

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



SUBMERSIBLE PUMPS

MODEL
S3C1-KW4 3/50/380

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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 which are mildly corrosive and abrasive. The basic material of construction is

aluminum, with bonded buna-n linings over the suction head and seal plate; the impeller is ductile iron. The pump may be operated fully or partially submerged. The integral 50 hertz electric 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:

NOTE

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



INSTRUCTIONS WHICH MUST BE FOLLOWED TO AVOID CAUSING DAMAGE TO THE PRODUCT OR OTHER EQUIPMENT INCIDENTAL TO THE INSTALLATION. THESE INSTRUCTIONS DESCRIBE THE REQUIREMENTS AND THE POSSIBLE DAMAGE WHICH COULD RESULT FROM FAILURE TO FOLLOW THE PROCEDURES.



THESE INSTRUCTIONS MUST BE FOLLOWED TO AVOID CAUSING INJURY OR DEATH TO PERSONNEL, AND DESCRIBE THE PROCEDURE REQUIRED AND THE INJURY WHICH COULD RESULT FROM FAILURE TO FOLLOW THE PROCEDURE.

WARNINGS - SECTION A

THESE WARNINGS APPLY TO THE S SERIES SUBMERSIBLE MOTOR DRIVEN PUMP AND CONTROL BOX.



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.



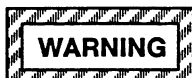
ALL ELECTRICAL CONNECTIONS MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND ALL LOCAL CODES. IF THERE IS A CONFLICT BETWEEN THE INSTRUCTIONS PROVIDED AND N.E.C. SPECIFICATIONS, N.E.C. SPECIFICATIONS SHALL TAKE PRECEDENCE. ALL ELECTRICAL EQUIPMENT SUPPLIED WITH THIS PUMP WAS IN CONFORMANCE WITH 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 **NOT** 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. **DO NOT** ATTEMPT TO PUMP ANY LIQUIDS FOR WHICH YOUR PUMP IS NOT APPROVED, OR WHICH MAY DAMAGE THE PUMP OR ENDANGER PERSONNEL AS A RESULT OF PUMP FAILURE. CONSULT THE FACTORY FOR SPECIFIC APPLICATION DATA.



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.



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.



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.



OBTAIN THE SERVICES OF A QUALIFIED ELECTRICIAN TO TROUBLESHOOT, TEST AND/OR SERVICE THE ELECTRICAL COMPONENTS OF THIS PUMP.

INSTALLATION – SECTION B

Review all WARNINGS 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.

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 m) of power cable. Inspect the cable for cuts or damage.
- 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 seal prevents oil leakage from the motor housing cavity and acts as back-up protection in the event of lower seal failure.

Both cavities are fully lubricated when the pump is shipped from the factory. Check lubrication levels before installing the pump (see **LUBRICATION in MAINTENANCE AND REPAIR**). An additional quart (0,95 liter) 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 Kilo- watts	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S3C1	380/3	4	2900	8	6	50	3 INCH

Table 2. Additional Specifications

Approximate Weights:	
Pump:	
Model S3C1-KW4 3/50/380	98 lbs. (44,4 kg)
Control Box Only	25 lbs. (11,3 kg)
50 ft. (15,2 m) of Cable	18 lbs. (8,2 kg)
Seal oil cavity capacity	1 U.S. pint (0,5 liters)
Motor oil cavity capacity	3 U.S. quarts (2,8 liters)
Cable	#10 AWG., .12 Conductor Dia., Type SO, 0.75 O.D.

Pump Dimensions

The standard pump is provided with a suction strainer to prevent large solids from clogging the impeller. On high discharge head applications, the

strainer can be removed, and the pump suction “staged” to the discharge of another pump, allowing one pump to feed the other. See Figure 1 for the approximate physical dimensions of this pump and control box.

OUTLINE DRAWING

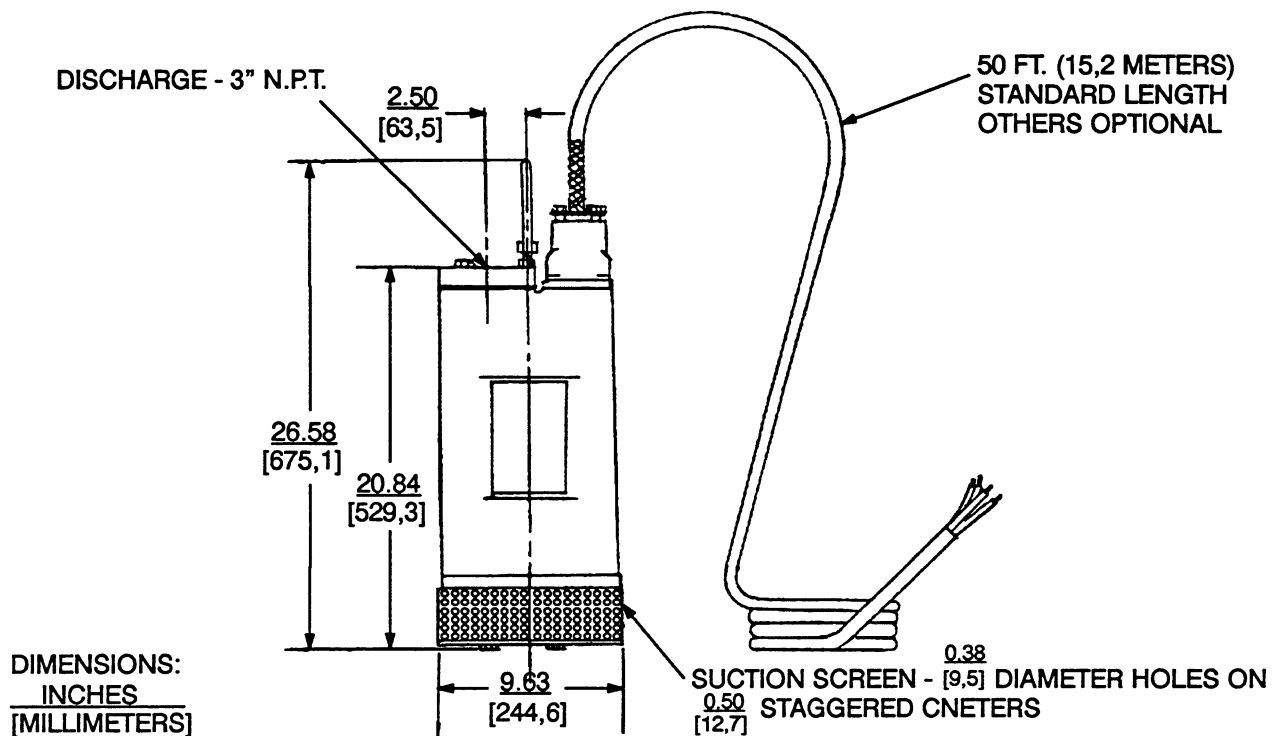


Figure 1. Pump Model S3C1-KW4 3/50/380

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.



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 air discharged through internal passages.

