

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



MODEL
S2D65-E1 460/3

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

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

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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 designed to operate fully or partially submerged. It is capable of handling most nonvolatile, nonflammable liquids, industrial chemical and low pH resistance materials which are mildly corrosive and abrasive. The basic material of construction is grade CD-4MCu stainless steel, including volute, impeller and wear plate. The pump is powered by an integral thermally protected electric motor which must be operated through a control box available from the factory as an option. Neither the pump nor the optional control box are explosion proof and should not be operated in an explosive atmosphere.

If there are any questions regarding the pump or motor 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	or	Gorman-Rupp of Canada Limited
P.O. Box 1217		70 Burwell Road
Mansfield, Ohio 44901-1217		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:

NOTE

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

CAUTION

Instructions which must be followed to avoid causing damage to the product or other equipment incidental to the installation. These instructions describe the requirements and the possible damage which could result from failure to follow the procedures.

WARNING

```

////////////////////////////////////
//
// These instructions must be followed to avoid causing in- //
// jury or death to personnel, and describe the procedure //
// required and the injury which could result from failure //
// to follow the procedure. //
// //
////////////////////////////////////

```


WARNINGS

WARNINGS - SECTION A

THESE WARNINGS APPLY TO THE "S-SERIES" SUBMERSIBLE MOTOR OPERATED PUMPS.

WARNING

```

////////////////////////////////////
//                               //
// Before attempting to open or service the pump: //
//                               //
// 1. Familiarize yourself with this manual. //
// 2. Lock out the power supply to the control panel to //
// ensure that the pump will remain inoperative. //
// 3. Allow the pump to cool if overheated. //
// 4. Close the discharge valve (if used). //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//                               //
// Do not attempt to pump volatile or flammable liquids for //
// which this pump has not been designed. //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//                               //
// After the pump has been installed, make certain that the //
// pump and all piping or hose connections are secure be- //
// fore operation. //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//                               //
// Before connecting any cable to the control box, be sure //
// to ground the control box. See Figure 4 on page B-8 for //
// suggested grounding methods. //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//                               //
// The pump is designed to be operated through an optional //
// control box. The control box provides overload pro- //
// tection and power control. Do not connect the pump mo- //
// tor directly to the incoming power lines. //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// All electrical connections must be in accordance with //
// the National Electric Code and all local codes. If //
// there is a conflict between the instructions provided //
// and N.E.C. specifications, N.E.C. specifications shall //
// take precedence. All electrical equipment supplied with //
// this pump was in conformance with N.E.C. requirements in //
// effect on the date of manufacture. Failure to follow //
// applicable specifications, or substitution of electrical //
// parts not supplied or approved by the manufacturer, can //
// result in severe injury or death. //
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Never attempt to alter the length or repair any power //
// cable with a splice. The pump motor and cable must be //
// completely waterproof. Injury or death may result from //
// alterations. //
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// The electrical power used to operate this pump is high //
// enough to cause injury or death. Make certain that the //
// control box is grounded, and that the power supply is //
// compatible with the motor phase and voltage, before con- //
// necting the power source. If the overload unit is //
// tripped during pump operation, correct the problem be- //
// fore restarting the pump. //
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Obtain the services of a qualified electrician to con- //
// nect the electrical circuits, and to service the control //
// box. //
//
////////////////////////////////////

```

WARNINGS

WARNING

```

////////////////////////////////////
//
// Approach the pump cautiously after it has been running. //
// Although the motor is cooled by the liquid being pumped, //
// normal operating temperatures can be high enough to //
// cause burns. The temperature will be especially high if //
// operated against a closed discharge valve. Never oper- //
// ate against a closed discharge valve for long periods of //
// time. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not remove plates, covers, gauges, pipe plugs, or //
// fittings from an overheated pump. Vapor pressure within //
// the pump can cause parts being disengaged to be ejected //
// with great force. Allow the pump to cool before servic- //
// ing. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not attempt to thaw the pump by using a torch or oth- //
// er source of flame. This could damage gaskets or heat //
// the oil within the pump above the critical point and //
// cause the pump to rupture or explode. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not attempt to lift the pump by the motor power cable //
// or the piping. Attach proper lifting equipment to the //
// hoisting bail fitted to the pump. //
// //
////////////////////////////////////

```


INSTALLATION

INSTALLATION - SECTION B

This section is intended only to summarize recommended installation practices for the pump. If there are any questions concerning your specific installation, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

A float switch, manual starting switch, and liquid level control box are offered as options with this pump.

For information on installing and operating this optional equipment, see the technical data accompanying the option.

CAUTION

Some of the nuts, bolts and screws used on this pump are metric and do not match standard American-measurement threads. If any threaded hardware is replaced, check the threads to determine if it must be replaced with metric type. Attempting to force a fastener with American threads will damage the mating threads.

PREINSTALLATION INSPECTION

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

- a. Check the pump assembly for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose bolts, nuts, capscrews, and other attaching hardware. Since gaskets tend to shrink after drying, check for and tighten loose hardware securing all mating surfaces.
- c. The standard pump is furnished with 50 ft. of power cable wired in the the pump head. Inspect the cable for cuts or damage.
- d. Compare the amperes, phase, voltage, and hertz indicated on the motor name plate to the ratings indicated for the control box.
- e. Carefully read all tags, decals, and markings on the pump assembly and perform all duties indicated.
- f. Check the pump and motor for any oil leaks. An oil leak may indicate a cut O-ring or other damage.
- g. 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.

Lubrication

This pump utilizes one lubrication cavity, located between the volute and the motor housing. It is filled with SAE No. 10 non-detergent oil and provides lubrication to the shaft seal. The motor operates in air and requires no lubrication.

The seal assembly is single faced. It is designed to prevent the liquid being pumped from entering the lubrication cavity at the impeller end. An oil seal is used to prevent moisture or lubrication oil from entering the motor housing cavity at the motor end.

The lubrication cavity was fully lubricated when shipped from the factory. Check the oil level before installing the pump (see **LUBRICATION** in **MAINTENANCE AND REPAIR**). If the oil level is abnormally low, determine the cause before putting the pump into service.

PUMP INSTALLATION

Pump Specifications

See Table 1 for the typical pump specifications and motor data.

Table 1. Pump Specifications

Model Number	Voltage /Phase	Motor Horse-power	Motor Speed (RPM)	Full Load Amps	No Load Amps	Locked Rotor Amps	Discharge Size NPT Threads
S2D65-E1	460/3	1	3450	1.4	0.8	10.5	2 Inches

Pump Dimensions

The standard pump is provided with a suction strainer to prevent large solids from clogging the impeller.

See Figure 1 on page B-3 for the approximate physical dimensions of the pump.

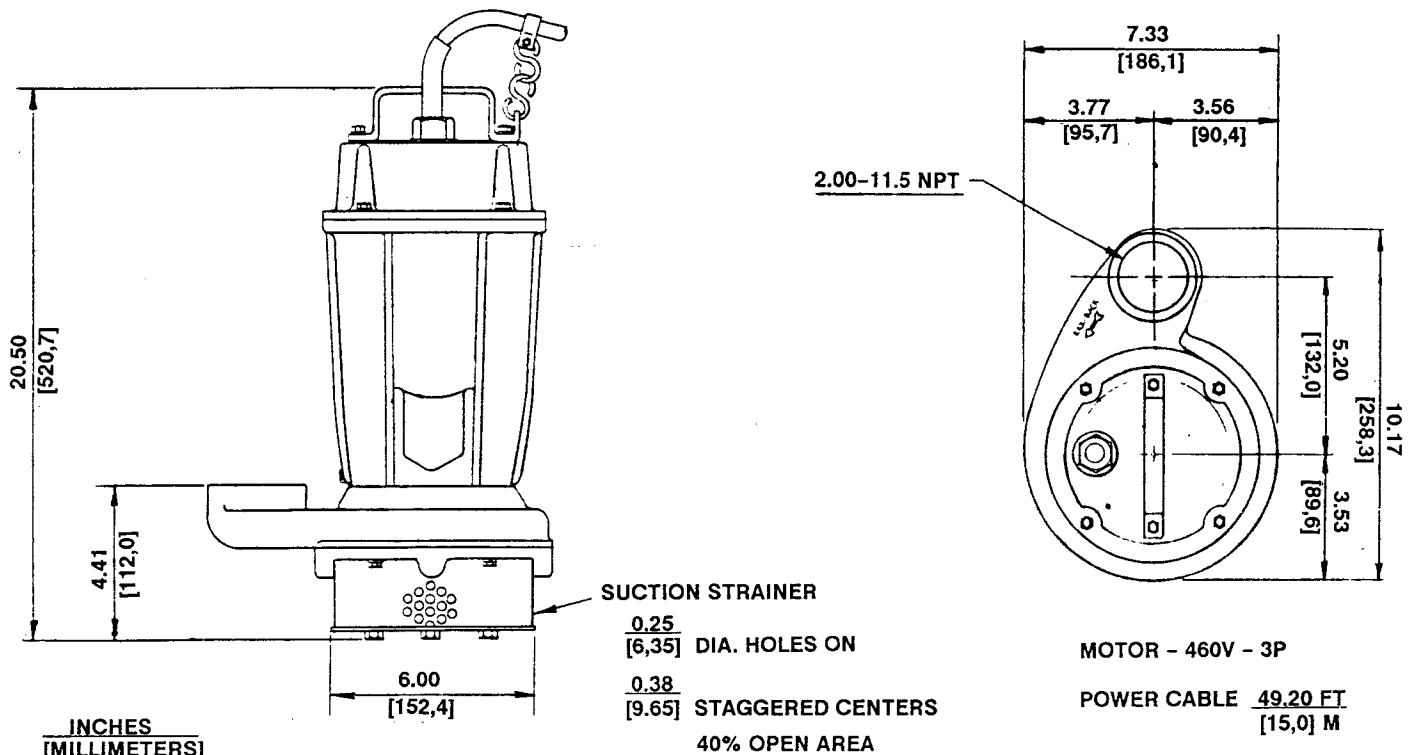


Figure 1. Pump Model S2D65-E1 460/3

Lifting

This pump weights approximately **58** pounds, not including the weight of accessories and options. Customer installed equipment such as rigid piping **must** be removed before attempting to lift.

