

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



**SE SERIES PUMP**

| MODEL                |
|----------------------|
| <b>SE2C3 115V 1P</b> |

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

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

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

Valid serial number and e-mail address required.

**RECORD YOUR PUMP MODEL AND SERIAL NUMBER**

Please record your pump model and serial number in the spaces provided below. Your Gorman-Rupp distributor needs this information when you require parts or service.

Pump Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

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## INTRODUCTION

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

This is an SE Series submersible pump. The basic material of construction is cast iron, with stainless steel hardware and fittings. The pump is light weight and portable, making it ideally suited to many domestic and industrial applications where low capacity dewatering or irrigation is required. The pump is powered by an integral, thermally-protected electric motor which is not explosion-proof. The pump may be operated fully or partially submerged. Do not operate the pump in a hazardous atmosphere.

All repairs to the pump motor must be performed by a Gorman-Rupp authorized submersible repair facility or the factory. Any repairs to the motor assembly performed by the customer or an unauthorized repair facility negates the warranty.

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

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

**The Gorman-Rupp Company**  
**P.O. Box 1217**  
**Mansfield, Ohio 44901-1217**  
**Phone: (419) 755-1011**  
 or:

**Gorman-Rupp of Canada Limited**  
**70 Burwell Road**  
**St. Thomas, Ontario N5P 3R7**  
**Phone: (519) 631-2870**

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 SE Series submersible motor driven pumps.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Make certain the control box or switch is in the OFF or STOP position, or that the power supply to the control box has been otherwise cut off and locked out to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
5. Close the discharge valve (if used).



This pump is not designed to pump volatile, explosive, or flammable materials. Do not attempt to pump any liquids for which you pump is not approved, or which may damage the pump or endanger personnel as a result of pump failure. Consult the factory for specific application data.



If the power cable is wired into an optional manual starting switch or control box, make sure that the enclosure is grounded. See Section B for recommended grounds.



The electrical power used to operate this pump is high enough to cause injury or death. Make certain the control box or switch is in the OFF or STOP position, or that the power supply to the control box has been otherwise cut off and locked out. Tag electrical circuits to prevent accidental start-up.



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 connections.



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.



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 and void warranty.



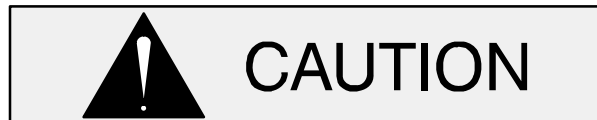
After the pump has been installed, make certain that the pump and all piping or hose connections are secure before operation.



Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.



Do not attempt to lift the pump by the motor power cable or discharge hose. Attach proper lifting equipment to the lifting device fitted to the pump.



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

## INSTALLATION – SECTION B

### GENERAL INFORMATION

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

Since pump installations are seldom identical, this section is intended only to summarize general recommendations and practices required to inspect, position, and arrange the pump and piping. If there are any questions concerning your specific installation, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.



Nuts, bolts and screws used on this pump are metric and do not match standard SAE measurement threads. If any threaded hardware is replaced, it must be replaced with metric type. Attempting to force in a fastener with SAE threads will damage the mating threads. An optional discharge adaptor is available to convert the metric pipe threads in the discharge flange to the SAE 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. Inspect the pump assembly 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 and tighten loose hardware at the mating surfaces.
- c. Inspect the power cable for cuts or any other obvious damage.
- d. Check that amperes, phase, voltage and hertz indicated on the name plate match the ratings on the control box and incoming power.
- e. Carefully read all tags, decals, and markings on the pump, and perform all duties indicated.
- f. Check for oil leaks. If there is any indication of an oil leak, see **LUBRICATION** at the end of this manual.
- 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.

### PUMP SEAL

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

The seal is lubricated by premium quality submersible pump oil.

### LUBRICATION

The pump is equipped with one double-faced seal assembly. It is designed to prevent the liquid being pumped from entering the lubrication cavity at the impeller end, and to prevent moisture or lubrication oil from entering the motor housing cavity at the motor end.

This pump was fully lubricated when shipped from the factory. However, lubrication levels **must be checked** before installing the pump (see **LUBRICATION** in the **MAINTENANCE AND REPAIR MANUAL**). If the oil level is abnormally low, determine the cause before putting the pump into service.

Refer to Table B-2 for the oil capacity and position for filling the seal cavity in the pump. Refer to **LUBRICATION**, Section C for lubrication specifications and intervals.

## PUMP INSTALLATION

### Pump Motor Specifications

See Tables B-1 and B-2 for pump specifications.

Table B-1. Pump Specifications

| Model | Voltage/<br>Phase | Liquid<br>Level<br>Control | Pump<br>HP/<br>KW | Motor<br>Speed<br>(RPM) | Full<br>Load<br>Amperes | No<br>Load<br>Amperes | Locked<br>Rotor<br>Amperes | Discharge<br>Size<br>(NPT)    |
|-------|-------------------|----------------------------|-------------------|-------------------------|-------------------------|-----------------------|----------------------------|-------------------------------|
| SE2C3 | 115/1             | NO                         | 1/2 HP            | 3470                    | 6.8                     | 4.3                   | 22.7                       | 2 INCH<br>w/BARBED<br>ADAPTOR |

Table B-2. Additional Specifications

| Pump<br>Model | Voltage/<br>Phase | Approximate<br>Weight – Lbs. (kg) |              | Oil Capacity<br>Ounces (Liters) |                 | Seal Cavity<br>Filling<br>Position<br>(H)orizontal |
|---------------|-------------------|-----------------------------------|--------------|---------------------------------|-----------------|--|
|               |                   | Pump                              | 50 Ft. Cable | Seal<br>Cavity                  | Motor<br>Cavity |  |
| SE2C3         | 115/1             | 52 (24)                           | 6 (3)        | 7 (0,2)                         | ---             | HORIZONTAL   |



**WARNING!**

When installing or servicing the pump or controls, follow all requirements for the installation of wiring or electrical equipment as outlined in the National Electric Code. Follow all safety requirements. Failure to observe these requirements could result in injury or death to personnel.

#### NOTE

Refer to the performance curve in Section E, **Maintenance and Repair** when determining the most efficient piping installation. **The recommended maximum submergence depth is 23 feet. Greater depths could result in damage to the pump**

### Pump Dimensions

For the approximate physical dimensions of your pump, refer to the pump specification data sheet or contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

#### Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.



**WARNING!**

**Do not attempt to lift the pump by the motor power cable or the piping. Attach proper lifting equipment or a rope to the lifting device fitted to the pump.**

#### Positioning the Pump

The pump is designed to operate fully or partially submerged. The rotating parts are oil lubricated, and the motor is cooled by a constant flow of liquid or air discharged through internal passages.

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.

The pump should be independently secured and supported by the lifting device fitted on the pump. 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 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 B-1 for 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.

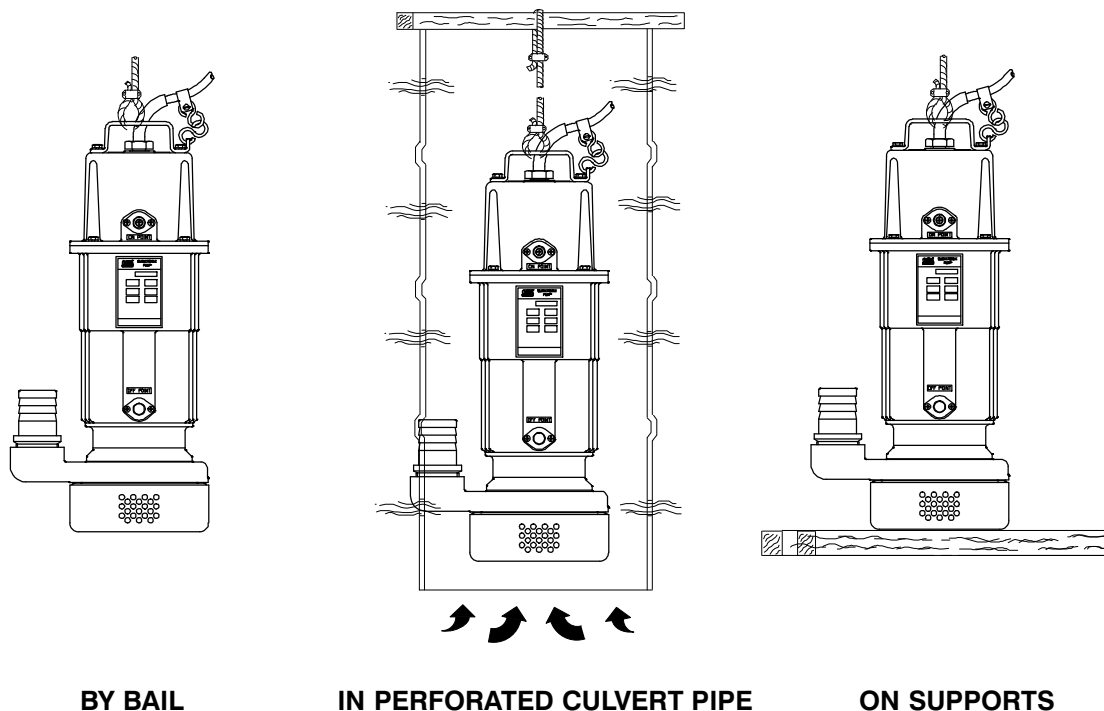


Figure B-1. Typical Pump Installations

**Piping**

No suction piping is required in a standard installation. This pump is provided with a suction strainer to prevent large solids from clogging the impeller.

