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Rev. A

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP

SUBMERSIBLE PUMPS

MODELS

S8D1-E275 460/3
S8D1-E275 575/3

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

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INTRODUCTION

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

The pump is capable of handling most non-volatile, non-flammable liquids. The basic materials of construction for wetted parts are aluminum, with austempered ductile iron impeller, diffuser and seal plate.

The pump may be operated fully or partially submerged, since the integral air-filled electric motor is thermally protected and cooled by the liquid being pumped. The motor must be operated through the control box furnished with the pump as standard equipment. Neither the pump nor the control box are explosion-proof, and should not be operated in a hazardous atmosphere.

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

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

or

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

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

DANGER!

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

WARNING!

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

CAUTION

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

NOTE

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

SAFETY - SECTION A

This information applies to the S Series submersible motor driven pumps and control boxs covered in this manual.

Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Lock out incoming power to the control box to ensure that the pump will remain inoperative.
3. Allow the pump to cool if overheated.
4. Close the discharge valve (if used).

The pump 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.

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 enclosure are properly grounded; never use gas pipe as an electrical ground. Be sure that the incoming power matches the voltage and phase of the pump and control before connecting the power source. Do not run the pump if the voltage is not within the limits. If the overload unit is tripped during pump operation, correct the problem before restarting the pump.

The electrical power used 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 out, 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.

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.

This pump is <u>not</u> designed to pump volatile, explosive, or flammable materials. refer to the chart in INSTALLATION, Section B for the basic materials of construction for each pump covered in this manual. <u>Do not</u> 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.

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.

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

The pump motor is thermally protected and subject to automatic restart. Always terminate power to the pump before performing service functions.

INSTALLATION - SECTION B

Review all SAFETY information in Section A.

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

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

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.

PREINSTALLATION INSPECTION

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

a. Inspect the pump 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 loose hardware at mating surfaces.

c. The standard pump is furnished with 50 feet (15,2 meters) of power cable. Inspect the cable for cuts or damage.

NOTE

This pump is equipped with two 50-foot (15,2-meter) power cables as standard equipment. Each cable must be checked and/or tested separately.

d. Inspect 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 nameplate 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 as 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 ensure maximum pump service.

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

Lubrication

There are two lubrication cavities in this pump, both contain premium quality submersible pump 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 shaft seal prevents oil leakage from the motor cavity, and also acts as backup protection in the event of lower seal failure.

Both cavities are fully lubricated when shipped from the factory. Check lubrication levels before installing the pump (see **LUBRICATION** in **MAINTENANCE AND REPAIR**). An additional gallon (3,8 liters) of 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 Tables 1 and 2 for pump specifications.

Table 1. Pump Specifications

Model	Voltage/ Phase	Motor Horse-power	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S8D	460/3	275	1750	320	73	1750	8 INCH
S8D	575/3	275	1750	256	58.4	1400	8 INCH

Table 2. Additional Specifications

Approximate Weights:	
Pump: Models S8D1-E275 460/3 & 575/3	3,462 lbs. (1570 kg)
Control Box Only	256 lbs. (116 kg)
50 ft. of Cable	300 lbs. (136 kg)
Seal oil cavity capacity	14.4 U.S. quarts (13,6 liters)
Motor oil cavity capacity	53.4 U.S. quarts (50,5 liters)
Power Cable (2)	#2/0 AWG.,6Conductor, Type GGC 1.75–inch (44,5 mm) O.D.
Control Cable	#14 AWG, 4 Conductor Type SO

Pump Dimensions

The standard pump is provided with a suction strainer to prevent large solids from clogging the impeller. See Figure 1 for the approximate physical dimensions of this pump and control box.

OUTLINE DRAWING

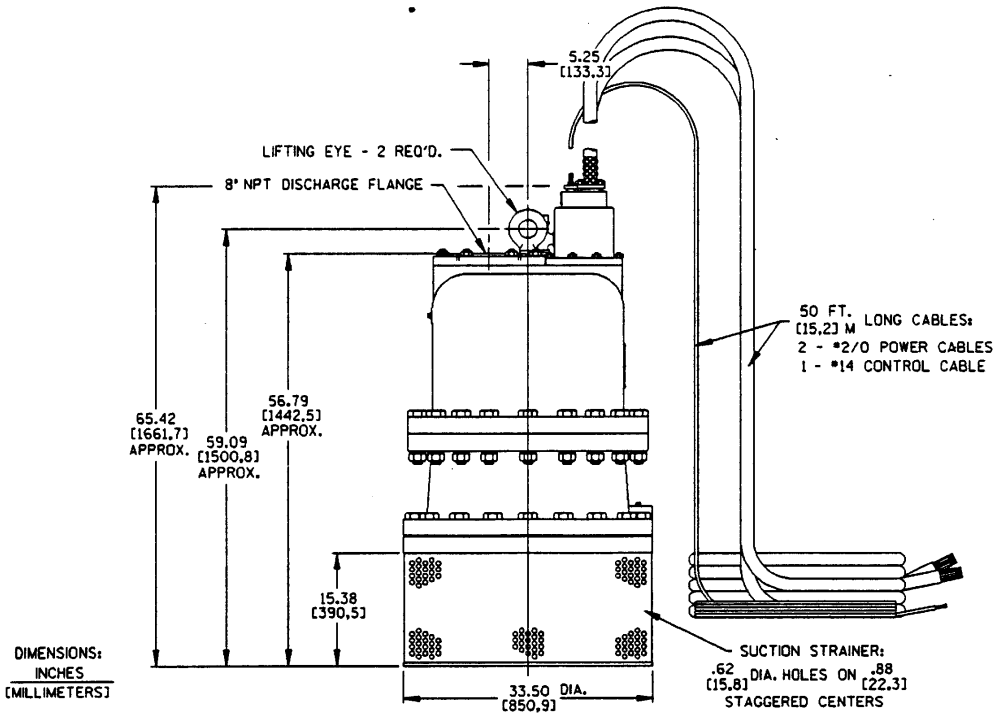


Figure 1. S8D1-E275 460/3 And S8D1-E275 575/3 Pump Models

Lifting

Use lifting equipment with a capacity of at least **5 times the weight of the complete unit** (include the weight of any customer-installed accessories, the power cable, and the control box if all are to be lifted). Refer to Table 2 for weights. Customer-installed equipment such as discharge piping **must** be removed before attempting to lift.

WARNING!

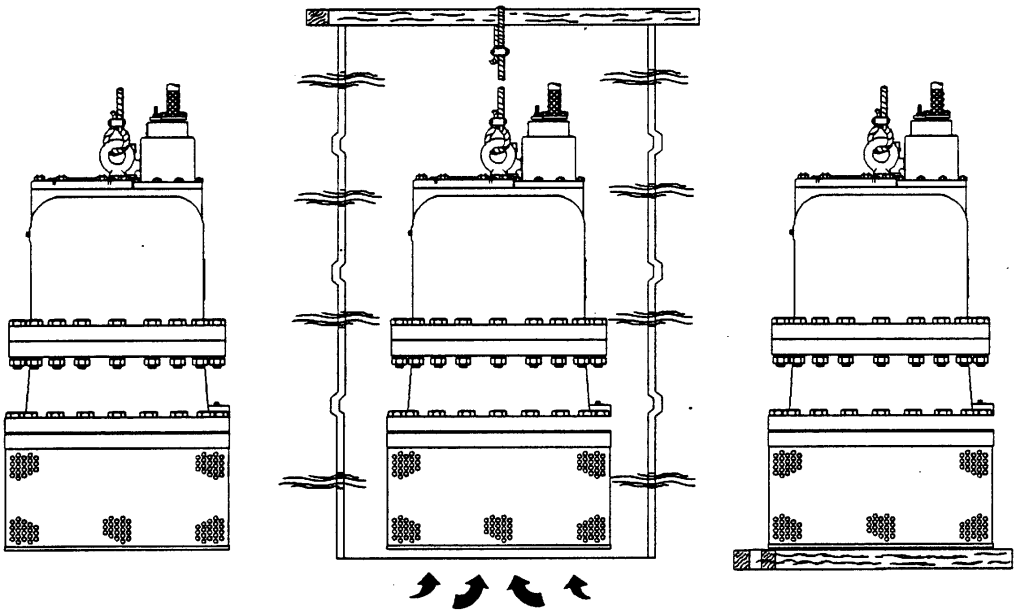
Do not attempt to lift the pump by the motor power cable or the piping. Attach proper lifting equipment to the lifting device fitted to the pump. If chains or cable are wrapped around the pump to lift it, make certain that they are positioned so as not to damage the pump, and so that the load will be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

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 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 2 for typical pump installations.



BY BAIL IN PERFORATED CULVERT PIPE ON SUPPORTS

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 im-

peller rotation to ensure that the pump is properly wired to the control box. See ***Checking Pump Rotation*** *in* ***OPERATION****, Section C.*

PIPING

No suction piping is required in a standard submerged application.

The 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 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

This pump is driven by an integral 60 hertz, 3 phase, 275 horsepower, 460 VAC or 575 VAC motor. It is designed to operate through the control box furnished with the pump.

WARNING!

The pump 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.

Control Box Specifications

WARNING!

After being placed in service, the tripping of the instantaneous trip circuit breaker is an indication that a fault current has been interrupted. Current carrying component parts of the magnetic motor controller should be examined and replaced if damaged to provide continued protection against fire or shock hazard. If burnout of the heater coil of the overload relay occurs, the complete overload relay must be replaced.

After replacing heater coils, press the reset button to set the relay. Allow 10 seconds for the relay to cool after tripping before pressing the reset. Increasing heater coil size **is not** recommended. **Do not** mount heater coils between terminal ends having turned up edges, as this will damage the coil.

Table 5. Control Box Specifications

	Overload Relay				Circuit Breaker	
Volts 60 Hz.	Heater Coil C.H. P/N 10177-	Hold Amps	Trip Amps	LRA Trip Time	Breaker Size (Amps)	Max Trip Amps*
460	H12	157	177	4 Sec.	500	5000
575	H10	131	147	4 Sec.	350	3500

* All three adjustment dials to be set on "high" position

Enclosure

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

Secure the control box vertically on a level surface, above flood level. The box 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.

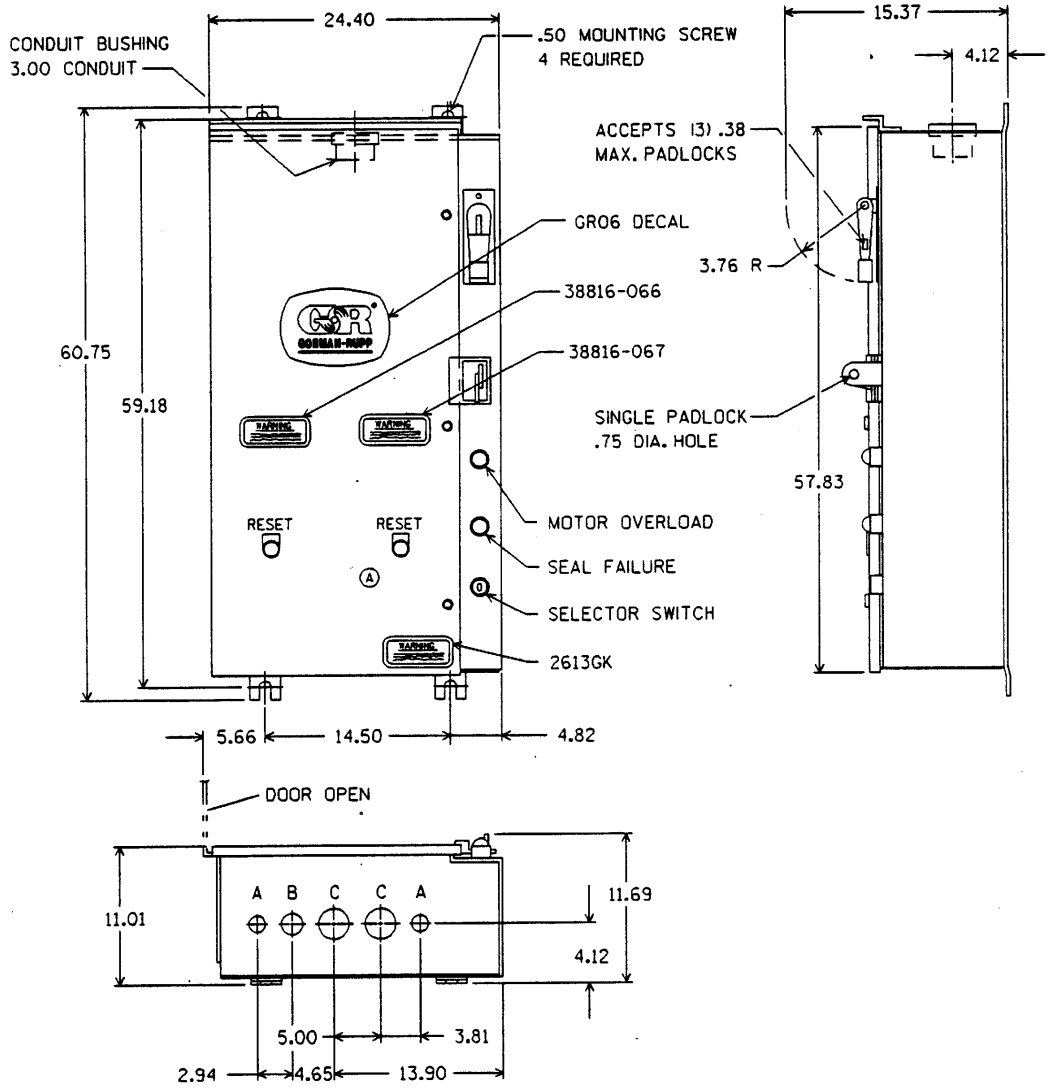


Figure 3. Control Box Dimensions (Both Voltages)

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 embedded 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 codes. See Figure 4 for some suggested grounding methods.

