification.

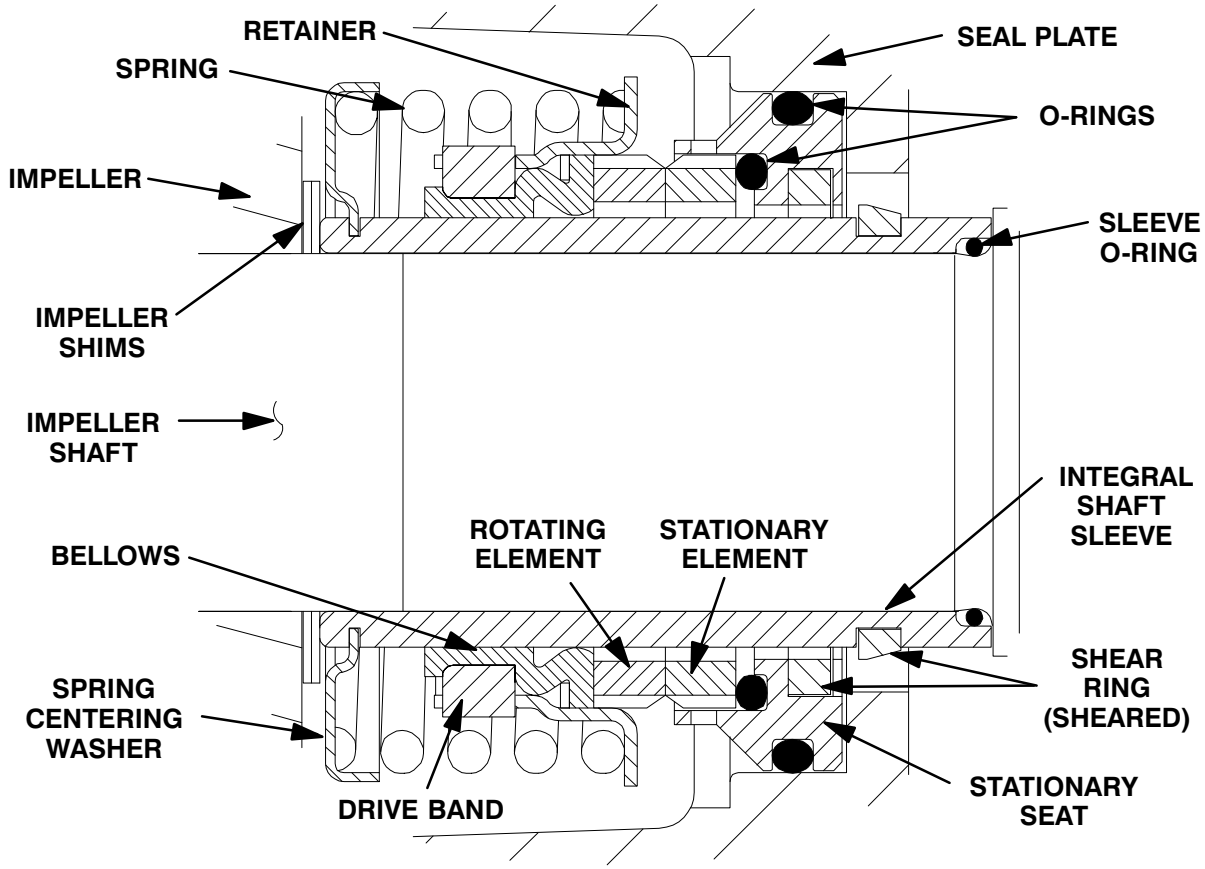


Figure 4. Cartridge Seal Assembly

CAUTION

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

If the seal plate (18) was removed, install the seal plate gasket (3). Position the seal plate over the shaft and secure it to the bearing housing with the hardware (16 and 17).