To determine the size of the discharge connection, see Table B-1. Either hose or rigid pipe may be used. To facilitate mobility and maintenance, it is recommended that the discharge line be fitted with a quick disconnect fitting near the pump. The discharge line must be independently supported to avoid strain and vibration on the pump.

Either hose or rigid pipe may be used to make discharge connections. For maximum pumping capacity, keep the line as short and straight as possible. Elbows and fittings used in discharge lines increase friction loss, minimize their use.

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.

**ELECTRICAL CONNECTIONS**



**WARNING!**

**Install and operate this pump in accordance with the National Electrical Code and all local codes. Have a qualified electrician perform all checks and connections in this section.**

**Never attempt to alter the length of the pump motor cable or to repair it with a splice. The power cable and pump motor must be kept completely waterproof. Serious damage to the pump and injury**

or death to personnel can result from any alteration to the cable.

#### Field Wiring Connections (Incoming Power)

The pump is designed to operate with a 115 volt, 1 phase, 60 hertz power supply. The voltage available **at the motor** must be within the range indicated in Table B-3.

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

- Measure the voltage **while the pump is operating at full capacity**. See wiring diagrams at the end of this section.
- Next, subtract the motor cable voltage drop (see Table B-5, **Pump Power Cable Specifications**).
- 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 B-3. Pump Voltage Requirements

| NOMINAL VOLTAGE | PHASE | MINIMUM VOLTAGE | MAXIMUM VOLTAGE |
|-----------------|-------|-----------------|-----------------|
| 115             | 1     | 110             | 120             |

#### Grounding Methods

If the power cable will be wired into an optional manual switch or control box, ground the enclosure before installing the wiring. In any of these cases, the electrical circuit must be grounded to a properly imbedded electrode.

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 B-2 for some suggested grounding methods.

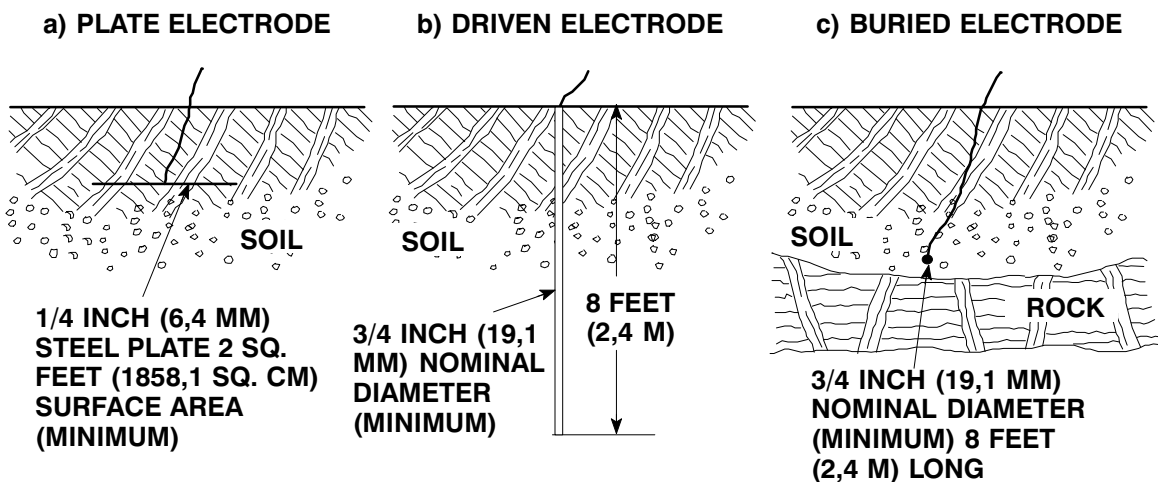


Figure B-2. Suggested Grounding Methods

- Plate Electrode:** An iron or steel plate, 1/4 inch (6,4 mm) thick, completely impeded in the ground. The plate must present a surface area of at least 2 square feet (1858,1 sq. cm.).
  - Driven Electrode:** A rod or pipe, 3/4 inch (19,1 mm) in diameter minimum, 8 feet (2,4 m) long, completely driven into the ground.
  - Buried electrode:** If rock or stone prevents embedding the full 8 foot (2,4 m) length of the ground rod, bury it horizontally in a trench.
- Space the ground rod or plates at least 6 feet (1,8) 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 connections.



**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.**

**Pump Power Cable Connections**



**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 connections. Make certain that the pump and receptacle or optional enclosure are properly grounded.**

The pump is provided with a 50 ft. (15,2 m) power cable (see Table B-4 for standard power cable

specifications) with one end wired into the pump head. The other end terminates in separate leads which must be connected to a control box or switch box.

Optional rainproof starting switches are available from the factory (see the parts list, 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.



**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 alternations.**

**Table B-4. Pump Power Cable Specifications**

| Pump Model | Voltage/Phase | A.W.G Cable Size | Cable O.D. Inches (mm) | Conductor Dia. Inches (mm) | Amp Rating (See Note Below) | Cable Type | DC Resistance (ohms) at 225°C (77°F) per 1000 ft. (305 m) | Voltage Drop per 100 ft. (30,5m) at Max. Load |
|------------|---------------|------------------|------------------------|----------------------------|-----------------------------|------------|---|---|
| SE2C3      | 115/1         | 16               | 0.43 (11)              | 0.06 (1,5)                 | 13*                         | SO         | 4.49  | 6.29  |

When necessary to change or connect the pump power cable to a control box, make certain the incoming power is **OFF** and **LOCKED OUT**. Make certain the control box is **PROPERLY GROUNDED** and that the electrical data on the control matches the motor name plate data.

Connect the pump power cable to the control switch as shown in the wiring diagram at the end

of this section. Make certain that all connections are tight and that cable entry points are rainproof.

**Control Box**



**Any control box used to operate the**

pump must be approved by the Gorman-Rupp Company for the application.

#### Motor Cable Grounding Test



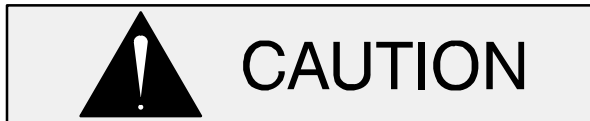
**Do not connect the pump control cable to the control box or incoming voltage before verifying the pump ground; otherwise, personnel will be exposed to serious injury or death.**

Using a volt-ohm meter, connect one lead to the motor cable green/yellow ground lead. Connect the other lead to an **uninsulated** point on the pump body. The test circuit should close.

If the test circuit does not close, there is a defect in the cable or motor which must be corrected.

#### Liquid Level Devices

The pump may be controlled to perform filling and dewatering as shown in Figure B-3 by using the float switch and liquid level control offered as options.



Overheating will occur if the liquid level falls

below the level required to cool the pump motor (see **LIQUID LEVEL** in **Operation**, Section C).

