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S **SERIES**

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



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

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INTRODUCTION

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

This pump is designed to operate fully or partially submerged. It is capable of handling most nonvolatile and nonflammable liquids which are mildly corrosive and abrasive. The basic material of construction is aluminum with cast iron or ductile iron wearing parts (impeller and diffuser are ductile iron; suction head and seal plate are cast iron). The integral electric motor must be operated through the control box furnished with the pump. Neither the pump nor the control box are explosion proof.

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		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 - 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 connections are secure before at-
// tempting to operate the pump.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// The pump motor is designed to be operated through the
// control box furnished with the pump. The control box
// provides overload protection and power control. Do not
// connect the pump motor directly to the incoming power
// lines.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// All electrical connections must be in accordance with //
// N.E.C. Article 250. 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 manu- //
// facture. Failure to follow applicable specifications, //
// or substitution of electrical parts not supplied or ap- //
// proved by the manufacturer, can result in severe injury //
// or death. //
// //
////////////////////////////////////

```

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

```

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 - SECTION B

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

Automatic liquid level devices are not furnished with the standard pump, but are available from Gorman-Rupp as options (see **Liquid Level Devices**, Section B); for information on installing and operating these devices, see the technical data accompanying that option.

PREINSTALLATION INSPECTION

The pump assembly and control box were 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 connected to the control box with 50-ft. of power cable. Inspect the cable for cuts or damage.
- d. Check the control box for cracks, dents, and other obvious damage.
- e. Check that all control box components are securely attached to their mounting surfaces, and that the electrical connections are tight and free of corrosion.
- f. Compare the amperes, phase, voltage, and hertz indicated on the motor name plate to the ratings indicated for the control box.
- g. Carefully read all tags, decals, and markings on the pump assembly and the control box, and perform all duties indicated.
- h. Check the pump and motor for any oil leaks. An oil leak may indicate a cut O-ring or other damage.
- i. If the pump and control box have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to insure 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

There are two lubrication cavities in this pump, both contain uninhibited transformer oil. The motor housing cavity provides lubrication to the motor assembly and rotor shaft bearings. The intermediate cavity provides lubrication to the seal assembly.

There are two shaft seals in this pump. The lower seal prevents liquid from entering the intermediate cavity at the impeller end. The upper seal prevents oil leakage from the motor housing cavity and acts as back-up protection in the event of lower seal failure.

Both lubrication cavities are fully lubricated when the pump is shipped from the factory. Check lubrication levels before installing the pump (see **LUBRICATION** in **MAINTENANCE AND REPAIR**). An additional quart of transformer oil has been provided with the pump to "top off" the oil cavities. If either 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	Pump Horse-power	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S8C1	460/3	140	1750	165	30	513	8

Pump Dimensions

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

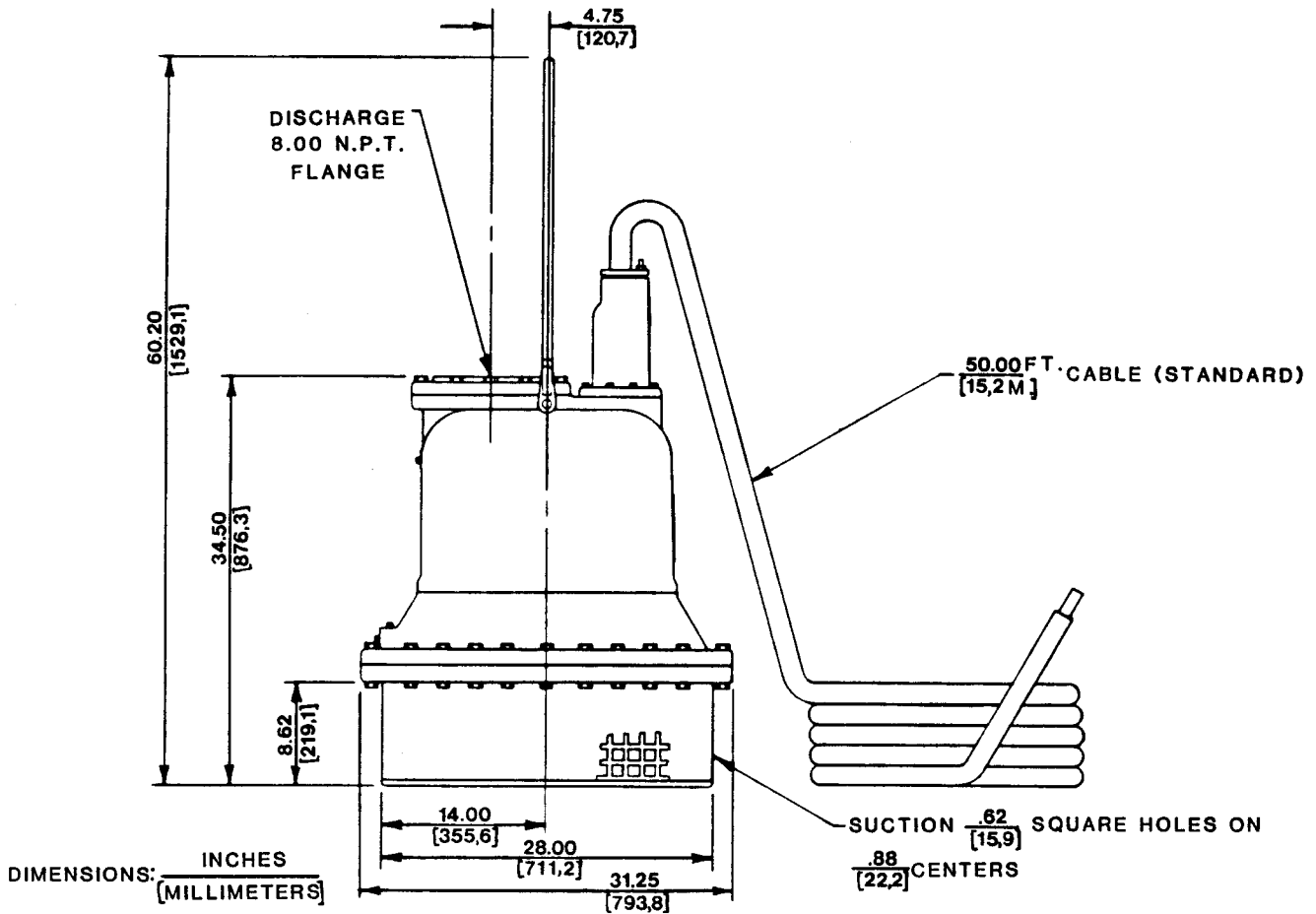


Figure 1. Pump Model S8C1-460V 3P

Lifting

Use lifting equipment with a capacity of a least **6000 pounds**. This pump weighs approximately **1225 pounds**, not including the weight of accessories and power cable.