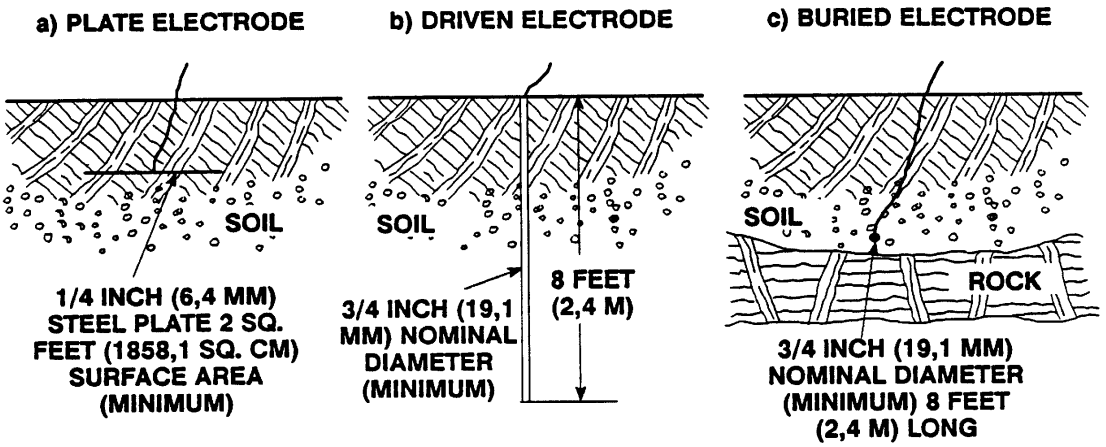


Figure 4. Suggested Grounding Methods

a. **Plate Electrode:** An iron or steel plate, 1/4 inch (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).

b. **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.

c. **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 m) 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)

The trailing cable from the power source to the control box must be furnished by the customer.

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 connections. Make certain that the pump and enclosure are properly grounded; never use gas pipe as an electrical ground. Be sure that the incoming power matches the voltage and phase of the pump and control before connecting the power source. Do not run the pump if the voltage is not within the limits.

The pump controls are designed to regulate either a 460 or 575 volt, 3 phase, 60 hertz power supply. The field wiring must be properly sized to ensure an ade-

quate voltage supply. The voltage available **at the motor** must be within the range indicated in Table 3.

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 the wiring diagrams in this section for power supply connections.

b. Next, subtract the motor cable voltage drop (see Table 4, **Pump Power 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 3. Pump Motor Voltage Limits

Nominal Voltage	Phase	Minimum Voltage	Maximum Voltage
460	3	420	500
575	3	520	630

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 rainproof. 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. Obtain the services of a qualified electrician to make all electrical connections. Make certain that incoming power to the control box is in the off position and locked out, or that the power supply to the control box has been otherwise cut off and locked out, before connecting power or accessory cables.

The standard pump is provided with two 50-foot (15,2-meter) power cables (see table 4 for power cable specifications). If longer cables are required, optional cables **must** be ordered from the factory. Splicing of the power cables 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 4. Pump Power Cable Specifications

Voltage/ Phase	A.W.G Cable Size	Cable O.D. (Inches) [mm]	Conductor Dia. (Inches) [mm]	Amp Rating * at 40°C (Amperes)	DC Resistance at 25°C (ohms/ 1000 ft. [304,8 m])	Voltage Drop at Max. Load per 100 ft. [30,5 m]
460/3	2/0	1.75 [44,5]	0.48 [12,2]	215	0.09	2.88
575/3	2/0	1.75 [44,5]	0.48 [12,2]	215	0.09	2.30

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

When necessary to change or connect the pump power cables 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 cables to the control box as shown in the wiring diagrams in this section. 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

Each 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 leads are used in conjunction with customer-supplied ground monitoring equipment. If this equipment is not used, the yellow leads should be used as additional ground leads by connecting them to the unused ground post in the terminal housing.

The control cable leads are connected to thermal and moisture sensors provided as standard equipment within the pump. Check the control box to be sure the thermal sensor leads (P1 and P2) are connected to the thermal shutdown circuit, and the moisture sensor lead (W1) is connected to the seal failure circuit.

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):

- **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 volts) circuitry which is specially designed to fit into the main pump control (see the parts list in Section E for part numbers).

The circuitry may be prewired as a factory option, or easily added in the field by qualified personnel. The unit is complete except for the remote float switches, and is available for both 460 and 575 volt applications. For installation and operation, see the detailed instructions included with the optional package.

CAUTION

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

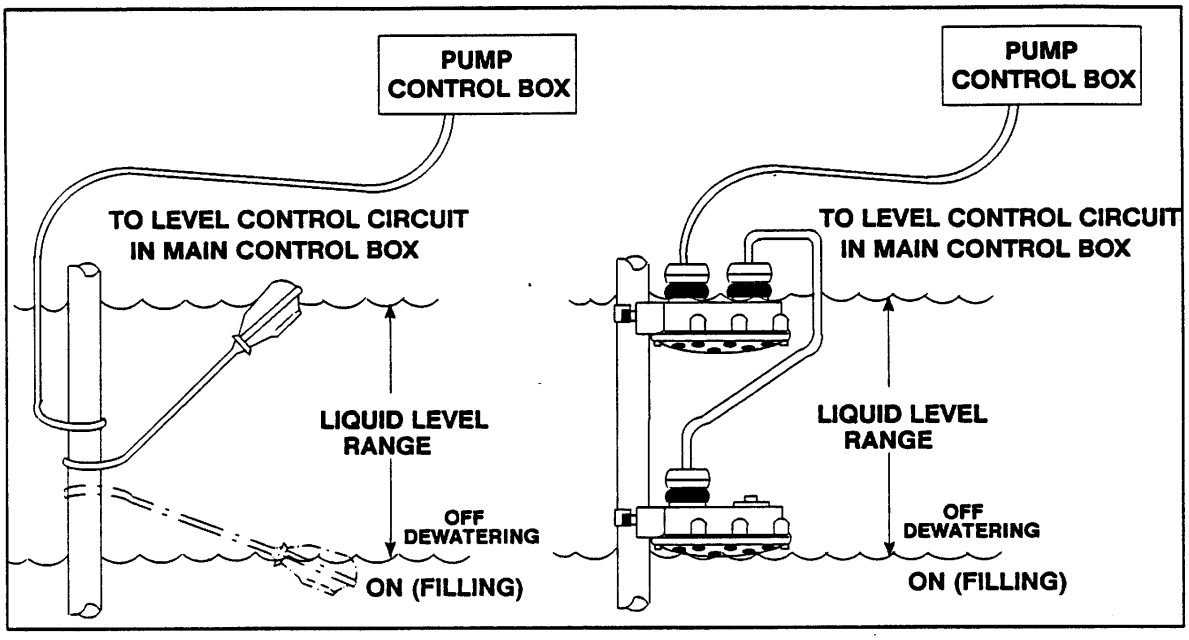


Figure 5. Liquid Level Devices

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.

WIRING DIAGRAMS

Consult the following elementary and pictorial wiring diagrams for both 460 and 575 volt control boxes.