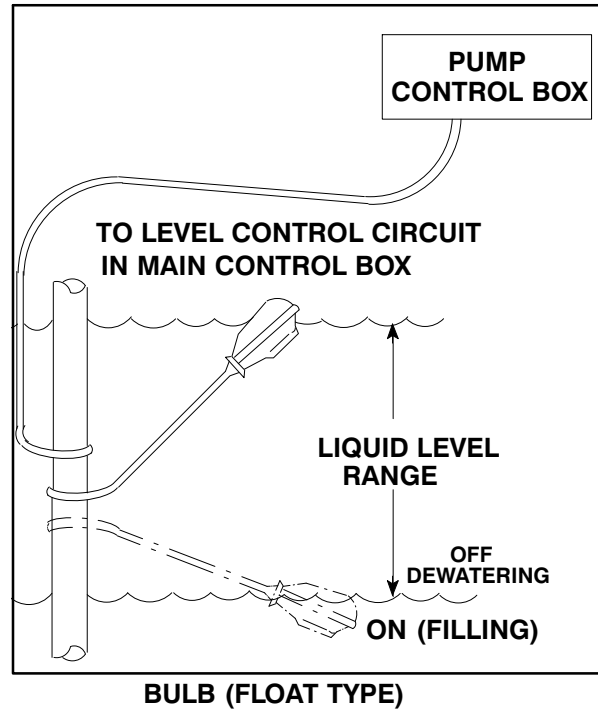


Figure B-3. Typical Float Switch Installation

## OPERATION – SECTION C

### GENERAL INFORMATION

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



**This pump is designed to handle most non-volatile, non-flammable liquids. Do not attempt to pump any liquids for which your pump is not approved, or which may damage the pump or endanger personnel as a result of pump failure. Consult the factory for specific application data.**



**The pump motor and optional accessories are not designed to be explosion-proof. Do not operate in an explosive atmosphere.**

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

### Pump Performance



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.

Refer to the pump performance curve on page E-1 for the specific performance for your pump.

### Pump Controls

The pump is driven by an integral 115 VAC, 60 hertz, 1 phase motor equipped with thermal motor overheat protection.

If the pump is 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 **HAND** 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 for the optional control box is provided by a customer-furnished fuse or breaker within the circuit. If the breaker trips repeatedly, operational problems exists. See **TROUBLE-SHOOTING**, Section D.



**The pump motor and control box are not designed to be explosion-proof. Do not operate in an explosive atmosphere. Improper location of a non-explosion proof control box could result in destruction of equipment, injury or death to personnel.**

See the operating instructions furnished with the control box and with other optional accessories and controls before attempting to start the pump.

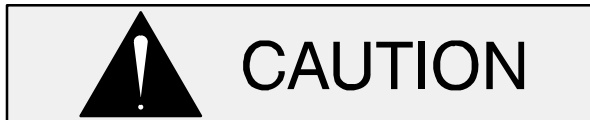
## PUMP OPERATION

Liquid Temperature and Overheating.



Overheated pumps can cause severe burns and injury. If the pump becomes overheated:

1. Stop the pump immediately.
2. Make certain the control box or switch is in the OFF or STOP position, or that the power supply to the control box has been otherwise cut off and locked out to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Close the discharge valve (if used).
5. Refer to instructions in this manual before restarting the pump.



Do not start the pump more than 6 times per hour. If the motor does not cool between starts it will overheat, resulting in damage to the motor windings.

The **maximum** liquid temperature for this pump is 120°F (490°C). Do not apply it at a higher operating temperature.

Overheating can occur if the pump is made to start and stop repeatedly without time to cool off between starts, the liquid level is allowed to fall too low to sufficiently cool the motor, or if the circuit breaker or fuse fails to provide adequate protection. Operating the pump against a closed discharge valve for an extended period will also cause the pump to overheat.



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 operate against a closed discharge valve for long periods of time.

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



Overheated pumps can cause severe burns and injuries. If overheating of the pump occurs:

1. Stop the pump immediately.
2. Ventilate the area.
3. Allow the pump to completely cool.
4. Check the temperature before servicing.
5. Vent the pump slowly and cautiously
6. Refer to instructions in this manual before restarting the pump.

### Impeller Rotation

Check impeller rotation as follows before operation to ensure that the impeller is rotating in the correct direction.



While checking impeller rotation, secure the pump to prevent the power cable from coiling.

Suspend the pump from the lifting device fitted on the pump.

As viewed from the top, the pump should kick in a **counterclockwise** direction; this will indicate that impeller rotation is correct.

If the pump kicks in a **clockwise** direction, impeller rotation is incorrect and the pump must be returned to the factory or a Gorman-Rupp authorized Submersible Repair Center. Since the pump is powered by a single-phase motor, the direction of rotation **can not** be altered by interchanging motor leads at the control box.

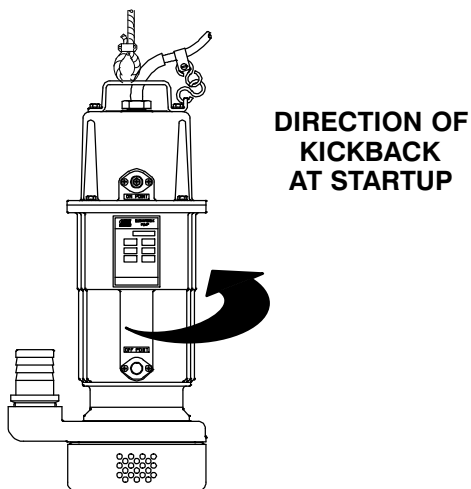


Figure C-1. Checking Pump Rotation

## STARTING, STOPPING, AND OPERATIONAL CHECKS

### Starting And Stopping

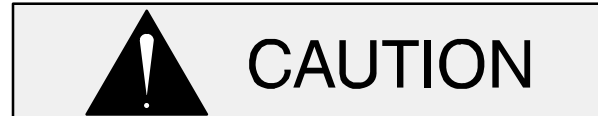
If an optional control box is used, follow the instructions accompanying the control box, start the pump, and run any recommended checks.

After the pump has been installed in a wet well so that it is fully submerged, start the pump as follows.

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

If the pump is wired into an optional automatic liquid level control box, set the control box selector switch to **HAND**; the pump will continue to run until the switch 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**.



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.

### Operational Checks

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

Check the pump for unusual noises or excessive vibration while it is operating. If noise or vibration is excessive, stop the pump and refer to the troubleshooting chart for possible causes.

Check the pump strainer screen for clogging caused by stones, sticks, or other debris. Clean the strainer screen when required. In some cases, stopping the 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 **PUMP DISASSEMBLY** in the Maintenance And Repair manual.



**Never introduce air or steam pressure**

into the pump casing to remove a blockage. This could result in personal injury or damage to the equipment. If back-flushing is absolutely necessary, limit liquid pressure input to 50% of the maximum permissible operating pressure shown in the pump performance curve (refer to the accompanying Parts List Manual).

Check the pump for overheating. Overheating can occur if the pump is made to start and stop repeatedly without time to cool off between starts, the liquid level is allowed to fall too low to sufficiently cool the motor, or if the circuit breaker or fuse fails to provide adequate protection. Operating the pump against a closed discharge valve for an extended period will also cause the pump to overheat.

Check the oil level(s) as indicated in the following **LUBRICATION** section.

## LIQUID LEVEL



Overheating will occur if the liquid falls below the level required to cool the pump motor.

The pump will operate fully or partially submerged. However, since the motor is cooled by the liquid being pumped, overheating will occur if the liquid is pumped below the required to cool the motor.

Models operated manually or with an optional liquid level device must remain sufficiently submerged. **Do not** allow the liquid level to fall below the top of the barbed discharge adaptor in order to provide sufficient cooling to the motor.

## COLD WEATHER PRESERVATION



**Do not attempt to thaw the pump by using a torch or other source of flame. This could damage gaskets, O-rings or heat the oil in the seal housing above critical temperatures, causing the pump to rupture or explode.**

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

If the pump does freeze while it is out of the liquid, submerge it until thawed; if the liquid is near freezing, the pump must be submerged for an extended period of time. Check thawing by starting the pump and checking that the shaft rotates freely. If the pump remains frozen, allow additional thawing time before attempting to restart.

If submerging does not thaw the pump, move it into a warm area until completely thawed.

## LUBRICATION



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

On a new pump, check the oil level in the seal cavity before initial startup. Drain and replace the oil after the first 200 hours of operation. Following this, check the oil level in the seal cavity after the first two weeks of operation, and every month thereafter.

Before installing or removing the lubrication plug, always clean the area around the plug to prevent contamination.

### Draining Oil

Refer to Section E, **Maintenance and Repair** for drain plug location.

It is not necessary to drain the oil from the seal cavity unless the pump casing will be separated from the motor housing.

Lay the pump horizontal on a flat work surface with the seal cavity drain plug facing up. Remove the drain plug slowly to release any pressure. Install a short pipe nipple in the hole. Place a **clean** container under the plug and roll the pump on its side to drain the seal housing.

### Condition Of Oil

Check the condition of the oil drained from the pump. Clear oil indicates that the pump seal is

functioning properly. If the oil is milky or contains a small amount of water, it must be changed.

If the oil contains a large amount of water, it must be changed, and the seal must be checked before the pump is put back in operation (refer to Section E, **Maintenance and Repair**).

### Adding Oil

Refer to Table B-2 in **INSTALLATION** for pump oil capacities.