To prevent damaging the shaft sleeve O-ring (22) on the shaft threads, stretch the O-ring over a piece of tubing 1-1/4 I.D. x 1-1/2 O.D. x 2-inches long (32 mm x 38 mm x 51 mm). Slide the tube over the shaft threads, then slide the O-ring off the tube and onto the shaft. Remove the tube, and continue to slide the O-ring down the shaft until it seats against the shaft shoulder.

When installing a new cartridge seal assembly, remove the seal from the container and, if so equipped, remove any mylar storage tabs from between the seal faces.

CAUTION

Some new cartridge seal assemblies are equipped with mylar storage tabs between the seal faces. If so equipped, these storage tabs **must** be removed before installing the seal.

Lubricate the external stationary seat O-ring with light oil. Slide the seal assembly onto the shaft until the external stationary seat O-ring engages the bore in the seal plate.

NOTE

Seal installation requires installing the impeller on the shaft. Immobilize the shaft by inserting a 1/2—inch square steel bar into the slot in the shaft as shown in Figure 3.

Clean and inspect the impeller as described in **Impeller Installation and Adjustment**. Install the full set of impeller shims (21) provided with the seal, and screw the impeller onto the shaft until it is seated against the seal (see Figure 5).

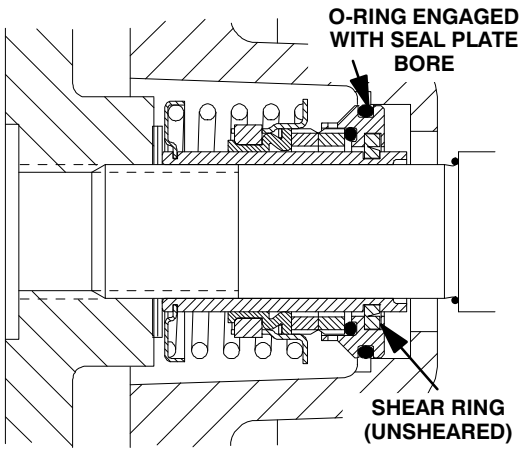


Figure 5. Seal Partially Installed

Continue to screw the impeller onto the shaft. This will press the stationary seat into the seal plate bore.

NOTE

A firm resistance will be felt as the impeller presses the stationary seat into the seal plate bore.

As the stationary seat becomes fully seated, the seal spring compresses, and the shaft sleeve will break the nylon shear ring. This allows the sleeve to slide down the shaft until seated against the shaft shoulder. Continue to screw the impeller onto the shaft until the impeller, shims, and sleeve are fully seated against the shaft shoulder (see Figure 6).

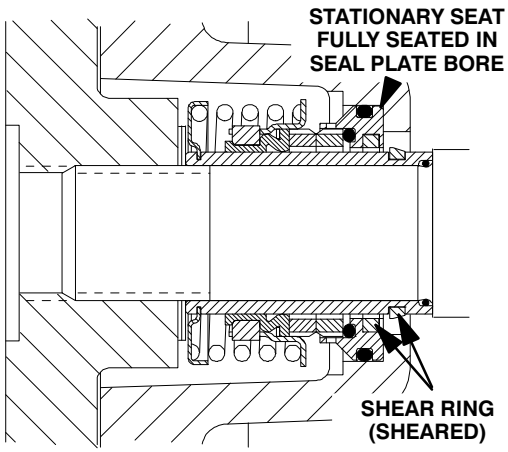


Figure 6. Seal Fully Installed

Measure the impeller-to-seal plate clearance, and remove impeller adjusting shims to obtain the proper clearance as described in **Impeller Installation and Adjustment**.

If necessary to reuse an old seal in an emergency, carefully separate the rotating and stationary seal faces from the bellows retainer and stationary seat.

CAUTION

A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

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.

Carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

CAUTION

Do not attempt to separate the rotating portion of the seal from the shaft sleeve when reusing an old seal. The rubber bellows will adhere to the sleeve during use, and attempting to separate them could damage the bellows.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Inspect the integral shaft sleeve for nicks or cuts on either end. If any components are worn, or the sleeve is damaged, replace the complete seal; **never mix old and new seal parts**.