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. If chains or cable //
// are wrapped around the pump to lift it, make certain //
// that they are positioned so as not to damage pump, and //
// so that the load will be balanced. //
//
////////////////////////////////////

```

Positioning The Pump

This pump is designed to operate fully or partially submerged. It may also be operated in air for extended periods. The rotating parts are oil lubricated, and the motor is cooled by a constant flow of liquid or air discharged through internal passage(s).

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 hoisting bail. 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 2 for typical pump installations.

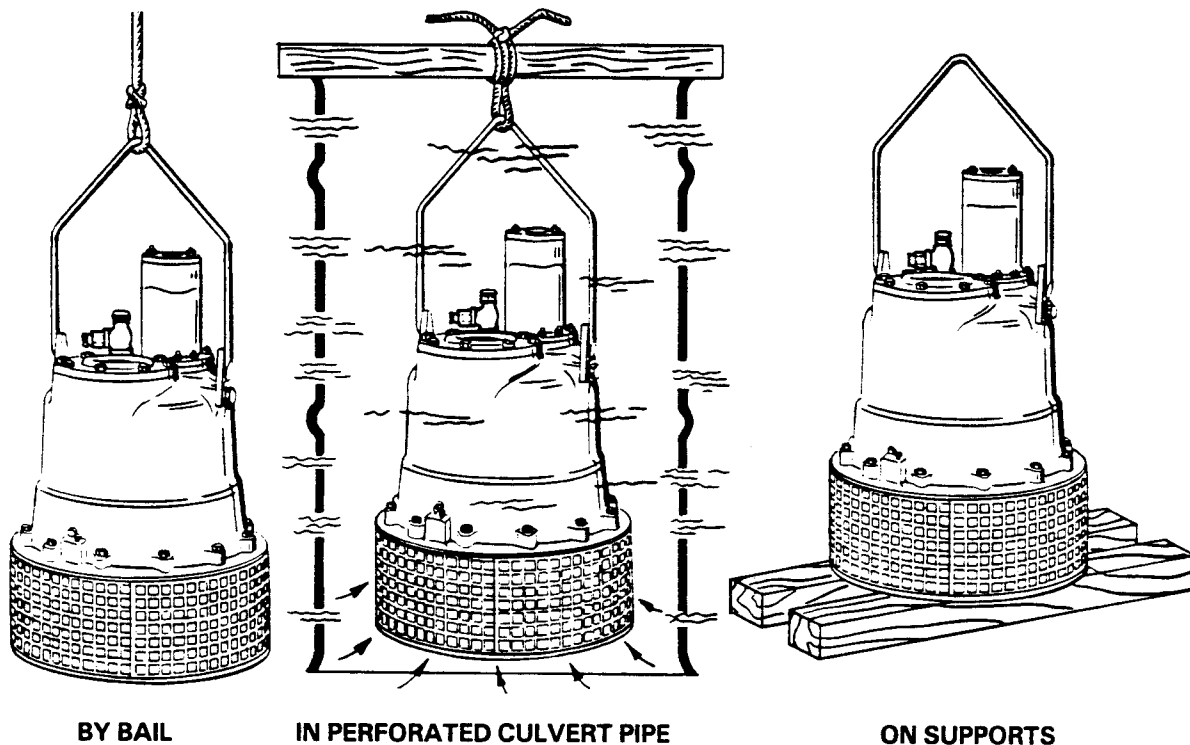


Figure 2. Typical Pump Installations.

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 to ensure that the pump is properly wired to the control box. 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. 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.

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, 140 HP motor. It is designed to operate through the control box furnished with the pump.

WARNING

////////////////////////////////////
//
// The pump motor is designed to be operated through the //
// control box furnished with the pump. The control box //
// provides overload protection and power control. Do not //
// connect the pump motor directly to the incoming power //
// lines. //
// //
////////////////////////////////////

Enclosure

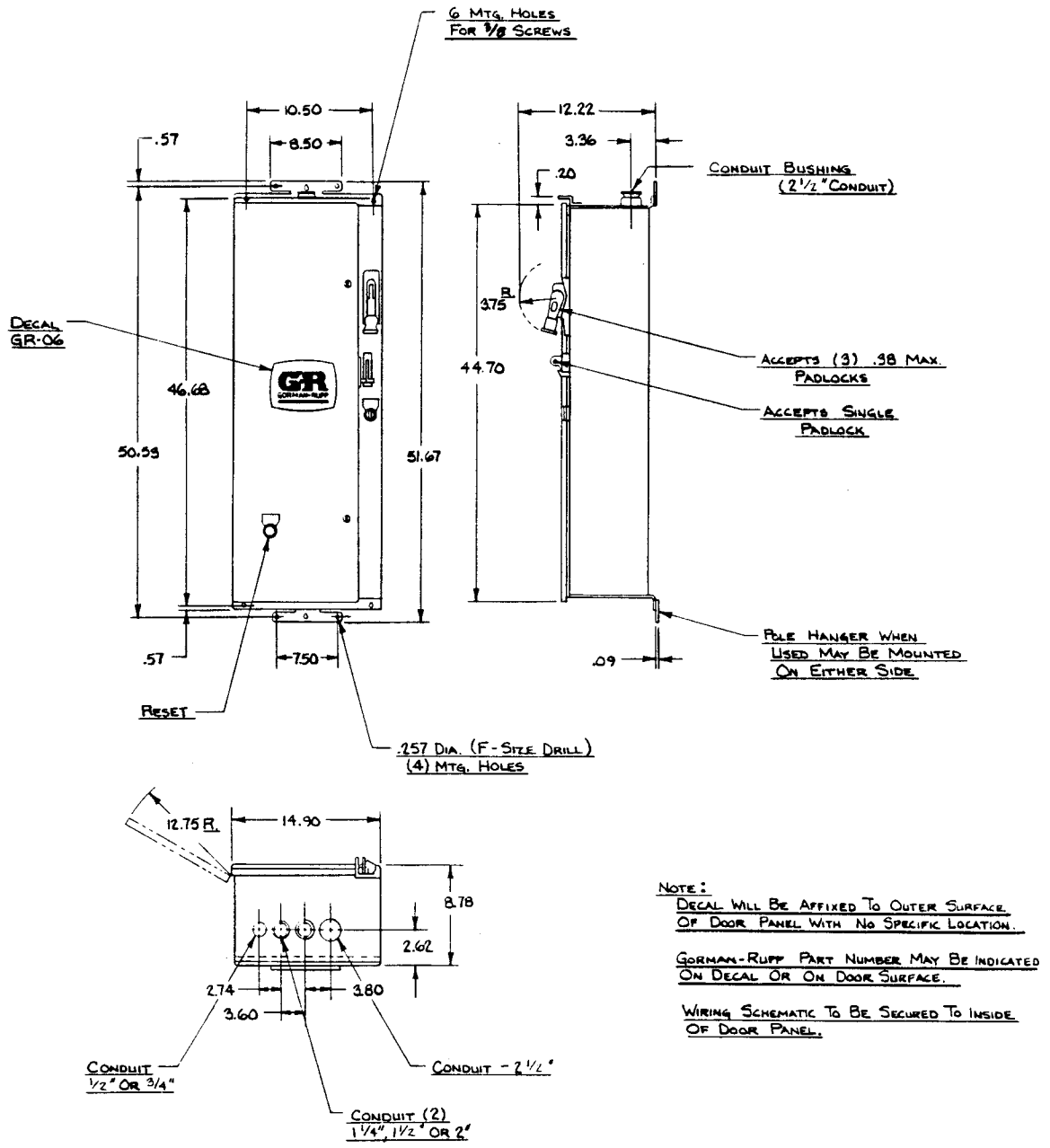
The control box is a rainproof enclosure with padlockable front cover. **The enclosure is not designed to be watertight, and should not be submerged.** See Figure 3 on page B-7 for enclosure dimensions and callouts.

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). After the box is installed, make certain the front cover latches properly.

CAUTION

Failure to mount the control box vertically on a level surface may affect operation of the pump controls.



PUMP CONTROL
ACROSS-THE-LINE STARTER 3 POLE
WITH FAST TRIP OVERLOAD RELAY AND INSTANTANEOUS
TRIP CIRCUIT BREAKER TYPE MCP
NEMA TYPE 3R ENCLOSURE

Figure 3. 27514-098 Control Box Assembly

Grounding Methods

Electrically ground the installation before connecting the field wiring to the control box. Install a grounding terminal to the enclosure and connect it 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 4 for some suggested grounding methods.

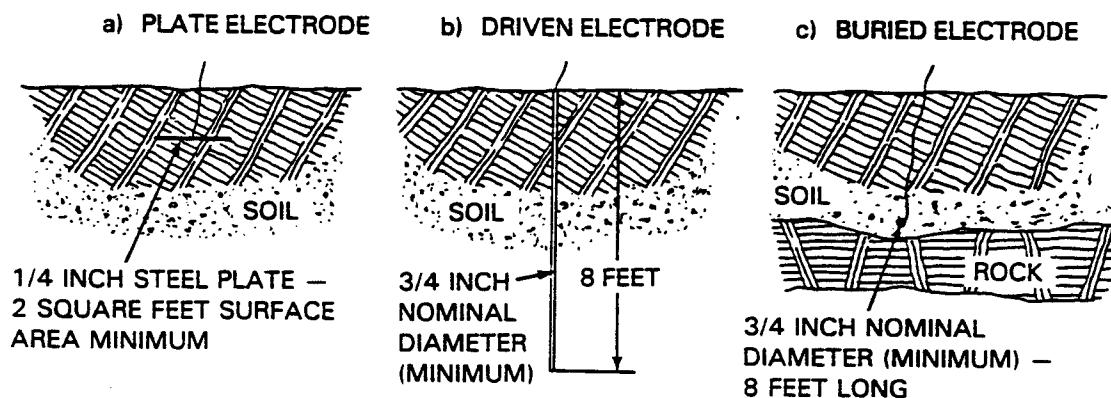


Figure 4. Suggested Grounding Methods

- 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.
- A rod or pipe, 3/4 inch diameter minimum, 8 feet long, completely driven into the ground.
- 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 //
// control box 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 enclosure are //
// properly grounded, and that the incoming power matches //
// the requirements of the pump and control. //
//
////////////////////////////////////

```

The pump control is designed to regulate a 460 volt, 3-phase, 60 hertz power supply. The field wiring must be properly sized to insure an adequate voltage 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 6 on page B-13.
- 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 insure an adequate voltage supply to the pump.

Table 2. Pump Motor Voltage Limits

Nominal Voltage	Phase	Minimum Voltage	Maximum Voltage
460	3	420	500

Use conduit or cable clamps to secure the incoming field wiring to the control box. Make certain all connections are tight and that cable entry points are waterproof. Support the cable weight, if required, to prevent excessive strain on cable clamps and cable.

Pump Power Cable Connections

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 connecting //
// power or accessory cables to the control box. Obtain //
// the services of a qualified electrician to make all //
// electrical connections. //
// //
////////////////////////////////////
    