WARNING

```

////////////////////////////////////
// Do not attempt to lift the pump by the motor power cable //
// or discharge hose. Lift the pump by a rope attached to //
// the carrying handle. //
// //
////////////////////////////////////
    
```

Positioning The Pump

This pump is designed to operate fully or partially submerged. **Do not** operate it in the air for extended periods of time; this will cause overheating of the motor and possible burnout.

The pump will operate if positioned on its side, but this is not recommended because the motor torque could cause the pump to roll during operation.

CAUTION

The **MAXIMUM** submergence depth for this pump is 23 feet. Placing it at a greater depth could result in damage to the pump.

The pump should be independently secured and supported by the carrying handle. If the application involves a lot of debris, protect the pump from excessive wear and clogging by suspending it in a perforated barrel or culvert pipe. If the bottom of the sump or wet well is heavily sludge-covered, rest the pump on support blocks or suspend it from a raft or similar device near the surface of the liquid. See Figure 2 for typical pump installations.

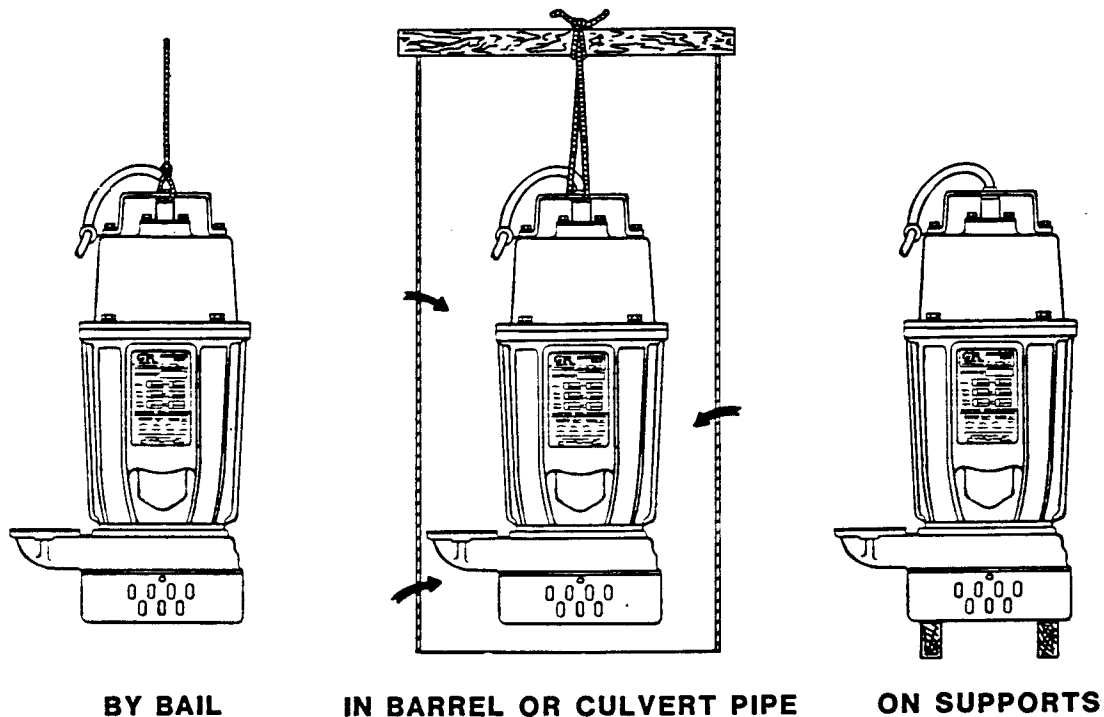


Figure 2. Typical Pump Installations.

All liquid entering the pump must pass through a strainer screen. Any spherical solids which pass through the screen will pass through the pump.

NOTE

Before actual operation, check the direction of impeller rotation. See **Checking Pump Rotation** in **OPERATION** section.

Piping

No suction piping is required in a standard submersed application.

To determine the size of the discharge connection, see Table 1, **Pump Specifications**. The standard pump may be fitted with a hose adaptor threaded into the discharge flange.

If rigid pipe is used on the discharge it is recommended that a quick disconnect fitting be used near the pump to facilitate mobility and maintenance.

For maximum pumping capacity, keep the discharge as short and straight as possible. Minimize the use of elbows and fittings which increase friction losses through the discharge piping system.

It is recommended that a check valve or throttling valve be installed in the discharge line to control siphoning or back flow when the pump is shut off.

CONTROL BOX INSTALLATION

This pump is driven by an integral 460 VAC, 60 hertz, 3 phase, 1 HP motor which is completely wired and ready for operation. The power cable furnished with the pump must be connected to an optional control box available from Gorman-Rupp.

WARNING

```

////////////////////////////////////
//
// The pump motor is designed to be operated through a con- //
// trol box available from the factory as an option. The //
// control box provides overload protection and power con- //
// trol. Do not connect the pump directly to the incoming //
// power lines. //
// //
////////////////////////////////////

```

CAUTION

<p>Since operation of the pump motor is dependent upon the quality and performance of the electrical controls, the pump warranty is valid only when controls have been specified or provided by the Gorman-Rupp Company.</p>
--

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 make all electrical con- //
// nections. Make certain that the pump and enclosure are //
// properly grounded, and that the incoming power matches //
// the requirements of the pump and control. //
//
////////////////////////////////////

```

Enclosure

The control box is a rainproof enclosure; however, **the enclosure is not designed to be water tight, and should not be submerged.**

Secure the control box vertically on a level surface, which is above flood level. It should be easily accessible to the operator, and located close enough to the pump to avoid excessive voltage drop due to cable length (see **Pump Power Cable Connections**).

CAUTION

<p>Failure to mount the control box vertically on a level surface may affect operation of the pump controls.</p>
--

Optional Control Box Wiring

Liquid level controls and/or accessories are not furnished with this pump as standard equipment. Install and connect these units in accordance with the literature accompanying the units.

Connect the pump motor cables to the optional control panel in accordance with Figure 3 on page B-7.

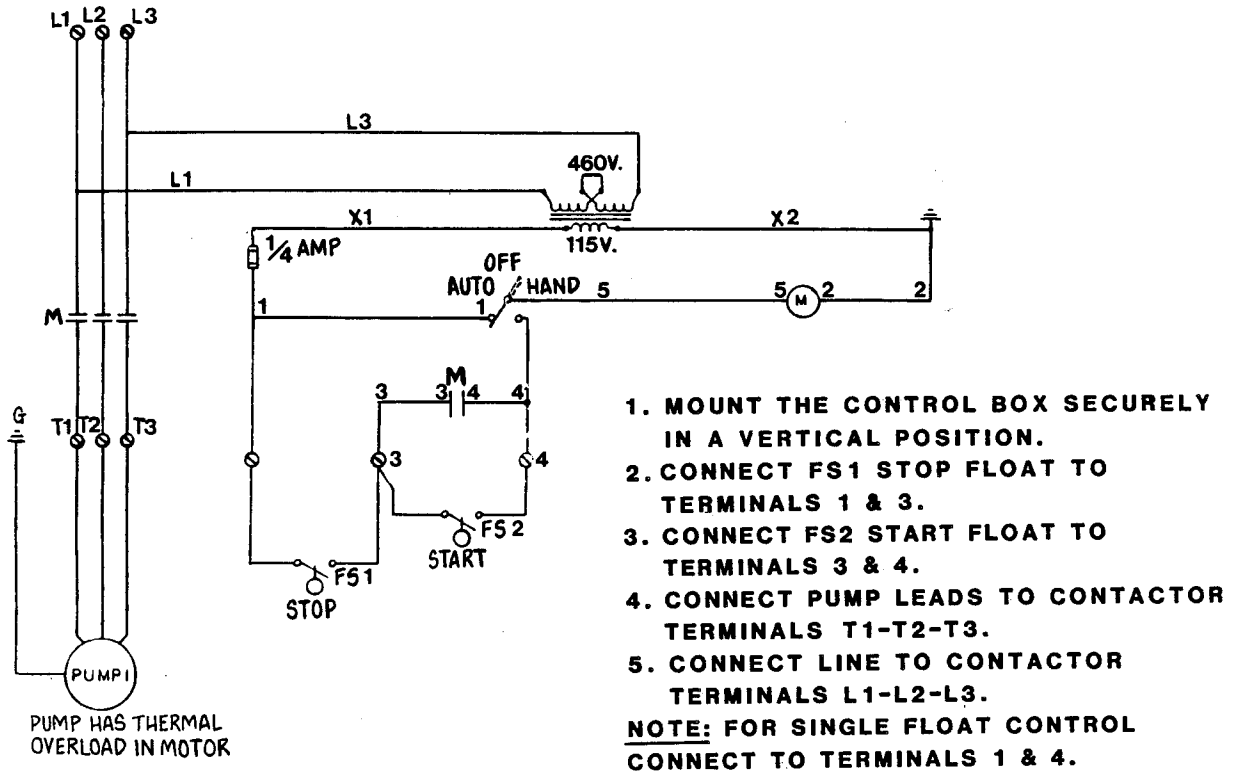


Figure 3. Control Box Wiring And Parts List

NOTE

Individual parts for the optional control box are listed by the vendor's part numbers. The complete control box can be ordered from Gorman-Rupp; however, replacement parts must be ordered directly from the vendors.

PART NAME	PART	VENDOR NUMBER	QTY NAME
OPTIONAL CONTROL BOX ASSEMBLY	27511-082	G-R	1
-NEMA 3 ENCLOSURE	8987K	HOFFMAN	1
-BACK PANEL	A10P8	HOFFMAN	1
-CONTACTOR	42BE35AF	FURNAS	1
-AUXILIARY INTERLOCK	49D22125001	FURNAS	1
-TRANSFORMER	V025BTZ13	MICRON	1
-1/4 AMP FUSE	BLF-1/4	LITTELFUSE	1
-H-O-A SELECTOR SWITCH	3191-0001	McGILL	1
-TERMINAL	KT3	CONNECTRON	1
-WIRE END	KAD	CONNECTRON	1
-SWITCH PLATE			
-MOUNTING SCREWS			
-GROUND LUG			

Grounding Methods

Ground the optional manual switch or control box before installing the wiring.

The material used for the electrode **must** be an excellent conductor of electricity, such as copper. If iron or steel is used, it must be galvanized or otherwise metal plated to resist corrosion. **Do not** coat the electrode with any material of poor conductivity such as paint or plastic.

The electrode must conform to the recommendations of N.E.C. Article 250. Follow all installation requirements of the N.E.C., and all applicable local codes. See Figure 4 for some suggested grounding methods.

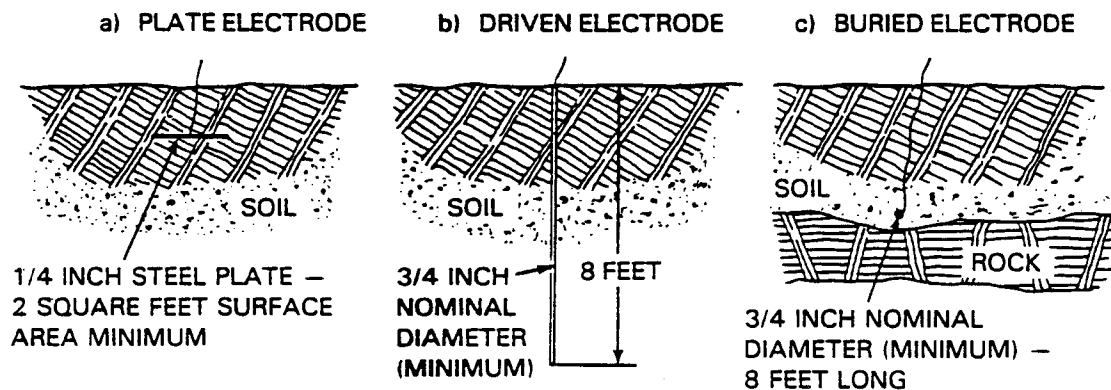


Figure 4. Suggested Grounding Methods

- a. **Plate Electrode:** An iron or steel plate, 1/4 inch thick, completely imbedded in the ground. The plate must present a surface of a least 2 square feet.
- b. **Driven Electrode:** A rod or pipe, 3/4 inch diameter minimum, 8 feet long, completely driven into the ground.
- c. **Buried Electrode:** If rock or stone prevents imbedding the full 8 foot length of the ground rod, bury it in a horizontal trench.

Space the ground rod or plates at least 6 feet from any other electrode or ground rod, such as those used for signal circuits, radio grounds, lightning rods, etc.

The earth surrounding the ground rod or plate **must** contain enough moisture to make a good electrical connection. In dry or sandy areas, pour water around the rod or consult qualified personnel to devise a method of improving the connection.

WARNING