Install the stationary seal element in the stationary seat. Press this stationary subassembly into the seal plate bore until it seats squarely against the bore shoulder. A push tube made from a piece of plastic pipe would aid this installation. The I.D. of the pipe should be slightly larger than the O.D. of the shaft sleeve.

Slide the rotating portion of the seal (consisting of the integral shaft sleeve, spring centering washer, spring, bellows and retainer, and rotating element) onto the shaft until the seal faces contact.

Proceed with **Impeller Installation and Adjustment**.

Impeller Installation

(Figure 2)

Inspect the impeller, and replace it if cracked or badly worn. Inspect the impeller and shaft threads for dirt or damage, and clean or dress the threads as required.

CAUTION

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

Install the same thickness of impeller adjusting shims (21) as previously removed. Apply 'Never-Seez' or equivalent to the shaft threads and screw the impeller onto the shaft until tight. Be sure the seal spring seats squarely over the shoulder on the back side of the impeller.

NOTE

At the slightest sign of binding, immediately back the impeller off, and check the threads for dirt. ***Do not*** *try to force the impeller onto the shaft*.

A clearance of .025 to .040 inch (0,64 to 1,02 mm) between the impeller and the seal plate is recommended for maximum pump efficiency. Measure this clearance, and add or remove impeller adjusting shims as required.

Coat the threads of the impeller capscrew (20) with 'Never-Seez' or equivalent compound, and install the impeller washer (19) and capscrew. Immobilize

the shaft as shown in Figure 3, and torque the capscrew to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.).

Rotating Assembly Installation

(Figure 1)

NOTE

If the pump has been completely disassembled, it is recommended that the back cover assembly be reinstalled at this point. The back cover assembly must be in place to adjust the impeller face clearance.

NOTE

There is a 1-1/2 inch diameter socket head pipe plug located in the side of the bearing housing. This hole is required for manufacturing purposes only; therefore the pipe plug should never require removal.

Install the bearing housing O-ring (8) and lubricate it with light grease. Ease the rotating assembly into the pump casing. **Be careful** not to damage the O-ring.

Install the rotating assembly adjusting shims (11) and secure the rotating assembly to the pump casing with the hardware (9 and 10).

To set the impeller and wear plate clearance, refer to the **Back Cover Installation And Adjustment**.

Suction Check Valve Installation

(Figure 1)

Inspect the check valve assembly (38) and replace it if badly worn.

NOTE

The check valve assembly must be replaced as a complete unit. Individual parts are not sold separately.

Reach through the back cover opening with the check valve, and position the check valve adaptor in the mounting slot in the suction flange (34). Align the adaptor with the flange hole, and secure the assembly with the check valve pin (39).

NOTE

If the suction or discharge flanges were removed, replace the respective gaskets, apply 'Permatex Aviation No. 3 Form-A-Gasket' or equivalent compound to the mating surfaces, and secure them to the pump casing with the attaching hardware.

Back Cover Installation And Adjustment

(Figures 1 and 7)

If the wear plate (12) was removed for replacement, carefully center it on the back cover and secure it with the hardware (14 and 15). The wear plate **must** be concentric to prevent binding when the back cover is installed.

Clearance between the impeller and wear plate is adjusted using four adjusting screws and locking collars (29 and 30). There are 18 detents on the I.D. of each locking collar. Indexing the collars one detent on the adjusting screws represents approximately .005 inch (0,13 mm) of wear plate clearance. The recommended clearance between the wear plate and the impeller is .010 to .020 inch (0,25 to 0,50 mm).

Replace the back cover O-rings (13 and 17), and lubricate them with a generous amount of No. 2 grease. Clean any scale or debris from the contacting surfaces in the pump casing that might interfere or prevent a good seal with the back cover.