As a safeguard against rupture or explosion due to heat, the pump is fitted with a pressure relief valve which will open if vapor pressure within the pump motor reaches a critical point.

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.

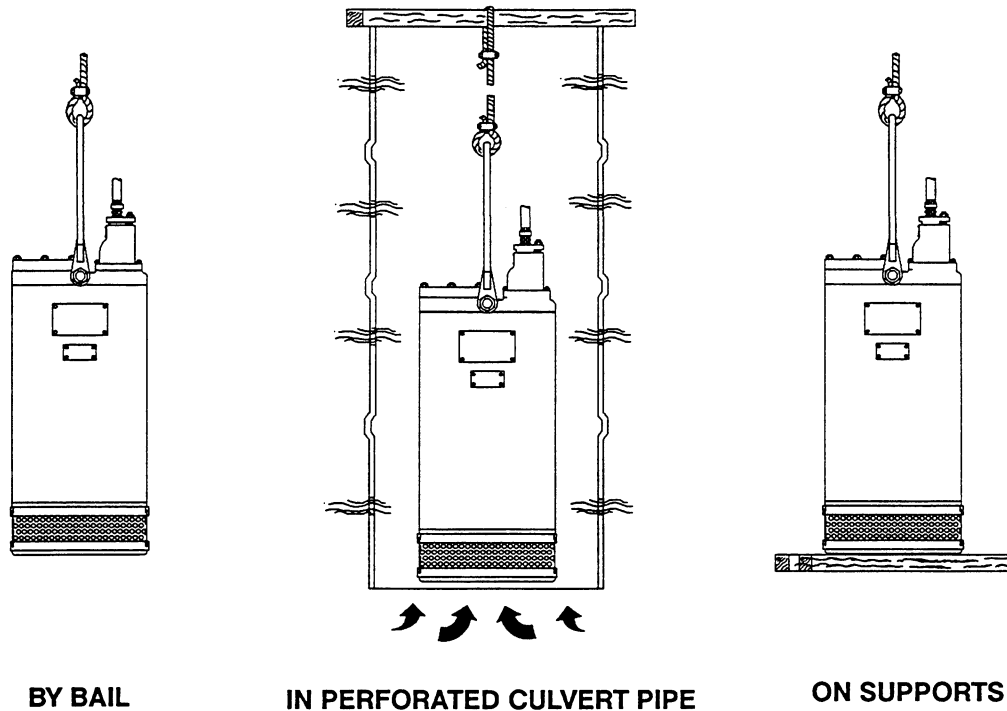


Figure 2. Typical Pump Installations

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

NOTE

*Before actual operation, check the direction of impeller rotation to ensure that the pump is properly wired to the control box. See **Checking Pump Rotation** in **OPERATION**, Section 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. On high discharge head applications, the strainer can be removed, and the pump suction "staged" to the discharge of another pump, allowing one pump to feed the other.

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

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

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

CONTROL BOX INSTALLATION

This pump is driven by an integral 380 volt, 4 kilowatt, 50 hertz, 3 phase motor. It is designed to operate through the control box furnished with the pump.



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.

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 sub-**

merged. 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.



FAILURE TO MOUNT THE CONTROL BOX VERTICALLY ON A LEVEL SURFACE MAY AFFECT OPERATION OF THE PUMP CONTROLS.

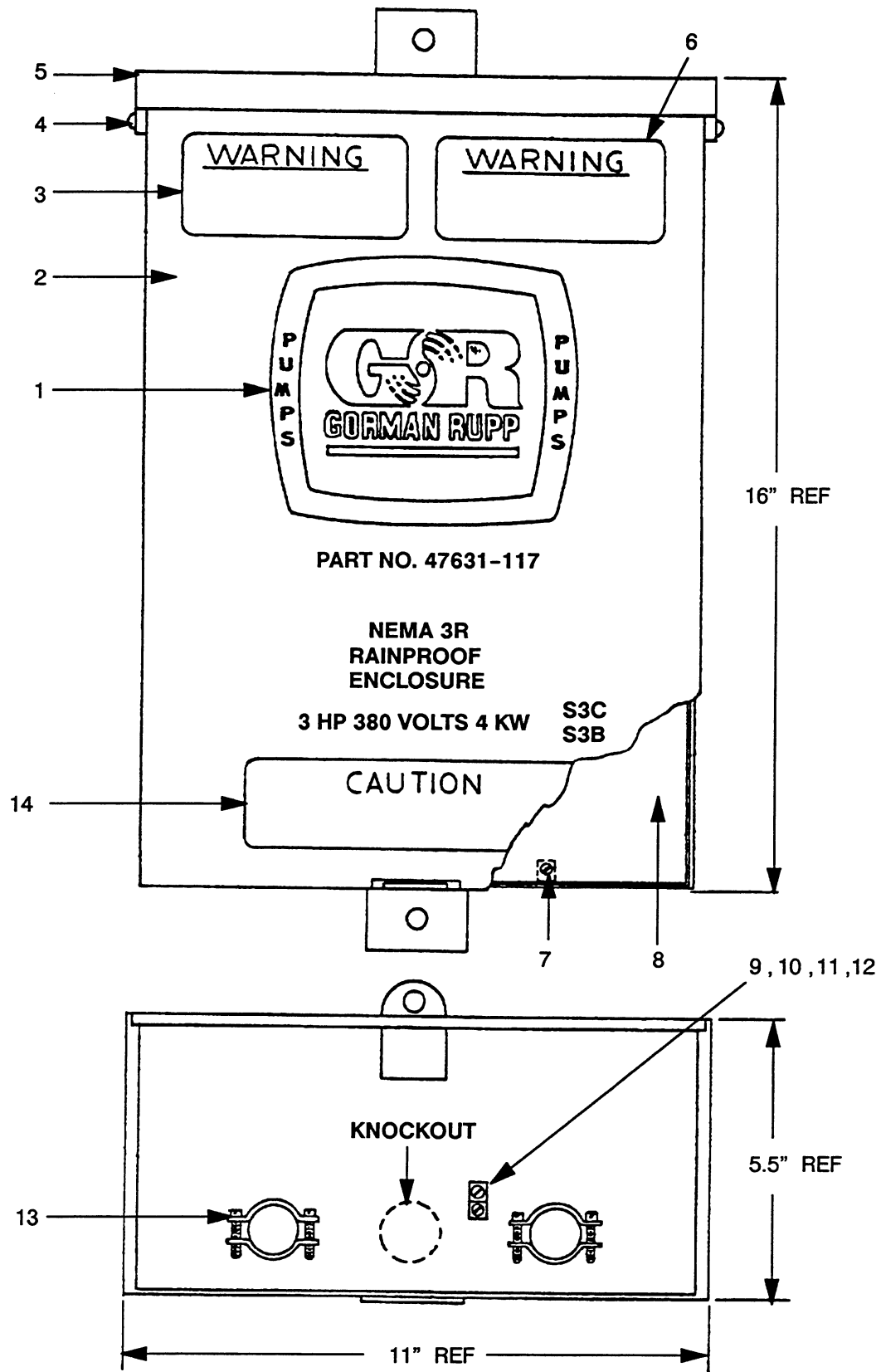


Figure 3. 47631-117 Control Box Dimensions

PARTS LIST, EXTERNAL PARTS
47631-117 Control Box

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	G-R LOGO	GR-06	-----	1
2	FRONT COVER	42821-106	-----	1
3	WARNING STICKER	38816-066	-----	1
4	TUBULAR RIVET 1/8	21118-008	-----	2
5	ENCLOSURE	42821-063	-----	1
6	WARNING STICKER	38816-067	-----	1
7	PHILLIPS HD MACHINE SCREW	CF#802	15991	2
8	INNER PANEL	42821-070	-----	1
9	GROUND LUG	27222-002	-----	2
10	PHILLIPS HD MACHINE SCREW	CF#802	15991	2
11	LOCKWASHER	AK#8	15991	2
12	HEX NUT	D#8	15991	1
13	CABLE CLAMP	27184-164	-----	2
14	CAUTION STICKER	38816-068	-----	1