```

////////////////////////////////////
//
// The electrical power used to operate this pump is high //
// enough to cause injury or death. Make certain that the //
// receptacle or optional enclosure is properly grounded //
// after installation. //
// //
////////////////////////////////////

```

Field Wiring Connections (Incoming Power)

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 make all electrical con- //
// nections. Make certain that the pump and receptacle or //
// optional enclosure are properly grounded, and that the //
// incoming power matches the requirements of the pump and //
// control. //
// //
////////////////////////////////////

```

The pump is designed to operate with a 460 VAC, 3 phase, 60 hertz power supply. The voltage available at the motor must be within the range indicated in Table 2.

To calculate the voltage available at the motor proceed as follows:

- a. Measure the incoming voltage across lines 1 & 2, 2 & 3, and 1 & 3 while the pump is **operating at full capacity**. See Figure 3 on page B-7.
- b. Next, subtract the motor cable voltage drop (see Table 3, Motor Cable Specifications).
- c. Do not continue to operate the pump if this voltage is not within the recommended limits. Obtain the services of a qualified electrician to determine the correct field wiring size and other details to ensure an adequate voltage supply to the pump.

Table 2. Pump Motor Voltage Limits

Nominal Voltage	Phase	Minimum Voltage	Maximum Voltage
460	3	420	500

Pump Power Cable Requirements

WARNING

```

////////////////////////////////////
//
// The electrical power used to operate this pump is high //
// enough to cause injury or death. Make certain that the //
// control box is properly grounded after installation. //
//
////////////////////////////////////
    
```

The standard pump is provided with 50 feet of power cable with one end wired into the pump head. The other end terminates into separate leads which must be connected to a control box.

Optional rainproof starting switches (with or without automatic liquid level controls) are listed on the Parts List in Section E.

NOTE

The optional rainproof starting switch listed in the Parts List is **not** designed to be watertight and must not be used in submerged applications.

Splicing of the power cable is **not** recommended by the Gorman-Rupp Company due to safety and warranty considerations. If a longer power cable is required, it should be of continuous length and should replace the existing cable. Any replacement cable **must** be to Gorman-Rupp standards, and **must** be approved by Gorman-Rupp.

WARNING

```

////////////////////////////////////
//
// Never attempt to alter the length or repair any power //
// cable with a splice. The pump motor and cable must be //
// completely waterproof. Injury or death may result from //
// alterations. //
//
////////////////////////////////////
    
```

Table 3. Cable Requirements for Pump Electrical Connections, Model S2D65-E1

Voltage/ Phase	A.W.G. Cable Size	Cable OD (inches)	Conductor Dia. (inches)	Amp Rating* at 30°C (amperes)	DC Resist- ance at 25°C (ohms/ 1000 ft)	Voltage Drop at Max. Load per 100 ft
460/3	16	0.49	0.06	10	4.49	2.87

*Applies only to S0 type cable. Refer to manufacturer's specifications for other cable.

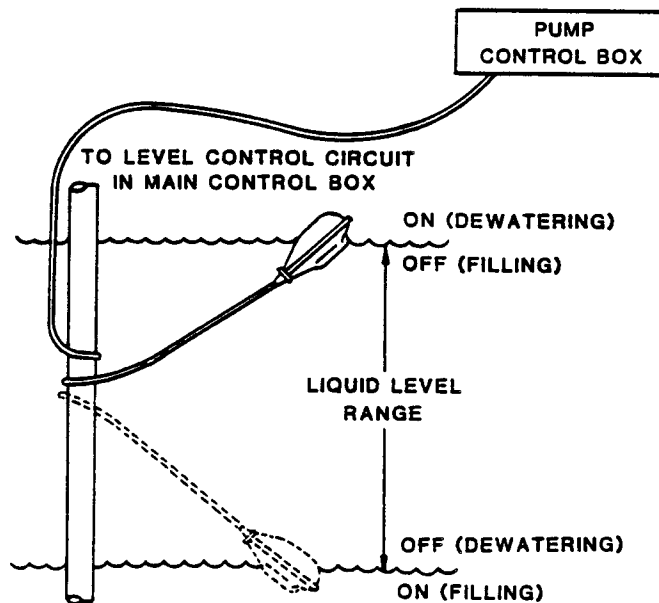
Liquid Level Devices

The standard pump is **not** furnished with a means to automatically regulate liquid level. However, the pump may be controlled to perform filling and dewatering by using the float switch and liquid level control offered as options (see Figure 5).

The circuitry may be prewired as a factory option, or easily added in the field by qualified personnel. For installation and operation, see the detailed instructions included with the optional package.

CAUTION

Liquid level device **MUST** be positioned far enough apart to allow 10 minutes between starts. If the pump motor cycles more than 6 starts per hour, it will overheat, resulting in damage to the motor windings or control box components.



BULB (FLOAT) TYPE

Figure 5. Typical Float Switch Installation

CAUTION

The internal wiring of the sensing devices are different for filling and dewatering functions. Be sure to follow the instructions included with the option before making wiring connections.

OPERATION - SECTION C

PUMP CONTROLS

WARNING

```

////////////////////////////////////
//
// This pump motor and optional accessories are not de- //
// signed to be explosion proof. Do not operate in an ex- //
// plosive atmosphere. //
// //
////////////////////////////////////

```

CAUTION

Since operation of the pump motor is dependent upon the quality and performance of the electrical controls, the pump warranty is valid only when controls have been specified or provided by the Gorman-Rupp Company.

The pump is equipped with a thermal overload protector which automatically shuts the motor down when the operating temperature exceeds designed limits. After the motor cools down, it will automatically restart. Always terminate power to the pump and control box before investigating pump or control box problems.

WARNING

```

////////////////////////////////////
//
// The pump motor is thermally protected and subject to au- //
// tomatic restart. Always terminate power to the pump and //
// control box before performing service functions. //
// //
////////////////////////////////////

```

If wired to an optional manual starting switch, the toggle switch within the rainproof enclosure will start and stop the pump.

If the pump power cable is wired into an optional automatic liquid level control box, pump operation is controlled by a selector switch. In the **OFF** position the switch prevents all operations of the pump. In the **MAN** position, it allows the pump to run continuously. In the **AUTO** position, it allows the pump to be controlled automatically by an optional liquid level device installed in the sump or wet well (see **Liquid Level Devices** in Section B).

Short circuit protection is provided by a fuse the optional control box. If the fuse blows repeatedly, operational problems exist (see Section D, **TROUBLESHOOTING**).

PUMP OPERATION

WARNING

```

////////////////////////////////////
//
// This pump is designed to handle industrial chemical and //
// low pH resistance materials that may be mildly corrosive //
// and abrasive. Do not attempt to pump volatile, //
// flammable, or highly corrosive liquids which may damage //
// the pump or endanger personnel as a result of pump fail- //
// ure. //
// //
////////////////////////////////////

```

Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 120° F. Do not apply it at a higher operating temperature.

Overheating can occur if the pump is misapplied, required to start repeatedly, or the control box fails to provide adequate protection. Operating the pump against a closed discharge for an extended period will also cause the pump to overheat.

If overheating occurs, stop the pump immediately and allow it to cool before servicing it. **Approach any overheated pump cautiously.**

WARNING

```

////////////////////////////////////
//
// Overheated pumps can cause severe burns and injury. If //
// overheating of the pump occurs: //
// //
// 1. Stop the pump immediately. //
// 2. Allow the pump to cool. //
// 3. Refer to instructions in this manual before re- //
// starting the pump. //
// //
////////////////////////////////////

```

Checking Pump Rotation

Check the direction of pump rotation before operation to ensure that the impeller is rotating in the correct direction.

Suspend the pump from the carrying handle. Turn the pump on momentarily and note the direction of twist. For correct rotation and operation, the twist must be in the **counterclockwise** direction when viewed from the **top**.

CAUTION

Secure the pump during rotation check to prevent coiling of the power cable.

