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



10 SERIES PUMPS

MODEL
16A22-B

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

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INTRODUCTION

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 10 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is designed for handling corrosive liquids containing specified entrained solids, residues and slurries. The basic material of construc-

tion for wetted parts is type 316 stainless steel.

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

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

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901-1217

or **Gorman-Rupp of Canada Limited**
70 Burwell Road
St. Thomas, Ontario N5P 3R7

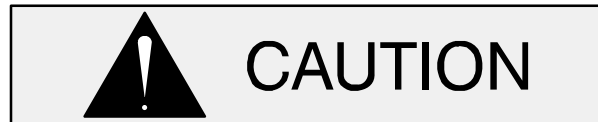
The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



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



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



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

NOTE

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

SAFETY - SECTION A

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



Before attempting to open or service the pump:

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



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



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



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



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.



This pump is designed to pump materials which could cause serious illness or injury through direct exposure or emitted fumes. Wear protective clothing, such as rubber gloves, face mask, and rubber apron, as necessary before disassembling the pump or piping.



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



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



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

INSTALLATION – SECTION B

Review all SAFETY information in Section A.

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

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

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

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

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

Pump Dimensions

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

OUTLINE DRAWING

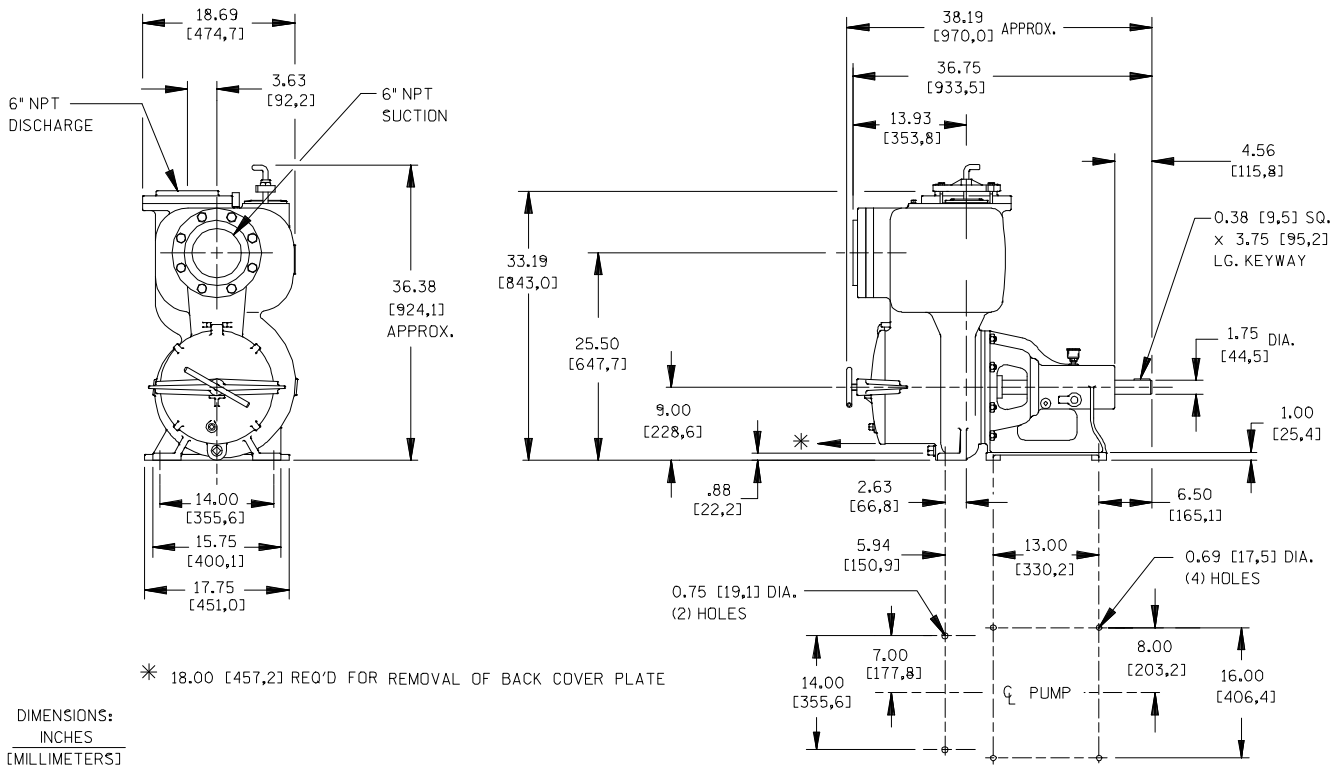


Figure B-1. Pump Model 16A22-B

PREINSTALLATION INSPECTION

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

- a. Inspect the pump for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.

- c. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated. Note that the pump shaft rotates in the required direction.



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

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

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

POSITIONING PUMP

Lifting

Use lifting equipment with a capacity of at least **3550 pounds (1610 kg)**. This pump weighs approximately **706 pounds (320 kg)**, not including the weight of accessories, base and power source. Customer installed equipment such as suction and discharge piping **must** be removed before attempting to lift.



The pump assembly can be seriously

damaged if the chains or cables used to lift and move the unit are improperly wrapped around the pump.

Mounting

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

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

Clearance

A minimum clearance of **18 inches** in front of the cover plate is required to permit removal of the cover and easy access to the pump interior.

SUCTION AND DISCHARGE PIPING

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

Materials

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

Line Configuration

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

Connections to Pump

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

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

Gauges

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

SUCTION LINES

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

Fittings

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

Strainers

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

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least

three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 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 distance equal to at least 3 times the diameter of the suction pipe.

Suction Line Positioning

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

NOTE

The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will

reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).