```

The standard pump is provided with a 50-foot power cable potted in the terminal housing assembly. (See Table 3 for cable specifications.). If a longer power cable is required, an optional housing/cable assembly **must** be ordered from the factory. Splicing of the power cable is **not** recommended by the Gorman-Rupp Company due to safety and warranty considerations.

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 S8C1

Voltage/ Phase	A.W.G. Cable Size	Cable OD (inches)	Conductor Dia. (inches)	Amp Rating* at 40°C (amperes)	DC Resist- ance at 25°C (ohms/ 1000 ft)	Voltage Drop at Max. Load per 100 ft
460/3	2/0	1.75	0.48	215	0.09	2.97

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

Before connecting the pump power cable to the 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 box as shown in Figure 6 on page B-13 and Figure 7 on page B-14. Use conduit or cable clamps to secure the power and accessory cables to the control box. Make certain that all connections are tight and that cable entry points are rainproof.

NOTE

The power cable furnished with this pump includes three electrical conductors (white, red, and black), two grounding conductors (green) and one ground check conductor (yellow). The yellow ground check lead is used in conjunction with customer supplied ground monitoring equipment. If this equipment is not used, the yellow lead should be connected with the green leads and used as a ground conductor.

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, or dewatering functions by using **either** of the following optional sensing devices: (see Figure 5 on page B-12).

- **Diaphragm Type:** two fixed position sensors (upper and lower) each contain a diaphragm which flexes with changes in liquid level, thus activating an enclosed miniature switch.
- **Bulb (Float) Type:** a bulb raises or lowers (floats) with the liquid level, thus activating an enclosed miniature switch.

For added safety, the sensing devices operate through low voltage 24 volt circuitry which is specially designed to fit into the main pump control box.

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.

TYPICAL ILLUSTRATION

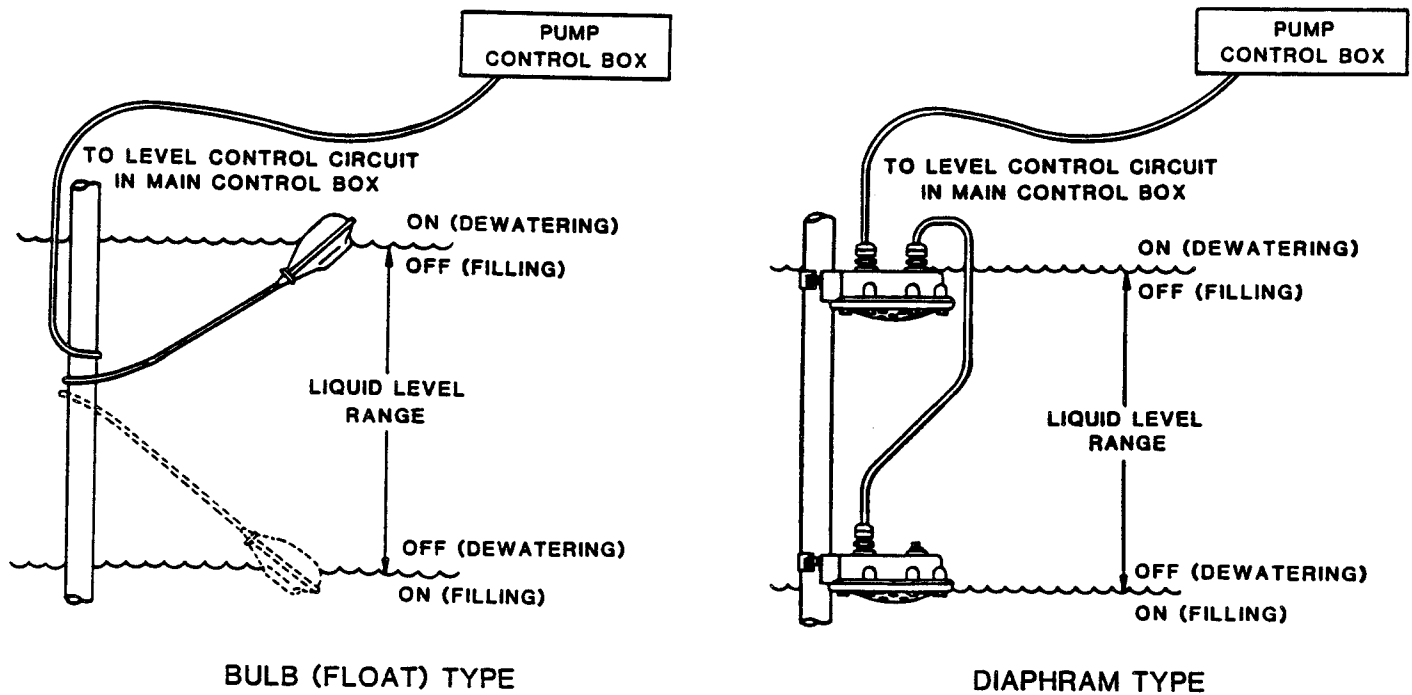
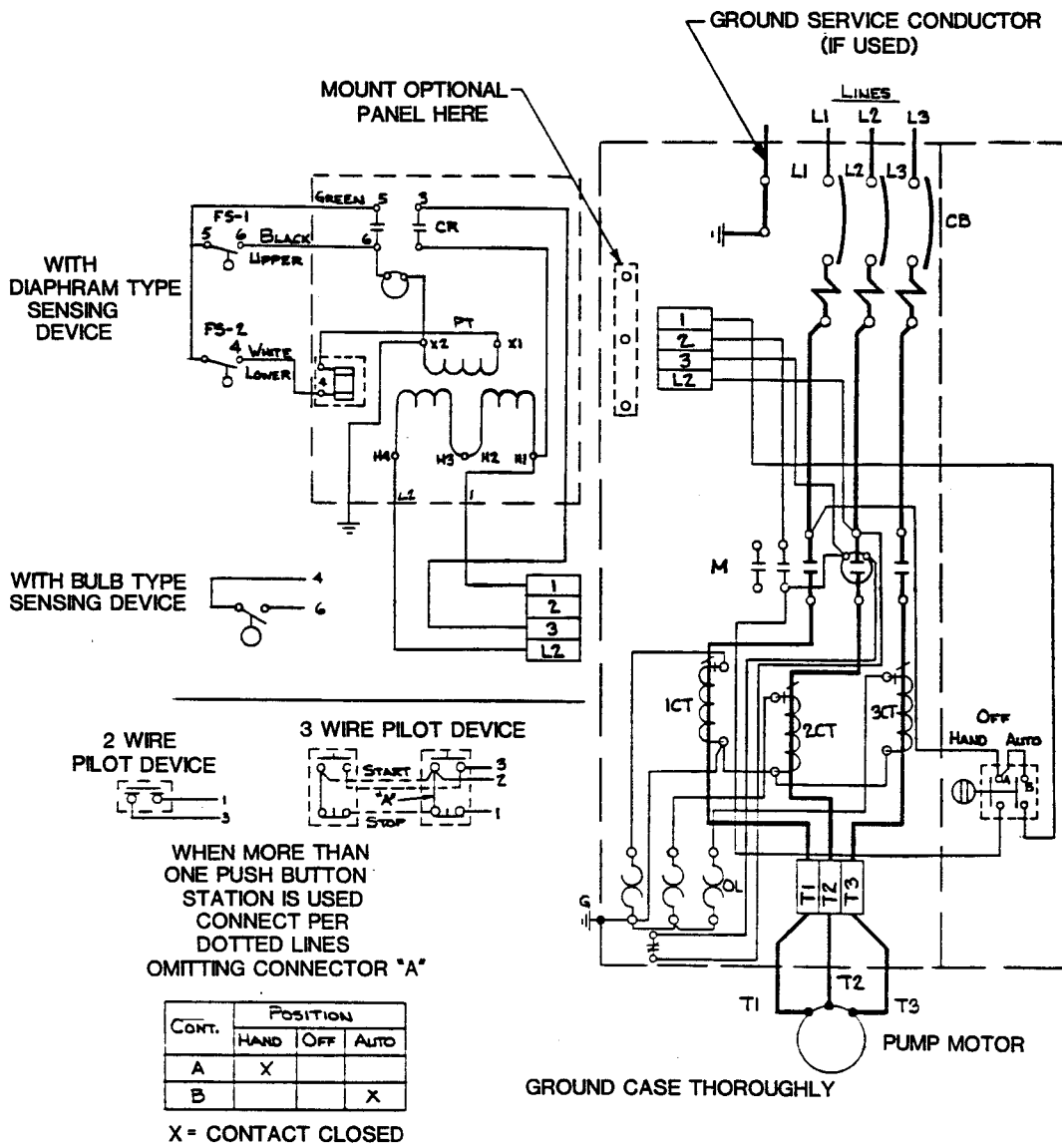


Figure 5. Liquid Level Devices

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.

CONNECTION DIAGRAM



MOTOR DATA			OVERLOAD RELAY				MCP CIRCUIT BREAKER		
Volts 3ø, 60 Hz.	FLA	LRA	Coil 10177	Amperes		LRA Trip Time	Breaker Ampere Size	Trip Current Amperes	
				Hold	Trip			Locking Pin Setting	Setting
460	165(8.25)	513	17*	160	180	9	250	N/A	1250

* 200:5 Current Transformer

Figure 6. Magnetic Controller Connection Diagram For Control Box 27514-098

ELEMENTARY DIAGRAM

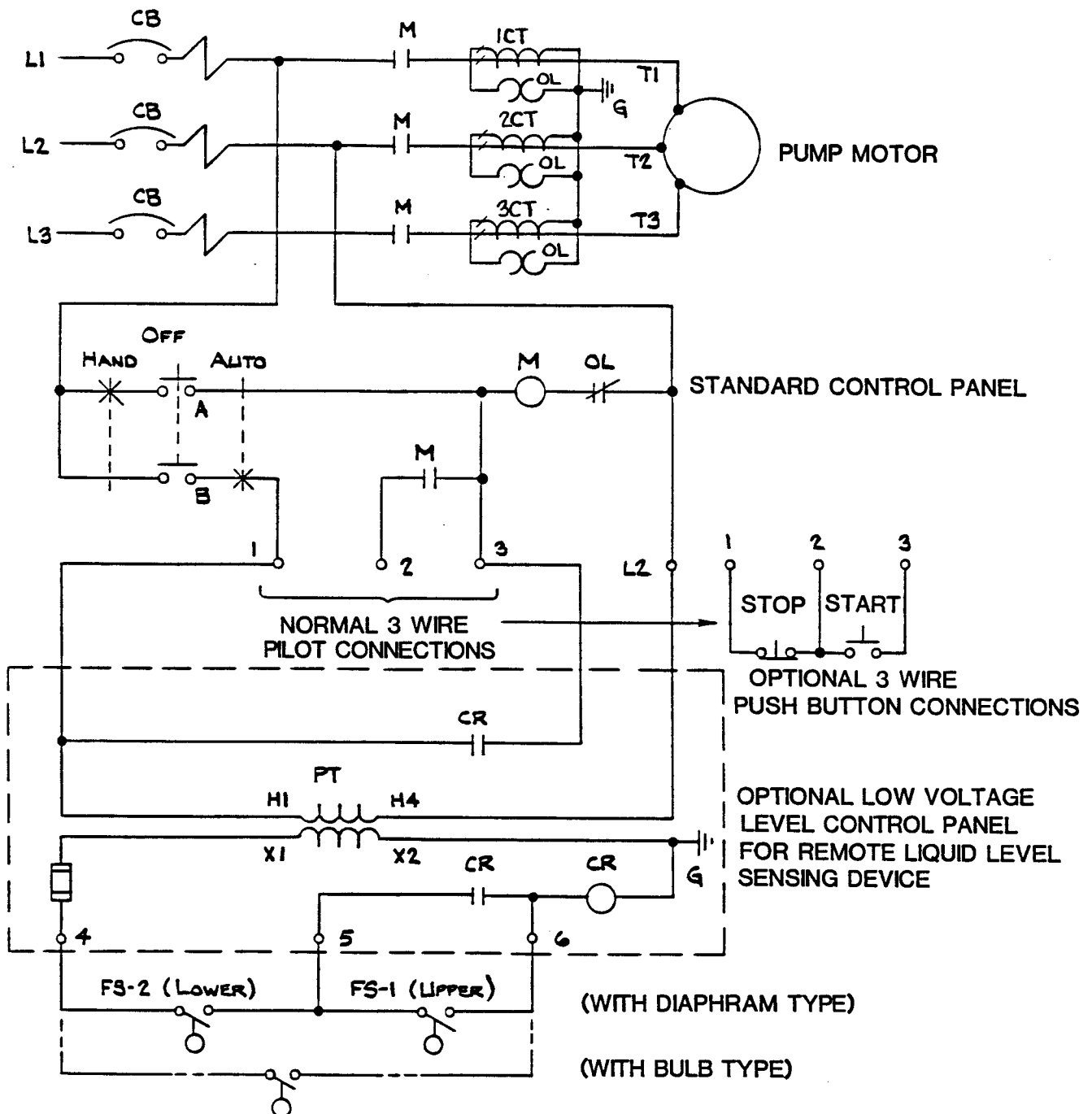


Figure 7. Magnetic Controller Elementary Diagram Based On Figure 6 on page B-13.

PARTS LIST, INTERNAL PARTS
27514-098 CONTROL BOX ASSEMBLY
 (see Figure 3 on page B-7 for external parts)

(Repair components identified by Cutler-Hammer part number.)

PART NAME	PART NUMBER	MATL CODE	QTY
CIRCUIT BREAKER 250 AMPS	45-775	-----	1
CONTACTOR - 3 POLE	C32KN31	-----	1
* RENEWAL CONTACT SET	6-36-2	-----	1
COIL	9-1891-3	-----	1
OVERLOAD RELAY	10-2145-3	-----	1
HEATER COIL	10177-H17	-----	3
COVER BOOT	32-524	-----	-
CURRENT TRANSFORMER	42-1003-2	-----	3
SELECTOR SWITCH	10250T14232M51	-----	1
CONTACT BLOCK	10250T2	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

OPERATION - SECTION C

CONTROL BOX FUNCTION

A control box is provided to facilitate operation of the pump. It contains controls for starting and stopping the pump, and provides overload protection for the pump motor. The pump control may be equipped with an optional automatic liquid level sensing device, in which case the low voltage circuits are also contained within the control box.

WARNING