Grounding Methods

Electrically ground the installation before 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 other-

wise 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.

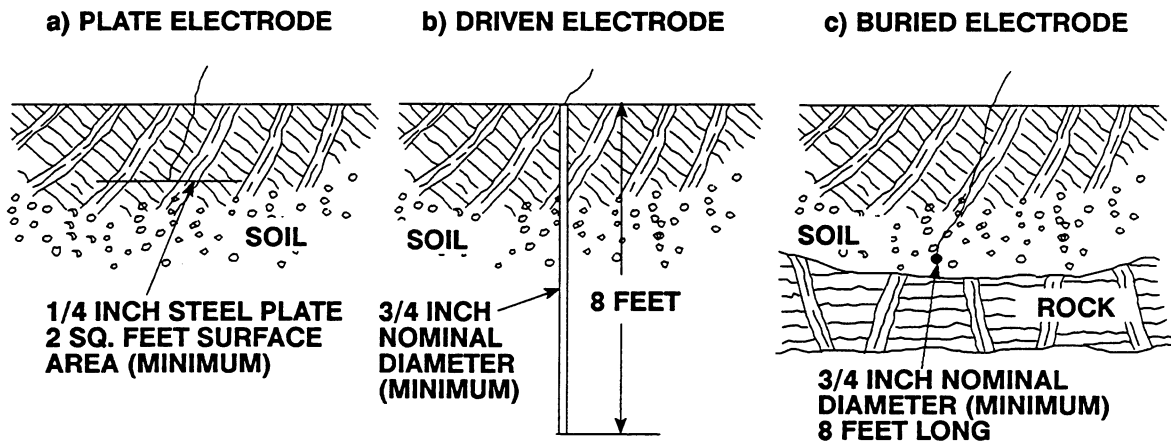


Figure 4. Suggested Grounding Methods

- 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.



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 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 control is designed to regulate a 380 volt, 3 phase, 50 hertz power supply. The field wiring must be properly sized to ensure an adequate 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:

- 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.
- Next, subtract the motor cable voltage drop (see Table 4, Pump Power Cable Specifications).
- Do not continue to operate the pump if this voltage is not within the recommended limits. Obtain the services of a qualified electrician to determine the correct field wiring size and other details to insure an adequate voltage supply to the pump.

Table 3. Pump Motor Voltage Limits

Nominal Voltage	Phase	Minimum Voltage	Maximum Voltage
380	3	340	420

Use the packing gland nuts to secure and seal 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.

NOTE

After the power cables have been connected to the control box, the packing gland nuts must be wired

Table 4. Pump Power Cable Specifications Model S3C1

Voltage/Phase	A.W.G Cable Size	Cable O.D. (Inches) [mm]	Conductor Dia. (Inches) [mm]	Amp Rating* at 30°C (Amperes)	DC Resistance at 25°C (ohms/1000 ft. or 304,8 m)	Voltage Drop at Max. Load per 100 ft. or 30,5 m
380/3	12	.75 [19,1]	.12 [3,1]	25	1.11	1.78

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

and sealed before operation. See *Terminal Housing And Power Cable Reassembly in Section E for instructions.*

Pump Power Cable Connections



THE ELECTRICAL POWER USED TO OPERATE THIS PUMP IS HIGH ENOUGH TO CAUSE INJURY OR DEATH. OBTAIN THE SERVICES OF A QUALIFIED ELECTRICIAN TO MAKE ALL ELECTRICAL CONNECTIONS. MAKE CERTAIN THAT 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 a 50 foot (15,2 meters) power cable (see table 4 for power cable specifications). If a longer cable is required, an optional cable assembly **must** be ordered from the factory. Splicing of the power cable is **not** recommended by the Gorman-Rupp Company due to safety and warranty considerations.



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.

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

Connect the pump power cable to the control box as shown in 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

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

Control Box Specifications

The circuit breakers within the control box are magnetic trip only, set to trip at approximately 9 to 11 times the full load current (FLA). If the breaker trips on motor starting, turn the adjustment knob to the next higher position; however, this setting **must not** exceed 13 times the full load current.



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 OVERLOAD PROTECTION OCCURS, THE COMPLETE OVERLOAD PROTECTION MUST BE REPLACED.

After replacing overload protection, press the reset button to set the relay. Allow 10 seconds for the relay to cool after tripping before pressing the reset.

Table 5. Control Box Specifications

			Overload Protection		
Volts	Hz.	Phase	C-H P/N	Hold Amps	Trip Amps
380	50	3	9485-N	10	11.4

* Maximum setting **must not** exceed 13 times Full Load Amps

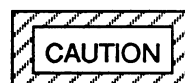
LIQUID LEVEL DEVICES

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. For installation and operation, see the detailed instructions included with the optional package.



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 OVERHEAT, RESULTING IN DAMAGE TO THE MOTOR WINDINGS OR CONTROL BOX COMPONENTS.