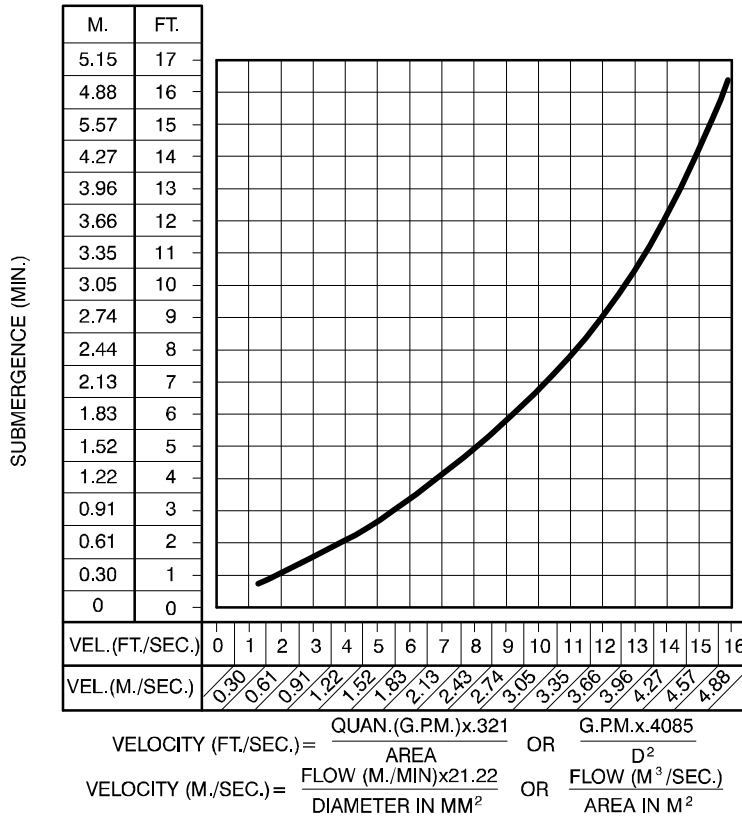


Figure B-2. Recommended Minimum Suction Line Submergence vs. Velocity

DISCHARGE LINES

Siphoning

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

Valves

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

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

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



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

Bypass Lines

Self-priming pumps are not air compressors. During the priming cycle, air from the suction line must be vented to atmosphere on the discharge side. If the discharge line is open, this air will be vented through the discharge. However, if a check valve has been installed in the discharge line, the discharge side of the pump must be opened to atmospheric pressure through a bypass line installed be-

tween the pump discharge and the check valve. A self-priming centrifugal pump **will not prime** if there is sufficient static liquid head to hold the discharge check valve closed.

NOTE

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

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



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

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

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

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



Except in certain specific applications (to prevent flooding during service of an automatic air release valve in a below-ground lift station), if a manual shut-off valve is installed **anywhere** in a bypass line, it **must** be a full-opening, **ball-type** valve to prevent plugging by solids.



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

Allow an over-heated pump to 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.

AUTOMATIC AIR RELEASE VALVE

When properly installed and correctly adjusted to the specific hydraulic operating conditions of the application, the 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.

Theory of Operation

Figures B-3 and B-4 show a cross-sectional view of the Automatic Air Release Valve, and a corresponding description of operation.

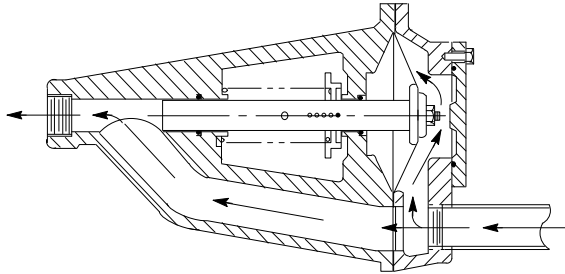


Figure B-3. Valve in Open Position

During the priming cycle, air from the pump casing flows through the bypass line, and passes through the Air Release Valve to the wet well (Figure B-3).

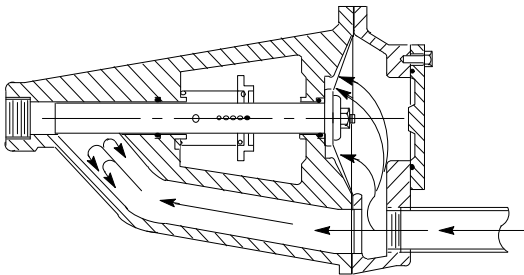


Figure B-4. Valve in Closed Position

When the pump is fully primed, pressure resulting from flow against the valve diaphragm compresses the spring and closes the valve (Figure B-4). The valve will remain closed, reducing the bypass of liquid to 1 to 5 gallons per minute, until the pump loses its prime or stops.



Some leakage (1 to 5 gallons (3,8 to 18,9 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.

When the pump shuts down, the spring returns the diaphragm to its original position. Any solids that may have accumulated in the diaphragm chamber settle to the bottom and are flushed out during the next priming cycle.

NOTE

The valve will remain open if the pump does not reach its designed capacity or head. Valve closing pressure is dependent upon the discharge head of the pump at full capacity. The range of the valve closing pressure is established by the tension rate of the spring as ordered from the factory. Valve closing pressure can be further adjusted to the exact system requirements by moving the spring retaining pin up or down the plunger rod to increase or decrease tension on the spring. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about an Automatic Air Release Valve for your specific application.

Air Release Valve Installation

The Automatic Air Release Valve must be independently mounted in a horizontal position and connected to the discharge line of the self-priming centrifugal pump (see Figure B-5).

NOTE

*If the Air Release Valve is to be installed on a **staged** pump application, contact the factory for specific installation instructions.*