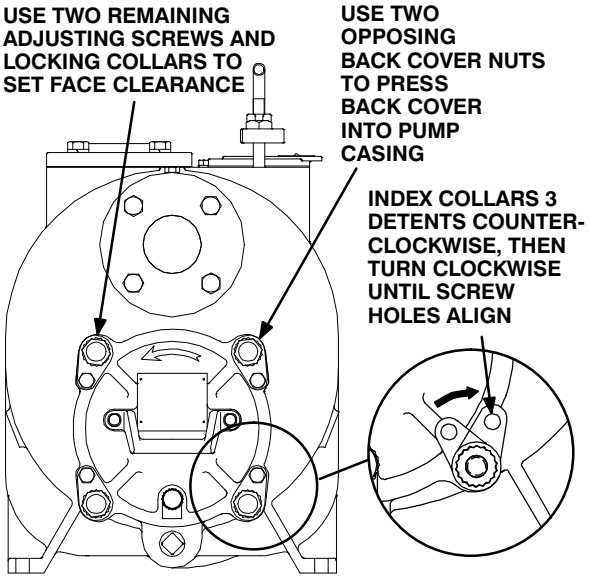


Figure 7. Installing and Adjusting Back Cover

Screw the four adjusting screws (30) into the tapped holes in the back cover plate until they are

just flush with the machined surface on the back side of the cover plate.

Align the back cover plate over the studs (31) and slide it into the pump casing. Use two back cover nuts (31) on diagonally opposing studs to press the back cover into the pump casing until the wear plate **just touches** the impeller when the shaft is turned by hand. **Tighten the back cover nuts evenly to avoid binding.**

With the wear plate just touching the impeller, turn the two free adjusting screws until they engage the pump casing. Position the locking collars over the adjusting screws so the holes in the collars for the locking screws align approximately with the holes in the cover plate.

Loosen the back cover nuts used to press the back cover into the pump casing one full turn.

Pull the collars off the adjusting screws, index them three detents counterclockwise, and reinstall the collars on the adjusting screws. Use the collars to turn the adjusting screws clockwise until the holes in the locking collars realign with the tapped screw holes in the back cover plate. Secure the locking collars to the back cover plate with the hardware (27 and 28). Install the two remaining back cover nuts snugly against the adjusting screws.

Remove the first two back cover nuts from their studs. Turn the adjusting screws clockwise until they engage the pump casing. Install the locking collars and hardware (27 and 28). Reinstall the back cover nuts.

Be sure the wear plate does not scrape against the impeller.

Over time it may be necessary to repeat the adjustment process to compensate for normal wear between the impeller and wear plate. When all of the adjustment has been used on the back cover side of the pump, an additional 0.125 inch (3,2 mm) of adjustment may be obtained by removing the rotating assembly adjusting shims (11).

Allow an installed pump to completely cool before draining liquid from the pump casing. Remove the back cover. Remove the rotating assembly adjusting shims, then reinstall the hardware securing the rotating assembly to the pump casing. Perform the back cover adjustment procedure described above to obtain the proper face clearance.

PRESSURE RELIEF VALVE MAINTENANCE

(Figure 1)

The back cover is equipped with a pressure relief valve (22) to provide additional safety for the pump and operator (refer to **Liquid Temperature And Overheating** in **OPERATION**).

It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

Periodically, the valve should be removed for inspection and cleaning. When reinstalling the relief valve, apply 'Loctite Pipe Sealant With Teflon No. 592', or equivalent compound, on the relief valve threads. Position the valve as shown in Figure 1 with the discharge port pointing down.

Final Pump Assembly

(Figure 1)

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

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

Remove the fill plug assembly (44) 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

Seal Assembly

(Figure 2)

Before starting the pump, remove the vented plug (8) and fill the seal cavity with approximately 40 ounces (1,2 liters) of SAE No. 30 non-detergent oil. Clean and reinstall the vented plug. Check the oil level regularly through the sight gauge (23) 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 vented plug.

Bearing

(Figure 2)

The bearing is permanently sealed and lubricated by the manufacturer, and no additional lubrication is required.

Motor

Consult the literature supplied with the motor, or contact your local motor 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