The grade of lubricant used is critical to the operation of this pump. Use SAE No. 10 non-detergent oil. Oil must be stored in a clean, tightly closed container in a reasonably dry environment.

When lubricating the seal cavity, remove the lubrication plug as indicated in **Draining Oil**. Add the non-detergent oil through this plug hole. With the pump positioned horizontally, sight down the plug hole and check that the oil level is high enough to cover the seal spring.

Install and tighten the lubrication plug.

## TROUBLESHOOTING – SECTION D

Review all SAFETY information in Section A.



The following precautions should be taken before attempting to service the pump; otherwise, injury or death could result.

1. Familiarize yourself with this manual.
2. Lock out incoming power to the control box or switch 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 discharge valve (if used).



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.

### NOTE

Many of the probable remedies listed below require use of electrical test instruments; for specific procedures, see **ELECTRICAL TESTING** following the chart.

**Table 1. Trouble Shooting Chart**

| TROUBLE   | POSSIBLE CAUSE   | PROBABLE REMEDY   |
|---|--|---|
| <b>PUMP FAILS TO START, OVERLOAD UNIT NOT TRIPPED (MANUAL MODE)</b> | Power source incompatible with pump motor.                                   | Correct power source.   |
|   | No voltage at line side of power cable connection.                           | Check power source for blown fuse, open breaker, broken lead, or loose connection.  |
|   | Open circuit in motor windings or power cable.                               | Check continuity.   |
|   | Defective motor.   | Check for and replace defective unit.   |
| <b>OVERLOAD UNIT TRIPS</b>  | Low or high voltage, or excessive voltage drop between pump and control box. | Measure voltage at control box. Check that wiring is correct type, size, and length. (See <b>Field Wiring Connections</b> , Section B). |
|   | Defective insulation in motor windings or power cable; defective windings.   | Check insulation resistance; check continuity.  |
|   | Impeller jammed due to debris or insufficient clearance.                     | Disassemble pump and check impeller.  |
|   | Bearing(s) frozen.   | Disassemble pump and check bearing(s).  |

Table 1. Trouble Shooting Chart (cont.)

| TROUBLE  | POSSIBLE CAUSE   | PROBABLE REMEDY  |
|--|--|--|
| <b>MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE</b> | Discharge head too high.   | Reduce head.   |
|  | Low or incorrect voltage.  | Measure control box voltage, both when pump is running and when shut-off.              |
|  | Discharge throttling valve partially closed; check valve installed improperly. | Open discharge valve fully; check piping installation.                                 |
|  | Discharge line clogged or restricted; hose kinked.                             | Check discharge lines; straighten hose.  |
|  | Liquid being pumped too thick.   | Dilute liquid if possible.   |
|  | Strainer screen or impeller clogged.   | Clear clog(s). Stop pump; back flow may flush away debris.                             |
|  | Insufficient liquid in sump or tank.   | Stop pump until liquid level rises.  |
| <b>PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION</b>           | Worn impeller vanes; excessive impeller clearance.                             | Check impeller and clearance. See <b>PUMP END REASSEMBLY</b> .                         |
|  | Pumping entrained air.   | Check liquid level in sump; check position of pump and liquid level sensing device(s). |
|  | Damaged or unbalanced impeller.  | Replace impeller.  |
|  | Discharge piping not properly supported.                                       | Check piping installation.   |
|  | Impeller jammed or loose.  | Check impeller.  |
|  | Motor shaft or bearings defective.   | Disassemble pump and check motor and bearings.   |
|  | Pump cavitation.   | Reduce discharge head, or restrict flow on low head applications.                      |

**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.



**Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.**



Be certain to refer to the wiring diagram(s) in the Installation Operations manual before reconnecting any electrical components which have been disconnected.

**Test Equipment**

A volt/amp/ohmmeter and megohmmeter of adequate range and quality will be required to conduct the following electrical tests. The suggested equip-

ment indicated below is commercially available, or an equivalent substitute may be used.

| Equipment | Use  |
|-----------|--|
| Ammeter   | To check AC Voltage and current (amperage) |
| Ohmmeter  | To measure resistance (ohms) to ground     |

### Motor And Motor 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 the two 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.
- c. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **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 Removal**, separate the pump head from the motor housing, and disconnect the power cable leads from the stator leads. Separately test each of the cable leads, (including the green ground lead) for continuity. 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 stator leads. 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 all leads as indicated in the Wiring Diagram, Figure D-1 and seal the connections with the male and female connector sleeves 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 power cable ground lead and touch the other test lead to each of the two power leads in turn.
- c. The reading obtained will indicate resistance values in both the power cable and the motor windings. If the resistance reading is infinity ( $\infty$ ), the insulation is in good condition. If the reading is between infinity ( $\infty$ ) 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 Removal/Installation in MAINTENANCE AND REPAIR**) and disconnect the power cable leads. Test the power cable leads and motor leads separately.
- e. Be certain to reconnect all leads as indicated in the Wiring Diagram, Figure D-1 and seal the connections with the male and fe-

male connector sleeves before reassembling the pump head to the motor housing.

**Capacitor**

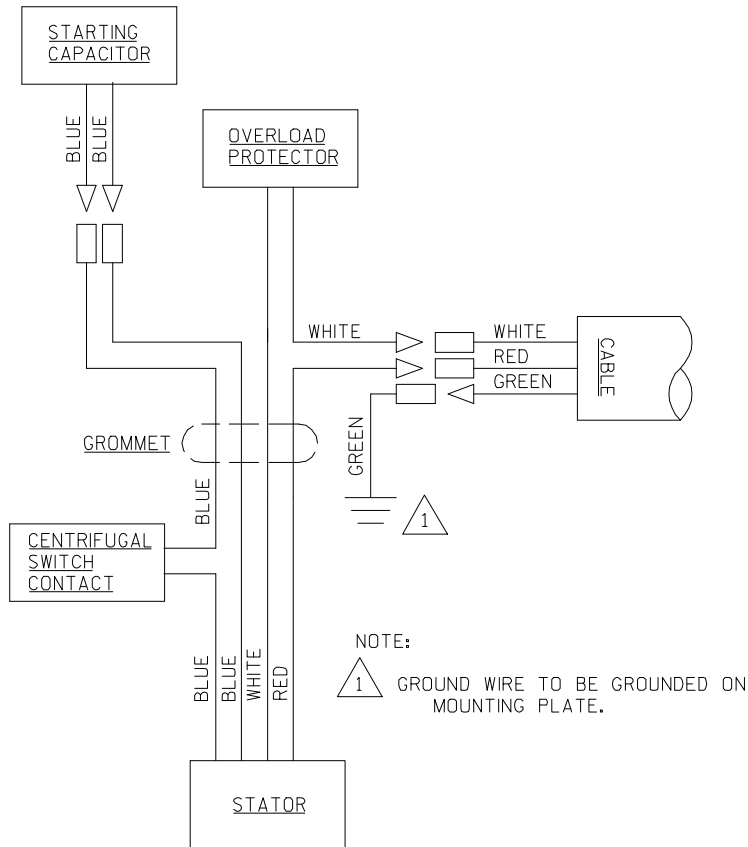
The start capacitor, located in the head of the pump, is designed to split the electrical phase during the initial power surge at motor startup.



Before disconnecting the capacitor leads, discharge the capacitor; use a screwdriver with an insulated handle, and place the blade across the two terminals of the capacitor to short the terminals.