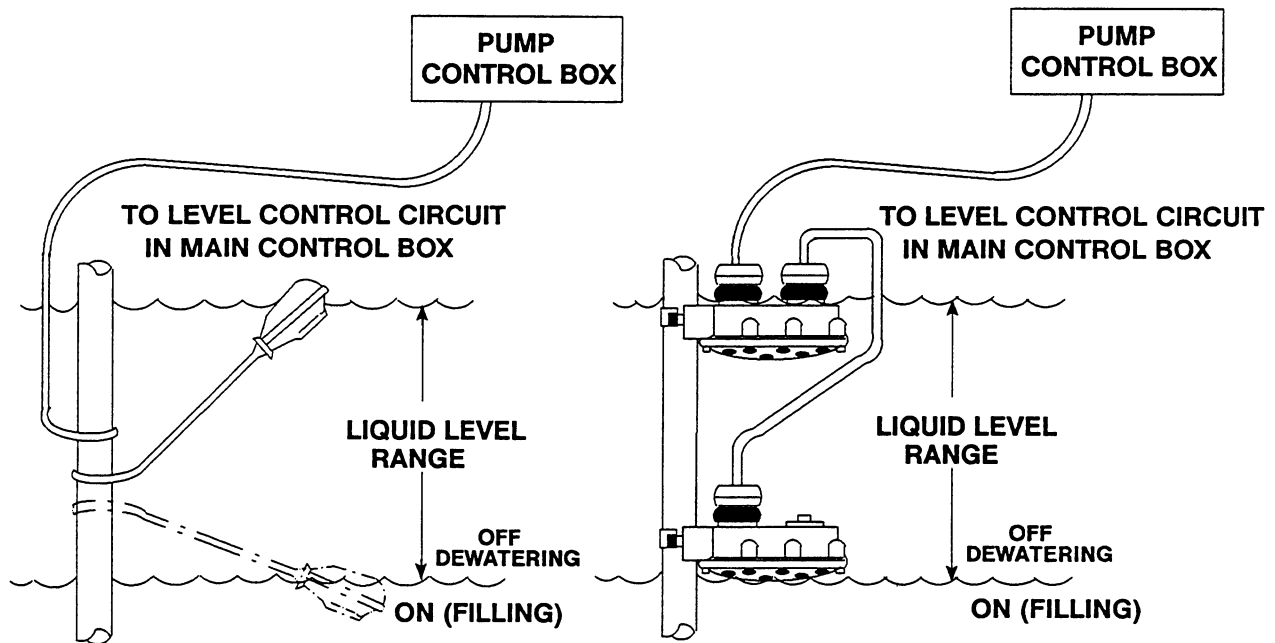
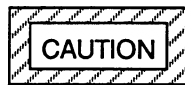


Figure 5. Liquid Level Devices

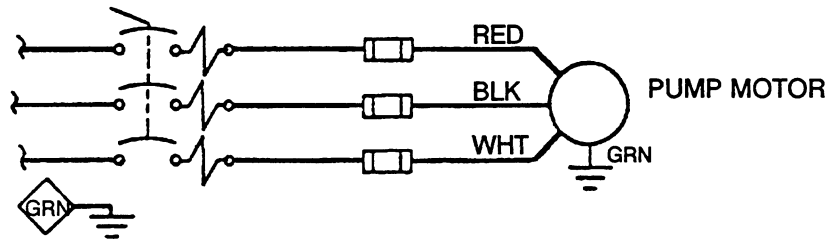


THE INTERNAL WIRING OF THE SENSING DEVICES ARE DIFFERENT FOR FILLING AND DEWATERING FUNCTIONS. BE SURE TO FOLLOW THE

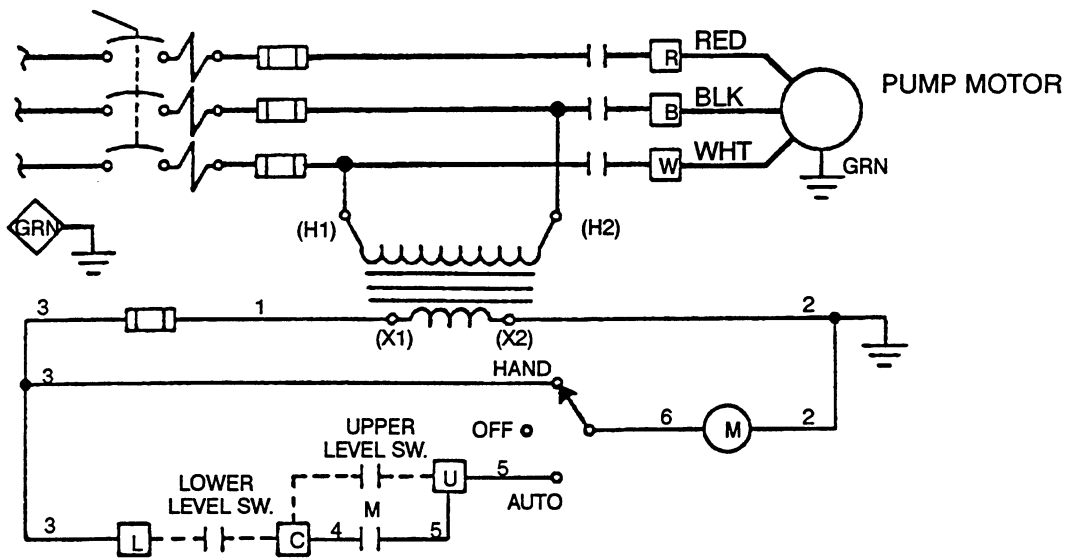
INSTRUCTIONS INCLUDED WITH THE OPTION BEFORE MAKING WIRING CONNECTIONS.

WIRING DIAGRAMS

Consult the following elementary and pictorial wiring diagrams for the control box applications.