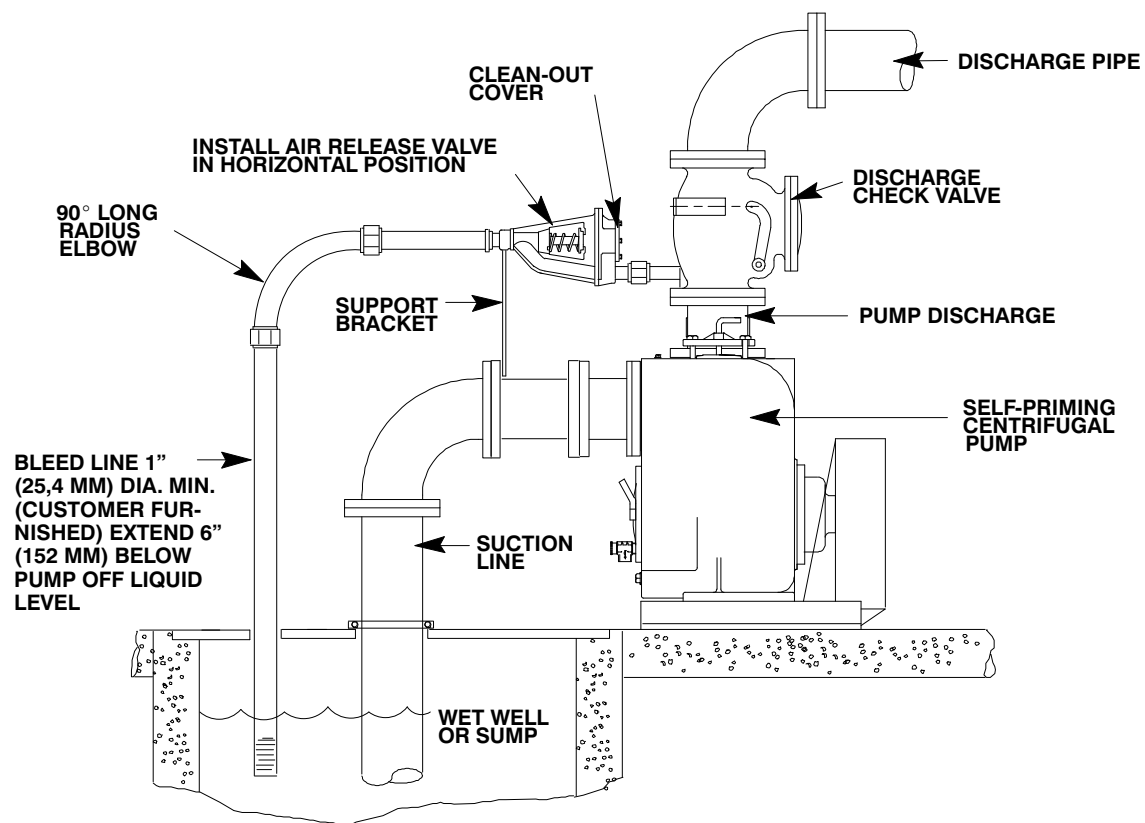


Figure B-5. Typical Automatic Air Release Valve Installation

The valve inlet line must be installed between the pump discharge port and the non-pressurized side of the discharge check valve. The valve inlet is at the large end of the valve body, and is provided with standard 1 inch NPT pipe threads.

The valve outlet is located at the opposite end of the valve, and is also equipped with standard 1 inch NPT pipe threads. The outlet should be connected to a bleed line which slopes back to the wet well or sump. The bleed line must be the same size as the inlet piping, or larger. If **piping** is used for the bleed line, avoid the use of elbows whenever possible.

NOTE

It is recommended that each Air Release Valve be fitted with an independent bleeder line directed back to the wet well. However, if multiple Air Release Valves are installed in a system, the bleeder lines may be directed to a common manifold pipe. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about installation of an Automatic Air Release Valve for your specific application.

ALIGNMENT

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

NOTE

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

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



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



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

Coupled Drives

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

Align spider insert type couplings by using calipers to measure the dimensions on the circumference of the outer ends of the coupling hub every 90°. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure B-6).

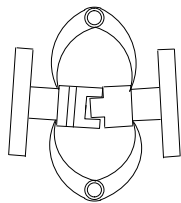


Figure B-6. Alignment of V-Belt Driven Pumps

Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure B-7).

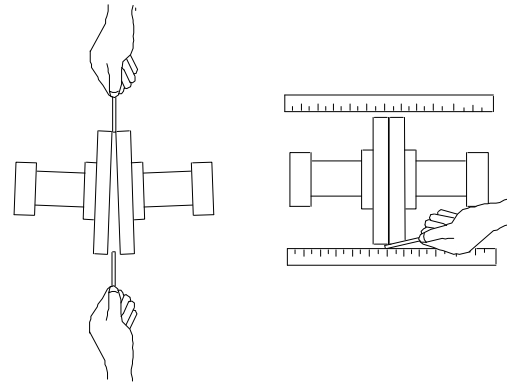


Figure B-7. Alignment of V-Belt Driven Pumps

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

V-Belt Drives

When using V-belt drives, the power source and the pump must be parallel. Use a straightedge along the sides of the pulleys to ensure that the pulleys are properly aligned (see Figure B-8). In drive systems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.

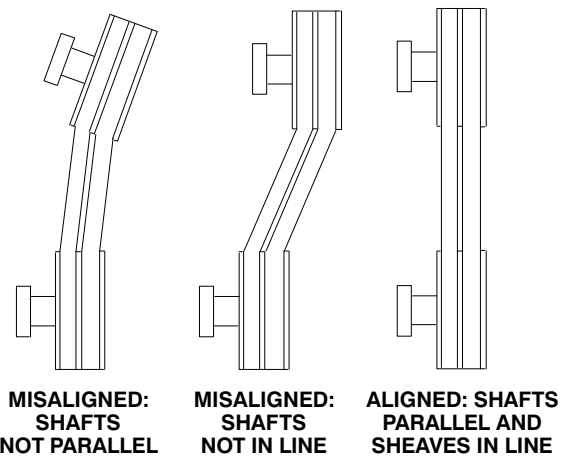


Figure B-8. Alignment of V-Belt Driven Pumps

Tighten the belts in accordance with the belt manufacturer’s instructions. If the belts are too loose,

they will slip; if the belts are too tight, there will be excessive power loss and possible bearing failure. Select pulleys that will match the proper speed ratio; overspeeding the pump may damage both pump and power source.



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

OPERATION – SECTION C

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

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



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



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

PRIMING

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

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



Never operate this pump unless there is liquid in the pump casing. The pump will

not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

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

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



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

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

STARTING

Consult the operations manual furnished with the power source.

Rotation

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



The pump must operate in the direction in-

indicated by the arrow on the pump, or accompanying decals. Reverse rotation could loosen the impeller and seriously damage the pump.

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

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

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

OPERATION

Lines With a Bypass

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.