Zero-balance the ohmmeter set to read RX100K, and test the capacitor as follows:

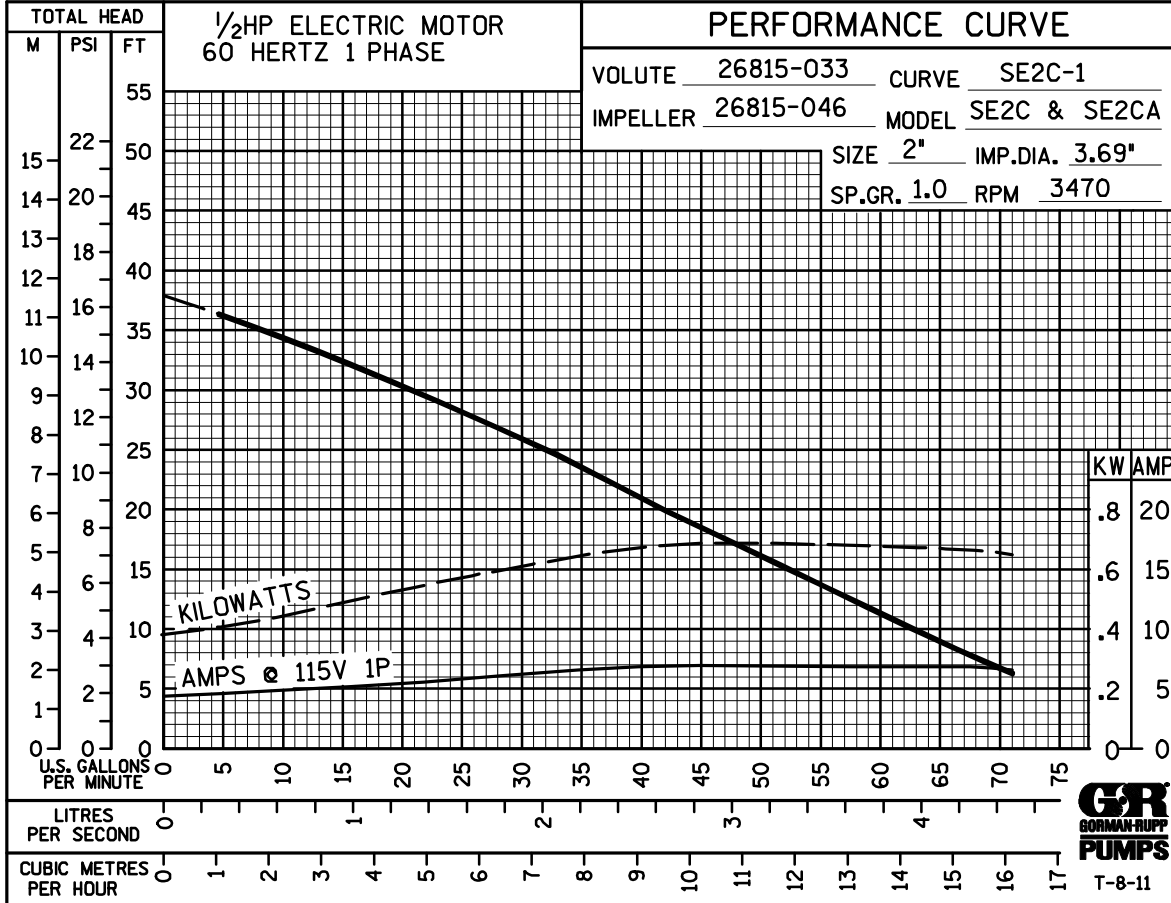
- a. See Figure E-1 in Section E, and disconnect the leads to the capacitor.
- b. Place a test lead against each of the capacitor terminals for a few seconds. If the ohmmeter needle moves toward zero, then slowly drifts back to the left, the capacitor is good. If the needle remains at infinity ( $\infty$ ) the capacitor is open. If the needle remains at zero, the capacitor is shorted. In either case, the capacitor must be replaced.
- c. Check for grounding by touching one test lead to the capacitor case and the other lead to each of the capacitor terminals in turn. The ohmmeter should read infinity ( $\infty$ ); if it does not, the capacitor is grounded and must be replaced.
- d. After the capacitor has been checked, reconnected the capacitor leads.



**Figure D-1. Wiring Diagram**

## PUMP MAINTENANCE AND REPAIR – SECTION E

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



SECTION DRAWING

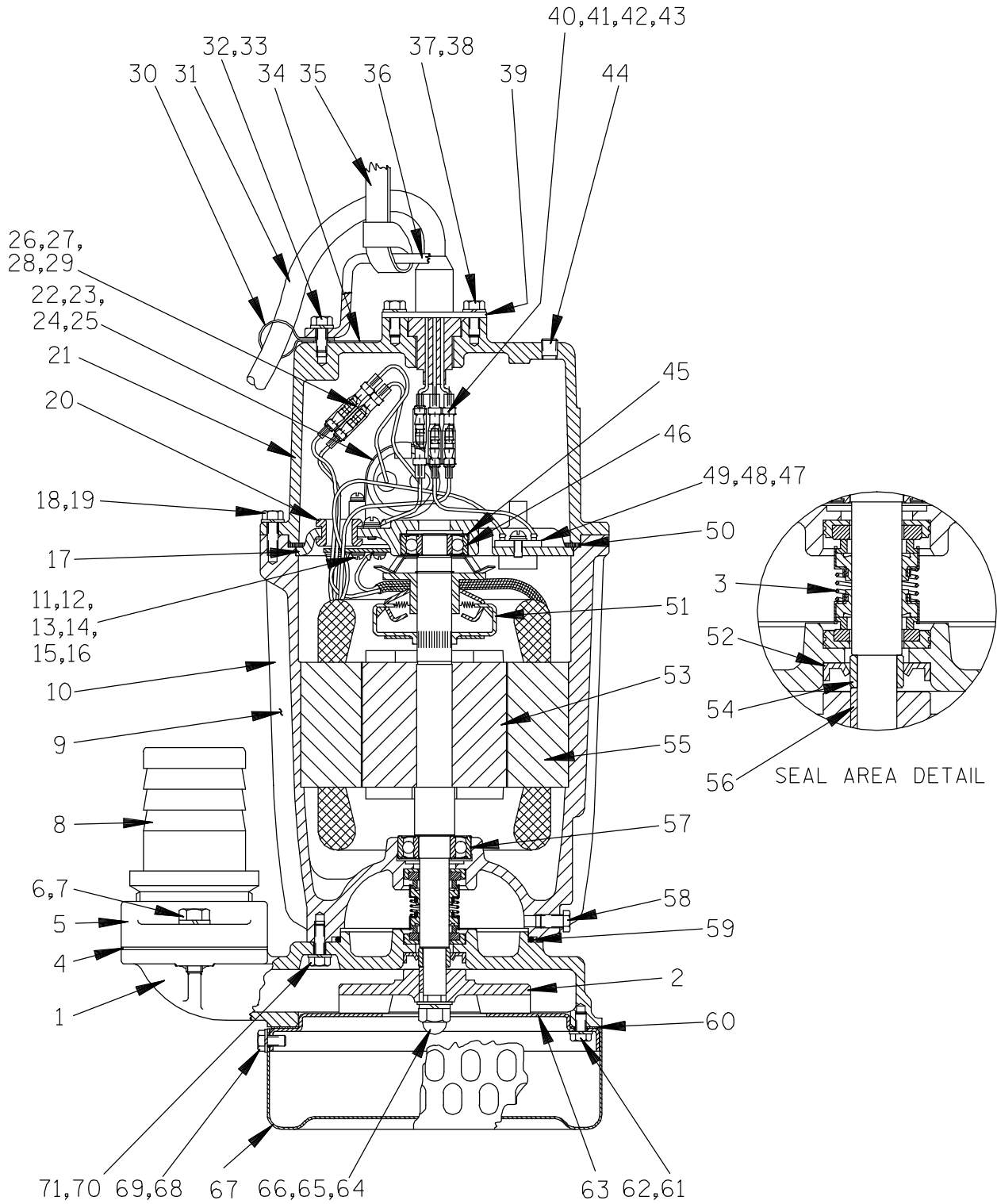


Figure E-1. Pump Model SE2C3 115V 1P



## PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

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

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

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional view (see Figure E-1) and the accompanying parts list.

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

Before attempting to service the pump, disconnect or lock out incoming power and take precautions to ensure that it will remain inoperative. Close any valves in the discharge line.



### WARNING!

**Pump motor maintenance may be performed only by a Gorman-Rupp authorized repair facility or the factory. Otherwise, the pump warranty will be negated, and damage to the pump, and injury or death to personnel can result. Contact the factory for the authorized repair facility closest to you.**

## PUMP END DISASSEMBLY

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



### WARNING!

**The electrical power used to operate this pump is high enough to cause injury or death. Make certain the control box or switch is in the OFF or STOP position, or that the power supply to the control box has been otherwise cut off and locked out. Tag electrical circuits to prevent accidental start-up.**



### CAUTION

Nuts, bolts, and screws used on this pump are metric and do not match standard English-measurement threads. If any threaded hardware is replaced, it must be replaced with metric type. Attempting to force in a fastener with English threads will damage the mating threads. An optional discharge adaptor is available to convert the metric pipe threads in the discharge flange to American pipe threads.

Use the lifting rope (35) to remove the pump from the wet well or sump, and move it to a location where the discharge line can be removed. It is not necessary to disconnect the discharge hose before removing the pump.



### WARNING!

**Do not attempt to lift the pump by the motor power cable or the piping. Use the lifting rope fitted to the pump. If chains or cable are wrapped around the pump to lift it, make certain that they are positioned so as not to damage the pump, and so that the load will be balanced.**

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

nance functions must be done by qualified personnel.