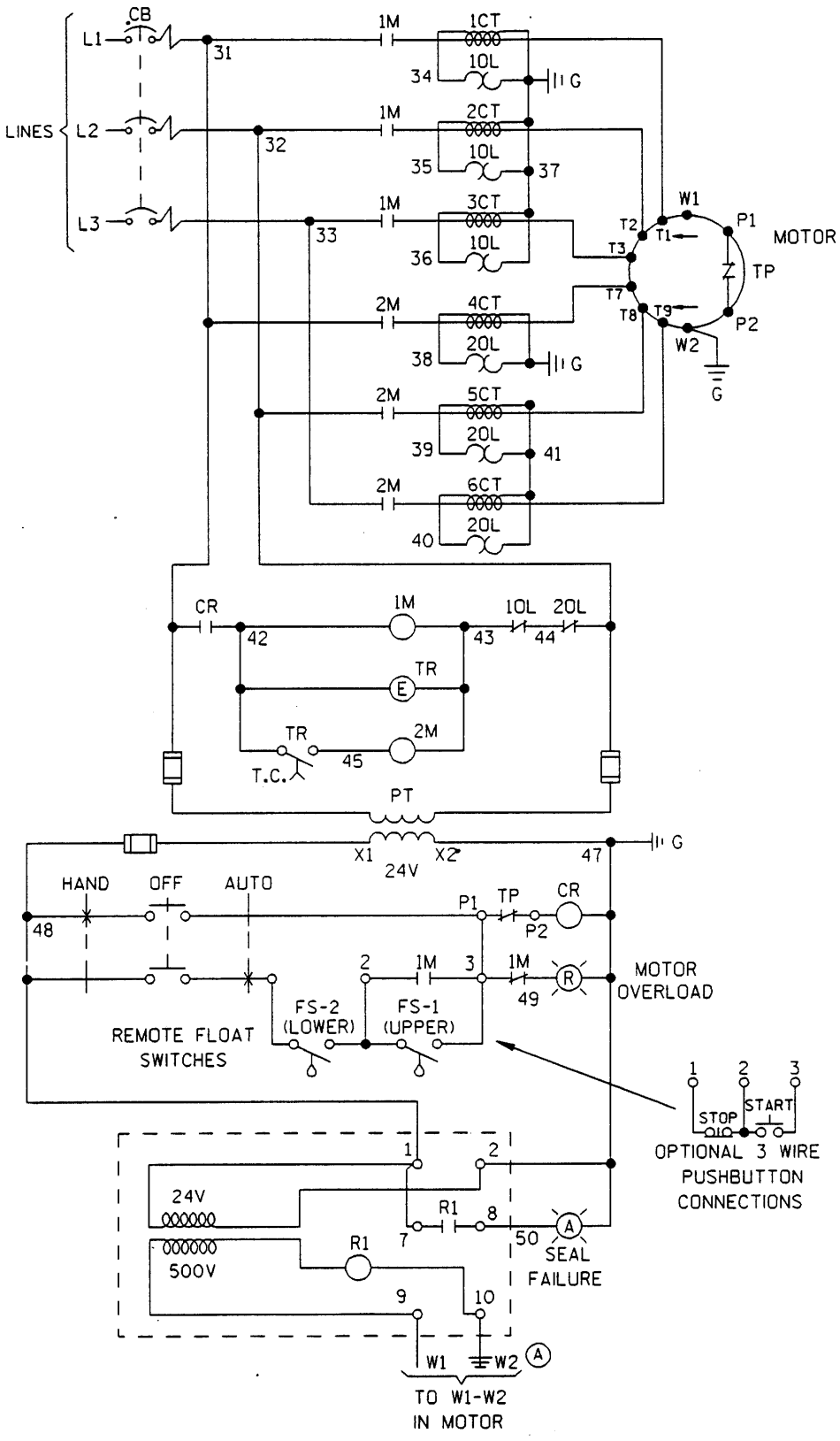


Figure 6. Elementary Diagram (27515-275 and 27515-276) Control Box

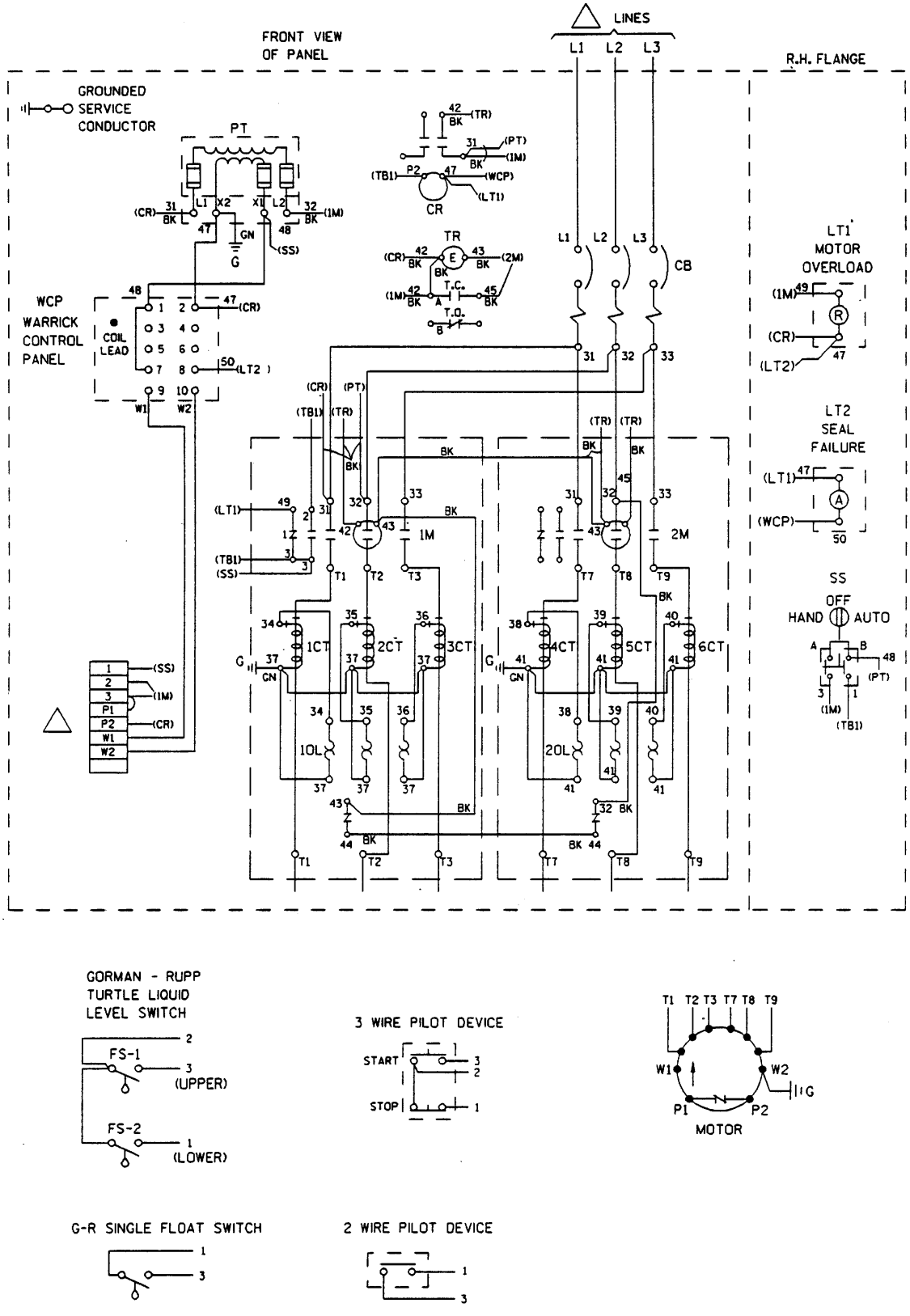


Figure 7. Pictorial Diagram (27515-275 and 27515-276) Control Box

REPAIR PARTS LIST
27515-275 AND 27515-276 STANDARD CONTROL BOXES

(Components Identified By Cutler Hammer Part Numbers)

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	CIRCUIT BREAKER (460V)	LS360500A	-----	1
	CIRCUIT BREAKER (575V)	KS360350A	-----	1
2	STARTER (460V)	A10GNOC-MOD	-----	2
	STARTER (575V)	A10GNOD-MOD	-----	2
	RENEWAL CONTACT SET	6-27	-----	2
	COIL	ON COIL	-----	2
3	OVERLOAD RELAY	10-2145-3	-----	2
	HEATER COIL (460V)	10177-H12	-----	6
	HEATER COIL (575V)	10177-H10	-----	6
	COVER BOOT	32-524	-----	2
4	SELECTOR SWITCH	10250T21KB	-----	1
	CONTACT BLOCK	10250T2	-----	1
5	PILOT LIGHT	10250T206	-----	2
	RED LENS	10250TC7	-----	1
	AMBER LENS	10250TC9	-----	1
6	CONTROL TRANSFORMER (460V)	C340AT	-----	1
	CONTROL TRANSFORMER (575V)	42-3602-6	-----	1
7	CONTROL RELAY	9575H2612	-----	1
	COIL	9-1811-14	-----	1
8	WARRICK CONTROL	1D7EO	-----	1
9	TRANSFORMER CONTROL CIRCUIT (460V)	44-2144-10 (.6A KLDR)		2
	TRANSFORMER CONTROL CIRCUIT (575V)	44-2144-9 (.5A KLDR)		2
	FUSE	44-2113-30 (.3A 3AG)		1
	TIMER (460V)	D80JE10C	-----	1
	TIMER (575V)	D80JE10D	-----	1

OPERATION - SECTION C

Review all SAFETY information in Section A.

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

CONTROL BOX FUNCTION

WARNING!

This pump motor and control box are not designed to be explosion-proof. Do not operate in an explosive atmosphere.

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 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

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.

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. (Do not confuse the function of the overload relay with that of the thermal overload protector within the motor. The reset pushbutton has no effect in restarting the pump after it has been shut down by the thermal overload protector within the pump motor.)

NOTE

If the circuit breaker 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.***

- The **liquid level devices** (optional equipment) operate in conjunction with the 3-position switch (HAND-OFF-AUTO) supplied as

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).

- The **operational warning lights** (optional on some boxes) provide a means of detecting abnormalities in pump operation. When the warning lights are energized, corrective action should be taken as soon as possible.

  The red motor overheat light works in conjunction with a temperature switch embedded in the motor windings. In the event of a high temperature condition, the motor is shut down. After the motor cools, the device is automatically reset.

  The amber seal failure light works in conjunction with a sensor probe located in the seal oil cavity. It detects an influx of moisture into the cavity. Should this condition occur, the pump motor should remain inoperative until the problem is corrected. Some boxes are equipped with a test circuit to validate proper operation of the seal failure circuit. When the test switch is depressed, the clear lamp should glow, indicating proper function of the sensor probe circuit.

PUMP OPERATION

This pump is <u>not</u> designed to pump volatile, explosive, or flammable materials. Refer to the chart in INSTALLATION, Section B for the basic materials of construction for each pump covered in this manual. <u>Do not</u> 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.

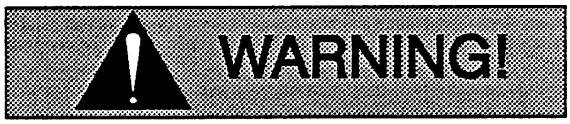
Liquid Temperature And Overheating

The maximum liquid temperature for this pump is 120° F (49° C). Do not apply the pump at higher operating temperatures.

Overheating can occur if the pump is misapplied, required to start repeatedly, or if the temperature of the liquid being pumped exceeds 120° F (49° C). Operating the pump against a closed discharge for an extended period of time will also cause the pump to overheat.

As a safeguard against rupture or explosion due to heat, this pump is equipped with a thermal overload protector which automatically shuts the motor down when the operating temperature exceeds design limits. After the motor cools down, **it will automatically restart.** Always terminate power to the pump and control box before investigating pump or control box problems.

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



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.**

WARNING!

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 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.**

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 lifting device fitted on the pump. Turn the pump on momentarily and note the direction of twist. For correct rotation and operation, the twist must be in a **counterclockwise** direction when viewed from the **top** (see Figure 1).

CAUTION

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

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

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Make certain that incoming power is off and locked out before interchanging motor leads.

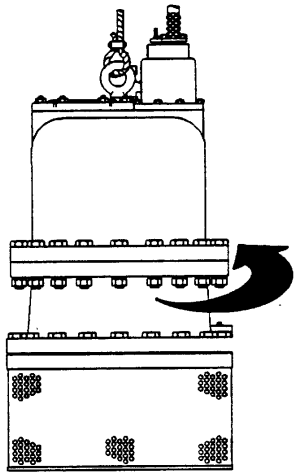


Figure 1. Checking Pump Rotation

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 this section.*

CAUTION

Never start the pump more than 6 times

per hour. If the pump motor does not cool between starts, it will over-heat, resulting in damage to the motor windings or control box components.

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 the 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 ON.

If desired to operate 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

As a safeguard against rupture or explosion due to heat, this pump is equipped with a thermal overload protector which automatically shuts the motor down when the operating temperature exceeds design limits. After the motor cools down, **it will automatically restart.** Always terminate power to the pump and control box before investigating pump or control box problems.

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

To stop the pump, turn the control handle OFF, thereby opening the circuit breaker. 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.

Operational 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 END DISASSEMBLY** in Section E).

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, **liquid pressure** must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve (see **MAINTENANCE AND REPAIR**, Section E).

Check the pump for overheating. The pump could overheat if operated against a closed discharge valve, or if subjected to repeated start cycles.

Cold Weather Preservation

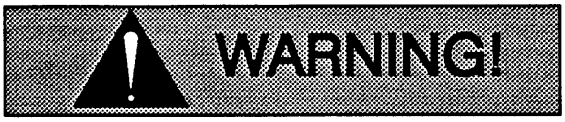
In freezing temperatures, the pump will not freeze as long as it is submerged in liquid. If the pump casing is not submerged, or if the liquid begins to freeze, remove the pump from the sump or wet well and allow it to dry thoroughly. Run the pump for two or three minutes to dry the inner walls.

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.

Do not attempt to thaw the pump by using a torch or other 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.

TROUBLESHOOTING - SECTION D

Review all SAFETY information in Section A.



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.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO START, OVERLOAD UNIT NOT TRIPPED (MANUAL MODE)	Power source incompatible with control box.	Correct power source.
	No voltage at line side of circuit breaker.	Check power source for blown fuse, open circuit breaker, broken lead, or loose connection.
	Open circuit in motor windings or power cable.	Check continuity.
	Defective motor power cable.	Replace cable.
	Thermal overload protection within the pump motor tripped (pump overheated).	Allow pump to cool. Correct cause of overheating.
	Motor defective.	Check for and replace defective unit.
	Liquid level device or control circuits improperly connected to main control box.	Check wiring diagrams; correct or tighten connections.
(AUTOMATIC MODE)	Level sensing device(s) improperly positioned.	Position device(s) at proper level.
	Level sensing device(s) fouled with mud or foreign material.	Clean sensing device(s).
	Float type sensing device(s) tangled or obstructed.	Check installation for free movement of float.
	Defective liquid level sensing device(s) or control panel.	Repair or replace defective unit(s).

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
OVERLOAD UNIT TRIPS	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 **Field Wiring Connections**,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).
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE	Discharge head too high.	Reduce discharge head, or install staging adaptor and additional pump
	Low or incorrect voltage.	Measure control box voltage, both when pump is running and when shut-off.
	Discharge throttling valve partially closed; check valve is 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 by heating 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.
	Worn impeller vanes; excessive impeller clearance.	Check impeller and clearance. See **PUMP END REASSEMBLY**.
	Pump running backwards.	Check direction of rotation and correct by interchanging any two motor leads at control box. (See **Pump Rotation**, Section C).
PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION	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.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION (CONT'D.)	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.