If the pump twists clockwise on start, interchange any two motor leads at the control box.

WARNING

//////
// The electrical power used to operate this pump is high //
// enough to cause injury or death. Make certain that in- //
// coming power is OFF and LOCKED OUT before interchanging //
// motor leads. //
//////

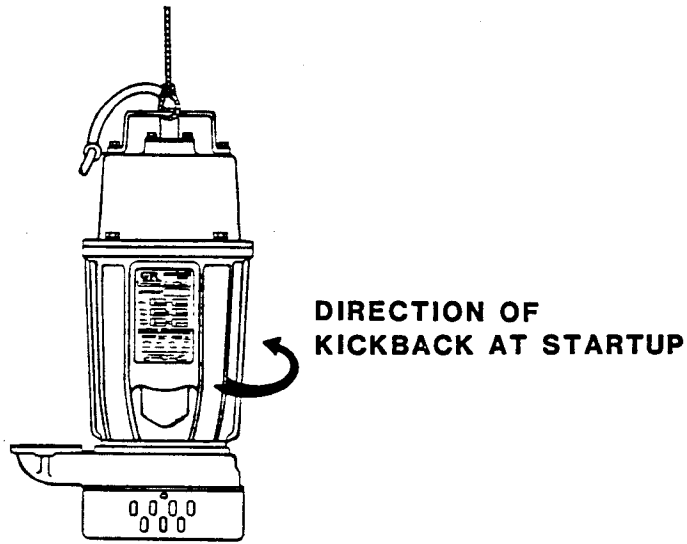


Figure 1. Checking Pump Rotation

OPERATION

STARTING AND STOPPING THE PUMP

After the pump and options have been installed, start the pump as follows:

NOTE

Before actual operation, check the direction of impeller rotation to ensure that the pump is properly wired. See **Checking Pump Rotation** in this section.

Standard Pump (No Liquid Level Device)

If wired into an optional manual switch, turn the switch within the rainproof enclosure to start or stop the pump.

With Automatic Liquid Level Devices

If the pump power cable is wired into an optional automatic liquid level control control box, set the control box selector switch to **MAN**; the pump will continue to run until the switch is returned to **OFF**, or reset to **AUTO**.

If desired to operate the pump in the automatic mode, set the selector switch to **AUTO**; pump operation will be controlled by the optional float switch. To terminate automatic mode, move the selector switch to **OFF** or **HAND**.

CAUTION

Moving the control box selector switch to OFF DOES NOT terminate incoming power through the field wiring connected to the control box.

It is recommended that a check valve or throttling valve be installed in the discharge line if there is any possibility of siphoning or back flow when the pump is shut off.

Operation Checks

Check the pump for proper operation when first started and periodically thereafter to identify minor problems.

Check for unusual noises or excessive vibration while operating. If noise or vibration is excessive, stop the pump and refer to Section D, **TROUBLESHOOTING** for possible causes.

Check the strainer screen for clogging caused by stones, sticks, or other debris. Clean the strainer screen when required. In some cases, stopping the

OPERATION

pump momentarily may back flush the strainer screen, purging most of the debris from it. If this fails to clean the screen, remove the pump from the sump and remove the debris manually (see Section E, PUMP DISASSEMBLY).

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.

Check the pump for overheating. The pump could overheat if operated for an extended period with a closed valve in the discharge line.

Cold Weather Preservation

In freezing temperatures, the pump will not freeze as long as it is submerged in liquid. If the pump casing is not submerged, or if the liquid begins to freeze, remove the pump from the sump or wet well and allow it to dry thoroughly. Run the pump for two or three minutes to dry the inner walls.

If the pump freezes, move it into a warm area until completely thawed, or submerge it into the liquid. If the liquid is near freezing, the pump must be submerged for an extended period of time. Start the pump and check for shaft rotation. If still frozen, allow additional thawing time before attempting to restart.

WARNING

```

////////////////////////////////////
//                               //
// Do not attempt to thaw the pump by using a torch or oth- //
// er source of flame. This could damage gaskets or heat //
// the oil within the pump above the critical point and //
// cause the pump to rupture or explode. //
//                               //
////////////////////////////////////

```


TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO START, OVERLOAD UNIT NOT TRIPPED (AUTOMATIC MODE) (cont.)	<p>Float type sensing device(s) tangled or obstructed.</p> <p>Defective liquid level sensing device(s) or control panel.</p>	<p>Check installation for free movement of float.</p> <p>Repair or replace defective unit(s).</p>
OVERLOAD UNIT TRIPS	<p>Low or high voltage, or excessive voltage drop between pump and control box.</p> <p>Defective insulation in motor windings or power cable; defective windings.</p> <p>Impeller jammed due to debris or insufficient clearance.</p> <p>Bearing(s) frozen.</p>	<p>Measure voltage at control box. Check that wiring is correct type, size, and length. (See Field Wiring Connection, Section B).</p> <p>Check insulation resistance; check continuity.</p> <p>Disassemble pump and check impeller.</p> <p>Disassemble pump and check bearing(s).</p>
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE	<p>Discharge head too high.</p> <p>Low or incorrect voltage.</p> <p>Discharge throttling valve partially closed; check valve installed improperly.</p> <p>Discharge line clogged or restricted; hose kinked.</p> <p>Liquid being pumped too thick.</p> <p>Strainer screen or impeller clogged.</p>	<p>Reduce head.</p> <p>Measure control box voltage, both when pump is running and when shut off.</p> <p>Open discharge valve fully; check piping installation.</p> <p>Check discharge lines; straighten hose.</p> <p>Dilute liquid if possible.</p> <p>Clear clog(s). Stop pump; back flow may flush away debris.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE (cont.)	Insufficient liquid in sump or tank. Worn impeller vanes; excessive impeller clear- ance.	Stop pump until liquid level rises. Check impeller and clearance. See PUMP END REASSEMBLY.
PUMP RUNS WITH EXCES- SIVE NOISE OR VIBRATION	Pumping entrained air. Damaged or unbalanced impeller. Discharge piping not properly supported. Impeller jammed or loose. Motor shaft or bearings defective. Pump cavitation.	Check liquid level in sump; check position of pump and liquid level sensing device(s). Replace impeller. Check piping installation. Check impeller. Disassemble pump and check motor and bearings. Reduce discharge head, or restrict flow on low head appli- cations.

ELECTRICAL TESTING

If you suspect that pump malfunctions are caused by defects in the motor, power cable or control box, perform the following checks to help isolate the defective part.