Check the chart in **TROUBLESHOOTING**, Section D, 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** in **TROUBLESHOOTING**, Section B, and have a qualified electrician check the control box, cable and head. If the problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY**, followed by **MOTOR DISASSEMBLY**. Otherwise, see **Head And Power Cable Disassembly**.

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. All gaskets and most O-rings **must** be replaced if disturbed (see the Parts List).

### Strainer And Impeller Cover Removal

To remove the strainer (67), disengage the hardware (68 and 69) securing the strainer to the impeller cover (63). To remove the impeller cover, remove the hardware (61 and 62) securing it to the pump casing (1). Remove the cover gasket (60).

#### NOTE

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

If the impeller (2) is clogged, the debris can usually be removed without further disassembly.

### Draining Oil From Seal Cavity

The oil should be drained from the seal cavity before performing any further disassembly



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.

Lay the pump on its side with the drain/fill plug (83) facing up. Clean any dirt from around the plug. Remove the plug. Tip the pump and drain the seal oil into a **clean** container. Inspect the oil for water, dirt, or cloudy condition which could indicate lower seal failure or poor gasket seal.

### Positioning Pump For Disassembly

It is recommended that the pump be positioned upside-down during disassembly. To hold the pump in the inverted position, rest the pump securely on blocks. Be careful not to damage the head (21) and power cable (31) while in this position.

### Impeller Removal

Wedge a piece of wood between the vanes of the impeller (2) and the pump casing (1) to prevent shaft rotation. Remove the impeller hardware (64, 65 and 66).

Remove the wood block and use a suitable puller to pull the impeller off the shaft. Retain the impeller key (56).

### Seal Removal

#### (Figures E-1 and E-2)

Remove the hardware (84 and 85) securing the pump casing to the seal chamber (9) and remove the casing.

Remove the hardware (70 and 71) securing the pump casing (1) to the motor housing (10). Carefully slide the pump casing, dust seal (52) and shaft sleeve (54) off the shaft. Press the shaft sleeve out of the pump casing from the back side.

#### NOTE

*The shaft sleeve (54) may not come free of the shaft*

when the seal chamber is removed. It may be necessary to heat the sleeve and tap it off the shaft.

Remove the pump casing O-ring (59).

The lower stationary seal seat and element will remain in the pump casing bore when removed. To remove the stationary portion of the seal, place the pump casing on a **clean** cloth with the seal bore side down. Use a drift pin or dowel to press on alternate sides of the stationary seat until the stationary element and seat are forced out of the bore.

Inspect the dust seal (52) and, if replacement is required, use a drift pin or dowel to press the dust seal out of the pump casing bore.

Lubricate the rotor shaft (53) adjacent to the bellows assembly, and pull the rotating portion of the seal from the shaft.

Slide a pair of stiff wires with hooked ends along the shaft and use the wires to pull the upper stationary seal seat and element from the motor housing (10).

### NOTE

*Do not disassemble the motor unless it is necessary and a 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.*

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

## PUMP END REASSEMBLY

### NOTE

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

## Cleaning And Inspection Of Pump Parts

With the pump inverted, stuff a clean tissue into the stationary seal seat bore of the motor housing (10) or wrap a small rag around the shaft to prevent foreign material from entering the motor cavity.

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.

Thoroughly clean all reuseable parts with a soft cloth soaked in cleaning solvent. Remove all O-rings and gaskets, and clean the sealing surfaces of dirt or gasket material. Be careful not to scratch gasket surfaces.



**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 rotor shaft (53) for damaged threads, scoring, or nicks. Remove nicks and burrs with a fine file or emery cloth to restore original contours. If the shaft is bent or severely damaged, the rotor and shaft must be replaced as an assembly (see **MOTOR DISASSEMBLY**).

### Seal Installation

(Figures E-1 and E-2)

The shaft seal assembly (3) should not be 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.

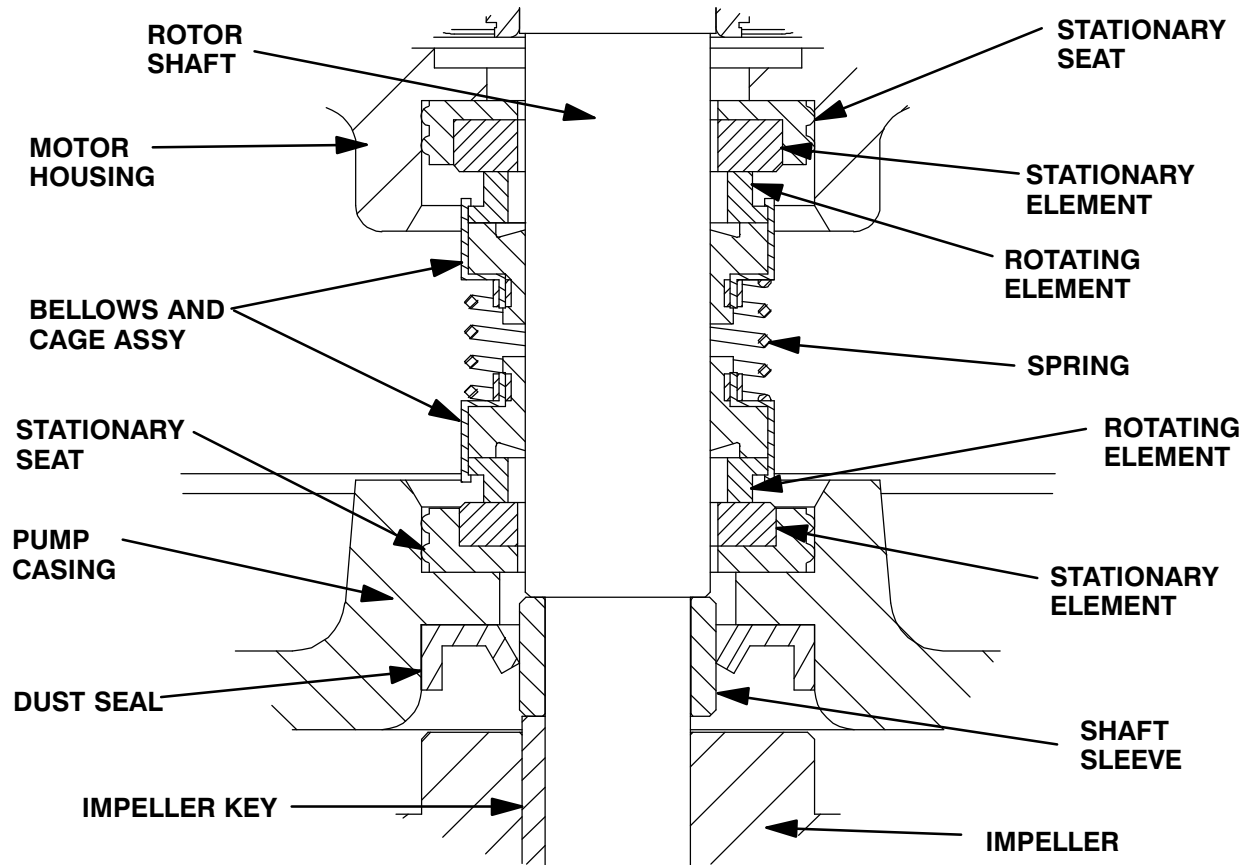
Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate the precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces

with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a circular pattern to avoid scratching the faces.

Inspect the seal components for wear, scoring,

grooves, and other damage that might cause leakage. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

Install the shaft seal as illustrated in Figure E-2.



**Figure E-2. Seal Assembly**



This seal is not designed for operation at temperatures above 120° F (49° C). Do not use at higher operating temperatures.

**Do not** unwrap a new seal assembly until time of installation. Cleanliness of seal components is critical, 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 pump casing.

#### NOTE

*When pressing seal components onto the shaft, use hand pressure only. A push tube cut from a length of plastic pipe will aid in installing seal com-*

*ponents. The I.D. of the push tube should be approximately the same as the I.D. of the seal spring.*

Unpack the upper stationary seat and element. Place a clean tissue over the sealing face of the stationary element and subassemble the stationary element into the stationary seat.

Apply a **light** coating of oil to the seal seat bore in the motor housing (10). Position the stationary subassembly in the motor housing bore with the sealing face up and cover the seal face with a clean tissue. Use your thumbs to press the assembly into the bore. Apply equal pressure on opposite sides until the seat contacts the bore shoulder. Remove the tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use clean tissue to wipe **lightly** in a concentric pattern. After cleaning, apply a drop light oil to the seal face.

Unpack the rotating portion of the seal. Be certain the sealing faces of the rotating elements are free of grit or surface damage. Make sure the drive grooves of the rotating elements fully engage the drive lugs of the bellows retainer.