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.



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.

Strainer Check

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

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the

equipment. If backflushing is absolutely necessary, **liquid pressure** must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve (see Section E, Page 1).

Pump Vacuum Check

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

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

STOPPING

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



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

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

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.



Before attempting to open or service the pump:

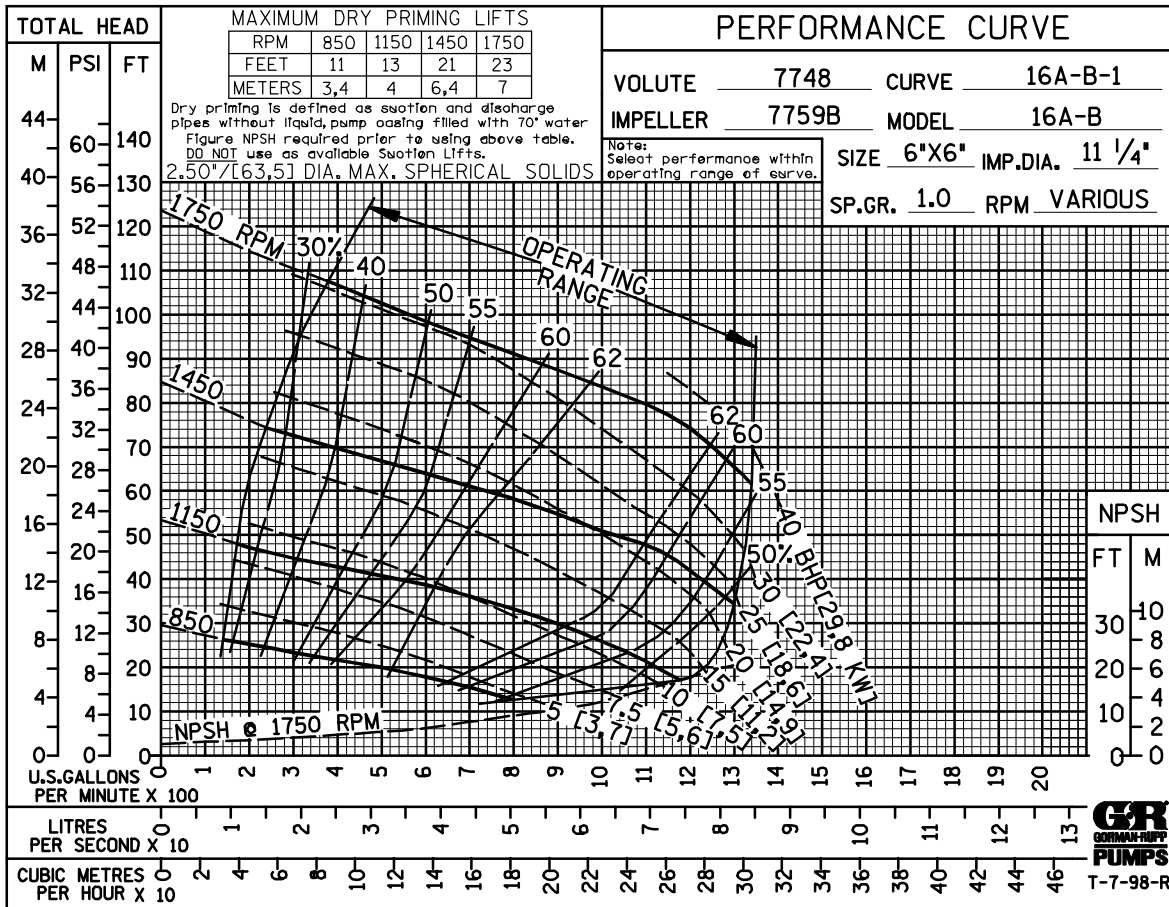
- 1. Familiarize yourself with this manual.**
- 2. Disconnect or lock out the power source to ensure that the pump will remain inoperative.**
- 3. Allow the pump to completely cool if overheated.**
- 4. Check the temperature before opening any covers, plates, or plugs.**
- 5. Close the suction and discharge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

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

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

PUMP MAINTENANCE AND REPAIR - SECTION E

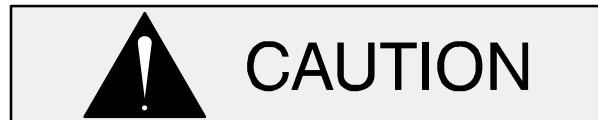
MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