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. //
//
////////////////////////////////////

```

CAUTION

Be certain to refer to the wiring diagram(s) in the INSTALLATION section of this manual before reconnecting any electrical components which have been disconnected.

Test Equipment

A megohmmeter of adequate range and quality will be required to conduct the following electrical tests. The suggested equipment indicated below is commercially available, or an equivalent substitute may be used.

Equipment	Manufacturer	Use
Megohmmeter	Herman H. Sticht Co. 25 Bark Place New York, N.Y.	To measure resistance (ohms) to ground

Voltage Imbalance

Each phase of the incoming three-phase power must be balanced with the other two as accurately as a commercial voltmeter will read. If the phases are balanced, check out the motor as described below. If the phases are out of balance, contact your power company and request that they correct the condition.

- a. Use a voltmeter, Amprobe, or equivalent meter to read the voltage across terminals 1 & 2, 2 & 3, and 1 & 3 in the control box or at the incoming power source. All three measured voltages must be the same, as accurately as the meter will read. If possible, measure the voltage with the pump off, with the pump running but out of the water (using a jumper

TROUBLESHOOTING

across the on-point and off-point of liquid level devices), and with the pump running in the water at full load. All the measured voltages at each condition must be the same.

- b. Use an Amprobe or equivalent meter to measure the current draw of each phase while the pump is running at full load and at no load. All three amperage readings must be the same at each condition, as accurately as the meter will read. Nominal amperage values are listed in Table 1, but these apply only when the actual voltage at the site is the nominal voltage listed.
- c. If the voltages are balanced with the pump off, but are unbalanced when the pump is running, a thorough check of the power source, all interconnecting cables, and the pump motor is required to isolate the defect.

Power Cable Continuity

To check continuity, zero-balance the ohmmeter set at the RX1 scale, and test as follows:

- a. Lock out incoming power and disconnect the power cable leads to the optional manual switch or automatic control box.
- b. Connect the test leads to any two of the three power cable leads (not to the green ground lead). If there is a high resistance reading on the ohmmeter, there is an open or broken circuit caused by a break in the power cable or motor windings, or by a bad connection between the motor and the power cable. Switch one test lead to the third power lead, and test again.
- c. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **Head And Power Cable Disassembly/Reassembly** in **MAINTENANCE AND REPAIR**). The entire motor power cable must be replaced; splicing or other means of repair are not recommended.
- d. If the power cable appears undamaged, see **Head And Power Cable Disassembly**, separate the pump head from the motor housing, and disconnect the power cable amp-lock cap from the amp-lock plug. Separately test each of the cable leads, (including the green ground lead) for continuity through the amp-lock cap. If any of the power cable leads do not check out for continuity, replace the entire power cable.
- e. If no break is found in the power cable, connect the test leads to the power contacts (not to the ground wire contact) of the amp-lock plug. If the test reading indicates an open or broken circuit, there is an open circuit in the motor.

NOTE

It is recommended that a pump with a defective motor be returned to Gorman-Rupp, or to one of the Gorman-Rupp authorized Submersible Repair Centers.

- f. Be certain to reconnect the amp-lock plug and cap before reassembling the pump head to the motor housing.

If insulation resistance is to be checked, do not assemble the pump head to the motor housing at this time.

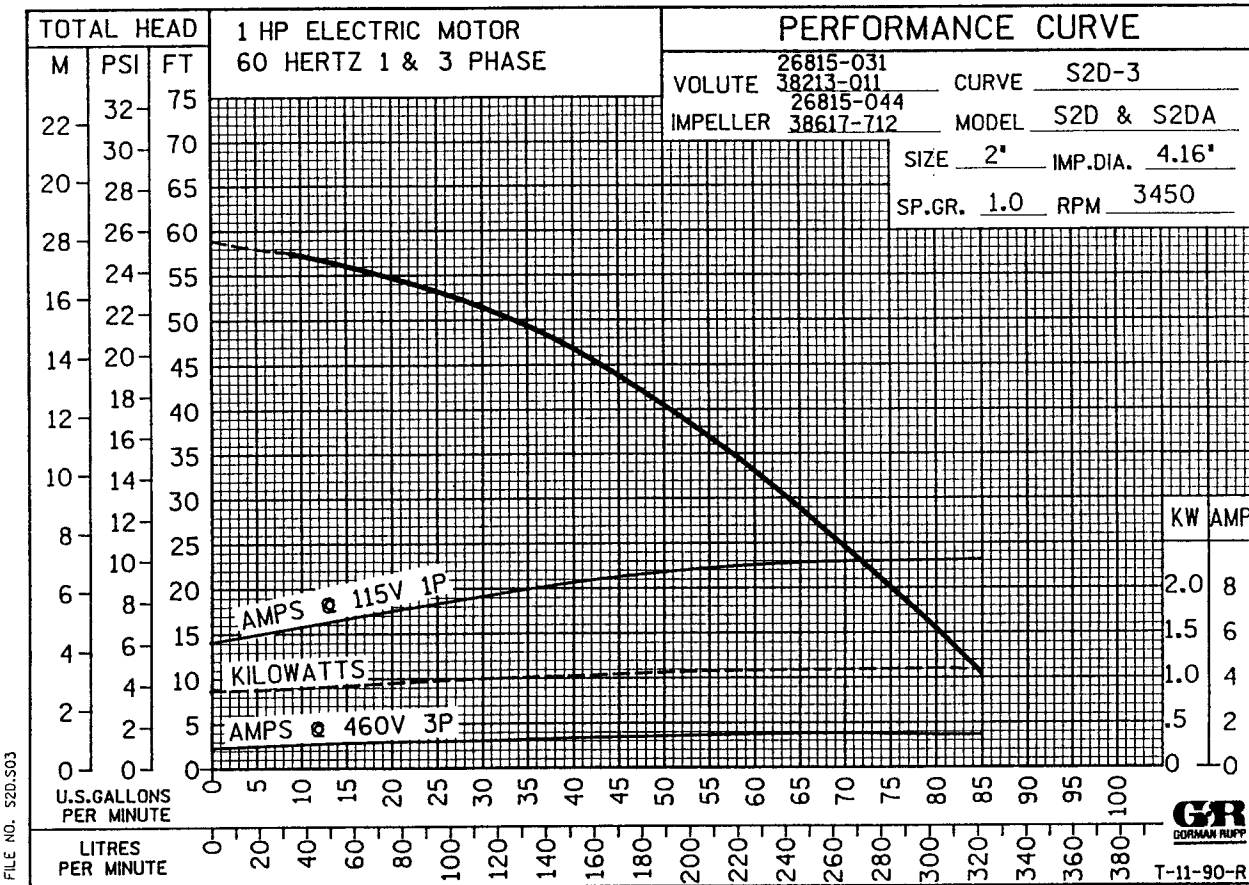
Insulation Resistance

To check insulation, zero-balance the ohmmeter set at the RX100K scale, and test as follows:

- a. Lock out incoming power and disconnect the power cable leads to the optional manual switch or automatic control box.
- b. Connect one test lead to the green ground lead, and touch the other test lead to each of the three power leads in turn.