WARNING!

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

CAUTION

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

Test Equipment

A volt/amp/ohmmeter and megohmeter of adequate range and quality will be required to conduct the following electrical tests. The suggested equipment indicated below is commercially available.

Equipment	Use
Ammeter	To check AC Voltage and current (amperage)
Ohmeter	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). If there is a high resistance reading on the ohmmeter, there is an open or broken circuit cause 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

*When shipped from the factory, the connections between the power cable leads and the terminal posts were encapsulated in heat shrink tubing and bonded to the terminal plate to provide a water tight seal. In service, these connections may have been potted by the pump operator. Do not cut the tubing or potting away unless absolutely necessary. Check the continuity of each lead from the motor side of the terminal plate. If the continuity is good, there is no need to remove the tubing or potting material. If there is no continuity through the lead, remove the tubing or potting from only that terminal, and check for a loose connection. Be sure to replace the tubing or 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:

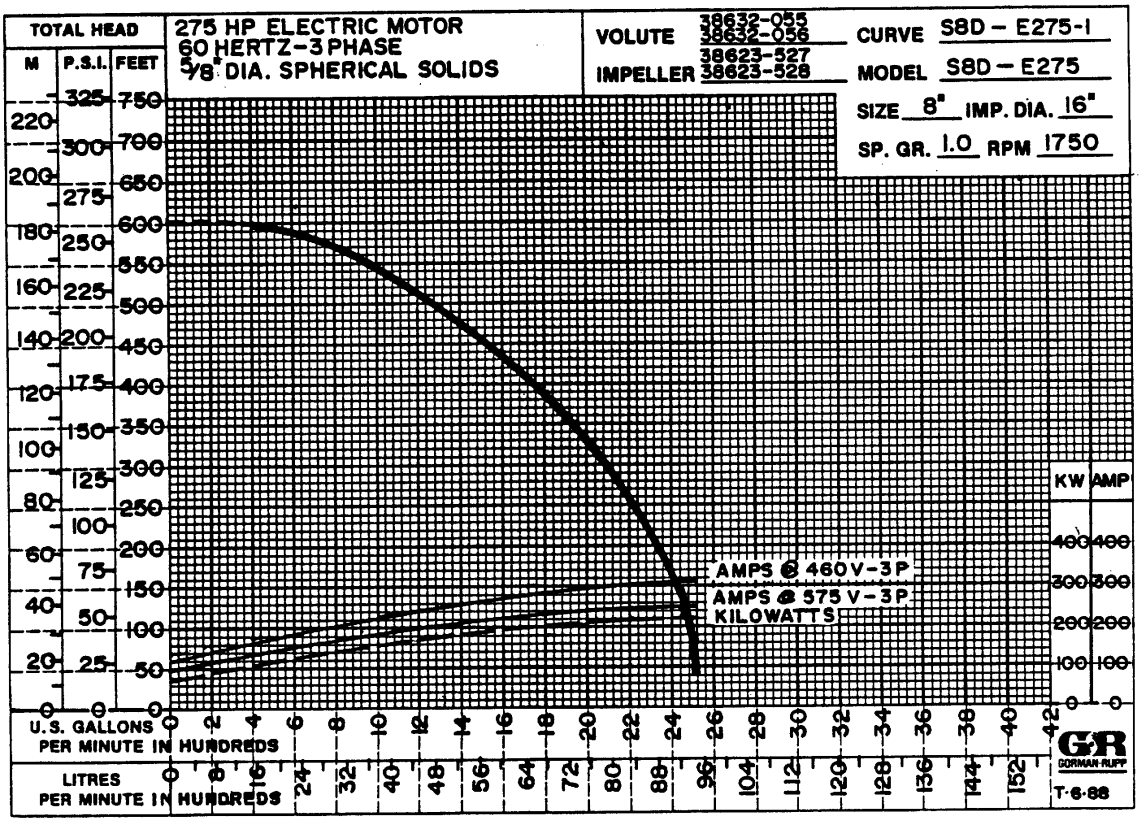
a. Disconnect the motor power cable leads from the control box. Connect one test lead to the power cable green ground lead, and touch the other test lead to each of the three power leads in turn.

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.

PUMP MAINTENANCE AND REPAIR - SECTION E

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



*** STANDARD PERFORMANCE FOR PUMP MODELS S8D1-E275 460/3 and S8D1-E275 575/P**

* Based on 70° F (21° C) clear water at sea level. Since pump installations are seldom identical, your performance may be difference 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.

SECTION DRAWING

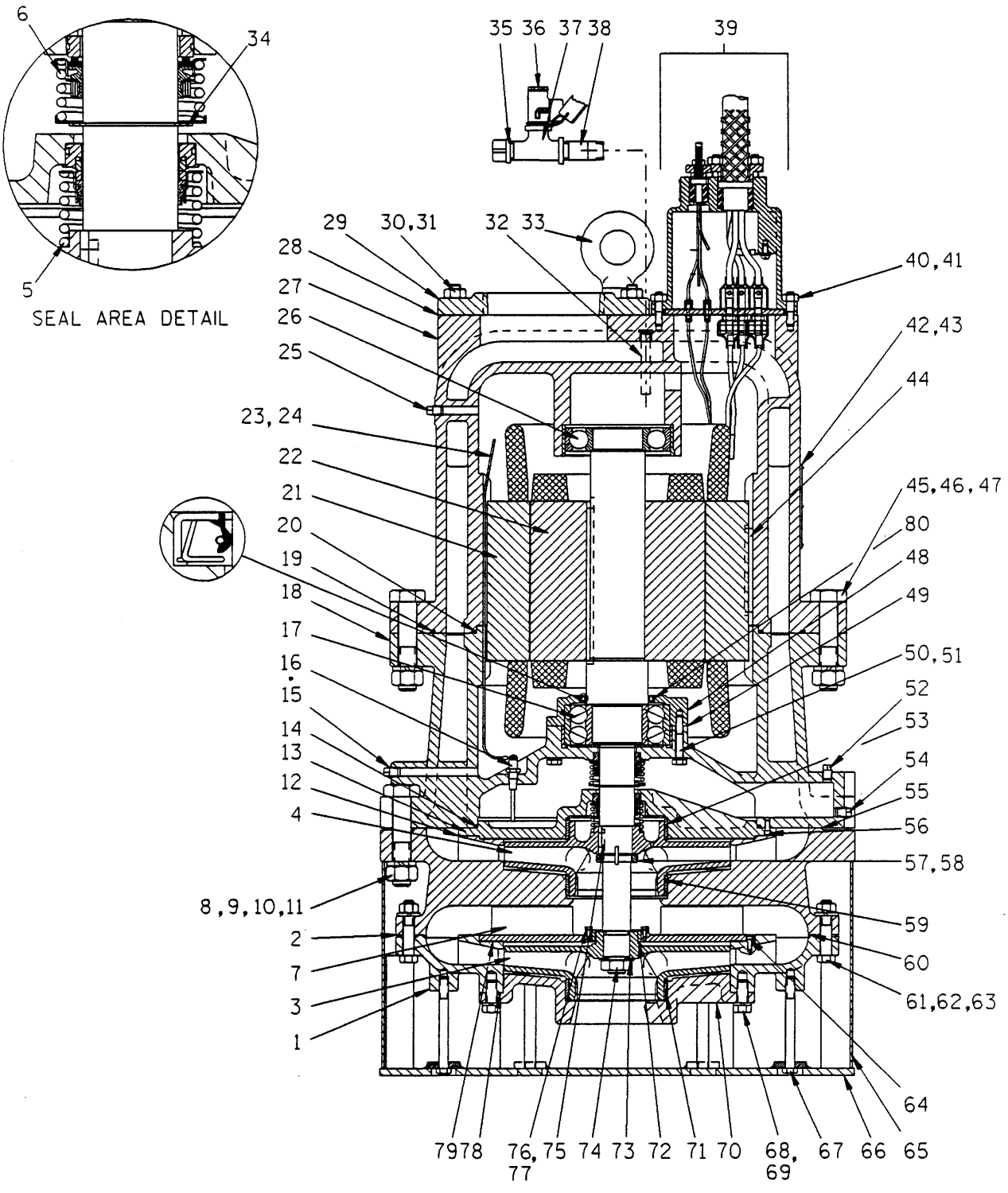


Figure 1. Pump Models S8D1-E275 460/3 and S8D1-E275 575/3

PARTS LIST

Pump Model S8D1-E275 460/3 and S8D1-E275 575/3

(From S/N 912513N up)

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

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		1ST STAGE DIFFUSER	38632-055	11030	1
2		2ND STAGE DIFFUSER	38632-056	11030	1
3		1ST STAGE IMPELLER	38623-527	11030	1
4		2ND STAGE IMPELLER	38623-528	11030	1
5	*	LOWER SEAL ASSY	46512-250	-----	1
6	*	UPPER SEAL ASSY	25271-291	-----	1
7		VANE PLATE	38632-543	11030	1
8		HEX HD CAPSCREW	B2025	15991	22
9		STUD	C2021	15991	2
10		LOCKWASHER	J20	15991	24
11		HEX NUT	D20	15991	24
12	*	DIFFUSER GASKET	38682-814	20000	1
13		SEAL PLATE	38272-709	10000	1
14	*	SEAL PLATE O-RING	25152-468	-----	1
15		PIPE PLUG	P06	17000	1
16		MOISTURE DETECTOR	27479-006	-----	1
17	*	LOWER BALL BEARING	23421-419	-----	1
18		INTERMEDIATE	38261-028	13000	1
19	*	MOTOR HSG O-RING	25152-475	-----	1
20	*	MOTOR HSG O-RING	25152-469	-----	1
21		STATOR (460V)	47113-052	-----	1
		STATOR (575V)	47113-053	-----	1
22		ROTOR/SHAFT ASSY	47112-032	-----	1
23		MOISTURE PROBE WIRE	18147-104	-----	1
24		TERMINAL	27214-503	-----	1
25		PIPE PLUG	P06	17000	1
26	*	UPPER BALL BEARING	23275-019	-----	1
27		MOTOR HOUSING	38311-701	13000	1
28	*	FLANGE GASKET	38683-824	20000	1
29		DISCHARGE FLANGE	25311-809	-----	1
30		STUD	C1414	15991	12
31		HEX NUT	D14	15991	12
32		FILL TUBE ASSY	46331-304	24040	1
33		EYE BOLT	AR2414	1505V	2
34		RETAINING RING	24124-050	-----	1
35		PIPE CAP	V16	11991	1
36	*	PRESS RELIEF VALVE	14139	-----	1
37		STREET TEE ASSY	14138	-----	1
38		HEAVY PIPE NIPPLE	THA1614	15071	1
39		TERMINAL HOUSING AND CABLE ASSEMBLY	47367-074	-----	1
40		STUD	C0809	15991	8
41		DEFORM HEX NUT	DD08	15991	8
42		NAME PLATE	2613CY	17020	1
43		DRIVE SCREW	BM#04-03	17000	6
44		KEY	N0824	17000	1
45		HEX HD CAPSCREW	B2025	15991	24
46		LOCKWASHER	J20	15991	24
47		HEX NUT	D20	15991	24
48		BEARING CAP	38322-423	10000	1
49	*	BEARING CAP GASKET	38683-607	20000	1
50		HEX HD CAPSCREW	B0812	15991	6
51		LOCKWASHER	J08	15991	6
52		PIPE PLUG	P06	17000	1
53		WEAR RING	38691-309	14000	1
54		PIPE PLUG	P06	17000	1
55	*	INTERMEDIATE GASKET	38683-823	20000	1
56		SOCKET HD CASPCREW	BD0503	17000	8
57		LOCK NUT	23962-062	-----	1
58		LOCKWASHER	23962-562	-----	1
59	*	WEAR RING	38691-309	14000	1
60	*	DIFFUSER GASKET	38682-815	20000	1
61		HEX HD CAPSCREW	B1216	15991	20
62		LOCKWASHER	J12	15991	20
63		HEX NUT	D12	15991	20
64		SOCKET HD CAPSCREW	BD0503	17000	7
65		STRAINER SCREEN	38661-702	1508V	1
66		BASE ASSY	41582-001	2415V	1
67		HEX HD CAPSCREW	B1027	15991	6
68		HEX HD CAPSCREW	B1207	17000	8
69		LOCKWASHER	J12	17000	8
70		SUCTION HEAD	38246-028	10010	1
71	*	WEAR RING	38691-309	14000	1
72	*	WEAR RING	38691-009	14000	1
73		IMPELLER WASHER	11199	17000	1
74		IMPELLER NUT	AT20S	17000	1
75	*	IMPELLER KEY	N00804	17000	1
76		HEX HD CAPSCREW	B0402	17000	2
77		LOCKWASHER	J04	17000	2
78		SUCTION HD GASKET	38683-817	20000	1
79	*	DIFFUSER GASKET	38683-815	20000	1
80	*	LIP SEAL	25227-971	-----	1
NOT SHOWN:					
		460V CONTROL BOX	27515-275	-----	1
		575V CONTROL BOX	27515-276	-----	1
		GAL SUB PUMP OIL	9568A	-----	1
		IMPELLER PULLER	5894	-----	1
		VOLTAGE TAG (460V)	6588BL	-----	1
		VOLTAGE TAG (575V)	6588BM	-----	1
OPTIONAL:					
	*	REPAIR GASKET SET	11000AF	-----	1
		LIQUID LEVEL DEVICES:			
		DIAPHRAGM TYPE	GRP48-03 or GRP48-06		1
		FLOAT TYPE	27471-155	-----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO. ..... AND UP