```

////////////////////////////////////
//
// The pump motor is designed to be operated through the //
// control box furnished with the pump. The control box //
// provides overload protection and power control. Do not //
// connect the pump motor 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>
--

Component Function

The control box contains the following hand operated switches and controls:

- The **control handle** operates the control box circuit breakers. In the OFF position, the control handle opens the circuit breakers to interrupt incoming power through the control box and prevent pump operation. In the ON position, it closes the circuit breakers to permit pump operation. The circuit breakers will open or "TRIP" automatically in the event of a short circuit overload current, or thermal excess within the pump motor or electrical system. When tripped, move the control handle to OFF and back to ON to reset the circuit breakers.
- The **selector switch** (optional on some boxes) controls the mode of operation. In the OFF position, it prevents all operation 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 the optional liquid level control system, if used.
- The **RESET** pushbutton resets the motor overload relay after it has been "TRIPPED" by an overload. The overload relay will trip automatically if the current drawn by the motor exceeds design specifications.

NOTE

If the overload unit trips, do not reset it immediately. Wait at least ten minutes before resetting the control handle back to the ON position. If the overload unit continues to trip, operational problems exist. See TROUBLESHOOTING.

WARNING

Warning text enclosed in slashes: // The motor will restart as soon as the RESET pushbutton is pressed, unless the selector switch is in the OFF position. Turn the selector switch to OFF and move the control handle to OFF before approaching the pump.

- The liquid level devices (optional equipment) operate in conjunction with the 3-position switch (HAND-OFF-AUTO) supplied as a part of that option. After the level sensors and circuitry have been installed, pump operation may be automatically controlled for filling or dewatering functions. (See LIQUID LEVEL DEVICES, Section B.)

PUMP OPERATION

WARNING

Warning text enclosed in slashes: // This pump is designed to pump most nonvolatile and nonflammable liquids which are mildly corrosive and abrasive. Do not attempt to pump liquids which may damage the pump or endanger personnel as a result of pump failure.

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, or if the control box fails to provide adequate protection. Operating the pump against a closed discharge for extended period will also cause the pump to overheat.

As a safeguard against rupture or explosion due to heat, this pump is equipped with a pressure relief valve which will open if vapor pressure within the pump motor reaches a critical point. If overheating does occur, stop the pump immediately.

diately 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. //
//
////////////////////////////////////

```

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

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 hoisting bail. Turn it 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

<p>Secure the pump during rotation check to prevent coiling of the power cable.</p>

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

```

STARTING

After the pump and control box 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 **OPERATION** section.

Standard Pump (No Liquid Level Devices)

If no liquid level devices have been installed, move the control handle to the ON position and turn the selector switch to HAND. The pump motor will start and pumping should begin.

The pump will continue to operate until it is stopped by turning the selector switch to OFF.

With Automatic Liquid Level Devices

If optional liquid level devices have been installed, move the 3-position selector switch to OFF and the control handle to the ON position.

If desired to operate the pump in the manual mode, set the selector switch to HAND; 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 maintained by the optional liquid level control system. To terminate automatic mode, move the selector switch to OFF or HAND.

STOPPING

To stop pump operation, turn the control handle OFF.

Power through the control box may be terminated by moving the control handle to the OFF position, thereby opening the circuit breakers. This **does not** terminate incoming power through the field wiring connected to the control box.

After stopping the pump, be sure to perform all required maintenance and preservation procedures.

NOTE

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 it is 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.

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>Insufficient liquid in sump.</p>	<p>Reduce discharge head, or install staging adaptor and additional pump.</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.</p> <p>Clear clog(s). Stop pump; back flow may flush away debris.</p> <p>Stop pump until liquid level rises.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE (cont.)	Worn impeller vanes; excessive impeller clear- ance. Pump running backwards.	Check impeller and clearance. See PUMP END REASSEMBLY. Check direction of rotation and correct by interchanging any two motor leads at control box. (See Pump Rotation, Section C).
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

<p>Be certain to refer to the wiring diagrams in the INSTALLATION section of this manual before reconnecting any electrical components which have been disconnected.</p>
--

Test Equipment

A volt/amp/ohmmeter and 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
Amprobe Model 300 or Amprobe, Jr.	Pyramid Instrument Corp. Lynbrook, NY	To check AC Voltage and current (amperage)
Megohmer	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. 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, 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.

Motor And Motor Power Cable Continuity

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

- a. Disconnect the motor power cable leads from the control box and connect the test leads to any two of the three power cable leads (not to the green ground lead or yellow ground check 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.
- b. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **MAINTENANCE AND REPAIR**). If there is no apparent damage to the motor cable, remove the terminal housing (see **MAINTENANCE AND REPAIR**) and check the continuity of each power cable lead at the terminal posts.

NOTE

The connections between the power cable leads and the terminal posts are potted to provide a water tight seal. **Do not** cut the potting away unless absolutely necessary. Check the continuity of each lead from the **motor** side of the terminal plate. If the continuity reading is good, there is no need to remove the potting material. If there is no continuity through the lead, remove the potting from only **that** terminal and check for a loose connection. After tightening the connection, recheck the continuity. **Be sure** to replace the potting and allow adequate drying time before putting the pump back into service. (See Power Cable Reassembly, Section E).

- c. If an open circuit still exists after each lead (terminal) has been tested and tightened, then the **entire** motor power cable must be replaced. Splicing or other means of repair are not recommended.

-
-
- d. If no break is found in the power cable, check the motor leads for continuity. 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.