- c. The reading obtained will indicate resistance values in both the power cable and the motor windings. If the resistance is infinity (∞), the insulation is in good condition. If the reading is between infinity (∞) and 1 megohm, the insulation is acceptable but should be rechecked periodically. If the reading is less than 1 megohm, the insulation should be checked more closely. A reading of zero indicates that the power cable or the motor is grounded.
- d. To determine whether the power cable or the motor is grounded, separate the pump head from the motor housing (see **Head And Power Cable Disassembly/Reassembly** in **MAINTENANCE AND REPAIR**) and disconnect the amp-lock plug and cap. Test the power cable leads and motor leads separately.
- e. Be certain to reconnect the amp-lock plug and cap before reassembling the pump head on the motor housing.

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 S2D65-E1 460/3**

*Based on 70°F clear water at sea level. 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.

SECTIONAL DRAWING

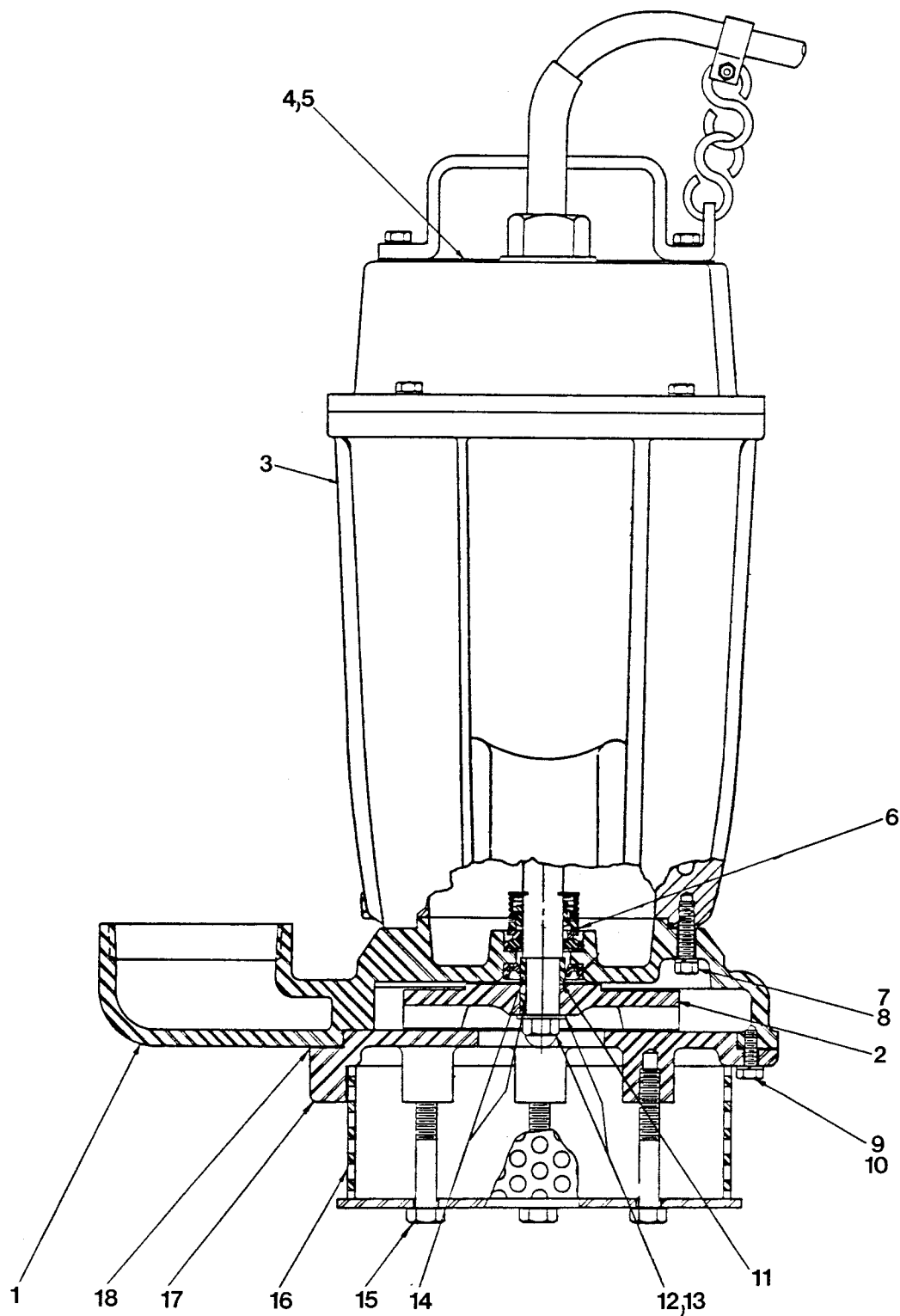


Figure 1. Pump Model S2D65-E1 460/3

PARTS LIST
Pump Model S2D65-E1 460/3
 (From S/N 794732 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	MATL CODE	QTY
1	VOLUTE	38213-011	1718H	1
2	* IMPELLER	38617-712	1718H	1
3	SUBMERSIBLE MOTOR ASSEMBLY (SEE FIGURE 2)	47111-015	-----	1
4	IDENTIFICATION PLATE	2613-EF	17010	1
5	CAUTION DECAL	38816-133	-----	1
6	SEAL ASSY	(SEE FIGURE 2)	-----	1
7	LOCKWASHER	21171-606	-----	4
8	HEX HD CAPSCREW	22645-825	-----	4
9	HEX HD CAPSCREW	22645-813	-----	4
10	LOCKWASHER	21171-605	-----	4
11	* IMPELLER SHIM SET	669	17090	1
12	IMPELLER CAPSCREW	(SEE FIGURE 2)	-----	1
13	IMPELLER WASHER	(SEE FIGURE 2)	-----	1
14	SLEEVE	(SEE FIGURE 2)	-----	1
15	HEX HD CAPSCREW	BT0508	17000	4
16	* STRAINER ASSY	46611-007	24170	1
17	* WEAR PLATE	38691-857	1718H	1
18	* WEAR PLATE GASKET	38682-018	19370	1
OPTIONS:				
	* LIQUID LEVEL CONTROL BOX	27511-082	-----	1
	FLOAT SWITCH	27471-155	-----	1
	MANUAL START SWITCH W/ENCLOSURE	27511-064	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

Above Serial Numbers Do Not Apply To Pumps Made In Canada.

CANADIAN SERIAL NO. AND UP

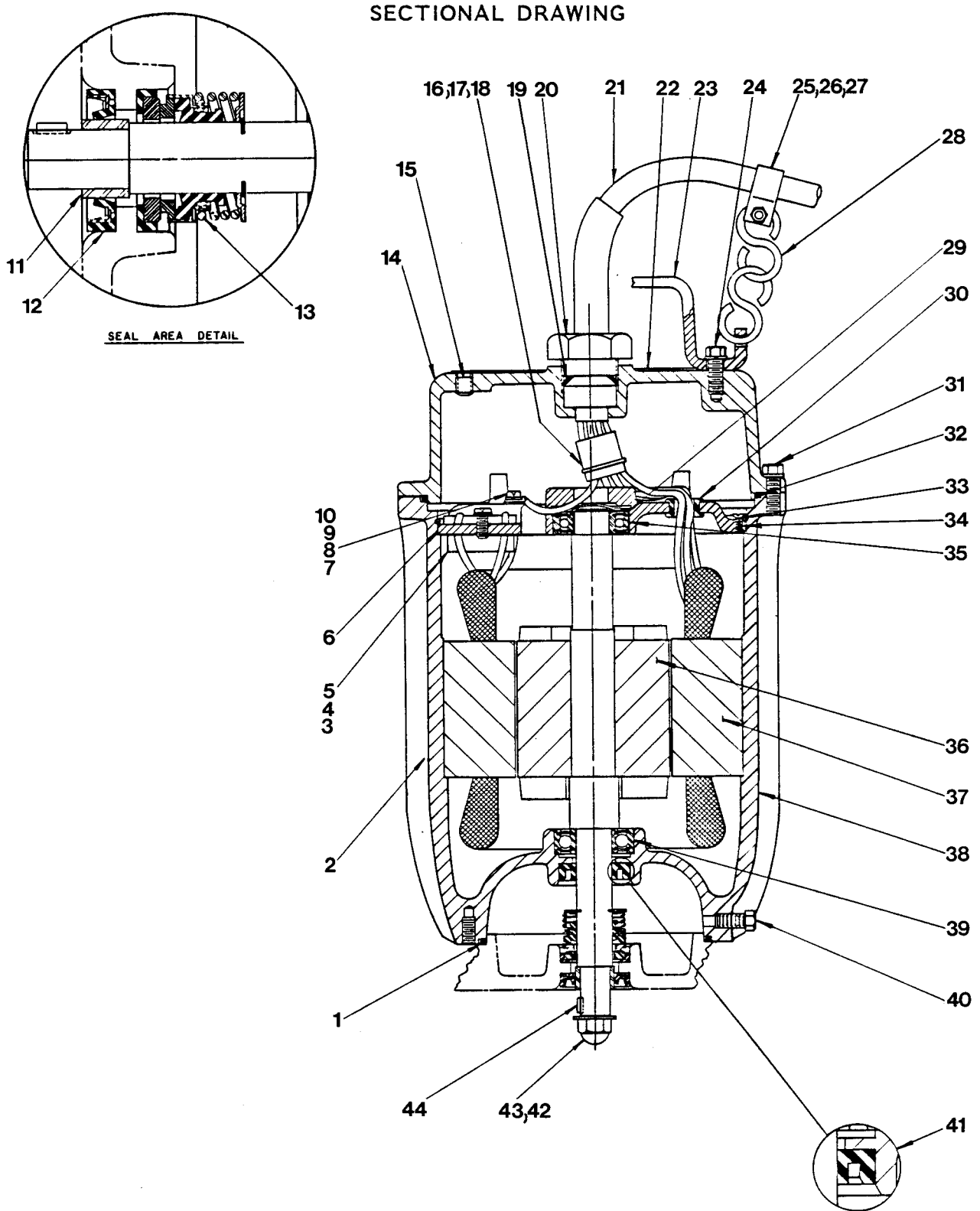


Figure 2. Submersible Motor Assembly

PARTS LIST
Submersible Motor Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	*VOLUTE O-RING	26815-142	-----	1	24	HEX HD CAPSCREW W/LOCKWASHER	26815-306	-----	2
2	NAME PLATE	26815-458	-----	1	25	RD HD PHLP SCREW	26815-342	-----	1
3	*OVERLOAD PROTECTOR	26815-203	-----	1	26	HEX NUT	26815-380	-----	1
4	RD HD PHLP SCREW W/LOCKWASHER	26815-341	-----	2	27	CABLE BAND	26815-260	-----	1
5	FLAT WASHER	26815-374	-----	2	28	CABLE CHAIN	26815-257	-----	1
6	MOUNTING PLATE	26815-160	-----	1	29	*BEARING SHIM	26815-133	-----	1
7	TERMINAL	26815-562	-----	1	30	GROMMET	25815-290	-----	1
8	GROUND WIRE	26815-600	-----	1	31	HEX HD CAPSCREW W/LOCKWASHER	26815-306	-----	4
9	RD HD PHLP SCREW W/LOCKWASHER	26815-341	-----	1	32	*HEAD O-RING	26815-140	-----	1
10	FLAT WASHER	26815-374	-----	1	33	RING CLAMP	26815-165	-----	1
11	*SHAFT SLEEVE	26815-280	-----	1	34	FLT HD MACH SCREW	26815-335	-----	2
12	*LIP SEAL	26815-121	-----	1	35	*UPPER BALL BRG	23257-003	-----	1
13	*SHAFT SEAL	26815-114	-----	1	36	ROTOR W/SHAFT	26815-096	-----	1
14	HEAD	26815-001	-----	1	37	STATOR	26815-107	-----	1
15	PRESS TEST PLUG	26815-405	-----	1	38	MOTOR HOUSING	26815-010	-----	1
16	AMP-LOCK PLUG	27245-024	-----	1	39	*LOWER BALL BRG	23257-006	-----	1
17	AMP-LOCK CAP	27245-034	-----	1	40	SEAL CAVITY DRAIN/FILL PLUG	26815-400	-----	1
18	CONTACT	26815-199	-----	8	41	*OIL SEAL	26815-120	-----	1
19	BEVELED WASHER	26815-254	-----	1	42	IMPELLER LOCKNUT	26815-053	-----	1
20	CABLE LOCKNUT	26815-250	-----	1	43	FLAT WASHER	21162-208	-----	1
21	*POWER CABLE	26815-242	-----	1	44	*IMPELLER KEY	26815-050	-----	1
22	IDENT PLATE	26815-471	-----	1					
23	CARRY HANDLE	26815-080	-----	1					

*INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND MOTOR DISASSEMBLY AND REASSEMBLY

CAUTION

<p>Some of the nuts, bolts and screws used on this pump are metric and do not match standard American-measurement threads. If any threaded hardware is replaced, check the threads to determine if it must be replaced with metric type. Attempting to force a fastener with American threads will damage the mating threads.</p>

WARNING