SECTION DRAWING

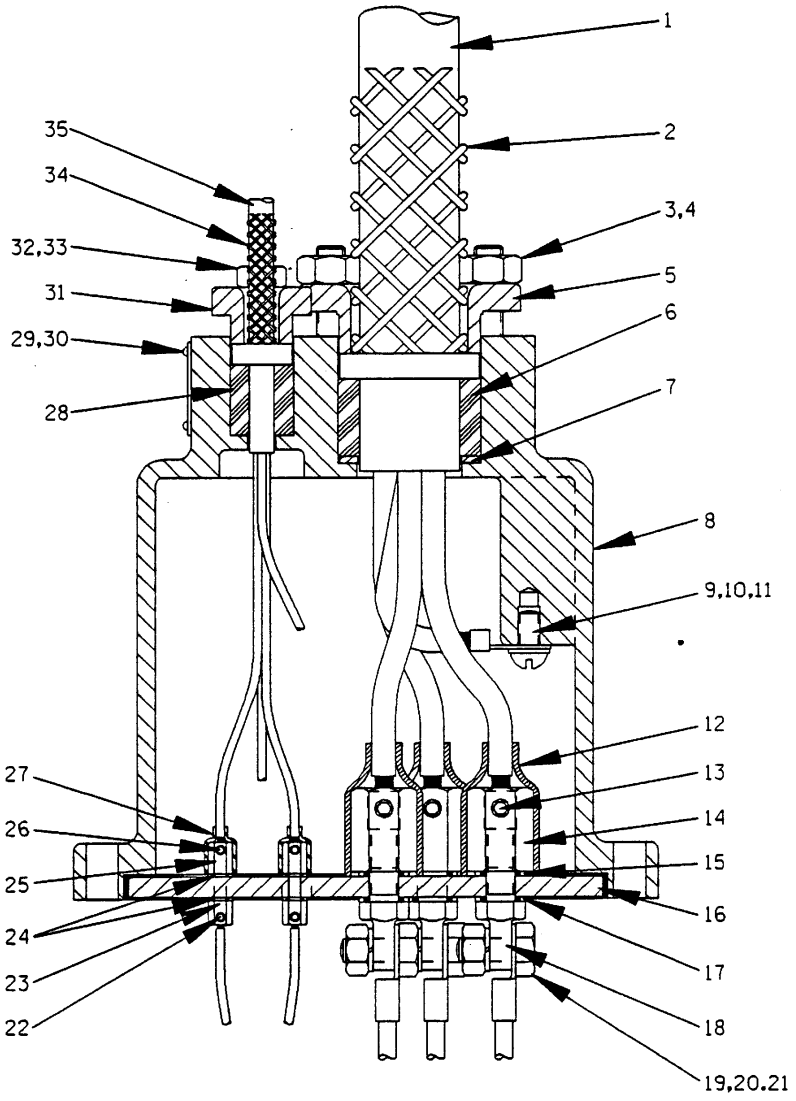


Figure 2. 47367-074 Terminal Housing And Cable Assembly

PARTS LIST
47367-074 Standard Terminal Housing And Cable Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	#2/0 POWER CABLE - 50 FT.	10325A	-----	2
2	CABLE GRIP	11227F	-----	2
3	STUD	C0808	15991	4
4	HEX NUT	D08	15991	4
5	TERMINAL GLAND	10658	13040	2
6	GLAND BUSHING	10758E	19100	2
7	TERMINAL WASHER	10659B	15991	2
8	TERMINAL HOUSING	38381-236	13000	1
9	#2/0 WIRE TERMINAL	27214-065	-----	3
10	RD HD MACHINE SCREW	X0603	14990	2
11	T-TYPE LOCKWASHER	AK06	15991	2
12	HEAT-SHRINK TUBE	31417-030	19530	6
13	ALLEN HEAD SETSCREW	GA0602	14990	6
14	TERMINAL COLLAR	31811-058	14100	6
15	DYNA-SEAL WASHER	S1916	-----	6
16	TERMINAL PLATE ASSY	47114-502	-----	1
17	DYNA-SEAL WASHER	S1916	-----	6
18	TERMINAL POST	38724-010	14100	6
19	HEX HD CAPSCREW	B0604	14990	6
20	LOCKWASHER	J06	15991	6
21	HEX NUT	D06	14990	6
22	HEAT-SHRINK TUBE	31415-151	19450	6
23	ALLEN HEAD SETSCREW	GA#10-01S	15991	3
24	TERMINAL POST	11181	14100	3
25	DYNA-SEAL WASHER	S1590	-----	6
26	TERMINAL COLLAR	31811-057	14100	3
27	ALLEN HEAD SETSCREW	GA#10-01S	15991	3
28	HEAT-SHRINK TUBE	31412-056	19530	3
29	GLAND BUSHING	10758H	19100	1
30	INFORMATION PLATE	38816-047	17990	1
31	DRIVE SCREW	BM#04-03	17000	4
32	TERMINAL GLAND	10756C	13040	1
33	STUD	C0606	15991	2
34	HEX NUT	D06	15991	2
35	CABLE GRIP	11227A	-----	1
36	#14 CONTROL CABLE - 50 FT.	47324-034	-----	1
NOT SHOWN:				
	1 OZ. HOT MELT ADHESIVE STICK	18661-045	-----	2
OPTIONAL:				
	HEAT SHRINK TUBE KIT	48315-011	-----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all SAFETY information in Section A.

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

The following maintenance and repair instructions are keyed to the Pump Model sectional view (Figure 1) and the Terminal Housing sectional view (Figure 2), and the accompanying parts lists.

Before attempting to service the pump or control, terminate the power supply to the control box. Close the discharge throttling valve, if so equipped.

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

WARNING!

The pump motor is thermally protected and subject to automatic restart. Always terminate power to the pump and control box. Before performing service functions.

WARNING!

The electrical power used 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 out, 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.

Use the lifting device fitted on the pump 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 a flexible discharge hose before removing the pump. If rigid discharge piping is used, disconnect the piping before attempting to move the pump.

WARNING!

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

Select a suitable location, preferably indoors, to perform the degree of maintenance required. If the motor housing is to be opened, the work must be done in a clean, well-equipped shop. All maintenance functions must be 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 D, and have a qualified electrician check the control box, cable and terminal housing. If the problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY**, followed by **MOTOR DISASSEMBLY**. Otherwise, see **Terminal Housing 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 deter-

mined and corrected before reassembly. All gaskets and most O-rings **must** be replaced if disturbed. Repair gaskets and O-rings are listed on the parts list.

PUMP END DISASSEMBLY

Strainer Removal

(Figure 1)

To remove the strainer screen (65), raise the pump slightly, or lay it on its side and remove the capscrews (67) securing the screen and base plate (66). Remove the base plate and strainer screen. If the impeller is clogged, the debris can usually be removed without further disassembly.

Draining Oil From Seal and Motor Cavities

(Figure 1)

If any further disassembly is to be performed on the pump, the seal and motor oil cavities must be drained.

CAUTION

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

Lay the pump on its side with the drain plugs (15 and 54) facing up, and clean any dirt from around the drain plugs. Remove the seal cavity drain plug (54), and install a short 3/8-inch NPT nipple in the hole. 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.

If motor problems are suspected, remove the motor cavity drain plug (15) and use the short nipple to drain the oil into a **clean** container. Inspect the oil for a dark color which could indicate motor overheating, dirt or water contamination. The presence 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

(Figure 1)

It is recommended that the pump be positioned upside-down and supported on blocks during disassembly. Two brackets with lifting eyes may be fabricated for this purpose as shown in Figure 3.

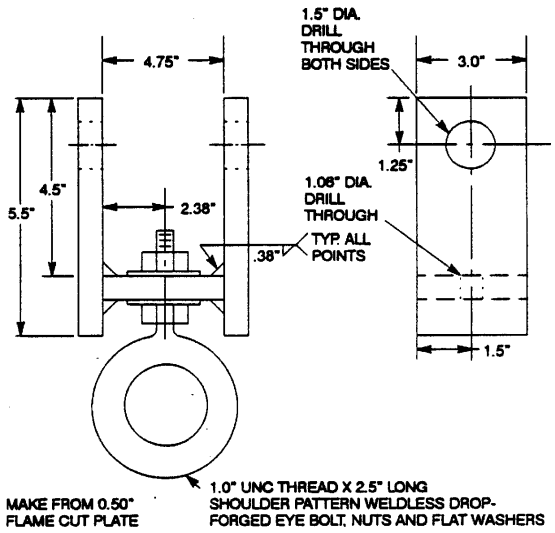


Figure 3. Lifting Brackets With Eyes

Remove two of the capscrews, lockwashers and hex nuts (45, 46 and 47) from opposite sides of the motor housing. Secure the brackets to the pump using two 1-1/4-16 UNC by 7-inch long capscrews (not supplied) and the lockwashers and nuts (46 and 47).

Remove the lifting eyes (33) and pressure relief valve and piping (35, 36, 37 and 38). Attach chains and a spreader bar to the eyes in the lifting brackets.

CAUTION

Use caution not to damage the terminal housing and cable assembly when inverting the pump for disassembly. Use wood blocks to support and level the pump while performing maintenance, and leave the lifting device attached if possible.

Use a lifting device of suitable capacity to raise the pump **just high enough** to be rotated to the inverted

position. Rest the pump securely on blocks positioned across the discharge flange. Be careful not to damage the terminal housing (39) or cable while in this position.

NOTE

If inverting the pump is not practical, lay the pump on its side and secure it. Be careful not to damage the terminal housing, cable, or pressure relief valve when positioning the pump.

Suction Head, First Stage Diffuser and Impeller Removal

(Figure 1)

Remove the hardware (68 and 69), and separate the suction head (70) from the first stage diffuser (1). Remove and discard the suction head gasket.

CAUTION

Use caution not to damage the suction head when removing the wear ring.

Inspect the wear ring (71) for excessive wear or scoring. If replacement is required, use a small bit to drill two holes horizontally through the wear ring, 180° apart. Use a chisel to complete the cuts through the wear ring, and remove it from the suction head. **Be careful** not to damage the suction head bore.

Immobilize the first stage impeller (3) by wedging a steel rod between the vanes. Remove the impeller nut and washer (73 and 74). Install two 3/8-16 UNC by 2-inch long capscrews in the tapped holes in the impeller, and use a suitable puller to remove the impeller from the shaft.

Disengage the hardware (61, 62 and 63) and separate the first stage diffuser (1), vane plate (7), and gasket (60) from the second stage diffuser (2).

Remove the socket head capscrews (64) and separate the vane plate and gasket (79) from the first stage diffuser.

Inspect the wear ring (72) for excessive wear or scoring. If replacement is required, remove the hardware (76 and 77), and use an arbor (or hydraulic) press to remove the wear ring.

Second Stage Diffuser and Impeller Removal

(Figure 1)

Disengage the hardware (8, 10 and 11) and separate the second stage diffuser (2) and gaskets (12 and 55) from the seal plate (13) and intermediate (18).