*** STANDARD PERFORMANCE FOR PUMP MODEL 16A22-B**

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

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



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

SECTION DRAWING

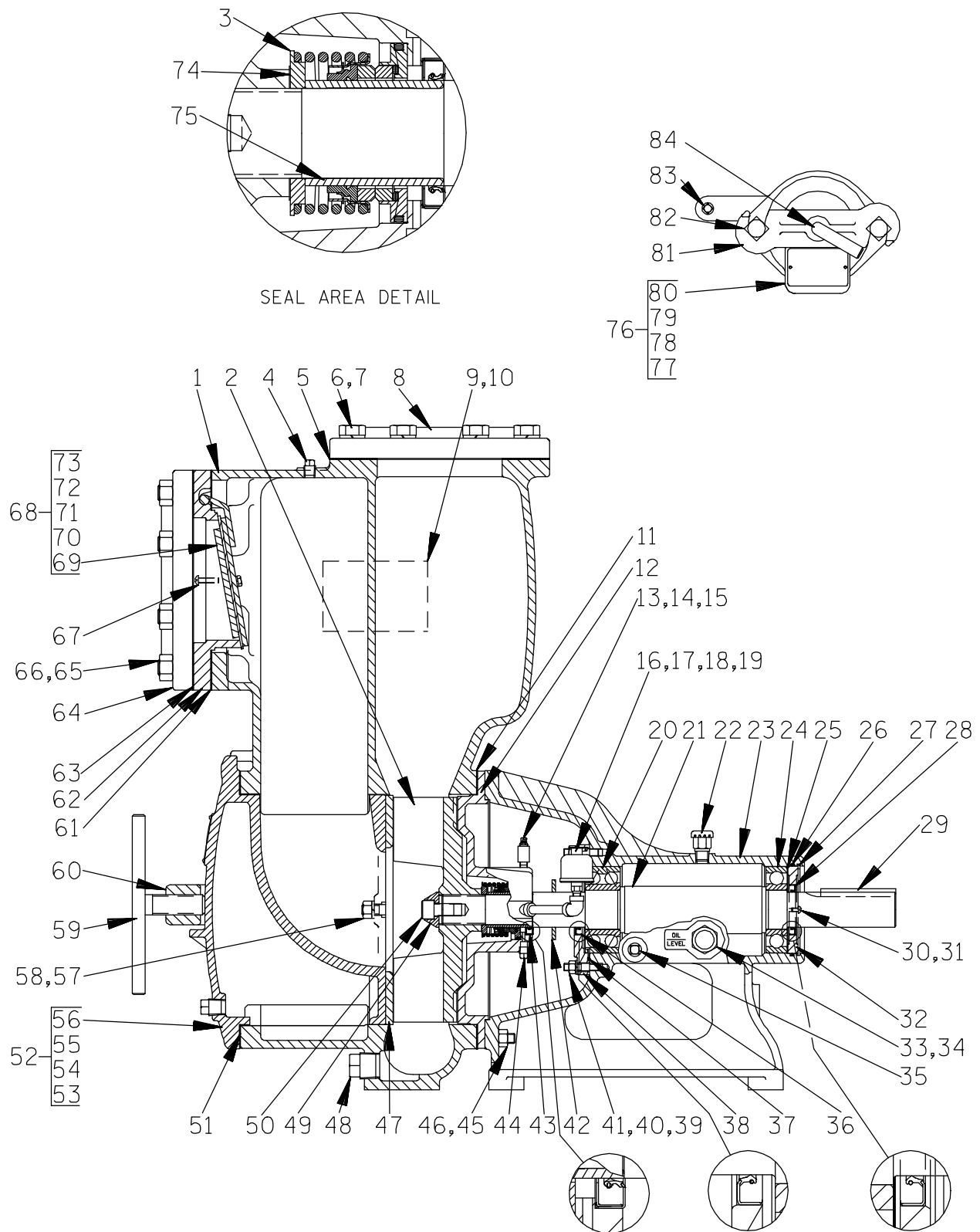


Figure E-1. Pump Model 16A22-B

PARTS LIST
Pump Model 16A22-B
 (From S/N 1068713 up)

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

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	VOLUTE HOUSING	7748	17070	1	48	CASING DRAIN PLUG	P16	17090	1
2 *	IMPELLER	7759B	17070	1	49 *	IMPELLER WASHER	10278	17090	1
3 *	SEAL ASSEMBLY	12461B	-----	1	50 *	SOC HD CAPSCREW	DM1004S	17090	1
4	ACCESSORY PLUG	P04	17090	1	51 *	COVER PLATE GSKT	7668GB	19410	1
5 *	DISCH FLANGE GSKT	1679G	19410	1	52 *	COVER PLATE ASSY	42111-933	-----	1
6	HEX HD CAPSCREW	B1208	17090	8	53	-COVER PLATE	NOT AVAILABLE		1
7	LOCKWASHER	J12	17090	8	54	-DRAIN PLUG	P08	17090	1
8	DISCHARGE FLANGE	1758	17070	1	55	-WARNING PLATE	2613EV	17090	1
9	NAME PLATE	38818-023	17010	1	56	-DRIVE SCREW	BM#04-03	17000	4
10	DRIVE SCREW	BM#04-03	17000	4	57	HEX NUT	D08	17090	2
11 *	CASING GSKT SET	34GB	19410	1	58	LOCKWASHER	J08	17090	2
12 *	SEAL PLATE	38272-517	17070	1	59	CLAMP BAR SCREW	2536	24000	1
13	PIPE COUPLING	AE02	15079	1	60	CLAMP BAR	2547	11010	1
14	PIPE NIPPLE	T02	15079	1	61 *	CHECK VALVE GSKT	7261GB	19410	1
15 *	AIR VENT	S2162	-----	1	62	CHECK VALVE SEAT	7261	17070	1
16	BOTTLE OILER	S1933	-----	1	63 *	SUCTION FLANGE GSKT	1679G	19410	1
17	PIPE ELBOW	R02	11999	1	64	SUCTION FLANGE	1758	17070	1
18	PIPE NIPPLE	T0212	15079	1	65	STUD	C1214	17090	8
19	STREET ELBOW	AGS02	11999	1	66	HEX NUT	D12	17090	8
20 *	BALL BEARING	S1030	-----	1	67	RD HD MACH SCREW	X0404	17090	2
21 *	IMPELLER SHAFT	38515-516	1706H	1	68	CHECK VALVE ASSY	7265F	-----	1
22 *	AIR VENT	S1703	-----	1	69	-HEX HD CAPSCREW	B0403	17090	2
23	PEDESTAL	3020B	10010	1	70	-LOCKWASHER	J04	17090	2
24 *	BALL BEARING	S1077	-----	1	71 *	-VALVE WEIGHT	7263	17090	1
25 *	BEARING SHIM SET	8546	15990	1	72 *	-CHECK VALVE	7264E	19540	1
26 *	O-RING	25152-245	-----	1	73 *	-VALVE WEIGHT	7262	17090	1
27 *	BRG RETAINING RING	S1165	-----	1	74 *	IMPELLER SHIM SET	5091	17090	REF
28 *	OIL SEAL	25227-534	-----	1	75 *	SHAFT SLEEVE	11907	1706H	1
29 *	SHAFT KEY	N0615	15991	1	76	FILL COVER ASSEMBLY	42111-346	-----	1
30 *	RD HD MACHINE SCREW	X#10-01 1/2S	15991	1	77 *	-FILL COVER GSKT	50G	19210	1
2					78	-COVER PLATE	NOT AVAILABLE		1
31	LOCKWASHER	J#10	15991	2	79	-WARNING PLATE	38816-097	17090	1
32 *	BEARING RETAINER	38322-522	26000	1	80	-DRIVE SCREW	BM#04-03	17000	2
33	OIL LEVEL SIGHT GAUGE	S1471	-----	1	81	CLAMP BAR	38111-004	11010	1
34	PIPE PLUG	P12	15079	1	82	MACHINE BOLT	A1014	17090	2
35	PEDESTAL DRAIN PLUG	P06	15079	1	83	PIPE PLUG	P04	17090	1
36 *	OIL SEAL	25227-534	-----	1	84	CLAMP BAR SCREW	31912-009	15000	1
37 *	BRG CAP O-RING	25152-248	-----	1		NOT SHOWN:			
38	BEARING CAP	38322-418	10010	1		DISCHARGE STICKER	6588BJ	-----	1
39	STUD	C0607	15991	6		ROTATION DECAL	2613M	-----	1
40	HEX NUT	D06	15991	6		SUCTION STICKER	6588AG	-----	1
41	LOCKWASHER	J06	15991	6		PRIMING DECAL	6588AH	-----	1
42 *	SLINGER RING	3209	19120	1		LUBE DECAL	38816-079	-----	1
43 *	OIL SEAL	S1935	-----	1		OPTIONAL:			
44	SEAL DRAIN PLUG	P02	17090	1		HI TEMP SHUT-DOWN KITS:			
45	HEX NUT	D08	17090	8		-145° F	48313-186	-----	1
46	STUD	C0810	17090	8		-130° F	48313-256	-----	1
47 *	WEAR PLATE ASSY	2545X	17040	1		-120° F	48313-257	-----	1