```

////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
//
// The electrical power to operate this pump is high enough //
// to cause injury or death. Make certain that the switch //
// on the control box is in the OFF position and locked, or //
// that the power supply to the control box has been other- //
// wise cut off and locked out, before attempting to open //
// or service the pump assembly. Tag electrical circuits //
// to prevent accidental start-up. //
// //
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

```

WARNING

```

////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
//
// Before attempting to open or service the pump: //
// //
// 1. Familiarize yourself with this manual. //
// 2. Lock out the power supply to the control panel to //
// ensure that the pump will remain inoperative. //
// 3. Allow the pump to cool if overheated. //
// 4. Close the discharge valve (if used). //
// //
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

```

WARNING

```

////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
//
// Do not attempt to lift the pump by the motor power cable //
// or the piping. Attach proper lifting equipment to the //
// hoisting bail fitted to the pump. //
// //
////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////

```

Use the hoisting bail to lift the pump from the wet well or sump and move it to a location where the discharge hose can be removed. It is not necessary to disconnect a flexible discharge hose before removing the pump. If rigid piping is used, disconnect the piping from the volute or the optional discharge flange.

Select a suitable location, preferably indoors, to perform the degree of maintenance required. If the motor housing is to be opened, the work must be done in a clean, well-equipped shop. All maintenance functions must be performed by qualified personnel.

Check the chart in **TROUBLESHOOTING** to determine the nature of the pump problem. If the problem is mechanical in nature, such as worn pump parts, seal replacement, lubrication, etc., refer to **PUMP END DISASSEMBLY** for instructions.

If the problem is electrical, complete disassembly may not be required. Refer to **Electrical Testing** and have a qualified electrician check out the optional control box, power cable, and electrical components within the head (14, Figure 2) and motor housing (38, Figure 2). If the problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY**, followed by **MOTOR DISASSEMBLY**.

All gaskets and O-rings **must** be replaced if disturbed. Recommended spare parts are indicated in the parts lists.

PUMP END DISASSEMBLY

Draining Oil From Pump

(Figure 2)

It is not necessary to drain the oil from the seal cavity unless the volute (1, Figure 1) will be separated from the motor housing (38).

CAUTION

Let the pump cool before removing the seal cavity drain/fill plug. Pressure built up within a hot pump could cause the oil to spray out when the plug is removed. Remove the plug slowly and permit pressure to vent to atmosphere.

To drain the oil, lay the pump on its side with the seal cavity drain/fill plug (40) facing up, and clean any dirt from around the plug. Remove the plug and drain the oil into a **clean** container. Inspect it for water, dirt or cloudy condition which could indicate seal failure or poor gasket seal.

Use 'Loctite Pipe Sealant With Teflon No. 592' or equivalent compound on the threads of the drain plug when reinstalling it.

Strainer And Wear Plate Removal

(Figure 1)

NOTE

Carefully inspect any O-rings or gaskets before removal and cleaning to determine if a proper seal and compression existed prior to disassembly. If sealing was faulty or questionable, the cause must be determined and corrected before reassembly. Replace any parts as required.

To remove the strainer (16), disengage the capscrews (15) and separate it from the wear plate (17).

To remove the wear plate, disengage the hardware (9 and 10) securing it to the volute (1). Remove the wear plate gasket (18).

If the impeller is clogged, the debris can usually be removed without further disassembly.

Impeller Removal

(Figure 1)

Wedge a block of wood between the vanes of the impeller (2) and the volute (1) to prevent shaft rotation, and remove the impeller locknut and flat washer (12 and 13).

Remove the wood block and pull the impeller off the shaft. Retain the impeller key (14).

Remove the impeller adjusting shims (11). Tie and tag the shims, or measure and record their thickness for ease of reassembly.

(Figure 2)

Inspect the lip seal (12) and shaft sleeve (11). If replacement is required, slide the sleeve off the shaft, and use a stiff wire with a hooked end to remove the seal from the volute bore.

If no further disassembly is required, proceed **Impeller Installation**.

Seal Removal

(Figures 2 and 3)

After draining the oil from the seal cavity and removing the impeller, remove the hardware (7 and 8, Figure 1) and separate the volute from the motor housing (38). Use caution when removing the volute; tension on the seal spring will be released.

Remove the volute O-ring (1).

The stationary seal seat and element will remain in the volute seal bore. To remove these parts, place the volute on a **clean** cloth with the seal side down, and use a dowel to press them out of the bore.

Slide the rotating portion of the seal off the shaft, and remove the seal spring and spring retaining ring.

NOTE

The mating faces of the rotating and stationary elements are precision finished and subject to wear. The complete seal should be replaced with each overhaul to ensure trouble-free operation; however, if the old seal must be reused, wrap the seal faces individually in tissue paper to prevent damage to the sealing faces.

It is not necessary to remove the seal retaining ring unless it is damaged or the lip seal (41) or motor requires replacement. Do not remove the seal unless replacement is required; the lip seal will be damaged or destroyed during removal. If removal is required, remove the retaining ring and use a suitable tool to pry the lip seal from the motor housing (38). **Be careful** not to scratch or damage the rotor shaft when removing the lip seal.

If no further disassembly is required, proceed to appropriate areas in **PUMP END REASSEMBLY**.

NOTE

Do not disassemble the motor unless it is necessary and clean well-equipped shop is available. If the motor housing components are to be serviced, see **MOTOR DISASSEMBLY** in this section. Do not reassemble the pump end components at this time.

PUMP END REASSEMBLY

NOTE

Reuse of old O-rings, gaskets, or shaft seal parts may result in premature leakage or reduced pump performance. It is strongly recommended that new gaskets, O-rings, and shaft seal assembly be used during reassembly (see the Parts List for part numbers).

Cleaning Old Parts

With the pump inverted, stuff a clean tissue into the stationary seat bore of the motor housing (38) (or wrap a small rag around the rotor shaft) to prevent foreign material from entering the motor cavity.

Carefully inspect O-rings or gaskets before removal and cleaning to determine if a proper seal and compression existed prior to disassembly. If sealing was faulty or questionable, the cause must be determined and corrected before reassembly. Replace any parts as required.

Thoroughly clean all reusable parts. Remove all O-rings and gaskets and clean the sealing surfaces of dirt or gasket material. Be careful not to scratch gasket surfaces.

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 prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

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 seal leakage. If any components are worn, replace the complete seal; **never mix old and new seal parts**. Install the seal as illustrated in Figure 3.

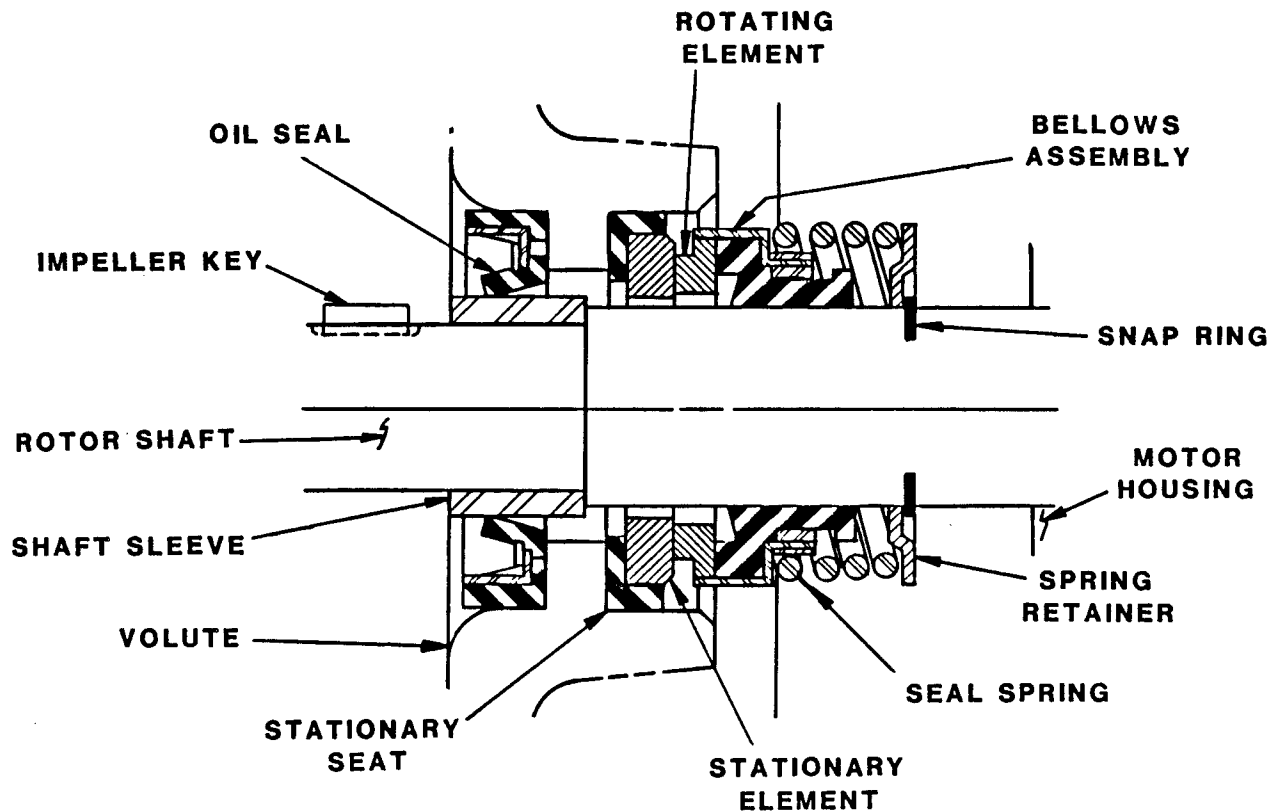


Figure 3. Seal Assembly 26815-114

CAUTION

This seal is not designed for operation at temperatures above 120° F. Do not use at higher operating temperatures.

Seal Installation**(Figures 2 and 3)**

If a new seal is to be installed, do not unwrap it until time of installation. Cleanliness of all seal components is a must, especially the seal faces.

Carefully remove the material stuffed into the seat bore (or unwrap the shaft). **Be sure** no debris stopped by the material falls into the motor cavity.

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the end of the shaft for damaged threads, scoring, and nicked or damaged keyway. Remove nicks and burrs with a fine file or hand honing stone to restore original contours. If the shaft is bent or damaged, the complete shaft and rotor (36) must be replaced as an assembly (see **MOTOR DISASSEMBLY**).

If the lip seal (41) was removed, lubricate the seal with water or a very **small** amount of light oil and position it on the shaft with the lip positioned as shown in Figure 2. Press the seal into the motor housing bore until fully seated. **Be careful** not to damage the lip of the seal on the shaft threads or keyway.

Install the snap ring on the rotor shaft just below the oil seal.

To ease installation of the seal, lubricate the stationary seat, rotor shaft, and bellows with water or a very **small** amount of light oil, and apply a drop of lubricating oil on the finished faces.

If a replacement seal assembly is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter. Place a clean tissue over the sealing face of the stationary element, and subassemble the element into the seat so that the grooves in the element engage the lugs in the seat.

Lay the volute (1, Figure 1) on a flat surface with the motor side up, and apply a **light** coating of oil to the seal seat bore. Position the subassembled seat and element in the volute bore with the sealing face up. Use your thumbs to apply equal pressure to opposite sides of the seat until the subassembly is fully seated against the bore shoulder.

Remove the tissue and inspect the seal face to ensure that it is clean. If cleaning is necessary, use a clean tissue to wipe **lightly** in a concentric pattern. After cleaning, apply a drop light oil to the seal face.

Unpack the seal spring, retainer, bellows and cage assembly, and rotating element. Be certain the seal face of the rotating element is free of grit or surface damage. Subassemble the drive grooves of the rotating element into the drive lugs of the bellows retainer.

Position the seal spring retaining ring over the snap ring on the rotor shaft. Install the seal spring over the retaining ring.

Carefully press the bellows and assembled rotating element onto the shaft so that the bellows cage slips into the seal spring.

NOTE

When pressing seal components onto the rotor shaft, use hand pressure only. A push tube cut from a length of plastic pipe will aid in installing seal components. The I.D. of the push tube should be approximately the same as the I.D. of the seal spring. Be careful not to damage the bellows on the shaft threads or keyway.

Inspect the face of the rotating seal element to make sure it is clean. If cleaning is necessary, use a clean tissue to wipe **lightly** in a concentric pattern. After cleaning, apply a drop of light oil to the seal face.

Replace the volute O-ring (1).

Install the volute (1, Figure 1) and assembled stationary seat and element on the shaft, and secure the volute to the motor housing (38) with the hardware (7 and 8, Figure 1). **Be careful** not to damage the stationary element on the shaft threads.

Position the sleeve (11) on the shaft so the O.D. chamfer is toward the impeller end of the shaft, and slide it on until seated squarely against the shaft shoul-

der. Apply a light coating of oil to the lip seal (12), and slide it over the shaft with the lip positioned as shown in Figures 2 and 3. Press the seal over the sleeve and into the volute until fully seated.

Impeller Installation

(Figure 1)

Inspect the impeller (2), and replace it if cracked or worn.

Install the same thickness of impeller adjusting shims (11) as previously removed. Install the impeller key (14) in the rotor shaft keyway, and press the impeller onto the shaft until it seats firmly against the impeller shims.

Wedge a block of wood between the impeller vanes to prevent shaft rotation, and install the impeller washer and locknut (12 and 13).

Strainer And Wear Plate Installation

(Figure 1)

Replace the wear plate gasket (18), and secure the wear plate (17) to the volute (1) with the hardware (9 and 10).

For maximum pump efficiency, there should be a clearance of .010 to .020 inch between the wear plate and the face of the impeller. Measure this clearance with a feeler gauge, and add or remove impeller adjusting shims (9) as required.

Install the strainer (16) on the wear plate (17), and secure it with the capscrews (15).

See LUBRICATION at the end of this section before putting the pump back into operation.

MOTOR DISASSEMBLY

Disassembly of the motor is rarely required except to replace the rotor, stator, bearings, or motor housing. Do not disassemble the motor unless it is necessary and a clean, well-equipped shop is available.

NOTE

It is recommended that a pump with a defective motor be returned to Gorman-Rupp, or to one of the Gorman-Rupp authorized Submersible Repair Centers.

WARNING

```

////////////////////////////////////
//
// The electrical power to operate this pump is high enough //
// to cause injury or death. Before attempting to open or //
// service the pump assembly, make certain that the switch //
// on the optional control box is in the OFF position, or //
// that the power supply to the control box has been other- //
// wise cut off and locked out. Tag electrical circuits to //
// prevent accidental start-up. //
// //
////////////////////////////////////

```

NOTE

Carefully inspect any O-rings or gaskets before removal and cleaning to determine if a proper seal and compression existed prior to disassembly. If sealing was faulty or questionable, the cause must be determined and corrected before reassembly. Replace any parts as required.

Head And Power Cable Disassembly

(Figure 2)

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 make all electrical con- //
// nections. //
// //
////////////////////////////////////

```

CAUTION

Note and record the colors and positions of all leads before disassembly. Failure to do so could result in damage to the motor if improperly connected during reassembly.