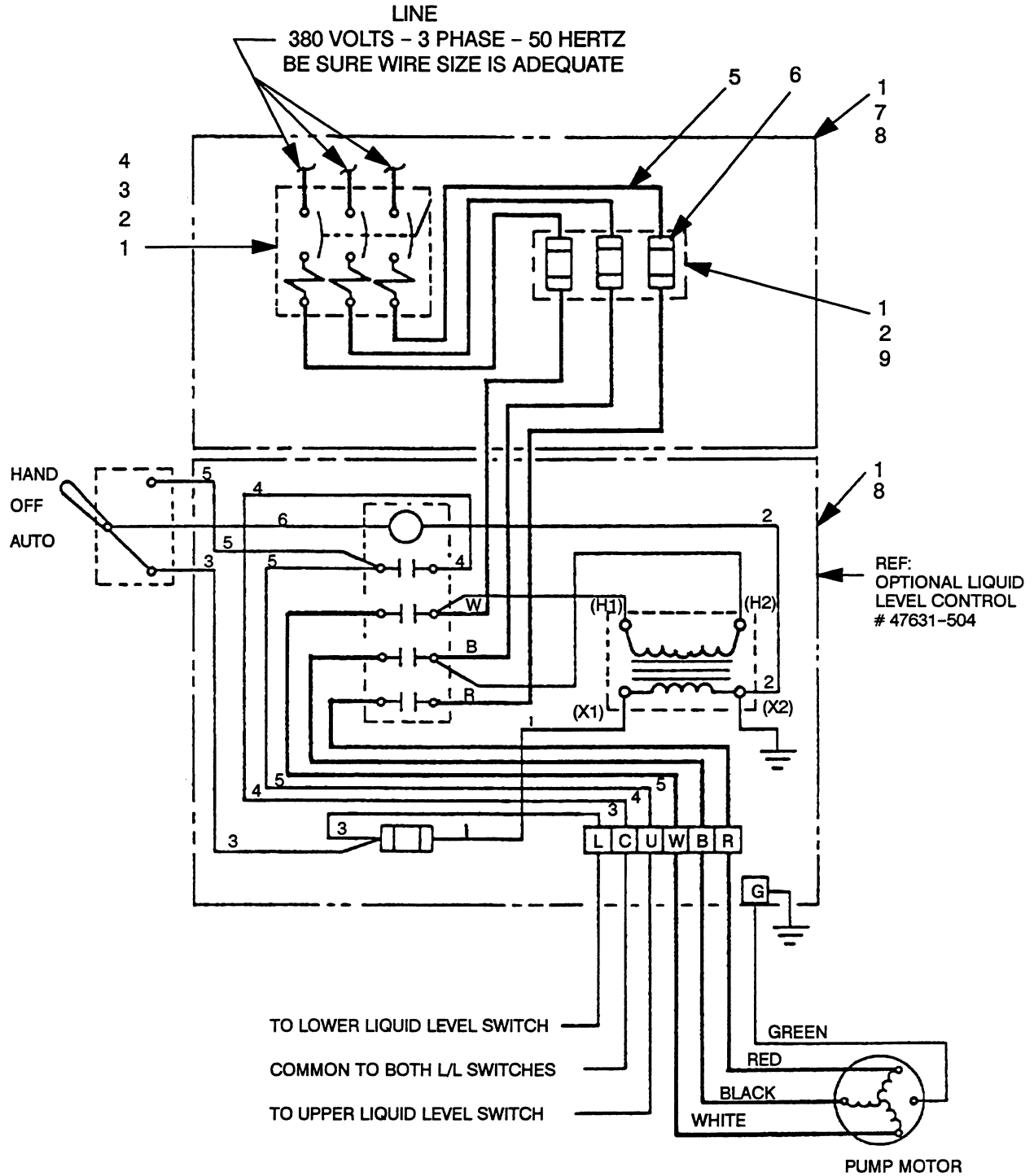


(Without Liquid Level Controls)



(With Liquid Level Controls)

Figure 6. Elementary Wiring Diagram 47631-117 Control Box



NOTE

When Only One Liquid Level Switch Is Used, Connect To Terminals L And U. Voltage To Float Switches - 24 Volts To Ground.

Figure 7. Pictorial Diagram 47631-117 Control Box

REPAIR PARTS LIST
47631-117 CONTROL BOX

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	LOCKWASHER #8	AK#8	15991	17
2	PHILLIPS HD MACHINE SCREW	CF#802	15991	13
3	FLAT WASHER #8	K#8	15991	6
4	OVERLOAD UNIT	9485-N	-----	1
5	WIRE ASSEMBLY	18162-043	-----	2
6	30 AMP FUSE	27311-120	-----	3
7	BACK PANEL	34621-062	-----	1
8	PHILLIPS HD MACHINE SCREW	CF#801	15991	8
9	FUSE BLOCK	27314-306	-----	1

OPERATION – SECTION C

Review all warnings in Section A.

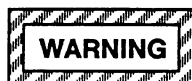
Follow the instructions on all tags, labels and decals attached to the pump and control box.

CONTROL BOX FUNCTION

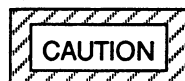


THIS PUMP MOTOR AND CONTROL BOX ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

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.



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.



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.

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).

PUMP OPERATION



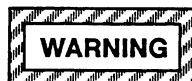
THIS PUMP IS **NOT** DESIGNED TO PUMP VOLATILE, EXPLOSIVE, OR FLAMMABLE MATERIALS. REFER TO THE CHART IN INSTALLATION, SECTION B FOR THE BASIC MATERIALS OF CONSTRUCTION FOR EACH PUMP COVERED IN THIS MANUAL. **DO NOT** ATTEMPT TO PUMP ANY LIQUIDS FOR WHICH YOUR PUMP IS NOT APPROVED, OR WHICH MAY DAMAGE THE PUMP OR ENDANGER PERSONNEL AS A RESULT OF PUMP FAILURE. CONSULT THE FACTORY FOR SPECIFIC APPLICATION DATA.

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 pressure relief valve which will open if vapor pressure within the pump motor reaches a critical point. Always terminate power to the pump and control box before investigating pump or control box problems.



APPROACH THE PUMP CAUTIOUSLY AFTER IT HAS BEEN RUNNING. ALTHOUGH THE MOTOR IS COOLED BY THE LIQUID BEING PUMPED, NORMAL OPERATING TEMPERATURES CAN BE HIGH ENOUGH TO CAUSE BURNS. THE TEMPERATURE WILL BE ESPECIALLY HIGH IF OPERATED AGAINST A CLOSED DISCHARGE VALVE. NEVER OPERATE AGAINST A CLOSED

DISCHARGE VALVE FOR LONG PERIODS OF TIME.

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



OVERHEATED PUMPS CAN CAUSE SEVERE BURNS AND INJURIES. IF OVERHEATING OF THE PUMP OCCURS:

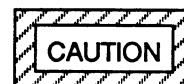
1. STOP THE PUMP IMMEDIATELY.
2. VENTILATE THE AREA.
3. ALLOW THE PUMP TO COOL.
4. CHECK THE TEMPERATURE BEFORE SERVICING.
5. VENT THE PUMP SLOWLY AND CAUTIOUSLY.
6. REFER TO INSTRUCTIONS IN THIS MANUAL BEFORE RESTARTING THE PUMP.

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).



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.



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.



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.

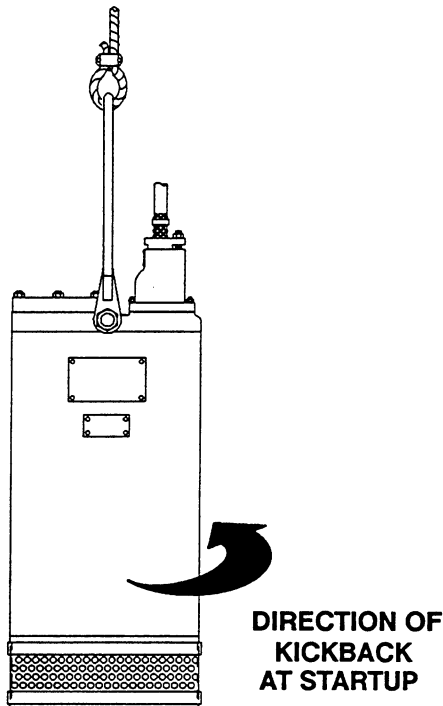


Figure 1. Checking Pump Rotation

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.

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

To stop the pump, switch 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 re-start.