* INDICATES PARTS RECOMMENDED FOR STOCK
 Above Serial Numbers Do Not Apply To Pumps Made In Canada.

CANADIAN SERIAL NO. AND UP

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.

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

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



Before attempting to open or service the pump:

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

Suction Check Valve Removal and Disassembly

Before attempting to service the pump, remove the pump casing drain plug (48) and drain the pump. Clean and reinstall the drain plug.

To service the suction check valve assembly (68), remove the suction piping. Remove the nuts (66) securing the suction flange (64) and suction flange gasket (63) to the check valve seat (62). Remove the machine screws (67) securing check valve seat (62) and check valve assembly (68) to the pump casing (1). Separate the check valve assembly from the check valve seat. Discard the suction flange gasket (63) and check valve gasket (61).

Inspect the check valve parts for wear or damage. If replacement is required, remove the hardware (69 and 70), and separate the check valve gasket (72), and weights (71 and 73).

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

Back Cover Removal

The wear plate (47) is easily accessible and may be serviced by removing the back cover assembly (52). Loosen the clamp bar screw (59) and remove the clamp bar (60). Pull the back cover and wear plate from the pump casing. Remove the back cover gasket (51). Clean the mating surfaces of the back cover plate and pump casing.

Inspect the wear plate and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (57 and 58) securing it to the back cover.

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

Pump Casing Removal

To service the impeller or seal assembly, disconnect the discharge piping. Remove the hardware securing the pump to the base. Disconnect the power source. Tie and tag any leveling shims used under the pump mounting feet to ease reassembly.

Remove the nuts (45), and using a suitable hoist and sling of sufficient capacity separate the pump casing (1) and gasket set (11) from the seal plate

(12) and pedestal (23). Clean the mating surfaces of the seal plate and pump casing. Tie and tag the gaskets, or measure and record their thickness for ease of reassembly.

Impeller Removal

Before removing the impeller, remove the bottle oiler and piping (16, 17, 18 and 19). Remove the seal drain plug (44) and drain the oil from the seal cavity to prevent the oil from escaping when the impeller is removed. Clean and reinstall the drain plug.

Immobilize the impeller by wedging a block wood between the vanes. Remove the impeller capcrew and washer (49 and 50).

If removed, install the shaft key (29). Install a lathe dog on the drive end of the shaft (21) with the "V" notch positioned over the shaft keyway.

With the impeller rotation still blocked, strike the lathe dog sharply in a counterclockwise direction (when facing the drive end of the shaft). The impeller may also be loosened by using a long piece of heavy bar stock to pry against the arm of the lathe dog in a counterclockwise direction (when facing the drive end of the shaft) as shown in Figure 2. **Use caution** not to damage the shaft or keyway. When the impeller breaks loose, remove the lathe dog and wood block and unscrew the impeller from the shaft.

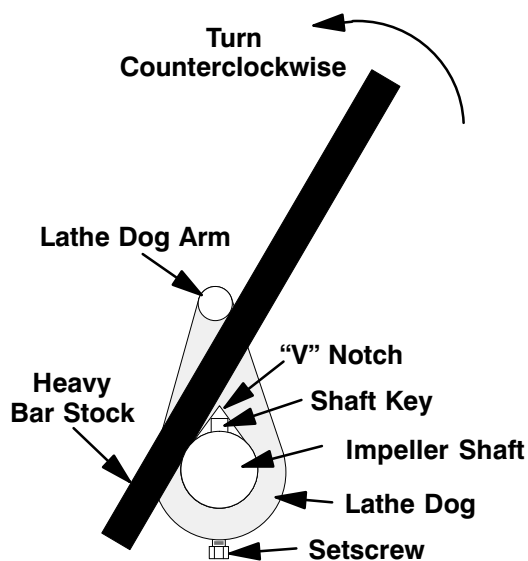


Figure 2. Loosening Impeller

Unscrew the impeller from the shaft. Use caution when removing the impeller; tension on the seal spring will be released as the impeller is unscrewed.

Inspect the impeller and replace it if cracked or badly worn. Slide the impeller adjusting shims (74) off the impeller shaft. Tie and tag the shims or measure and record their thickness for ease of reassembly.

Seal Removal and Disassembly

Remove the spring centering washer and seal spring. Slide the shaft sleeve (75) and rotating portion of the seal off the shaft as a single unit. Apply oil to the sleeve and work it up under the bellows. Slide the rotating portion of the seal off the shaft sleeve. Use a stiff wire with a hooked end to remove the stationary element, seat and O-rings from the seal plate. Slide the seal plate (12) and oil seal (43) off the shaft. Use a suitable sized dowel and press the oil from the seal plate.