Inspect the wear ring (59) for excessive wear or scoring. If replacement is required, use a small bit to drill two holes horizontally through the wear ring, 180° apart. Use a chisel to complete the cuts through the wear ring, and remove it from the second stage diffuser. **Be careful** not to damage the diffuser bore.

A tool for removing the lock nut (57) may be fabricated as shown in Figure 4.

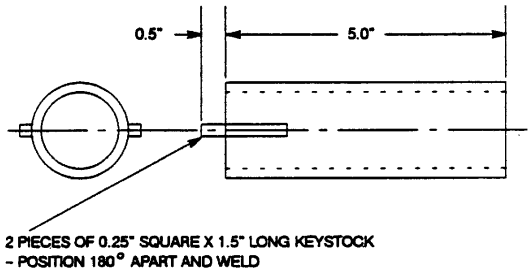


Figure 4. Impeller Locknut Tool

Wedge a steel rod between the vanes of the impeller (1) and one of the studs (9) to prevent shaft rotation. Straighten the taps on the impeller lockwasher (58), and position the locknut removal tool over the shaft so the keystock engages the slots in the locknut. Use a pipe wrench to turn the tool and remove the locknut and washer.

Remove the rod from the impeller vanes, and install two 3/8-16 UNC by 2-inch long capscrews in the tapped holes in the impeller, and use a suitable puller to remove the impeller from the shaft. Use caution when removing the impeller; tension on the seal spring will be released. Retain the impeller key (75).

Lower Seal Removal

(Figures 1 and 5)

Remove the lower seal spring. Lubricate the rotor shaft adjacent to the seal.

Remove the socket head capscrews (56), and slide the seal plate (14) and seal components off the shaft. Remove and discard the seal plate O-ring.

Press the stationary seat O-ring out of the seal plate from the back side.

NOTE

Use caution not to damage the moisture detector (16) after the seal plate is removed.

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

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

Upper Seal Removal

(Figures 1 and 5)

Unless damaged or motor disassembly is required, it is not necessary to remove the intermediate (18) for access to the upper seal assembly (6).

CAUTION

If intermediate removal is required, see the procedure under **MOTOR DISASSEMBLY** in this section. **Do not** attempt to loosen the hardware (45, 46 and 47) securing the intermediate, or the hardware (50 and 51) securing the bearing cap (48) before referring to that section; otherwise, the rotor shaft and bearings could be damaged.

Remove the seal retaining ring (34) with snap ring pliers. Use caution when removing the retaining ring; tension on the seal spring will be released.

Remove the seal spring retainer and spring. Lubricate the shaft adjacent to the seal, and work oil up under the rubber bellows. Position a screwdriver or other suitable device on each side of the bellows retaining flange, and pry the bellows upward until the rotating portion is off the shaft.

Slide the hook ends of two stiff wires along the shaft and under the stationary seal seat. Hook the back side of the seat, and pull it from the intermediate bore.

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

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.*

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

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

PUMP END REASSEMBLY

NOTE

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

Cleaning And Inspection Of Pump Parts

(Figure 1)

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. Use a clean cloth lightly dampened with solvent to clean the lower motor housing, suction head, diffuser, and seal plate. **Do not** allow the solvent to enter the motor.

WARNING!

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

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

Inspect the rotor shaft 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**).

Neither of the shaft seal assemblies should 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 concentric 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 seals as illustrated in Figure 5.

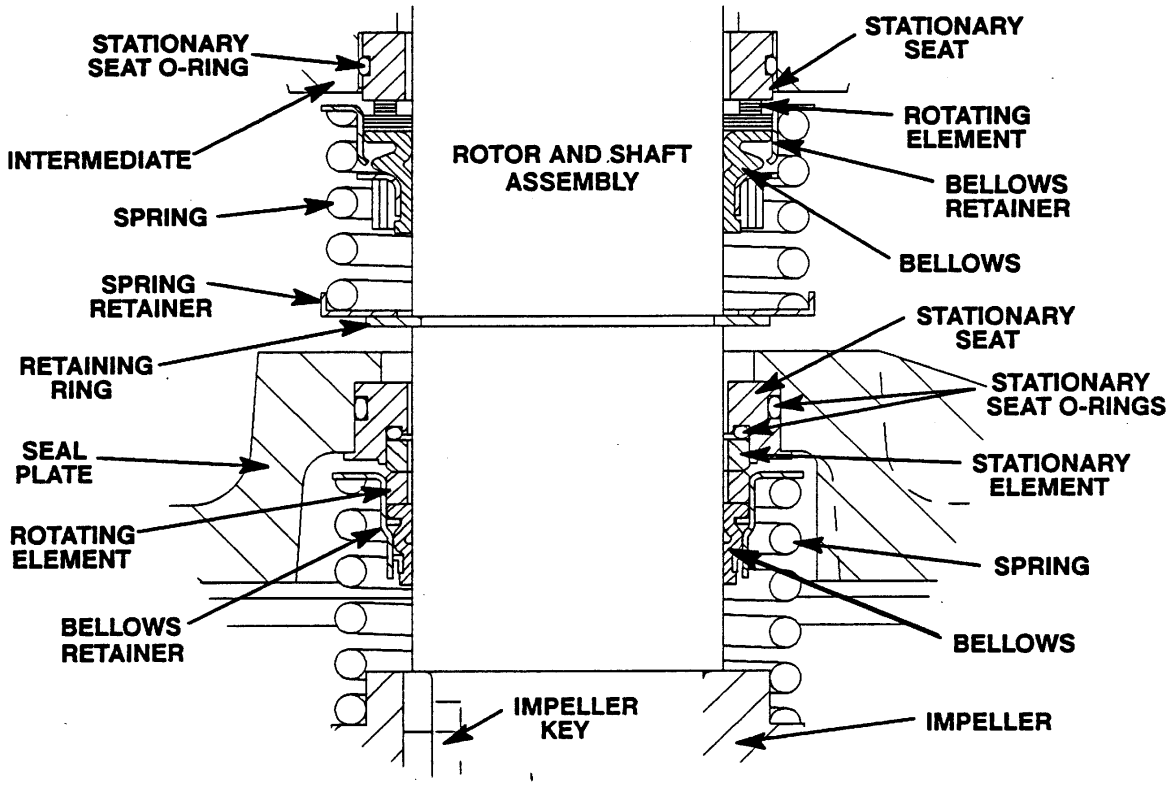


Figure 5. 46512-250 (Lower) And 25271-291 (Upper) Seal Assemblies

CAUTION

The seals are not designed for operation at temperatures above 120° F (49° C). Do not use at higher operating temperatures.

Upper Seal Installation

(Figures 1 and 5)

If a **new** upper seal assembly is to be installed, do not unwrap it 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 motor cavity.

Clean the rotor shaft and seal cavity area of the intermediate. Be sure the area is dry and free of lint and dirt. **Do not** permit cleaning solvent or debris to fall into the motor cavity. Check the seal bore for burrs or nicks that might prevent a good seal. Apply a **light** coating of oil to the bore.

Unpack the stationary seat. Apply a **light** coating of oil to the stationary seat O-ring. Keep the sealing face dry.

NOTE

When pressing seal components onto the impeller shaft, use hand pressure only. A push tube cut from a length of plastic pipe will aid in installing seal components. The I.D. of the push tube should be approximately the same as the I.D. of the seal spring.

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 is fully seated in the bore. 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 of the rotating element is free of grit or surface damage. Place a **small** amount of grease at equal spaces on the back of the element, and assemble the drive grooves of the rotating element into the drive lugs of the bellows retainer. The grease should hold the element in position until the seal is installed.

Apply a light coating of oil to the seal seating surface on the shaft, the groove for the retaining ring (34), and the I.D. of the bellows. Apply a single drop of **light** lubricating oil to the precision-finished seal face. Position the rotating seal portion on the shaft with the seal face down. Apply firm, steady pressure on the bellows retainer until it slides down the shaft and the seal faces contact. This step should be done in one continuous motion to prevent the bellows from sticking or rolling as it passes over the retaining ring groove.

Slide the seal spring over the shaft and bellows retainer, and install the spring retainer. Install the seal retaining ring (34). See Figure 5 for proper order of seal assembly.

Lower Seal Installation

(Figures 1 and 5)

If the wear ring (53) was removed from the seal plate (13), position the replacement ring in the bore with the chamfer on the O.D. toward the inside. Press the wear ring into the seal plate until fully seated. Be sure the ring seats squarely in the seal plate bore.

NOTE

*The wear ring **must** seat squarely in the seal plate; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Thoroughly clean the sealing surfaces and seal bore of the the seal plate . The seal bore must be free of burrs and nicks which could damage the seal.

NOTE

When pressing seal components onto the impeller shaft, use hand pressure only. A push tube cut from a length of plastic pipe will aid in installing seal components. The I.D. of the push tube should be approximately the same as the I.D. of the seal spring.

Unpack the stationary seat, and check that the O-rings are properly installed (see Figure 5). Press the stationary element into the seat, making sure that the grooves in the element engage the lugs on the seat. Apply a **light** coating of oil to the seal plate bore and the outer O-ring. Keep the sealing face dry.

Position the seal plate on a flat surface with the impeller side up. 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 sealing elements until it is fully seated in the bore. Remove the

tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use a clean tissue to wipe **lightly** in a concentric pattern.

Lubricate the O-ring (14) with light oil, and install it on the seal plate shoulder. Apply a light coating of oil on the O-ring seating surface in the intermediate. Carefully position the seal plate and assembled stationary portion of the seal over the shaft. **Be careful** not to damage the stationary element. Align the holes for the socket head capscrews (56), and press the seal plate into the intermediate until fully seated. Install the socket head capscrews.

Unpack the rotating portion of the seal. Be certain the seal face of the rotating element is free of grit or surface damage. Place a **small** amount of grease at equal spaces on the back of the element, and assemble the drive grooves of the rotating element into the drive lugs of the bellows retainer. The grease should hold the element in position until the seal is installed.

Apply a light coating of oil on the I.D. of the bellows, and the seal seating surface on the shaft. Position the rotating portion of the seal on the shaft with the seal face down. Apply firm, steady pressure on the bellows retainer until it slides down the shaft and the seal faces contact.

Slide the seal spring over the shaft and bellows retainer. See Figure 5 for proper order of seal assembly.

Second Stage Diffuser and Impeller Installation

(Figure 1)

Inspect the impeller (4) for cracks, broken vanes, or wear from erosion, and replace it if damaged. Inspect the diffuser (2) and replace it if defective.

Clean the I.D. of the wear ring (53), and clean and oil the impeller shaft and the I.D. of the impeller.

Install the impeller key (75) in the rotor shaft keyway, align the impeller keyway, and press the impeller onto the shaft until it is fully seated against the shaft shoulder. **Be sure** the seal spring seats squarely over the shoulder on the back of the impeller.

Slide the impeller lockwasher (57) onto the shaft until the inside tab on the lockwasher seats in the milled slot on the shaft. Screw the impeller lock nut (58) onto the shaft and tighten it with the lock nut tool. When the lock nut is fully tight, back the nut off to the nearest castellation, and bend two of the tabs on the lockwasher up to lock the nut in place.

If the wear ring (59) was removed from the second stage diffuser (2), position the replacement ring in the bore with the chamfer on the O.D. toward the inside. Press the wear ring into the diffuser until fully seated. Be sure the ring seats squarely in the diffuser bore.

NOTE

*The wear ring **must** seat squarely in the diffuser; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Thoroughly clean the gasket surfaces, and the I.D. of the wear ring (59). Install the gaskets (12 and 55), and position the diffuser against the intermediate (18). Apply 'Never-Seez' or equivalent compound to the threads of the capscrews and studs (8 and 9), ant secure the diffuser to the intermediate by torquing the hardware (8, 10 and 11) to 300 ft. lbs. (3600 in. lbs. or 41,5 m. kg.).

First Stage Impeller, Diffuser and Suction Head Installation

(Figure 1)

If the wear ring (72) was removed from the vane plate (7), position the replacement ring in the bore from the back side and align the holes for the capscrews (76). Press the wear ring into the vane plate until fully seated. Be sure the ring seats squarely in the vane plate bore.

NOTE

*The wear ring **must** seat squarely in the vane plate; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Secure the wear ring in the vane plate with the hardware (76 and 77).