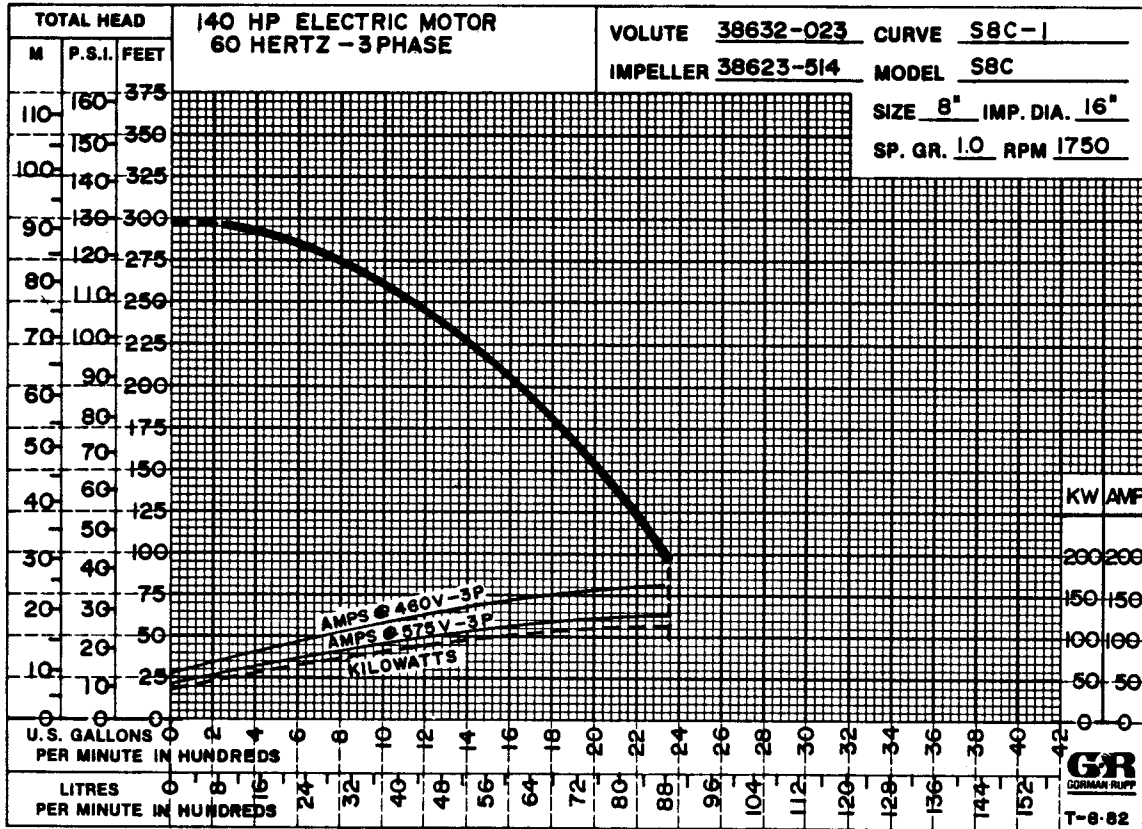
Insulation Resistance

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

- a. Disconnect the motor power cable leads from the control box. Connect one test lead to the power cable green ground lead, and touch the other test lead to each of the three power leads in turn.
- b. The reading obtained will indicate resistance values in both the power cable and the motor windings. If the resistance reading 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.
- c. To determine whether the power cable or the motor is grounded, remove the terminal housing (see **MAINTENANCE AND REPAIR**), disconnect the motor leads from the motor terminals, and test the power cable leads and motor leads separately.

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 S8C1-460V 3P

*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.

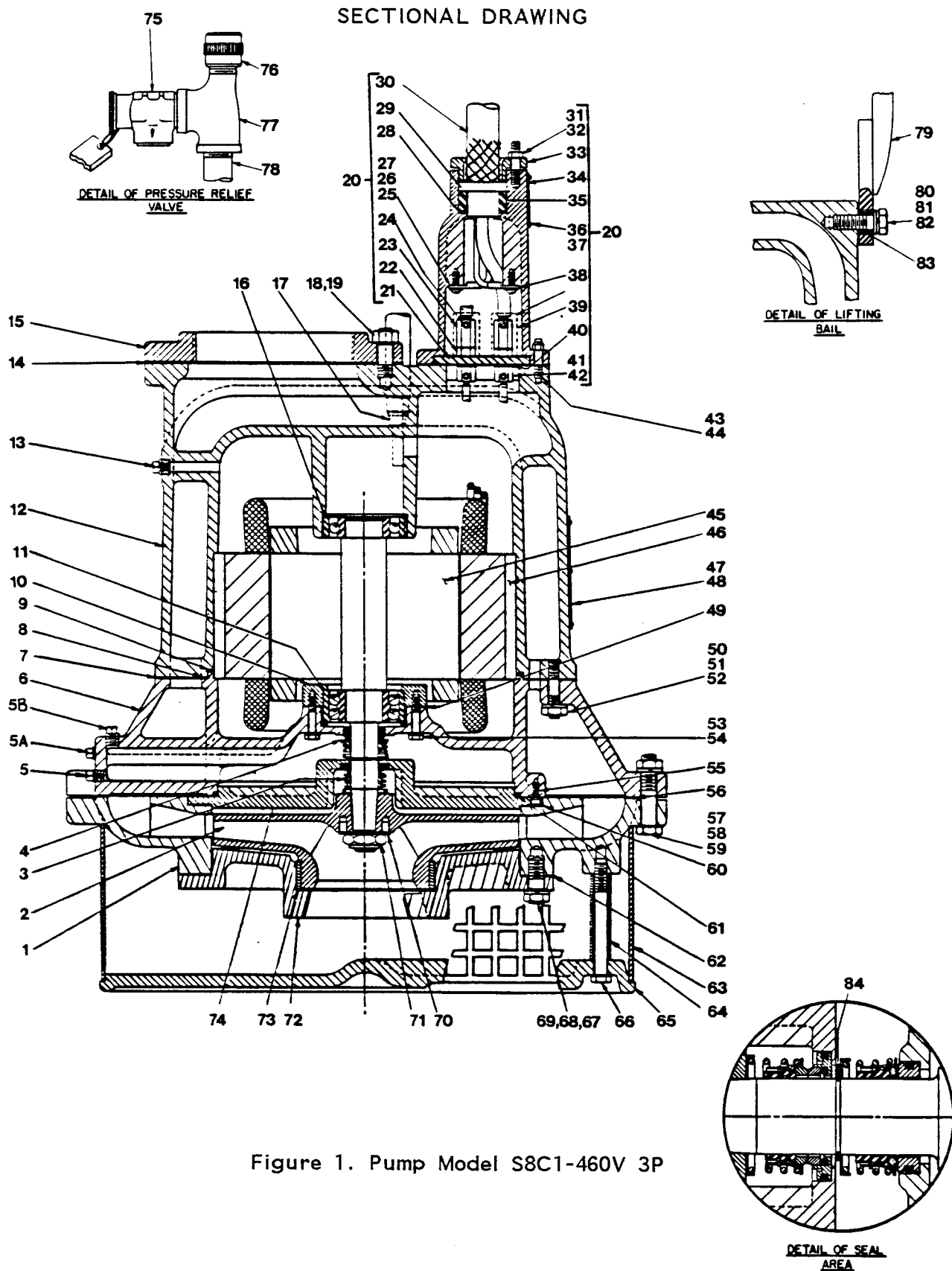


Figure 1. Pump Model S8C1-460V 3P

MAINTENANCE AND REPAIR

PARTS LIST
 Pump Model S8C1-460V 3P
 (From S/N 779485 up)

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	DIFFUSER	38632-023	11030	1	50	HEX NUT	D00010	17000	12
2	*IMPELLER	38623-514	11030	1	51	STUD	10443	17000	12
3	*OUTER SEAL ASSY	46512-055	-----	1	52	LOCKWASHER	J00010	17000	12
4	*INNER SEAL ASSY	25271-947	-----	1	53	LOCKWASHER	J00006	15991	4
5	SEAL CAV DRAIN PLUG	P00006	17000	1	54	HEX HD CAPSCREW	B00608	15991	4
5A	MTR CAV DRAIN PLUG	P00006	17000	1	55	SCKT HD CAPSCREW	BD00503	17000	6
5B	SEAL CAV FILL PLUG	P00006	17000	1	56	*DIFFUSER GSKT	38682-813	20000	1
6	INTERMEDIATE	38261-022	13040	1	57	HEX HD CAPSCREW	B01216	15991	20
7	*MOTOR HOUSING GSKT	38684-703	20000	1	58	LOCKWASHER	J00012	15991	20
8	*MOTOR HOUSING GSKT	10062-G	20000	1	59	HEX NUT	D00012	15991	20
9	*MOTOR HOUSING GSKT	10038-G	20000	1	60	*SEAL PLATE GSKT	38682-812	20000	1
10	BEARING CAP	10085	10010	1	61	*SEAL PLT O-RING	S02207	-----	1
11	*LOWER BALL BEARING	S01169	-----	1	62	*SUCT HEAD GSKT	38683-817	20000	1
12	MOTOR HOUSING	42822-015	24130	1	63	*STRAINER SCREEN	10090	15991	1
13	MTR CVTY FILL PLUG	P00006	17000	1	64	BASE PLT SPACER	31413-026	15079	6
14	*DISCH FLANGE GSKT	1759-G	18000	1	65	BASE PLATE	10036	13080	1
15	DISCHARGE FLANGE	1759	10010	1	66	HEX HD CAPSCREW	B01024	15991	6
16	*UPPER BALL BEARING	S01077	-----	1	67	STUD	C01211	17000	8
17	FILL TUBE ASSY	10040	24040	1	68	HEX NUT	D00012	17000	8
18	STUD	C01211	15991	8	69	LOCKWASHER	J00012	17000	8
19	HEX NUT	D00012	15991	8	70	IMP WASHER	11199	17000	1
20	TERM HSG/CABLE ASSY	47367-013	-----	1	71	DEFORMED LOCKNUT	22565-105	-----	1
21	TERM PLATE ASSY	11163	24010	1	72	SUCTION HEAD	38246-028	10010	1
22	HEX NUT	D00006	14990	3	73	*WEAR RING	38691-309	14000	1
23	TERM COLLAR	10052-A	14100	3	74	SEAL PLATE	38272-705	10010	1
24	AL HD SETSCREW	GA00602	14990	3	75	*PRESS REL VALVE	14139	-----	1
25	GRD TERMINAL	27214-058	-----	1	76	OIL FILL CAP	V00016	11991	1
26	TOOTH LOCKWASHER	AK00006	15991	2	77	STREET TEE	14138	-----	1
27	RD HD MACH SCREW	X00603	14990	2	78	HVY PIPE NIPPLE	THA01614	15071	1
28	TERM WASHER	10659-B	15991	1	79	HOISTING BAIL	10039	24001	1
29	* CABLE GRIP	11227-F	-----	1	80	FLAT WASHER	K00012	15991	2
30	* POWER CABLE	10325-A	-----	1	81	LOCKWASHER	J00012	15991	2
31	STUD	C00808	15991	2	82	HEX HD CAPSCREW	B01210	15991	2
32	HEX NUT	D00008	15991	2	83	BAIL BUSHING	10045	15071	2
33	TERM GLAND	10658	13040	1	84	SEAL RET RING	S00264	-----	1
34	TERM HOUSING	10088-B	13040	1		NOT SHOWN:			
35	* GLAND BUSHING	10758-E	19100	1		CONTROL BOX ASSY	27514-098	-----	1
36	INFO PLATE	38816-047	-----	1		(460 V)			
37	DRIVE SCREW	BM#04-03	17000	4		IMP KNOCKER	2177-C	14070	1
38	GRD CK TERMINAL	S01542	-----	1		*TRANSFORMER OIL	9568	-----	1
39	* POTTING MOLD	11632	19220	3		(1QUART)			
40	* DYNA-SEAL WASHER	S01586	-----	3		OPTIONAL:			
41	TERM POST	11192	14100	3		REPAIR GASKET SET	11000-V	-----	1
42	AL HD SETSCREW	GA00501 1/2	14990	3		REPOTTING KIT	12442-A	-----	1
43	STUD	C00607	15991	6		TERM HOUSING AND	10325-P	-----	1
44	DEFORMED LOCKNUT	DD00006	15991	6		CABLE ASSY - 200 FT			
45	*ROTOR ASSY	47112-015	-----	1		LIQUID LEVEL DEVICES:			
46	STATOR ASSY	47113-011	-----	1		DIAPHRAGM TYPE	GRP48-3 or GRP48-6	-----	1
47	NAME PLATE	2613-CY	17020	1		FLOAT TYPE	27471-155	-----	1
48	DRIVE SCREW	BM#04-03	17000	6		LOW VOLT CONTROL	S01657	-----	1
49	*BRG CAP GSKT	10085-G	20000	1		(24 VOLT)			

*INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO AND UP

PUMP AND MOTOR DISASSEMBLY AND REASSEMBLY

The following maintenance and repair instructions are keyed to the sectional view (see figure 1) and the accompanying parts list. ,

WARNING

```

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

```

Before attempting to service the pump or control, cut off the power supply to the control box. Close the valve in the discharge line, if used.

Use the hoisting bail to remove the pump from the wet well or sump and move it to a location where the discharge line can be removed.

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

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. If chains or cable //
// are wrapped around the pump to lift it, make certain //
// that they are positioned so as not to damage pump, and //
// so that the load will be balanced. //
// //
////////////////////////////////////

```

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 instruction.

If the problem is electrical, complete disassembly may not be required. Refer to **Electrical Testing** and have a qualified electrician check out control box, cable and terminal housing assembly. If problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY** followed by **MOTOR DISASSEMBLY**. Otherwise, see **Control Box and Terminal Housing And Power Cable Disassembly**.

All gaskets and most O-rings **must** be replaced if disturbed. A repair gasket kit is listed on the parts list as an option.

PUMP END DISASSEMBLY

Strainer Disassembly

To remove the strainer screen (63) and base plate (65) raise the pump slightly, or lay it on its side and disengage the strainer capscrews (66). Separate the screen and base plate from the pump and retain the spacer sleeves (64).

Draining Oil From Seal And Motor

CAUTION

Let the pump cool before removing the seal cavity drain 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.

With the pump in a vertical position, clean any dirt from around the seal cavity drain plug (5) and motor cavity drain plug (5A). Remove plug (5) and drain the seal oil into a **clean** container. Inspect it for water, dirt or cloudy condition which could indicate lower seal failure or poor gasket seal.

If motor problems are suspected, drain the oil from the motor cavity into a **clean** container at this time. Inspect the oil for dark color which could indicate motor overheating, dirt or water contamination. The presents of dirt or water could indicate a breakdown in the waterproof integrity of the motor cavity, probably due to poor gaskets or seals.

Positioning Pump For Disassembly

It is recommended that the pump be positioned upside down during disassembly. To hold the pump in the inverted position, secure the discharge studs (22) to a bench or work stand, or rest the pump securely on blocks. Be careful not to damage the terminal housing (34), cable (30) or pressure relief valve (77) while in this position. Use adequate equipment and personnel to safety handle the pump until it is secured. If inverting the pump is not practical, lay the pump on its side and secure it.

Suction Head And Diffuser Disassembly

Remove the hardware (68 and 69) and pull the suction head (72) from the diffuser (1). Remove the suction head gasket (62). Inspect the wear ring (73) for excessive wear or damage; replace it if required.

Disengage the hardware (57, 58, and 59) securing the diffuser to the intermediate (6). Tap around the parting surface with a soft faced mallet and separate the assemblies.

Impeller Disassembly

To remove the impeller, insert a rod (3/4 inch square X 36 inches long) between the vanes of the impeller to prevent impeller rotation. Remove the deformed locknut (71) and lockwasher (70). Screw the impeller knocker (supplied with pump) onto the rotor shaft. Use two pry bars to exert pressure on the back of impeller and strike the knocker sharply until impeller breaks loose.

NOTE

The rotor shaft is tapered and forms a friction fit with the impeller. Screw the impeller knocker onto the shaft until it bottoms out. Strike the knocker sharply with a hammer.

After the impeller is free, remove the impeller knocker. Remove impeller and inspect it for excessive wear or damage. Replace it if required. If no further disassembly is required, proceed to the appropriate areas in **PUMP END REASSEMBLY**.

Outer Seal Disassembly

See Figure 1 and 2.

Lubricate the rotor shaft adjacent to the outer seal (3) and work oil under the rubber bellows. Use a stiff wire with a hooked end to pull the rotating portion of the seal from the shaft. To remove the stationary portion, disengage the socket head capscrews (550) and pull the seal plate (74) from the shaft.

Place the seal plate on a flat surface with the impeller side down. Use a drift pin or screw driver to press on alternate sides of the stationary seat until removed.

If no further disassembly is required, proceed to appropriate areas in **Pump End Reassembly**

Inner Seal Disassembly

See Figures 1 and 2.

Remove the seal retaining ring (84) with snap ring pliers. Work oil under the bellows using a knife blade or fine stiff wire. Use a stiff wire with a hooked end to pull the rotating seal portion off the shaft. If a wire is not available, use a pair of pry tools to pry on each side of the bellows retaining flange. Work the bellows upward until the rotating seal portion is forced from the shaft. Lubricate the shaft to permit the seal to slide easily.

Slide the hooked end of two wires along the shaft and under the stationary seal seat. Hook the back side of the seat and pull it from the intermediate.

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

Do not remove the four capscrews (54) around the rotor shaft.

NOTE

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 an overhaul gasket kit and shaft seal assembly be used during reassembly. (See the parts list for numbers.)

Cleaning Old Parts

With the pump inverted, stuff a clean tissue into the stationary seat bore of the intermediate (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. Remove all O-rings and gaskets and clean the sealing surfaces of dirt or gasket material. Be careful not to scratch gasket surfaces.

Inner Seal Reassembly

See Figure 2

NOTE

Handle seal parts with care to prevent nicking or scratching the seal faces. The seal rings should be handled by the edges only since even finger prints on the precision finished faces can shorten seal life.

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.

Clean the rotor shaft and seal cavity area of the intermediate (6). Be sure the area is dry and free of lint and dirt.

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

Carefully clean the seal seat area in intermediate (6). Check the O-ring bore and pilot for burrs or nicks that might cut the seal O-ring or prevent a good seal.

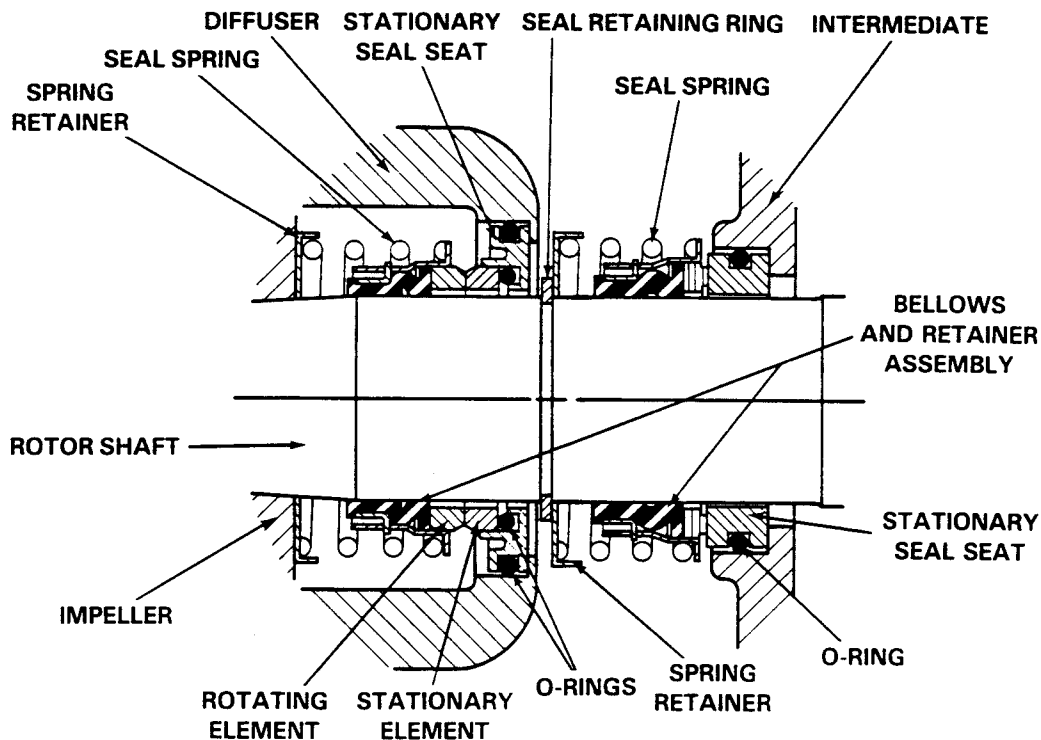


Figure 2. Seal Assemblies 46512-055 and 25271-947

Unpack the stationary seal seat, taking care not to touch sealing face. Apply a light coating of petroleum jelly to the seal seat bore and O-ring. Keep the sealing face dry.

Position the seat in the bore with the sealing face up and cover it with a clean tissue. Use your thumbs to press the seal into the bore. Apply equal pressure on opposite sides of the seat until it 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.

Fill the retaining ring groove (84) in the shaft with petroleum jelly and apply a thin coating on the I.D. of the bellows. Thoroughly lubricate the straight part of shaft.

Position the rotating portion of the seal on the shaft. Apply firm, steady pressure, with clean hands, on the seal retainer until it slides down over the straight portion of shaft. Stop just above the spring retainer groove. Work the seal assembly up and down on the shaft until the bellows slides easily. This allows the lubricant to work its way between the bellows and shaft.

After free movement is attained, push the seal assembly down over the groove and onto the lower part of the shaft. Be sure it makes full contact with the stationary seat. This step must be done in one quick motion.

Be sure to keep the sealing faces clean and dry.

Slide the seal spring over the shaft and bellows retainer. Install the spring retainer and seal retaining ring (84). See Figure 2 for proper order of seal assembly.

Seal Plate Reassembly

Thoroughly clean the seal plate gasket surfaces and stationary seal seat bore. The seal seat bore must be free of burrs and nicks which could damage the seal seat O-rings.

Replace the seal plate O-ring (61) and carefully install the seal plate (74) onto the intermediate (6). Secure the assembly using the six socket head capscrews (55).

Outer Seal Reassembly

See Figure 2.

NOTE

Handle seal parts with care to prevent nicking or scratching the seal faces. The seal rings should be handled by the edges only since even finger prints on the precision finish can shorten seal life.

Do not unwrap the seal until time of installation. Cleanliness of all seal components is a must, especially the seal faces.

Be sure the seal bore in the seal plate and rotor shaft are clean, dry, and free of lint.

Inspect the stationary seat bore for burrs or nicks that might cut the seal O-ring or prevent a good seal.

Unpack the stationary seal seat, taking care not to touch sealing faces. Apply a light coating of petroleum jelly to the seal seat bore and O-ring. Keep the sealing faces dry. Be certain the drive grooves of the stationary element are properly fitted into the drive lugs in the stationary seat.

Position the seat in the bore with the sealing face up and cover it with a clean tissue. Use your thumbs to press the seat into the bore. Apply equal pressure on opposite sides of the seat until it 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.

Unpack the rotating portion of the seal. Be certain the seal face is free of grit or surface damage. Assemble the drive grooves of stationary element into the drive lugs in the bellows retainer.

If the rotating element does not stay in the bellows retainer when turned upside down, place a small amount of grease at equal spaces on the **back** of the element and position it into bellows retainer. The grease should hold the element in position until the seal is installed.

Apply a light coating of petroleum jelly to the shaft and I.D. of the bellows. Place the rotating seal portion on shaft with seal face down. Apply firm, steady pressure, with clean hands, on the seal retainer until it slides down the shaft and makes contact with the stationary seal.

Slide the seal spring over the shaft and bellows retainer and install the spring retainer washer. See Figure 2 for proper order of seal assembly.

Impeller Reassembly

Inspect the impeller, and replace it if cracked or worn. **Be certain** that the impeller bore and the tapered section of the shaft are clean and dry. Do **not** apply lubricants of any kind to the impeller bore or tapered section of the shaft. Install the impeller and washer (70) on the shaft. Coat the threads of the rotor shaft with "Never-Seez" or equivalent compound. (Do this **only** after the impeller has been installed.) Insert a rod (3/4 inch square X 36 inches long) between the vanes of the impeller to prevent shaft rotation, and install the impeller deformed locknut (71). Torque the locknut to 300 ft. lbs. (3600 inch lbs.).

Turn the impeller to check for free rotation.

NOTE

If the impeller is not fully seated and binds against the diffuser, the shaft and lower bearing have been driven out of position during impeller removal. If this occurs, the lower bearing must be pressed back into place. (See **Motor Disassembly and Motor Reassembly.**)

Suction Head And Diffuser Reassembly

Thoroughly clean the diffuser (1) and each of its gasket surfaces. Cement the diffuser gasket (56) in position using 3M#EC1300 gasket cement, or equivalent. Carefully position the diffuser onto the intermediate and secure it by torquing the hardware (57, 58, and 59) to 120 ft. lbs. (1440 in. lbs.).

Clear the suction head gasket surface and replace the gasket (62). Position the suction head (72) over the studs (67) and secure it by torquing the hardware (68 and 69) to 120 ft. lbs. (1440 in. lbs.).

Turn the impeller and check for free rotation. If the impeller binds, disassemble the suction head and check the wear ring (73) for proper installation.

Strainer Reassembly

Position the strainer screen (63) on the shoulder of the diffuser.

Pack heavy grease into the spacer sleeves (64) and assemble the sleeves to the base plate (65) by installing the long capscrews (66). The grease should prevent the sleeves from sliding off the capscrews. Remove any grease from the end of the capscrews and apply 'loctite #242 threadlocker' or equivalent on the threads. Secure the complete strainer assembly to the pump end.

See LUBRICATION and FINAL ASSEMBLY before putting the pump back into service.

MOTOR DISASSEMBLY

Disassembly of the motor is rarely required except to replace the motor rotor, stator, bearings, or intermediate. 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. Make certain that the control //
// handle on the control box is in the OFF position and //
// locked, or that the power supply to the control box has //
// been otherwise cut off and locked out, before attempting //
// to open or service the pump assembly. Tag electrical //
// circuits to prevent accidental start-up. //
// //
////////////////////////////////////

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.

Terminal Housing/Power Cable Disassembly

WARNING