NOTE

An alternate method of removing the seal assembly is to slide the seal plate, shaft sleeve and seal assembly off the shaft as a single unit. Place the seal plate on a flat surface with the impeller side down. Using a suitable sized dowel, press the seal components from the seal plate. Press the oil seal from the seal plate.

Inspect the seal plate and replace it if cracked or badly worn.

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

Shaft and Bearing Removal and Disassembly

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



Shaft and bearing disassembly in the field is not recommended. These operations

should be performed only in a properly-equipped shop by qualified personnel.

Remove the pedestal drain plug (35) and drain the bearing lubricant. Clean and reinstall the drain plug.

Remove the slinger ring (42).

Using snap ring pliers, remove the bearing retaining ring (27) from the pedestal bore.

Remove the machine screws and lockwashers (30 and 31) in the bearing retainer (32). Install two machine screws (#10-32 X 1" long) and using two screwdrivers against the heads of the machine screws pry the bearing retainer from the pedestal bore.

NOTE

Do not use the machine screws to jack against the ball bearings.

Remove the bearing shim set (25); tie and tag the shims or measure and record their thickness for ease of reassembly.

Press the oil seal (28) from the bearing retainer, and remove the bearing retainer O-ring (26) from the pedestal bore.

Remove the hardware (40 and 41) and remove the the bearing cap (38). Press the oil seal (36) from the bearing cap. Remove the O-ring (37).

Place a block of wood against the drive end of the shaft and tap the shaft (21) and assembled bearings (20 and 24) from the pedestal. **Be careful** not to damage the shaft.

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



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

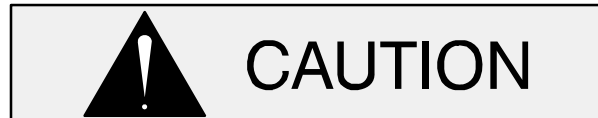
be replaced **any** time the shaft and bearings are removed.

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



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

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



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

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

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

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

Shaft and Bearing Reassembly and Installation

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



CAUTION

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

Inspect the shaft for distortion, nicks or scratches, or for thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

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

NOTE

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

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



WARNING!

Use caution when handling hot bearings to prevent burns.

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

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

against the shaft shoulders. Position the inboard bearing on the shaft with the retaining ring facing toward the impeller end of 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.

Slide the shaft and assembled bearings into the pedestal until the inboard bearing seats against the pedestal bore.



CAUTION

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

Install the oil seal (36) in the bearing cap (38) with the lip positioned as shown in Figure 1. Install the bearing cap O-ring (37) in the bearing cap. Slide the assembled bearing cap over the shaft and secure it to the pedestal (23) with the hardware (40 and 41). **Be careful** not to damage the oil seal lip.

Apply a light coating of soft grease on the bearing retainer O-ring (26) and the O-ring groove. Install the O-ring in the pedestal. Install the same thickness of bearing adjusting shim (25) as previously removed.

Press the outboard oil seal (28) in the bearing retainer (32) with the lip positioned as shown in Figure E-1. Press the bearing retainer into the pedestal until it seats against the bearing. **Be careful** not to damage the oil seal lip on the shaft keyway. Be sure the machine screws and lockwashers (30 and 31) are fully screwed into the bearing retainer and are positioned horizontally in line.

Using snap ring pliers, secure the bearing retainer with the bearing retaining ring (27). Check the shaft endplay.

NOTE

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

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

Seal Reassembly and Installation

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



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

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

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emer-

gency, **carefully** wash all metallic parts in **fresh** cleaning solvent and allow to dry thoroughly.

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

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Clean and polish the shaft sleeve (75), or replace it if there are nicks or cuts on either end. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the O-rings, bellows and shaft sleeve 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 E-3).