Secure the vane plate to the first stage diffuser (1) with the socket head capscrews (64). Install the gasket (60) and position the first stage diffuser against the second stage diffuser. Apply 'Never-Seez' or equivalent compound to the capscrews (61), install the capscrews, lockwashers and hex nut (61, 62 and

63), torque the capscrews to 120 ft. lbs. (1440 in. lbs. or 16,6 m. kg.).

Inspect the first stage impeller (3) for cracks, broken vanes, or wear from erosion, and replace it if damaged. Clean the threads of the rotor shaft to remove any old thread locking material.

If the wear ring (71) was removed from the first stage impeller (3), position the replacement ring in the bore with the chamfer on the O.D. toward the inside. Press the wear ring into the impeller until fully seated. Be sure the ring seats squarely in the impeller bore.

NOTE

*The wear ring **must** seat squarely in the impeller; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Press the impeller onto the shaft until fully seated against the shaft shoulder. Install the impeller washer (73).

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**).*

After the impeller has been installed, coat the threads of the rotor shaft with 'Loctite Threadlocker No. 242' or equivalent compound. Use a steel rod to block impeller rotation, install the impeller nut (74), and torque to 300 ft. lbs. (3600 in. lbs. or 41,5 m. kg.).

If the wear ring (71) was removed from the suction head (70), position the replacement ring in the bore with the chamfer on the O.D. toward the inside. Press the wear ring into the suction head until fully seated. Be sure the ring seats squarely in the suction head bore.

NOTE

*The wear ring **must** seat squarely in the suction head; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Clean the I.D. of the wear ring (71). Install the gasket (77) and position the suction head against the first stage diffuser. Apply 'Never-Seez' or equivalent compound to the capscrews (68), install the capscrews and lockwashers (69), and torque to 120 ft. lbs. (1440 in. lbs. or 16,6 m. kg.).

(Figure 1)

Strainer Installation

(Figure 1)

Inspect the strainer screen (65) for cracks or broken welds. Straighten or weld as required.

Position the strainer screen and base (66) on the shoulder of the diffuser. Apply 'Loctite Threadlocker No. 242' or equivalent compound on the threads of the capscrews (67), and secure the complete strainer assembly to the suction head and first stage diffuser.

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 or bearings. 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 control handle on the control box is in the off position and locked out, 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 And Power Cable Removal And Disassembly

(Figure 2)

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

The terminal housing and power cables may be serviced without disassembling the motor housing or pump end.

Secure the pump in an upright position. To remove the terminal housing assembly (8, Figure 1), disengage the deform locknuts (41, Figure 1) and raise the assembly to gain access to the control terminal posts (24) and motor terminal posts (18).

Loosen the allen head setscrews (23) in the control cable terminal posts, and disconnect the leads.

The motor cable leads are protected against shorting by heat-shrink tubing. Cut the tubing away to provide access to the terminal post connections.

Remove the hardware (19, 20 and 21), and disconnect the motor leads from the terminal posts. Separate the terminal housing and power cable assembly from the motor housing.

No further disassembly is required to test the stator or power cables.

To separate the power and control cables (1 and 36) from the terminal housing, remove the nuts (4 and 34) securing the terminal glands (5 and 32) to the terminal housing, and slide the glands back along the cables.

Compress the wire mesh of the cable grips (2 and 35) and move them back along the cables. Oil the gland bushings (6 and 29) and cable jackets, allowing the oil to leak in around the bushings by agitating the cables in the bores. After the cables have been lubricated and loosened, it should be possible to push the cables into the terminal housing so that the terminal plate (16) comes free. This will permit access to the cable connections in the terminal plate.

NOTE

Sometimes pressure exerted on the gland bushings (6 and 29) will deform the cable jackets. If this occurs, additional oil and effort will usually free the cables. If the cables cannot be separated from the gland bushings, it may be necessary to cut the cables.

When shipped from the factory, the connections between the cable leads and the terminal collars (14 and 26) were encapsulated in heat-shrink tubing (12 and 28) and bonded to the terminal plate with hot-melt adhesive. In service, the adhesive may have been replaced by potting compound during previous repair. **Do not** remove the adhesive and heat-shrink tubing unless the terminals or terminal plate require replacement. If replacement is required, cut away the tubing and adhesive, and loosen the allen head setscrews (13 and 27). Disconnect the leads from the terminal collars, and separate the terminal plate from the terminal housing.

To remove the cables from the terminal housing, disengage the hardware (9, 10 and11), securing the green and yellow ground leads to the terminal housing. Pull the cables out of the terminal housing.

If the gland bushings come out of the terminal housing with the cables, remove them from the cable, and then remove the terminal glands and cable grips. If the gland bushings remain in the terminal housing, it may be necessary to cut them out of the terminal housing.

Remove the terminal washers (7) from the terminal housing.

If it is necessary to replace the terminal plate (16) or terminal components, unscrew the collars (14 and 26), and remove the collars, dyna seal washers (15, 17 and 25), and terminal posts (18 and 24).

Shaft And Rotor Removal

(Figure 1)

See **PUMP END DISASSEMBLY**, and remove all pump end and seal components.

With the pump end disassembled, the motor cavity drained, and the terminal housing removed, secure the pump in an inverted position.

Remove the hardware (45, 46 and 47) securing the motor housing (27) to the intermediate. **Do not** remove the six capscrews (50) around the rotor shaft.

Install three lifting eyes (not supplied) in the holes for the capscrews (8) in the intermediate (18), and hook a three-leg sling to the lifting eyes.

Use a suitable lifting device to hoist the intermediate, rotor and shaft assembly (22) and ball bearings (17 and 26) from the motor housing as and assembly. If necessary, use a soft-faced mallet to break the seal between the intermediate and the motor housing. Remove the motor housing O-rings (19 and 20).

Cover the motor housing with a clean, lint-free cloth to avoid contamination by dirt or other foreign material.

Lightly rest the inboard bearing end of the rotor on a clean work surface. Leave the lifting slings attached, reducing tension slightly.

Remove the hardware (50 and 51) securing the bearing cap to the intermediate. Steady the rotor and shaft assembly, and separate the intermediate. If necessary, tap the impeller end of the shaft with a soft-faced mallet to loosen the seal between the lower ball bearing (17) and the intermediate bore.

Remove the bearing cap gasket (49).

Disconnect the probe wire (23) at the terminal (24), and unscrew the moisture detector (16) from the intermediate.

CAUTION

It is **strongly** recommended that the bearings be replaced **any** time the shaft and rotor assembly is removed.

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

Use a suitable puller to remove the upper bearing from the shaft. Use the bearing cap and capscrews (50), in conjunction with a bearing puller, to remove the lower bearing from the shaft. Remove the lower bearing from the bearing cap.

Press the oil seal (80) out of the bearing cap.

Stator Removal

(Figure 1)

Do not remove the stator (35) unless it is defective (open windings, insulation resistance low, or stator core damaged). If the stator must be removed, remove the terminal housing as indicated in **Terminal Housing And Power Cable Disassembly.**

With the pump end, intermediate, and rotor and shaft assembly removed, position an expandable tool, such as a split disc, approximately 2 inches (51 mm) down 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 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.

When the stator is free of the motor housing, remove the key (44). Wrap the stator 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.

MOTOR REASSEMBLY

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.

NOTE

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

Stator Installation

(Figure 1)

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

WARNING!

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

After the motor housing is thoroughly cleaned, position it on a flat surface with the discharge end down.

Do not unwrap the stator until the motor housing has been prepared for stator installation. The stator **must** be kept clean and dry. When handling the stator, do not set it on 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 D, 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 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. Position them as close to the motor end turns as possible.

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. Install the key (44), and 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 upper motor housing shoulder, remove the expandable disc tool and untape or remove the protective sleeve from the stator leads.

Cover the motor housing with a clean, lint-free cloth to prevent contamination before the rotor and shaft assembly is installed.

Shaft And Rotor Installation

(Figure 1)

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).

CAUTION

It is **strongly** recommended that the bearings be replaced **any** time the shaft and rotor assembly is removed.

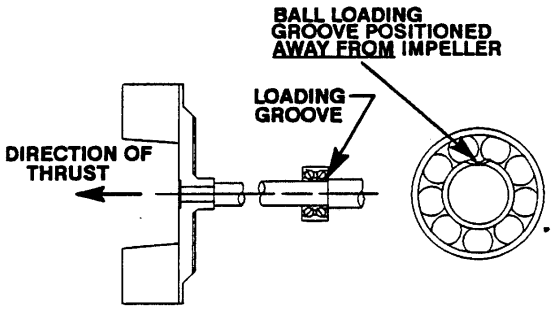
The bearings may be heated to ease installation. An induction heater or hot plate may be used to heat the bearings. Because the lower bearing (17) is grease lubricated, it is **not** recommended that a hot oil bath or electric oven be used to heat the bearings. Bearings should **never** be heated with a direct flame or directly on a hot plate.

CAUTION

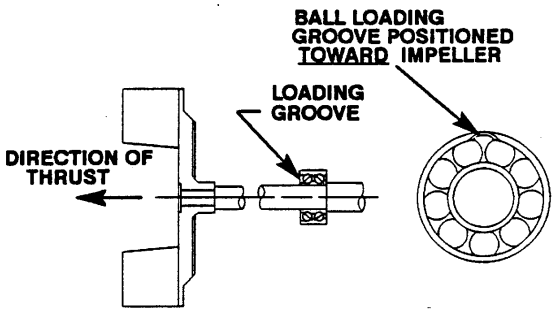
Use caution when handling hot bearings to prevent burns.

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

Press the lip seal (80) into the bearing cap (48) with the lip positioned as shown in Figure 1. Position the lower bearing (17) as shown in Figure 6, and slide it into the bearing cap until fully seated.



INSTALLATION OF NEW DEPARTURE OR BCA/FEDERAL MOGAL 5300W SERIES BEARINGS (OPEN OR ENCLOSED IMPELLERS)



INSTALLATION OF MRC/SKF 5300M OR FAFNIR 5300W SERIES BEARINGS (OPEN OR ENCLOSED IMPELLERS)

Figure 6. Double-Row Bearing Positioning

If an induction heater is used, heat **only** the inner race, and **do not** heat the bearing cap. Slide the assembled bearing and bearing cap onto the shaft until the bearing seats squarely against the shaft shoulder.

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

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

CAUTION

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

Use **fresh** solvent to clean the bearing seating bore of the motor housing (27). Install the O-rings (19 and 20) in the grooves on the motor housing. Apply 'Loctite Pipe Sealant With Teflon No. 592' or equivalent compound to the threads of the moisture detector (16), and screw it into the tapped hole in the interme-

diate. Secure the probe wire to the moisture detector with the terminal (24).

Slide the intermediate over the shaft until it is fully seated over the lower bearing. Align the tapped holes in the bearing cap with the holes for the capscrews (50). Apply 'Never-Seez' or equivalent compound on the threads of the capscrews, install the lockwashers (51), and secure the bearing cap to the lower motor housing by torquing the capscrews to 60 ft. lbs. (720 in. lbs. or 8,3 m. kg.).

Install three lifting eyes (not supplied) in the holes for the capscrews (8) in the intermediate (18), and hook a three-leg sling to the lifting eyes.

Lift the intermediate, rotor and shaft assembly, and align it with the motor housing and stator. Feed the end of the probe wire (23) down the groove in the inside of the motor housing, between the stator and the motor housing.

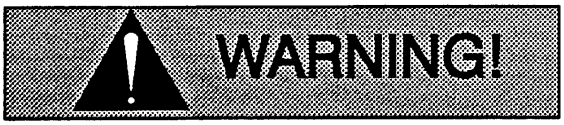
Lower the intermediate, rotor and shaft assembly down into the stator until the upper bearing (26) is fully seated in the bore of the motor housing.

Apply 'Loctite Threadlocker No. 242' or equivalent compound to the threads of the capscrews (45), and secure the intermediate to the motor housing with the hardware (45, 46 and 47). Torque the capscrews to 300 ft. lbs. (3600 in. lbs. or 41,5 m. kg.).

Refer to **PUMP END REASSEMBLY**, and reassemble the pump end components.

Terminal Housing And Power Cable Reassembly

(Figure 2)



The electrical power used 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 out, 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 startup. Obtain the services of a qualified electrician, and refer to the wiring diagram(s) in INSTALLATION, Section B, to make electrical connections.