```

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

```

If the pump is maintained in an upright position, the terminal housing may be serviced without draining the oil from the motor cavity. However, the oil must be drained before attempting to disassemble the motor housing and components. To drain the oil see **Draining Oil** in **PUMP END DISASSEMBLY**.

Total disassembly of the terminal housing and power cable is not always required. Disassemble and replace only the parts which have been proven defective by inspection or testing. See **Electrical Testing** in **TROUBLESHOOTING**.

The terminal housing/power cable assembly (20) can be serviced without disassembling the motor housing or pump end.

To remove the terminal housing (34), remove the deformed locknuts (44) and raise the assembly to gain access to the motor terminal posts (41). Loosen the allen head setscrews (42), and disconnect the motor leads. Remove the terminal housing/power cable assembly.

To separate power cable (30) from the terminal housing, remove the hex nuts (32) securing the terminal gland (33) to the terminal housing. Slide the gland back along the power cable. Compress the wire mesh of the cable grip (29) and move it back along power cable. Oil the rubber bushing (35) and terminal housing bore and pull firmly on the cable. (Allow the oil to leak in around the bushing by agitating the cable in the bore. After the bushing has been loosened, the cable should pull out far enough to expose the rubber bushing. Apply oil on the cable jacket and slide the bushing back along the cable. Quite often, pressure exerted on the bushing will deform the cable jacket. If such is the case, additional oil and effort will be required to remove the bushing.

NOTE

If the rubber bushing cannot be removed from the terminal housing as indicated, it may be necessary to cut the bushing into small pieces or cut the cable.

Push approximately 6 inches of the power cable into the terminal housing so that the terminal plate assembly (21) comes free of the terminal housing. This should permit access to the power cable connections in the terminal plate.

To disconnect the power cable, remove the round head machine screws (27) and T-type lockwashers (26) securing the green and yellow ground leads. Cut away the potting mold (39) and potting compound, and loosen the allen head setscrews (24) in the terminal collars (23). Disconnect the power cable leads from the terminal collars.

Pull the power cable out of the terminal housing. The bushing (35), cable grip (29) and terminal gland (33) can be removed from the cable.

If necessary to replace the terminal plate (21) or terminal components, unscrew the terminal collars (23) and then the nuts (22). Remove the terminal posts (41) from the terminal plate.

See **Terminal Housing/Power Cable Reassembly** if no further disassembly is required.

Rotor Disassembly

See **Pump End Disassembly**, and remove all pump end and seal components.

With the pump end disassembled and the motor cavity drained, secure the pump in an inverted position. Remove the hex nuts (50) and lockwashers (52) securing the motor housing to the intermediate. Do **not** remove the four hex head capscrews (54) around the rotor shaft.

Hook a three-leg sling in the intermediate flange holes and hoist the assembled rotor and intermediate from the motor housing. The intermediate (6), the rotor (45), bearing cap (10) and both ball bearings (11 and 16) will now lift from the motor housing as an assembly. If necessary, tap around the parting surfaces with a soft faced mallet.

Cover motor housing with a clean, lint free sheet to avoid contamination of dirt or other foreign material.

Set the intermediate/rotor assembly on a clean work area. Leave the lifting slings attached and reduce the tension slightly. Remove the capscrews (54) and lockwashers (53) securing the bearing cap to the intermediate. Steady the rotor and lift the intermediate off. Tap the impeller end of the shaft with a soft mallet to loosen rotor bearing (11).

Remove the lower and upper ball bearings from the rotor shaft. Use a bearing puller if necessary. Remove the bearing cap from the rotor shaft.

NOTE

It may be necessary to use the bearing cap (10) and capscrews (54) in conjunction with the bearing puller to remove the rotor bearing (11).

Stator Disassembly

It is recommended that the stator (46) be left in place unless it is defective. If the stator must be removed, disconnect the motor leads as indicated in **Terminal Housing/ Power Cable Disassembly**.

Position an expandable tool, such as a split disc, inside the stator (approximately 2 inches down) and expand it tightly and squarely on the I.D.. Attach a lifting device to center lifting eye of the disc and raise the assembly 1 inch off floor. Use a soft faced mallet to rap alternate edges of the motor housing (12) 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 to permit stator removal.

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.

Relief Valve And Hoisting Bail Maintenance

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

When installing the relief valve (77), use "Loctite Retaining Compound #680" on both ends of the heavy pipe nipple (78); do not use on caps, plugs, and valves. Use "Loctite pipe sealant with Teflon #92", or equivalent compound, on the relief valve and cap (76). Position the valve out of the way, next to the terminal housing. Allow enough space for the terminal housing (34) to clear.

If the hoisting bail (79) requires replacement, remove the hex head capscrews (82), lockwashers (81), and flat washers (80) securing the bail to the motor housing; be certain to reinstall the bushings (83) during reassembly.

MOTOR REASSEMBLY

NOTE

Reuse of old O-rings, gaskets, or shaft seal parts may result in premature leakage or reduce pump performance. It is strongly recommended that an overhaul gasket kit and shaft seal assembly be used during reassembly. (See the parts list for numbers.)

Stator Reassembly

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 (12) with fresh solvent. The interior **must** be dry and free of dirt or lint.

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

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

```

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

Position an expandable tool, such as a split disc, approximately 2 inches from the end of the stator (opposite the lead wire end). Expand it tightly on the I.D. of stator. Carefully raise stator with a lifting device attached to center lifting eye of disc. Take care not to damage the stator end turns.