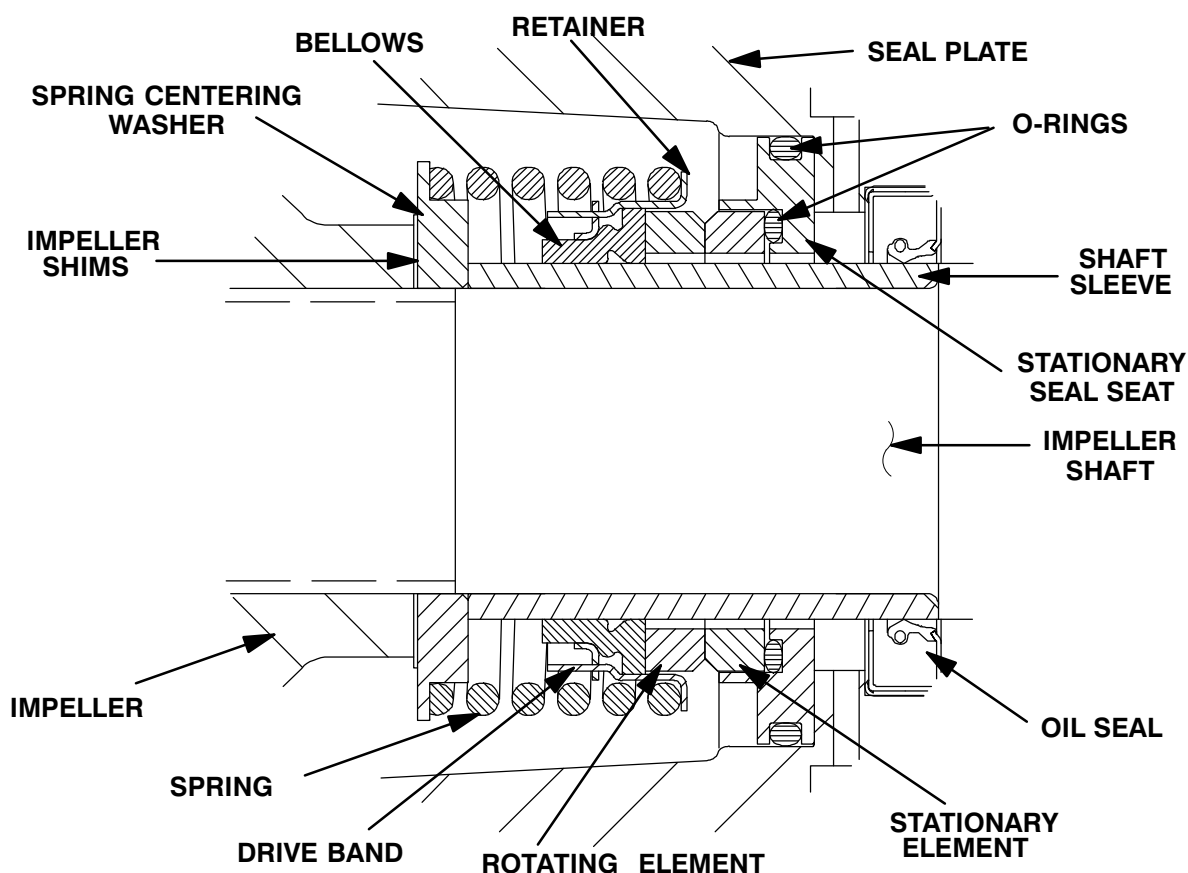


Figure E-3. 12461B Seal Assembly



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

Install the slinger ring (42) on the shaft.

Place the seal plate on a flat surface with the impeller side up. Press the oil seal (43) into the seal plate (12) with the lips positioned as shown in Figure E-1.

Lightly lubricate the stationary seat O-rings with a small amount of oil. Subassemble the stationary element in the stationary seat with the chambered side out. Press the stationary seat into the seal plate until it bottoms against the seal plate bore. A push tube cut from a length of plastic pipe would aid this installation. The I.D. of the pipe should be approximately the same diameter as the I.D. of the seal spring.

Slide the seal plate over the shaft until fully seated against the pedestal (23). **Be careful** not to damage the oil seal lip on the shaft threads.

Align the threaded seal lubricant hole in the seal plate with the pedestal opening and temporarily secure the seal plate using two capscrews and nuts (1/2 UNC X 1-1/2 inch long, not supplied).

Slide the lubricated shaft sleeve (75) onto the shaft and push it through the stationary seat and oil lip seal. **Be careful** not to damage the oil seal lip. Lightly lubricate the rotating subassembly (consisting of the rotating element, retainer and bellows) and press it onto the lubricated shaft sleeve. Continue to push the subassembly until the seal faces contact. Install the seal spring and the spring centering washer.

After the impeller has been installed, reinstall the bottle oiler and piping (16, 17, 18 and 19) and the air vent and piping (13, 14 and 15) in the seal plate. Lubricate the seal assembly as indicated in **LUBRICATION**.

Impeller Installation And Adjustment

Inspect the impeller, and replace it if cracked or badly worn. Install the same thickness of impeller shims (74) as previously removed. Apply 'Never-Seez' or equivalent compound to the shaft threads and screw the impeller onto the shaft until tight.

A clearance of .020 to .040 inch (0,51 to 1,02 mm) between the impeller and the seal plate is necessary for maximum pump efficiency. Measure this clearance and add or remove impeller shims until this clearance is reached.

NOTE

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

Apply a thin coat of 'Never-Seez' or equivalent compound to the threads on the socket head capscrew (50) and install the capscrew and impeller washer (49). Torque the impeller capscrew to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.)

Pump Casing Installation

Remove the hardware temporarily securing the seal plate to the pedestal. Install the same thickness of pump casing gaskets (11) as previously removed. Using a suitable hoist and sling, secure the pump casing (1) to the seal plate (12) and pedestal (23) with the nuts (45). **Do not** fully tighten the nuts at this time.

NOTE

It is recommended that the back cover be installed now. The back cover assembly must be in place to adjust the impeller face clearance.

A clearance of .008 to .015 inch (0,20 to 0,38 mm) between the impeller and the wear plate (47) is also recommended for maximum pump efficiency. Set this clearance by adding or removing gaskets in the pump casing gasket set (11) until the impeller scrapes against the wear plate when the shaft is turned. After the impeller scrapes, add approximately .008 inch (0,20 mm) of gaskets.

After the face clearance has been set, tighten the nuts (45) securing the pump casing to the pedestal.

Back Cover Installation

If the wear plate (47) was removed for replacement, secure it to the cover plate (53) using the attaching hardware (57 and 58). The wear plate must be concentric to prevent binding when the back cover is installed.

Clean any scales or debris from the contacting surfaces on the pump casing that might prevent a good seal with the back cover. Replace the back cover gasket (51) and slide the back cover assembly (52) into the pump casing. **Be sure** the wear plate does not scrape against the impeller.

NOTE

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

Secure the back cover assembly by installing the clamp bar (60) and tightening the clamp bar screw (59). **Do not** over-tighten the clamp bar screw; it should be just tight enough to seal the back cover shoulder.

Suction Check Valve Installation

Inspect the check valve components and replace as required. Subassemble the check valve weights (71 and 73) and check valve gasket (72) using the attaching hardware (69 and 70).

Position the check valve assembly (68) in the check valve seat (62) with the large weight toward the inside of the pump casing. Install the check valve seat gasket (61) and secure the valve seat to the suction port with the machine screws (67).

NOTE

To ease future disassembly, apply a film of grease in the valve seat slot for the check valve. This action will help reduce rust and seizing.

Replace the suction flange gasket (63) and secure the suction flange (64) with the nuts (66). Check

the operation of the check valve to ensure proper seating and free movement.

Final Pump Assembly

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

Install the shaft key (29) and secure the pump to the power source with the previously removed hardware. **Be sure** the pump and power source are securely mounted to the base.

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

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

Remove the fill cover assembly (76) and fill the pump casing with clean liquid. Reinstall the fill cover and tighten it.

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

LUBRICATION

Seal Assembly

Fill the bottle oiler (16) with SAE No. 30 non-detergent oil while venting the seal cavity at the air vent (15). Check the oil level regularly and keep the bottle oiler full.

Bearings

The pedestal was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (33) and maintain it at the middle of the gauge. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (22). **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 pedestal once each year and refill with clean oil to the middle of the sight gauge. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the bearing 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
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