Apply a **light** coating of oil to the I.D. of the bellows. Slide the rotating portion of the seal onto the shaft until the upper sealing faces contact. The seal spring cannot be compressed and held in place until the pump casing is installed.

Unpack the lower stationary seat and element. Place a clean tissue over the sealing face of the stationary element and subassemble the stationary element into the stationary seat.

Apply a **light** coating of oil to the seal seat bore in the pump casing (2). Position the stationary subassembly in the pump casing bore with the sealing face up and cover the seal face with a clean tissue. Use your thumbs to press the assembly into the bore. Apply equal pressure on opposite sides until the seat contacts the bore shoulder. Remove the tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use clean tissue to wipe **lightly** in a concentric pattern. After cleaning, apply a drop light oil to the seal face.

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

Carefully position the assembled pump casing, stationary seat and element over the shaft until the sealing faces contact. Secure the pump casing to the motor housing by tightening the hardware (70 and 71) in an alternating pattern.

Position the shaft sleeve (54) on the shaft with the chamfer on the O.D. toward the impeller end of the pump, and slide the sleeve onto the shaft until fully seated.

Position the dust seal (52) in the pump casing bore as shown in Figure E-1 and press it into the pump casing until fully seated.

### Impeller Installation

Inspect the impeller (2) for cracks, broken vanes, or wear from erosion, and replace it if damaged. Clean the threads on the rotor shaft to remove any old thread locking material.

Install the impeller key (8) in the shaft keyway, align the impeller keyway, and press the impeller onto the shaft until it seats firmly against the shaft sleeve.

Install the impeller hardware (64, 65 and 66). Wedge a block of wood between the vanes of the impeller to prevent shaft rotation, and tighten the impeller lock nut (66).

Remove the block of wood, and turn the impeller to check for free rotation. Check the front clearance after installing the impeller cover (63).

Install the impeller cover gasket (60). Position the impeller cover (63) over the pump casing (1) and secure the cover with the hardware (61 and 62).

### Impeller Clearance

For best performance, there should be a clearance of .010 to .020 inch (0,25 to 0,51 mm) between the impeller cover and the face of the impeller. Use a feeler gauge to measure this clearance.

If the impeller scrapes against the back of the impeller cover when the impeller is turned by hand, remove the impeller cover and add another impeller cover gasket (60). Reinstall the impeller cover, and recheck clearance.

### Strainer Installation

Inspect the strainer (67) for cracks, distortion or erosion, and replace it if defective.

Position the strainer squarely on the shoulder of the impeller cover (63) and secure with the hardware (68 and 69). Make certain that the strainer seats properly against the shoulder of the impeller cover.

See **VACUUM/PRESSURE TESTING** and **LUBRICATION** before putting the pump back into service.

### MOTOR DISASSEMBLY

Disassembly of the motor is rarely required except to replace the rotor, stator, bearings or motor hous-

ing. 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.*



**The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the plug on the pump power cable is disconnected from its receptacle.**

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 Removal

Total disassembly of the head (21) and power cable (31) is not always required. Disassemble and replace **only** the parts proven defective by inspection or testing. See **Electrical Testing** in **TROUBLESHOOTING**.

The head and power cable may be serviced without disassembling the motor housing or pump end, or without draining the oil from the motor cavity. However, the oil **must** be drained before attempting to disassemble the motor housing and components.

Secure the pump in an upright position. Remove the hardware (18 and 19) securing the head to the motor housing (10). Raise the head for access to the electrical connections.

Pull the male and female connector sleeves (26, 28, 40 and 42) apart, then pull the cable lead plugs (41) from the overload protector and ground lead receptacles (43).

Remove the assembled head and power cable. Remove the head gasket (50).

To disconnect the power cable from the head, remove the hardware (32 and 33) securing the cable lock (30) and handle (36) to the head. Remove the hardware (37 and 38) and pull the cable out of the head.

If necessary, remove the remaining hardware (32 and 33) securing the handle to the head.

To remove the start capacitor (22), pull the male and female connector sleeves (26 and 28) apart, then pull the capacitor lead plugs (27) from the receptacles (29). Remove the hardware (24 and 25) securing the start capacitor holder (23), and remove the start capacitor from the mounting plate (17).

Remove the hardware (48 and 49), disconnect the motor lead and remove the overload protector (47).

Using caution not to strain any electrical leads, lift the mounting plate (17) while guiding the electrical leads through the grommet (20) to access the centrifugal switch contact (14). Remove the hardware (12 and 13) and separate the motor lead terminals (11) from the contact.

Carefully remove the mounting plate; the bearing shim (45) will become a free part. Disengage the hardware (15 and 16) to remove the centrifugal switch contact (14).

### NOTE

*The centrifugal switch actuator (51) is a press fit onto the rotor shaft and cannot be removed until the rotor is removed.*

See **Head And Power Cable Installation** if no further disassembly is required.

### Rotor And Shaft Removal

See **PUMP END DISASSEMBLY** and remove all pump end components and **Head And Power Cable Removal** and remove the head and cable.

Carefully lift the rotor/shaft (53) with assembled bearings (45 and 47) and centrifugal switch actuator (51) from the motor housing. Use caution to pre-

vent the rotor from falling on the stator windings. If necessary, tap the impeller end of the rotor shaft with a block of wood or soft-faced mallet to loosen the seal between the bearing and the motor housing bore.

### Bearing Removal



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 rotor assembly is removed.

Before removing the bearings from the rotor shaft, clean and inspect the bearings **in place** as follows.

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



**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.**

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

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the mounting plate (17) and motor housing (10). Replace the shaft and rotor (as an assembly), motor housing or mounting plate if the proper bearing fit is not achieved.

If replacement is required, use a bearing puller to remove the bearings from the rotor shaft.

### Centrifugal Switch Actuator Removal

Remove the snap ring securing the switch actuator to the shaft. Use a felt tip ink marker to scribe the location of the actuator on the shaft. Use a suitable puller to remove the actuator from the shaft.

### Stator Removal

Do not remove the stator (55) unless it is defective (open windings, insulation resistance low, or stator core damaged).

To remove the stator, position an expandable tool, such as a split disc, approximately 2 inches (51 mm) inside the stator, and expand it tightly and squarely on the I.D. Attach a lifting device to the lifting eye of the tool, and raise the assembly approximately 1 inch (25 mm) off the work surface. Take care not to damage the stator end turns.

The motor housing (10) must be heated with a torch to expand it enough for the stator to be removed. Apply heat evenly to the outside of the motor housing; excessive heat is not required. When the motor housing is sufficiently heated, 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.



Use caution not to damage the stator end turns during removal from the motor housing.

After the stator has been removed, wrap it in clean, dry rags or other suitable material until reassembly. 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.



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, shaft seal parts will result in premature leakage or reduce pump performance. It is strongly recommended that new gaskets and shaft seal assemblies be used during reassembly (see the parts lists for 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, and replace defective parts as required.

Thoroughly clean the inside of the motor housing (10) with fresh solvent. The interior **must** be dry and free of dirt or lint.



**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.**

### Stator Installation

### NOTE

*Stator installation involves heating the motor housing. This process must be done quickly, therefore it is recommended that these steps be performed by two people to promote efficient installation of the stator.*

After the motor housing is thoroughly cleaned, position it on a flat surface with the discharge end down. Do not unwrap the stator (55) until the motor housing has been prepared for stator installation. The stator **must** be kept clean and dry. When han-

dling the stator, do not set it on the end windings; lay it on its side and block it from rolling.

Test the new stator as indicated in **Electrical Testing** in **TROUBLESHOOTING**, Section B, to ensure that no damage has occurred during transit or handling.

### NOTE

*Remove any drops of varnish from the ends of the stator before installation to ensure proper stack-up height when assembled.*

Position an expandable tool, such as a split disc, approximately 2 inches (51 mm) down inside the stator (opposite the lead wire end), and expand it tightly and squarely on the I.D. Attach a lifting device to the lifting eye of the tool, and carefully lift the assembly. Take care not to damage the stator end turns. Slip a sleeve over the stator leads, or tape them together to protect them during installation.

### NOTE

*Stator installation involves heating the motor housing. This process must be done quickly to allow the stator to slide into the motor housing before the housing cools.*

Heat the motor housing with a torch to expand it enough for the stator to be installed; when heating the motor housing, **make sure** that the stator is clear to avoid a fire hazard or damage to the windings. Apply heat evenly to the outside of the housing; excessive heat is not required.