With the motor housing in an inverted position, carefully lower the stator into the motor housing. The stator leads **must** line up on either side of the anti-rotation plate welded to the motor housing I.D. If the stator "cocks" in motor housing, remove it and try again. If heating the motor housing is necessary, the stator must be clear of the housing to avoid heat damage to the windings. 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.

NOTE

Slide a plastic or cardboard sleeve over the stator leads to protect them from being pinched or cut during reassembly.

After the stator is fully and squarely seated on the motor housing shoulder, remove the split disc tool.

Use 3M #EC1300 gasket cement, or equivalent, to cement gasket (9) into position on the motor housing.

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

Rotor Reassembly

Inspect the seal and bearing areas of the shaft, as well as the impeller taper. Replace the shaft if any area is damaged. (Shaft and rotor are one assembly.)

Clean the bearing cap (10) and cement the gasket (49) into position. Slide this assembly over the tapered end of the shaft with the capscrew holes pointing away from the rotor.

The bearings (11 and 16) must be pressed onto the shaft until fully seated against the shaft shoulder. Protect the bearings from dirt during reassembly. Turn the bearings by hand to check for roughness or damage.

NOTE

Install rotor bearing (11) so that the bearing loading groove faces toward the rotor.

Protect the bearing (16) with a clean plastic bag (or wrap it and the shaft with lint free material). Position the tapered end of the shaft up and rest the rotor end on clean wooden blocks. Cover the upper bearing with lint free material while intermediate is being cleaned.

Clean all gasket surfaces of the intermediate (6), completely removing old gasket and cement material. Inspect the sealing surfaces for burrs, nicks and pits which could cause a poor seal. Repair or replace as required.

Use fresh solvent to thoroughly clean the seal and motor cavities in the intermediate. The surfaces must be dry and free of dirt and lint.

WARNING

Warning text enclosed in a double-slash border: 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.

Uncover the bearing (16) mounted on the rotor shaft. Steady the rotor and position the intermediate over the shaft. Work the bearing (16) into the intermediate bore. Align the holes in the bearing cap (10) with the intermediate and secure it with capscrews and lockwashers (54 and 53).

See PUMP END REASSEMBLY to finish.

Terminal Housing/Power Cable Reassembly

WARNING

Power cable MUST be disconnected from the power source.

Clean the exterior of the 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.) 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 cut off.

For ease of reassembly, lubricate the power cable exterior and bushing bore of the terminal housing with petroleum jelly. Slide the terminal gland (33), cable grip (29), bushing (35) and terminal washer (28) onto shaft in that order. Recheck for proper order of assembly before proceeding. (See Figure 1.)

Work the cable components up the cable to allow approximately 3 ft. of cable to extend below the terminal housing. Feed the cable through the top of the terminal housing (34). Temporarily tape the ground wires (green and yellow) to the cable.

If the power cable has been removed from the terminal collar (23), it must be repotted. A repotting kit is available from Gorman-Rupp (see parts list) as an option with this pump. Use this kit, or Products Research Corp. PR-1201-Q class 1 potting compound, or equivalent.

WARNING

Do not attempt to operate this pump unless the power cable terminals (except for the ground terminal) are properly potted. Moisture entering the terminal housing could cause a short circuit, resulting in death or injury to personnel.

Remove all the old potting compound from the terminal collars (27), terminal posts (41), hardware (22 and 24), and terminal plate assembly (21). Inspect the terminal posts for damage, and replace as required. Use a medium-grit sandpaper to prepare the surface of the terminal plate in the area of the potting molds.

NOTE

Clean the cable leads and terminal plate in areas to be potted with cleaning solvent before potting. Potting compound will not adhere properly to oil or grease coated surfaces.

Assemble the terminal posts (41), dyna seal washers (40), hex nuts (22) and terminal collars (23) to the terminal plate assembly.

If the bonding material which seals the terminal plate assembly to the terminal housing has been noticeably **compressed**, it should be supplemented with a new gasket contained in the overhaul gasket kit. (See options listed on parts list.) Slide this gasket over the cable leads, then slide a potting mold (39) over each lead. If the bonding material on the terminal plate is severely **worn or cracked**, the terminal plate must be replaced.

Tin the ends of each power cable and motor lead with solder to prevent fraying.

Insert the three standard power cable leads into the terminal collars, and secure them with the allen head setscrews. Slide the potting molds down over the terminal collars and onto the terminal plate. Hang the cable in vertical position with terminal plate horizontal. The cable and terminal collars should be centered in potting mold. Use a quick-setting cement, such as "3-M Weather Seal" to secure the potting molds to the terminal plate.

WARNING

////////////////////////////////////
//
// Most potting base compounds contain toluene; use adequate ventilation and avoid prolonged breathing of vapors. Most potting accelerators contain lead; avoid ingestion or prolonged contact with the skin. Read and follow all warnings and recommendations accompanying the potting kit.
//
////////////////////////////////////

See the instructions with the potting kit regarding application life, and setting and curing time. Mix the base compound and accelerator and fill the molds completely. Tamp the potting material to eliminate air bubbles and ensure the material has completely covered the area around the terminal collars.

When potting has been completed, leave the terminal plate assembly undisturbed until the potting material has cured. Complete curing usually takes about 24 hours. Curing time can be shortened by using a heat lamp, but be careful not to melt the potting or potting mold, or burn the cable. When potting material is no longer "tacky" to the touch, it has cured.

After the potting material has cured, untape the ground leads and slide the terminal housing down the cable. Connect the two green ground leads to the ground terminal (25) and connect the yellow ground check lead to the opposite ground terminal (38). **Be sure** the terminals make good contact with the housing.

Pull gently on the power cable to remove any excess length from within the terminal housing. The terminal plate should fit loosely into the terminal housing.

Slide the terminal washer (28) down the cable and into the bushing bore of the terminal housing. Coat the bore and cable with petroleum jelly and slide the bushing (35) into place. Compress the wire mesh of the cable grip (29) and slide it down the cable, making sure it comes in contact with the bushing. Slide the gland (33) into place. Coat the threads of studs (31) with "Never-Seez", or equivalent, and engage nuts (32), finger tight. Do not tighten at this time.

Attach the motor leads to the terminal posts (41) using allen head setscrews (42). If required, rotate the terminal housing and twist the motor leads to remove excess slack. Coat the threads of studs (43) with "Never-Seez", or equivalent, and secure the terminal housing to the motor housing using deformed locknuts (44). Tighten the hex nuts (32) drawing the terminal gland (33) down into terminal bore. **Do not** overtighten and damage the terminal gland or hardware.

See **FINAL ASSEMBLY** and **LUBRICATION**.

FINAL ASSEMBLY

If the discharge flange (15) has been removed from the motor housing, replace the discharge flange gasket (14), and secure it with hex nuts (19).

Connect the discharge hose, and reposition the pump. If rigid piping or long hose is used, reposition the pump then connect the piping.

LUBRICATION

Before initial startup, after the first two weeks of operation, and every month there after, check the oil level in the seal cavity and motor housing.

NOTE

The pump must be cool to accurately check the oil level.

The grade of lubricant used is critical to the operation of this pump. Use uninhibited transformer oil as specified in Table 2.

Table 2. Pump Oil Specifications

Specifications	
Type	Uninhibited transformer oil
Neutralization	0.01
Dielectric	26,000(min)
Pour point	-55°F
Typical products and suppliers	
Gulf Oil Company	Transcrest H
Texas Oil Company	Texaco 55
Sun Oil Company	Sunoco D Transformer Oil
Westinghouse Electric Company	WEMCO C-2772
General Electric Company	Transil 10C

Seal Cavity

To fill the seal cavity, remove the seal cavity oil level/fill plug (5B) in the intermediate, and add approximately 6 1/2 quarts of a recommended grade uninhibited transformer oil. **Maintain the oil level** even with the oil level plug (5B) opening. Apply "Loctite pipe sealant with Teflon #92", or equivalent sealant, to the threads of any plug, each time it is reinstalled.

Periodically inspect the seal cavity oil for contamination. If the oil is cloudy or contains water, drain the cavity immediately by removing the drain plug (5). Disassemble the pump (see **Pump End Disassembly**) and determine the cause and repair.

Motor Housing Cavity

To fill the motor housing cavity, remove the fill cap (76) located on top of the pressure relief fitting. Add approximately 18 quarts of a recommended grade of uninhibited transformer oil. **Maintain the oil level** even with the oil level plug (13) opening. Apply "Loctite Pipe Sealant with Teflon #92", or equivalent sealant, to the threads of the fill cap and level plug each time they are reinstalled. Periodically inspect the motor housing oil for contamination. If the oil is cloudy or contains water, drain the cavity immediately by removing the drain plug (5A). Disassemble pump (see **PUMP END DISASSEMBLY** and **MOTOR DISASSEMBLY**) and determine cause and repair.

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

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