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.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
OVERLOAD UNIT TRIPS	<p>Low or high voltage, or excessive voltage drop between pump and control box.</p> <p>Defective insulation in motor windings or power cable; defective windings.</p> <p>Impeller jammed due to debris or insufficient clearance.</p> <p>Bearing(s) frozen.</p>	<p>Measure voltage at control box. Check that wiring is correct type, size, and length. (See Field Wiring Connections, Section B).</p> <p>Check insulation resistance; check continuity.</p> <p>Disassemble pump and check impeller.</p> <p>Disassemble pump and check bearing(s).</p>
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE	<p>Discharge head too high.</p> <p>Low or incorrect voltage.</p> <p>Discharge throttling valve partially closed; check valve is installed improperly.</p> <p>Discharge line clogged or restricted; hose kinked.</p> <p>Liquid being pumped too thick.</p> <p>Strainer screen or impeller clogged.</p> <p>Insufficient liquid in sump or tank.</p> <p>Worn impeller vanes; excessive impeller clearance.</p> <p>Pump running backwards.</p>	<p>Reduce discharge head, or install staging adaptor and additional pump.</p> <p>Measure control box voltage, both when pump is running and when shut-off.</p> <p>Open discharge valve fully; check piping installation.</p> <p>Check discharge lines; straighten hose.</p> <p>Dilute liquid by heating if possible.</p> <p>Clear clog(s). Stop pump; back flow may flush away debris.</p> <p>Stop pump until liquid level rises.</p> <p>Check impeller and clearance. See PUMP END REASSEMBLY.</p> <p>Check direction of rotation and correct by interchanging any two motor leads at control box. (See Pump Rotation, Section C).</p>
PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION	<p>Pumping entrained air.</p> <p>Damaged or unbalanced impeller.</p> <p>Discharge piping not properly supported.</p>	<p>Check liquid level in sump; check position of pump and liquid level sensing device(s).</p> <p>Replace impeller.</p> <p>Check piping installation.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION (CONT'D.)	Impeller jammed or loose. Motor shaft or bearings defective. Pump cavitation.	Check impeller. Disassemble pump and check motor and bearings. 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.

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.



OBTAIN THE SERVICES OF A QUALIFIED ELECTRICIAN TO TROUBLESHOOT, TEST AND/OR SERVICE THE ELECTRICAL COMPONENTS OF THIS PUMP.

Test Equipment

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

Equipment	Manufacturer	Use
Amprobe Model 300 or Amprobe, Jr.	Pyramid Instrument Corp. Lynbrook, NY	To check AC Voltage and current (amperage)
Megohmer	Herman H. Sticht Co. 25 Bark Place New York, NY	To measure resistance (ohms) to ground

Motor And Motor Power Cable Continuity

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

cable. Switch one test lead to the third power lead, and test again.

- 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
- 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.