To remove the head (14), disengage the hardware (31) and raise the head just enough to provide access to the electrical connections. Disconnect the amp-lock cap (17) from the amp-lock plug (16) and separate the head and power cable (21) from the motor housing.

Remove the head O-ring (32).

To separate the power cable from the head, remove the hardware (25 and 26) securing the cable band (27) to the cable. Compress the four contacts (18) inside the amp-lock cap (17) and slide the cap off the cable leads. Unscrew the cable lock nut (20), remove the beveled washer (19), and pull the power cable out through the bore of the head.

If desired to remove the carry handle (23) remove the hardware (24) securing it to the head.

For access to the bearings (35 and 39), rotor and shaft (36), or stator (37), the mounting plate (6) must be removed from the motor housing.

Remove the hardware (9 and 10) securing the ground wire (8) and terminal (7) to the mounting plate (6). Remove the hardware (4 and 5) securing the overload protector (3) to the mounting plate.

Remove the machine screws (34) securing the ring clamp (33), and remove the clamp. Lift the mounting plate out of the motor housing while working the stator leads down through the grommet (30). Use caution not to strain the leads.

Lay the mounting plate to the side of the motor housing and remove the bearing shim (29). Proceed with motor disassembly.

NOTE

It is not necessary to remove the amp-lock plug (16) or overload protector (3) from the stator leads for access to the internal motor components. Remove the amp-lock plug and overload protector only if replacement is required.

To disconnect the amp-lock plug, compress the four contacts inside the plug and slide the plug off the leads. To remove the overload protector, match-mark the three leads running to the overload protector and unsolder the connections.

Rotor And Bearing Removal And Disassembly

(Figure 2)

If not previously removed, see **Pump End Disassembly**, and remove all pump end components.

With the head (14) removed and the mounting plate (6) separated from the motor housing, tap the impeller end of the shaft with a soft-faced mallet or block of wood until the rotor and assembled ball bearings (35 and 39) can be pulled out through the stator (37). Use caution to prevent the rotor from falling on the stator windings.

Use a suitable puller to remove the bearings from the rotor shaft.

Wrap the rotor in a clean cloth and put it aside until ready to reassemble the motor (see **Rotor And Bearing Reassembly And Installation**).

Stator Removal

(Figure 2)

It is recommended that the stator (37) be left in place unless it is defective. If the stator must be removed, position an expandable tool, such as split disc, at the midpoint of the stator, and expand it tightly and squarely on the I.D.. Attach a lifting device to the eye of the expandable tool, and raise the stator and assembled motor housing slightly off the work surface. Take care not to damage the stator end turns or leads.

Use a soft-faced mallet to rap alternate edges of the motor housing, and "walk" the stator out. Continue this process until the stator clears the motor housing.

NOTE

It may be necessary to heat the motor housing with a torch to permit stator removal. When heating the motor housing, make certain the stator leads are clear to avoid damaging them. Apply heat evenly to the outside of the motor housing; excessive heat is not required.

After the stator has been removed, wrap it in clean dry rags or other suitable material. The stator **must** be kept clean and dry. When handling the stator, do not set it on the end windings; lay it on its side.

CAUTION

Do not attempt to rewind the stator. Winding tolerances and materials are closely controlled by the manufacturer, and any deviation can cause damage or operating problems. Replace the stator, or return it to one of The Gorman-Rupp Authorized Submersible Repair Centers or The Gorman-Rupp factory, if defective.

MOTOR REASSEMBLY

NOTE

Reuse of old O-rings, gaskets, or shaft seal parts may result in premature leakage or reduced pump performance. It is strongly recommended that new gaskets, O-rings, and seal assembly be used during reassembly (see the Parts List for part numbers).

Clean all gasket and O-ring surfaces completely, removing any old gasket and cement material. Inspect the sealing surfaces for burrs, nicks, and pits which could cause a poor seal. Replace parts as required.

Thoroughly clean the inside of the motor housing (38, Figure 2) with fresh solvent, and dry with compressed air. The interior **must** be dry and free of dirt or lint.

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 prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

Stator Installation

(Figure 2)

Do not unwrap the stator (37) until the motor housing has been prepared for stator installation. The stator **must** be kept clean and dry. When handling the stator, do not set it on its end windings; lay it on its side.

Test a new stator as indicated in **Electrical Testing** in **TROUBLESHOOTING** to ensure that no damage has occurred during handling.

Stand the motor housing upright. Position an expandable tool, such as a split disc, at the midpoint of the stator and expand it tightly and squarely on the I.D.. Attach a lifting device to the eye of the expandable tool. Lift the stator and carefully lower it into the motor housing until seated squarely against the motor housing shoulder. Take care not to damage the stator end turns.

If the stator "cocks" in the motor housing, remove it and try again. If necessary, heat the motor housing with a torch to expand it enough for the stator to be installed; when heating the motor housing, **make certain** the stator and stator leads are clear to avoid damage to these parts. Apply heat evenly to the inside of the motor housing; excessive heat is not required. Be careful not to damage the stator lead insulation during reassembly.

After the stator is fully and squarely seated against the motor housing shoulder, remove the lifting device and cover the motor housing with a clean, lint-free cloth while the rotor and bearings are being installed.

Rotor And Bearing Reassembly And Installation

(Figure 2)

Inspect the seal and bearing areas of the rotor shaft. Inspect the shaft for damaged threads, scoring, and a nicked or damaged keyway. Remove nicks and burrs with a fine file or honing stone. If the shaft is bent or damaged, replace the shaft and rotor (a single assembly).

Clean the bearings (35 and 39) thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil.

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 prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

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.

CAUTION

<p>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.</p>
--

The bearing tolerances provide a tight press fit onto the rotor shaft and a snug slip fit into the motor housing and mounting plate. Replace the shaft and rotor (as an assembly), motor housing, or mounting plate if the proper bearing fit is not achieved.

Press the upper and lower ball bearings (35 and 39) onto the rotor shaft until seated squarely against the shaft shoulders.

CAUTION

<p>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.</p>

Carefully ease the rotor and bearings through the stator until the inboard bearing (39) is firmly seated in the motor housing bearing bore. Use caution to prevent the rotor from falling on the stator windings.

Head And Power Cable Reassembly

WARNING

```

////////////////////////////////////
//                               //
// The electrical power to operate this pump is high enough //
// to cause injury or death. Make certain that the switch //
// on the control box is in the OFF position and locked, or //
// that the power supply to the control box has been other- //
// wise cut off and locked out, before attempting to open //
// or service the pump assembly. Tag electrical circuits //
// to prevent accidental start-up.                               //
//                               //
////////////////////////////////////

```

NOTE

If the overload protector (3) and amp-lock plug (16) were removed, refer to the color and positions of the leads recorded at disassembly. Compress the four contacts on the stator leads and slide the amp-lock plug over the contacts. Be sure all four contacts extend completely through the plug and lock in place. Resolder the leads to the overload protector.

Install the bearing shim (29) in the mounting plate (6) as shown in Figure 2.

Work the stator leads up through the grommet (30) while sliding the mounting plate down into the motor housing. When the mounting plate is fully seated over the bearing (35), secure it with the ring clamp (33) and machine screws (34).

Secure the overload protector to the mounting plate with the hardware (4 and 5). Secure the terminal (7) and ground lead (8) to the mounting plate with the hardware (9 and 10).

Clean the exterior of the pump power cable with warm water and mild detergent, and check for obvious physical damage. Check the cable for continuity and insulation resistance (see **Electrical Testing** in TROUBLESHOOTING).

CAUTION

<p>Do not attempt repairs except at either end of the power cable. Splicing is not recommended.</p>

If the power cable (21) was removed from the head (14), refer to the color and positions of the leads recorded at disassembly.

Slide the cable lock nut (20) and beveled washer (19) up the power cable, and slide the end of the power cable down through the head until the integral stress relief on the cable seats fully in the head bore. Slide the beveled washer down the cable into the head, and secure with the cable lock nut.

Compress the four contacts on the power cable leads and slide the amp-lock cap (17) over the contacts. Be sure all four contacts extend completely through the cap and lock in place.

Connect the amp-lock plug to the cap. Install the head O-ring (32), and secure the head to the motor housing with the hardware (31).

Secure the power cable with the cable band (27) and hardware (25 and 26). If the carry handle (23) was removed, secure it to the head with the hardware (24).

After motor reassembly has been completed, see **PUMP END REASSEMBLY** and reinstall the pump end components.

MOTOR LEAK TEST

(Figure 2)

After the pump has been completely reassembled, remove the pressure test plug (15), and apply a vacuum of 20 inches of mercury to the head and motor cavity. Hold for five minutes. If the vacuum does not hold, check the head O-ring (32) for leaks, and check that the cable locknut (20) is secure.

Use 'Loctite Pipe Sealant With Teflon No. 592' or equivalent compound on the threads of the pressure test plug, and reinstall and tighten the plug.

Before starting the pump, see **LUBRICATION**.

LUBRICATION

(Figure 1)

The seal cavity is the only area of this pump that requires lubrication.

NOTE

To accurately check the oil level the pump must be cool.

Check the oil level before initial startup, after the first two weeks of operation, and every month thereafter. To check the level, lay the pump on its side with the seal cavity drain/fill plug (40) up, and remove the plug. Sight down the plug hole and check that the oil level is high enough to cover the seal spring. Add lubrication as required, and apply 'Loctite Pipe Sealant With Teflon No. 592' or equivalent compound on the drain/fill plug threads before reinstalling the plug.

NOTE

If the seal cavity has been drained, refill the cavity with approximately 7 ounces of SAE No. 10 non-detergent oil.

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