When the motor housing is sufficiently heated, position the stator so that the leads are in line with the terminal opening. Carefully lower the stator into the motor housing until fully seated against the housing shoulder. Be careful not to damage the stator lead insulation during reassembly. If the stator "cocks" in the motor housing, remove it and try again.

After the stator is fully and squarely seated on the motor housing shoulder, remove the expandable disc tool. Untape or remove the protective sleeve from the stator leads.

Cover the motor housing with a clean, lint-free cloth while the rotor is being assembled.

### Centrifugal Switch Actuator Installation

Press the centrifugal switch actuator (51) on the rotor shaft so that the actuator flange sits just flush with the snap ring groove. The lower side should align with the scribed mark on the shaft. Secure the switch with the snap ring.

### Bearing Installation

Inspect the rotor shaft for damaged threads, scoring in the seal area, and a nicked or damaged keyway. If the bearings were removed, inspect the bearing areas for scoring or galling. Remove nicks and burrs with a fine file or emery cloth. Inspect the rotor area for separated laminations. If the shaft is bent or damaged, or if the laminations are separated, replace the shaft and rotor (a single assembly).



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 rotor assembly is removed.

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 (46 and 57) to a uniform temperature **no higher than** 250°F (120°C). Slide the bearings onto the shaft, one at a time, until they are fully seated against the shaft shoulders. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.



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 out of position in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings. Make certain that they are seated squarely against the shaft shoulders.

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



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.

### Rotor And Shaft Installation

With the stator installed and the motor housing upright, carefully ease the rotor/shaft (53) and assembled bearings through the stator so that the lower bearing (57) seats squarely in the bore of the motor housing (10).

Wrap the impeller end of the shaft in a clean cloth to protect it during installation of the head and power cable.

### Head And Power Cable Installation



**The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the plug on the pump power cable is disconnected from its receptacle.**

Clean the exterior of the power cable with warm water and mild detergent. Check for obvious physical damage. Check the cable for continuity and in-

sulation resistance (see **Electrical Testing** in **TROUBLESHOOTING**). **Do not** attempt repairs except to cut off either end of the cable; **splicing is not recommended**. Reinstall any wire tags or terminals which may have been removed.



**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.**

Secure the centrifugal switch contact (14) to the mounting plate (17) with the hardware (15 and 16). Secure the terminals (11) of the short blue stator lead to the centrifugal switch contact with the hardware (12 and 13). (The C1 blue lead from the contact to the start capacitor should already be installed on the contact.)

Inspect the mounting plate grommet (20), and replace if required. Feed the remaining leads from the stator through the grommet and mounting plate.

Position the bearing shim (45) on the upper bearing (46), then carefully slide the mounting plate down over the bearing shim and upper bearing. Make certain that the bearing seats squarely in the bore.

Secure the overload protector (47) to the mounting plate with the hardware (48 and 49).

Test the start capacitor (22) for shorts and grounding (see **Electrical Testing** in the **TROUBLESHOOTING**). Install the start capacitor in the capacitor holder (23) and secure the holder to the mounting plate with the hardware (24 and 25).

Secure the terminal of the green ground wire to the mounting plate with the previously removed hardware. Make certain the terminal makes good contact with the plate.

Install the head gasket (50) against the mounting plate.

Install the cable lock (30) on the power cable (31). Lubricate the bore of the head (21) and install the

power cable through the bore. Secure the cable to the head with the cable lock plate (39) and hardware (37 and 38). Secure the cable lock and handle (36) to the head with the hardware (32 and 33).

Install the cable lead plugs (41) in the stator lead receptacles (43), then secure with the male and female connector sleeves (40 and 42). Make certain that the green power cable ground lead is securely connected to the short ground cable, and that the ground cable is firmly attached to the mounting plate.

Connect the start capacitor plugs (27) in the stator lead receptacles (29), then secure them with the male and female connector sleeves (26 and 28).

### NOTE

*Check the wiring diagram in **Troubleshooting, Section D** to make sure that all electrical leads are correctly installed.*

Position the head (21) on the motor housing (10) and secure with the hardware (18 and 19).

See **PUMP END REASSEMBLY** to reassemble the pump end components.

See **VACUUM TESTING** followed by **LUBRICATION**.

## VACUUM/PRESSURE TESTING

To ensure the water-tight integrity of the pump, it is recommended that the motor and seal cavities be vacuum and pressure tested any time the seal and/or motor are serviced. The seal cavity **must** be pressurized to prevent separation of the seal faces or unseating the stationary seal seat between the seal and motor cavities. Use a manometer with a range of 30 to 0 to 30 inches of mercury to perform the vacuum test. **Do not** use a vacuum gauge. Vacuum gauges are not sensitive enough to detect minor leaks.

Drain **all** of the oil from **both** the seal and motor cavities before performing the test. Oil within the motor cavity will be drawn into the system, resulting in damage to the vacuum pump or manometer.

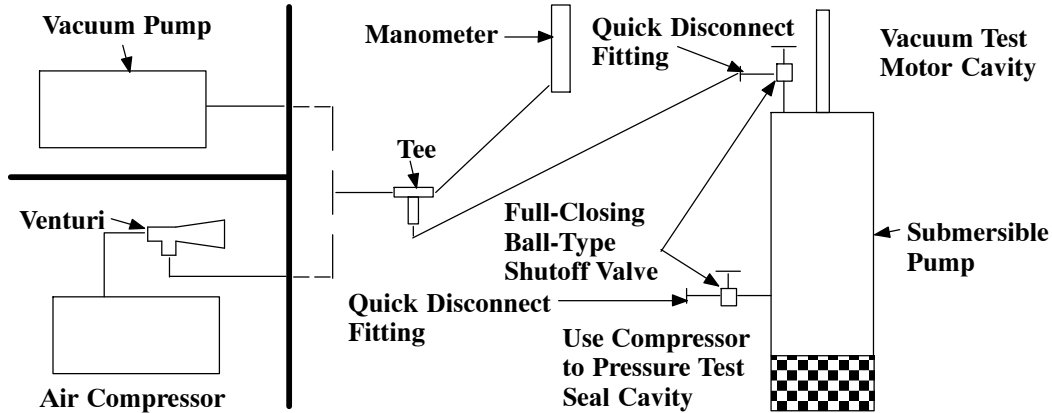
It is recommended that a vacuum pump be used to draw the vacuum on the motor cavity. If a vacuum pump is not available, a compressor/venturi sys-

tem may be used. If the compressor/venturi cannot draw the vacuum level shown in Table E-1, draw the motor cavity vacuum down as far as the system will allow, then pressurize the seal cavity so the differential between the two cavities is the same as the differential between the readings shown in the table.

If a compressor/venturi system is used, install full-

closing ball-type shutoff valves with quick-disconnect fittings in the pipe plug holes in both the motor and seal cavities. This will allow the pressure (or vacuum) to be maintained while using the compressor to perform the second portion of the test.

Figure E-3 shows a simple schematic for setting up either a vacuum pump or a venturi/compressor test system.



**Figure E-3. Vacuum/Pressure Test System**

Table E-1 shows the motor cavity vacuum and seal cavity pressure readings for the test, and the duration to maintain each reading. **Any** change in the

readings during the test indicates a leak which **must** be identified and corrected before putting the pump back into service.

**Table E-1. Vacuum/Pressure Test Data**

| Pump Model | Motor Cavity Vacuum (In. Hg.) | Duration (Minutes) | Seal Cavity Pressure (PSI) | Duration (Minutes) |
|------------|-------------------------------|--------------------|----------------------------|--------------------|
| S2C3       | 30                            | 1                  | 15                         | 1                  |

## LUBRICATION

### Seal Cavity

Check the oil level in the seal cavity before initial startup, after the first two weeks of operation, and every month thereafter.



**Check the oil level only when the pump is cool. If the oil level plug is removed when the pump is hot, pressure in the seal cavity can cause hot oil to be ejected as the plug is removed.**

To check the seal cavity oil, lay the pump on its side and remove the seal cavity drain/fill plug (58) in the motor housing. Tip the pump and drain off a small amount of oil into a transparent cup. If the oil level is abnormally low, or the color milky or dark, refer to **Draining Oil From Seal Cavity** in this section for instructions and troubleshooting tips.

To fill the seal cavity, remove the seal cavity drain/fill plug (58) and add 7 ounces (0,2 liter) of SAE No. 10 non-detergent oil. Refer to Section B, **Installation**, for positioning of the pump during filling of the seal cavity. Apply 'Loctite Pipe Sealant With Teflon No. 592' or equivalent to the threads of the pipe plug, before reinstalling the plug.

### Motor Cavity

The motor cavity is cooled by the liquid being pumped. No further lubrication is required.

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