Clean the exterior of the power and control cables with warm water and mild detergent, and check for obvious physical damage. Check the cables for continuity and insulation resistance (see **Electrical Testing** in **TROUBLESHOOTING**). **Do not** attempt repairs except to cut off either end of the cables; **splicing is not recommended.** Reinstall any wire tags or terminals which may have been removed.

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

Use oil to lightly lubricate the outside of the pump power and control cables (1 and 36), the rubber gland bushings (6 and 29), and the bores of the terminal glands (5 and 32) and cable grips (2 and 35) for ease of assembly.

Slide the terminal glands onto the cables. Compress the wire mesh on the cable grips, and slide them onto the cables, allowing approximately 1 ft. (0,3 m) of each cable to extend beyond the mesh. Slide the rubber cable grip bushings and washers (7) onto the cables. Temporarily tape the green and yellow ground wires to the cables.

Sealing Terminal Housing Connections With Hot Melt Adhesive

(Figure 2)

WARNING!

Do not attempt to operate this pump unless the power cable leads are properly sealed in the terminal housing. Moisture entering the terminal housing could cause a short circuit, resulting in pump damage and possible serious injury or death to personnel.

When shipped from the factory, the cable leads and terminal collars (14 and 26) were encapsulated in heat-shrink tubing (12 and 28), and bonded to the terminal plate (16) with hot-melt adhesive to provide a water-tight seal. If this insulating material has been damaged or removed during maintenance, **it must** be replaced using materials and equipment approved by Gorman-Rupp (see the parts list for repair kits).

NOTE

*Heat-shrink tubing **must** be used to seal the power and control cable leads to the terminals before bonding the leads to the terminal plate. If a hot melt adhesive glue gun with the required temperature range is not available in the field, a commercially available potting kit may be used to bond the connections to the terminal plate. If this alternate seal method is used, refer to the instructions in **Sealing Terminal Plate Connections With Potting Compound**. Use **only** materials and heating equipment approved by Gorman-Rupp for field repairs.*

Before resealing the power and control cables, remove all the old adhesive material (or potting compound) from the terminal collars, terminal posts (18 and 24), and terminal plate (16). Inspect all parts for damage, and replace as required.

NOTE

Clean the cable leads and terminal plate in the areas to be sealed with cleaning solvent. Use a medium grit sandpaper to prepare the surface of the terminal plate. Incomplete sealing will occur if the surfaces are oil or grease coated.

Slide the terminal housing (8) up the cables, and temporarily secure it with the cable grips (5 and 32)

Assemble the terminal collars, dyna-seal washers (15, 17 and 25), and terminal posts (18 and 24) to the terminal plate as shown in Figure 2.

NOTE

Both the power and control cable leads should be tinned prior to reassembly.

Slide a length of heat-shrink tubing (12 and 28) up over each of the power cable leads. Refer to Figure 7, and insert the standard power cable leads into the large terminal collars (14), and secure them with the setscrews (13). Insert the control leads into the small terminal collars (26) and secure them with the setscrews (27).

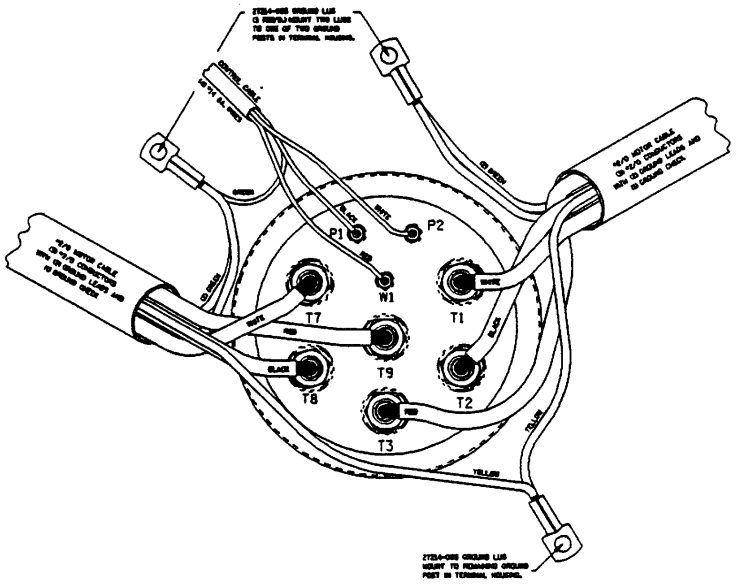


Figure 6. Terminal Housing Wiring Connections

Slide the heat-shrink tubing down the leads and over the collars until they seat against the terminal plate. The tubing must completely cover the collars and extend up the leads far enough to ensure a good seal.

Carefully heat each tube with a commercially available hot air gun capable of producing 750°F (399°C), and shrink the tubes around the cable leads and terminals.

NOTE

To ensure adhesion of the hot-melt adhesive to the terminal plate, pre-heat the adhesive gun to at least 400°F (204°C). It is also recommended that the terminal plate be preheated to 125°F - 150°F (52°C - 66°C) to ensure adhesion. Use a commercially available hot-air gun to heat the terminal plate at this point.

After the wire terminals have been secured and locations checked for correctness, apply the adhesive (G-R part number 18661-045) over the terminal posts with a hot-melt adhesive tool (Terlan model TM-80, or equivalent) set at 400°F (204°C). The adhesive must **completely** insulate electrical connections. Allow the adhesive to cool before securing the terminal housing to the motor housing.

WARNING!

Do not attempt to operate this pump unless the power cable leads are properly sealed in the terminal housing. Moisture entering the terminal housing could cause a short circuit, resulting in pump damage and possible serious injury or death to personnel.

Sealing Terminal Plate Connections With Potting Compound

(Figure 2)

Potting compound and hot-melt adhesive have the same electrical properties when correctly applied. Hot-melt adhesive is used at the factory to facilitate production. A commercially available potting kit (Products Research Corp., part number PR-1201-Q Class 1 potting compound, Chemseal potting compound, part number GS3100, or equivalent) may also be used to seal the connections.

Clean and assemble all terminal components as indicated in **Sealing Terminal Plate With Hot-Melt Adhesive**. Use medium grit sandpaper to prepare the surface of the terminal plate in the area where the potting mold will be installed.

NOTE

Clean the cable leads and terminal plate in the areas to be sealed with cleaning solvent. Incomplete sealing will occur if the surfaces are oil or grease coated.

Trim the potting mold so it is long enough to fully cover the terminal collars, and so that the potting compound, when applied, will seal the bottoms of the terminal lead jackets.

Slide the potting mold up over the leads of the power and control cables.Secure each cable lead as described in the previous section. Slide the potting mold down over the terminal collars and against the terminal plate.

Hang the cable in a vertical position, with the terminal plate horizontal. The cable leads and terminals should be centered in the potting mold. Use quick-setting cement, such as '3-M Weather Seal' to secure the potting mold 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 mold until the electrical connections are completely insulated. Tamp the potting material to eliminate air bubbles and ensure the material has completely covered the area around the terminal posts.

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 the potting material is no longer "tacky" to the touch, it has cured.

Terminal Housing and Power Cable Installation

(Figure 2)

After the heat-shrink tubing has been installed, untape the ground leads, and slide the terminal housing down the cables. Refer to Figure 6 and connect the green ground leads to two of the terminals (9), and connect the yellow ground check leads to the third terminal.

Secure the terminals to the terminal housing with the hardware (9, 10 and 11); **be sure** the terminals make good contact with the housing.

Pull gently on the cables to remove any excess length from within the terminal housing. The terminal plate should fit loosely against the terminal housing.

Slide the terminal washers (7) down the power cables and into the upper bore of the terminal housing. Oil the bores and cables, and slide the gland bushings (6 and 29) into place. Compress the wire mesh of the cable grips (2 and 35), and slide them down the cables, making sure they contact the bushings. Slide the terminal glands (5 and 32) into place, and engage the nuts (4 and 34) finger tight. Do not fully tighten the nuts at this time.

Before installing the terminal housing, group the motor leads together in the upper motor housing, and secure them with a cable tie.

Slide a length of heat-shrink tubing (22) over each of the motor cable leads. Using the hardware (19,.20 and 21), attach the motor leads to the terminal posts (18 and 24).

CAUTION

The motor cable leads **must** be connected directly below the terminal posts, with a **minimum** of 3/8-inch (10 mm) between leads. The leads **must** be sealed with heat-shrink tubing to prevent possible shorting.

Slide the heat-shrink tubing up over the terminal posts and hardware. Carefully heat each tube with a commercially available hot air gun capable of producing 750°F (399°C), and shrink the tubes around the cable leads and terminals.

Attach the brown probe wire lead (23, Figure 1) to terminal W1. Attach the thermal shut down leads from the motor to terminals P1 and P2.

If required, rotate the terminal housing and twist the motor leads to remove excess slack. Coat the threads of the terminal housing studs (40, Figure 1) with 'Never-Seez' or equivalent, and secure the terminal housing assembly to the motor housing with the nuts (41, Figure 1); torque the nuts to 60 ft. lbs. (272 in. lbs. or 8,3 m. kg.).

Tighten the nuts (4 and 34), drawing the terminal glands down into the terminal bore. **Do not** overtighten and damage the terminal glands or hardware.

See **FINAL ASSEMBLY** and **LUBRICATION,** followed by **MOTOR LEAK TEST.**

FINAL ASSEMBLY

(Figure 1)

Install the lifting eyes (33) in the motor housing.

Apply 'Loctite No. 680 or No. 609' or equivalent compound on both ends of the pipe nipple (38), and install the nipple, pressure relief valve (36) pipe cap (35), and tee (36).

If the discharge flange (29) was removed from the motor housing, replace the discharge flange gasket (28). Apply 'Never-Seez' or equivalent compound on the flange studs, and secure the flange with the nuts (31).

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

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, remove the seal cavity oil level plug (54) and install a short, 3/8-inch pipe nipple in the hole. Using a clean container, tip the pump slightly until oil runs out.

If the oil level is abnormally low, or if the oil contains water, dirt, or appears cloudy, the lower seal or gaskets may require replacement. If the oil is clear, top off the seal cavity by adding oil through the hole for the fill plug (52) until oil runs out of the oil level plug hole. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plugs before reinstalling the plugs.

When lubricating a dry (overhauled) pump, add approximately 14.4 U.S. quarts (13,6 liters) of lubricant (see Table 1 for lubricant specifications).

The grade of lubricant used is critical to the operation of this pump. Use premium quality submersible pump oil as specified in the following table. Oil must be stored in a clean, tightly closed container in a reasonably dry environment.

Table 1. Pump Oil Specifications

Specifications:	
Type	Premium high viscosity index, anti-wear hydraulic oil
Viscosity @ 100°F (38°C)	110 to 155
Viscosity @ 210°F (99°C)	40 to 50
Dielectric	26,000 (volts-min)
Recommended supplier:	
Gulf Oil Company	Gulf Harmony HVI AW 26
Acceptable alternate suppliers:	
Gulf Oil Company	Gulf Harmony 32 AW
Texas Oil Company	Rando HD 32 or HD AZ 32
Sun Oil Company	Sunvis 816 or 916
SOHIO (Also Boron & British Petroleum Oil Companies)	Energol-HLP 32
Shell Oil Company	Tellus 32, Tellus T-23 or T32
ARCO	Duro 32
Exxon	Nuto H 32

Motor Housing Cavity

To check the motor cavity oil, position the pump on its side with the pipe plug (25) facing up. Remove the plug and install a short, 3/8-inch pipe nipple in the hole. Using a clean container, roll the pump slightly until oil runs out.

Inspect the oil for dark color, which could indicate motor overheating, dirt or water contamination. The presence of dirt or water could indicate a breakdown in the waterproof integrity of the motor cavity, probably due to poor gaskets or seals.

When lubrication is required, position the pump upright and remove the oil level plug (25). Remove the pipe cap (35) from the tee where the pressure relief valve is located, and the recommended grade of submersible pump oil until oil runs out of the oil level pipe plug hole. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plugs before reinstalling the plugs.

When lubricating a dry (overhauled) pump, add approximately 53.4 U.S. quarts (50,5 liters) of lubricant (see Table 1 for lubricant specifications).

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
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