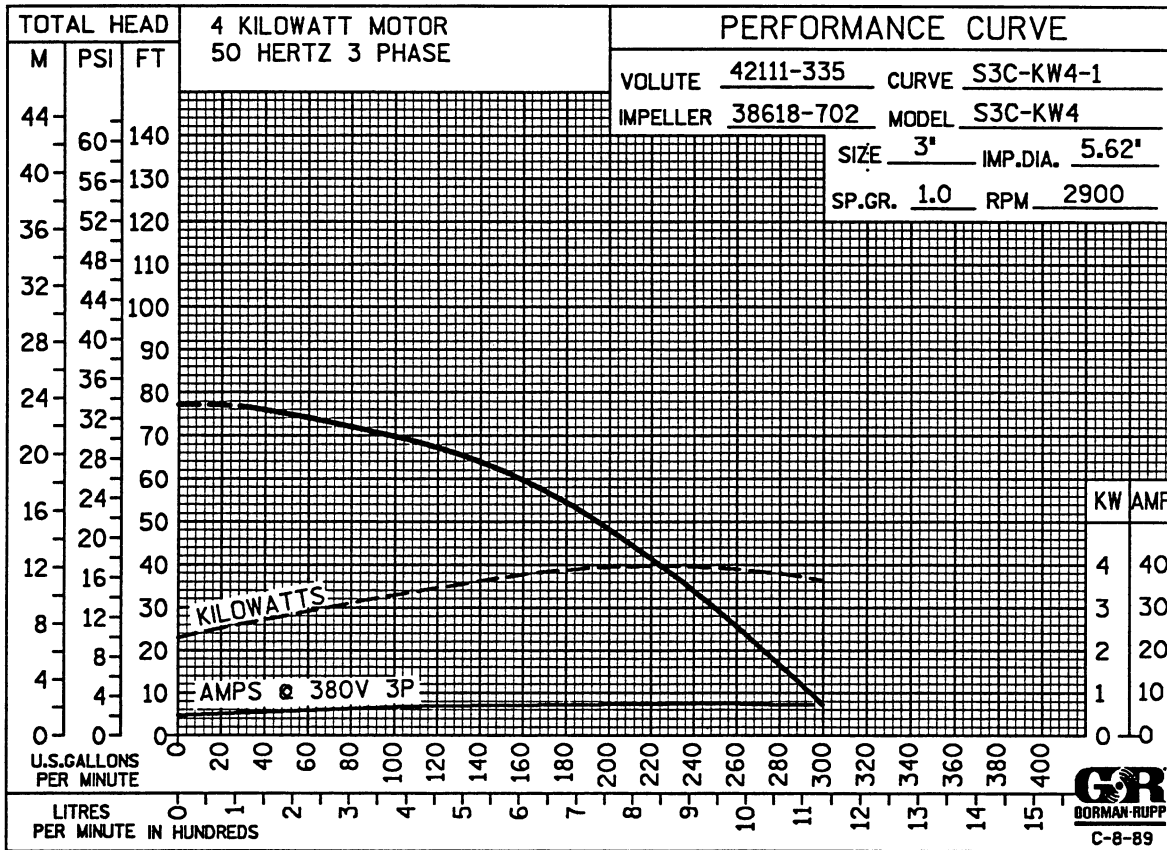
Insulation Resistance

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 MODEL S3C1-KW4 3/50/380**

* 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

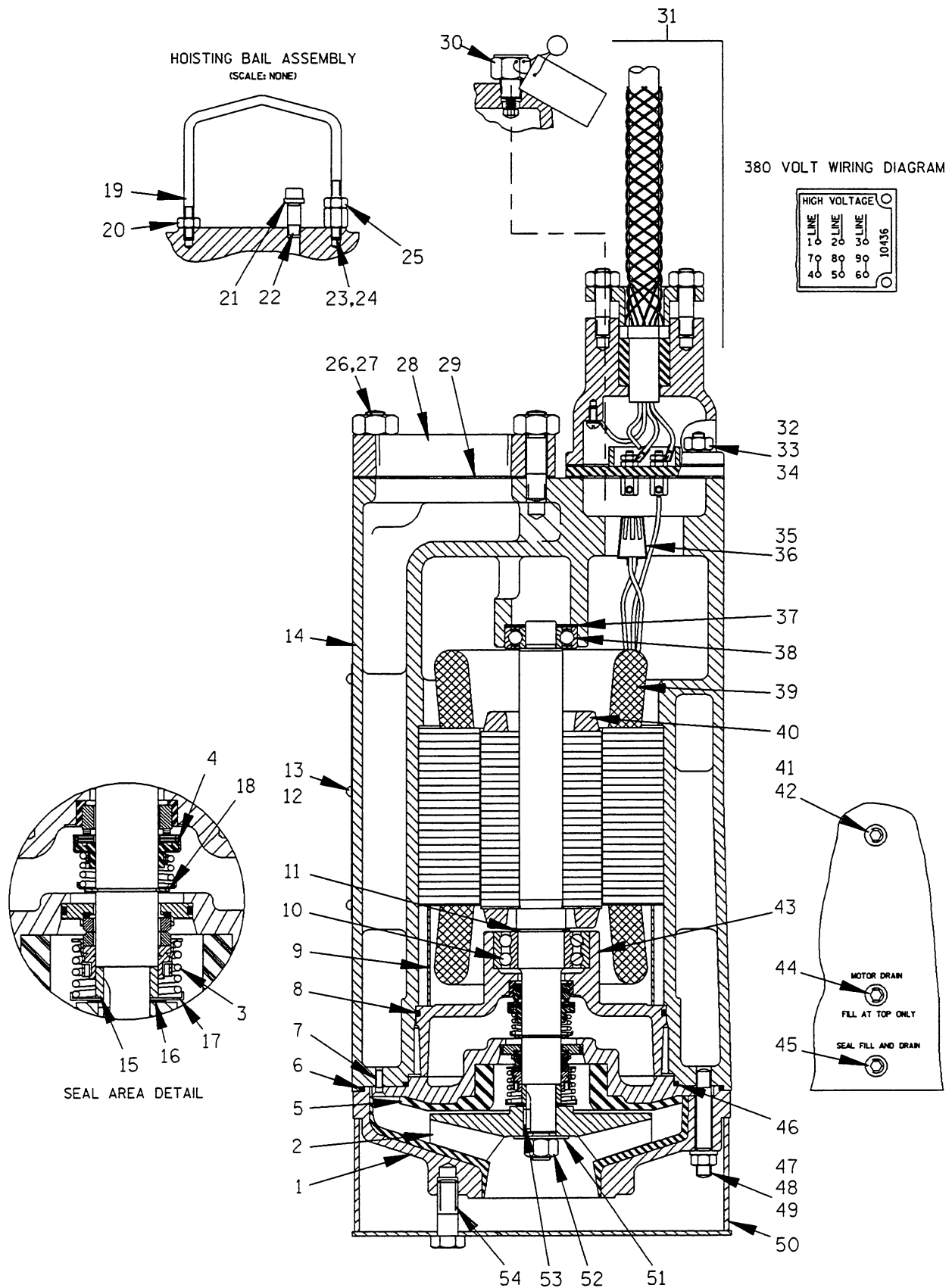


Figure 1. Pump Model S3C1-KW4 3/50/380

PARTS LIST
Pump Model S3C1-KW4 3/50/380
 (From S/N 1084901 up)

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

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	SUCTION HEAD ASSY	42111-335	24010	1	40 *	ROTOR & SHAFT ASSY	47112-806	-----	1
2 *	IMPELLER	38618-702	11060	1	41	ALLEN HD SETSCREW	GA0603	15990	1
3 *	LOWER SEAL ASSY	25277-345	-----	1	42	SOC HD PIPE PLUG	PC04	17000	1
4 *	UPPER SEAL ASSY	S1832	-----	1	43	INTERMEDIATE	38311-803	13040	1
5	SEAL PLATE ASSY	42111-066	24010	1	44	SOC HD PIPE PLUG	PC04	17000	1
6 *	MTR HSG O-RING	25152-270	-----	1	45	SOC HD PIPE PLUG	PC04	17000	1
7	FH MACH SCREW	Y#10-03	17000	2	46 *	SEAL PLATE O-RING	S2194	-----	1
8 *	INTERM O-RING	25152-258	-----	1	47	STUD	C0611	17000	6
9	MOTOR BUSHING	31173-017	23010	1	48	LOCKWASHER	J06	17000	6
10 *	LOWER BALL BEARING	23425-007	-----	1	49	HEX NUT	D06	17000	6
11	SNAP RING	S1831	-----	1	50	STRAINER	46611-001	2415V	1
12	NAME PLATE	2613CY	17020	1	51	FLAT WASHER	KB08	17000	1
13	DRIVE SCREW	BM#04-03	17000	6	52	HVY IMPELLER NUT	22561-145	-----	1
14	MOTOR HOUSING	38311-012	13040	1	53 *	IMPELLER KEY	N0302 1/2	17000	1
15	SHAFT SLEEVE	13878	17020	1	54	NYLOCK CAPSCREW	BT0806	15991	3
16 *	IMPELLER ADJ SHIM SET	2Y	17090	REF	NOT SHOWN:				
17 *	SPRING RETAINER	8793	17990	1		MOTOR PLATE	10436	17000	1
18	RETAINING RING	S362	-----	1		DRIVE SCREW	BM#04-03	17000	4
19	HOIST BAIL	31926-009	1503V	1		QT. SUB PUMP OIL	9568	-----	1
20	HEX NUT	D08	15991	1		CONTROL BOX ASSY	47631-117	-----	1
21	PIPE CAP	25381-003	-----	1		MOTOR VOLTAGE TAG	38816-381	-----	1
22	HVY PIPE NIPPLE	THA0608	15071	1		IMPELLER PULLER	10285	-----	1
23	STUD	C0806	15991	1		CABLE TIE	27111-212	-----	1
24	COUPLING NUT	31811-019	15031	1		INSTRUCTION TAG	6588-AC	-----	1
25	HEX NUT	D08	15991	1	OPTIONAL:				
26	STUD	C0809	15991	3	* REPAIR GASKET SET	11000S	-----		1
27	HEX NUT	D08	15991	3	STAGING ADAPTOR KIT	48272-003	-----		1
28	DISCHARGE FLANGE	38641-006	13040	1	-DISCHARGE FLANGE	38641-006	13040		1
29 *	DISCH FLANGE GASKET	38687-045	20000	1	-GASKET	38687-045	19370		1
30 *	RELIEF VALVE ASSY	46431-608	-----	1	316 SST IMPELLER	38618-702	17070		1
31	TERMINAL HOUSING AND CABLE ASSY	47367-041	-----	1	CD4MCU IMPELLER	38618-702	17180		1
32	STUD	C0506	15991	4	SST STRAINER	46611-006	24170		1
33	LOCKWASHER	J05	15991	4	* BEARING REPAIR KIT	48124-902	-----		1
34	HEX NUT	D05	15991	4	LIQUID LEVEL DEVICES:				
35	CONNECTOR	S1718	-----	3	DIAPHRAGM TYPE	GRP48-03 or GRP48-06	1		
36	HEAT SHRINK TUBE	31411-235	19450	3	FLOAT TYPE	27471-155	-----		1
37	SPRING WASHER	S1554	-----	1	24V LOW VOLT CONTROL 47631-502 ----- 1				
38 *	UPPER BALL BEARING	S1044	-----	1					
39	STATOR ASSY	47113-861	-----	1					

* INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO. AND UP

SECTION DRAWING

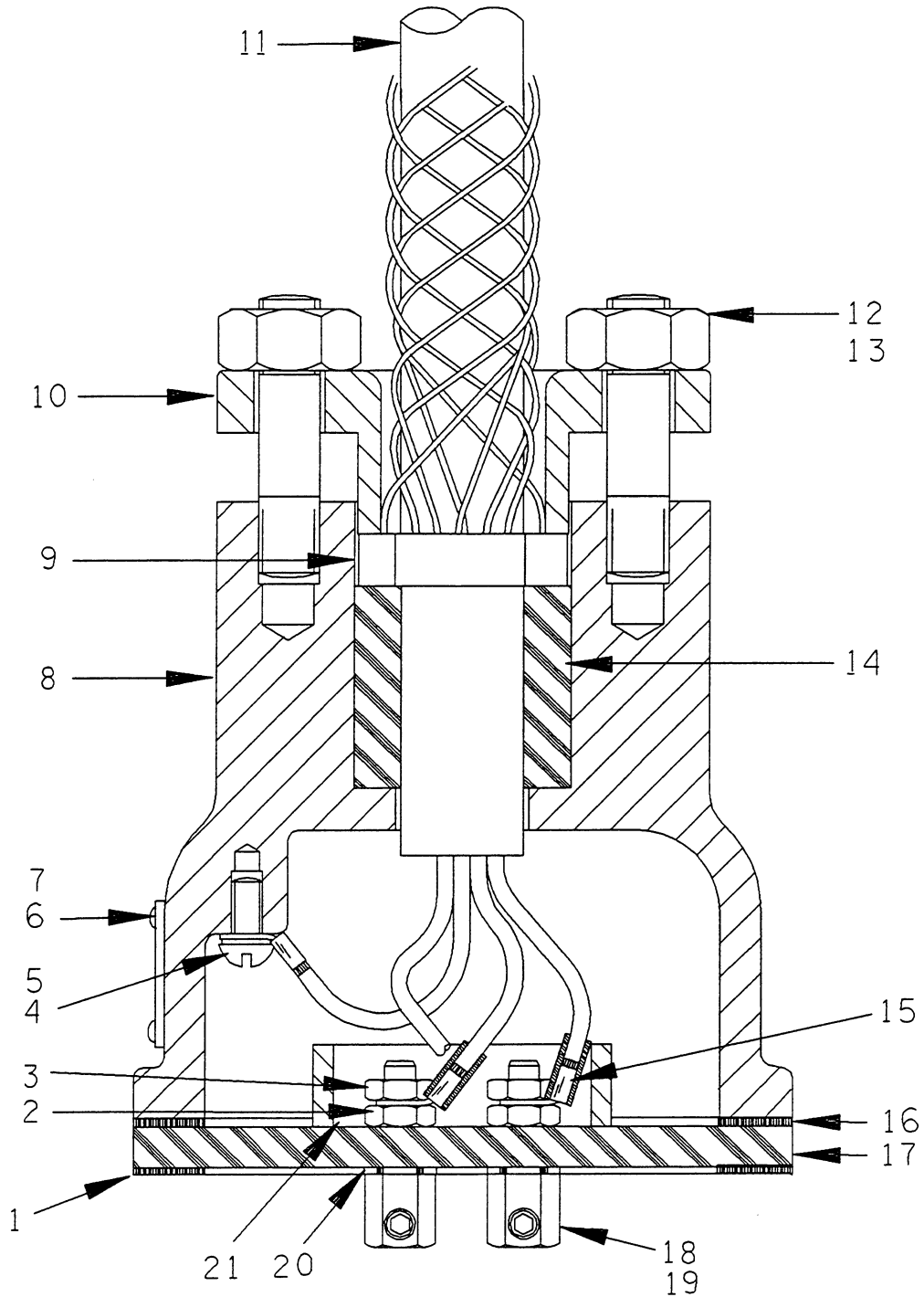


Figure 2. 47367-041 Terminal Housing And Cable Assembly

PARTS LIST
47367-041 Terminal Housing And Cable Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	* LOWER TERMINAL PLATE GASKET	10321G	20000	1
2	HEX NUT	D#10	14990	3
3	HEX NUT	D#10	14990	3
4	RD HD MACH SCREW	X#10-01 1/2	14990	1
5	T TYPE LOCKWASHER	AK#10	15991	1
6	INFORMATION PLATE	38816-047	17990	1
7	DRIVE SCREW	BM#04-03	17000	4
8	TERMINAL HOUSING	10757	13040	1
9	CABLE GRIP	11227B	-----	1
10	TERMINAL CAP	10756B	13040	1
11	CABLE ASSY	9166H	-----	1
12	STUD	C0606	15991	2
13	HEX NUT	D06	15991	2
14	* GLAND BUSHING	10758F	19100	1
15	HEAT SHRINK TUBE	31411-203	19530	3
16	* UPPER TERMINAL PLATE GASKET	10321G	20000	1
17	TERMINAL PLATE	10320A	23010	1
18	TERMINAL	11181	14100	3
19	ROUND HEAD NYLOCK MACHINE SCREW	XA#10-01-1/4S	14990	3
20	* DYNA SEAL WASHER	S1590	-----	3
21	SEALANT RESERVOIR	31143-090	19220	1
NOT SHOWN:				
	1 OZ. HOT MELT ADHESIVE STICK	18661-045	-----	2
OPTIONAL:				
	HEAT SHRINK TERM KIT	48315-008	-----	1

* INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all warnings in Section A.

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

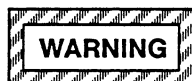
The following maintenance and repair instructions are keyed to the Pump Model sectional view (Figure 1) and the Terminal Housing sectional view (Figure 2), and the accompanying parts lists.

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



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 DAM-

AGE 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 determined 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 (50), raise the pump slightly, or lay it on its side and disengage the strainer hardware (54). Remove the strainer (50). If the impeller is clogged, the debris can usually be removed without further disassembly.

Draining Oil From Seal Cavity

(Figure 1)

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



LET THE PUMP COOL BEFORE REMOVING THE SEAL CAVITY DRAIN PLUG. PRESSURE BUILT UP WITHIN A HOT PUMP COULD CAUSE THE OIL TO SPRAY OUT WHEN THE PLUG IS REMOVED. REMOVE THE PLUG SLOWLY AND PERMIT PRESSURE TO VENT TO ATMOSPHERE.

Lay the pump on its side with the pipe plugs (44 and 45) facing up. Clean any dirt from around the plug. Remove the seal cavity drain plug (45), and install a short 1/4-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.

Draining Oil From Motor Cavity

(Figure 1)

If motor problems are suspected, remove the motor cavity drain plug (44), and install a short nipple in the hole. Tip the pump and drain the motor oil into a **clean** container. Inspect the oil for dark color which could indicate motor overheating, water or dirt 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)

After the strainer screen has been removed, remove the hardware (48 and 49) securing the suction head (1) to the motor housing (14). Remove the suction head. Remove and discard the suction head O-ring.

It is recommended that the pump be positioned upside-down during disassembly. To hold the pump in the inverted position, screw a pipe in the discharge elbow (28) and clamp it in a large vise. If the discharge flange has been removed, the pump may also be secured by the discharge studs (26) to a bench or work table. Be careful not to damage the terminal housing or cable while in this position. Use adequate equipment and personnel to safely handle the pump until it is secured. If inverting the pump is not practical, lay the pump on its side and secure it to prevent rolling.

Impeller Removal

(Figure 1)

Wedge a piece of wood between the vanes of the impeller (2) and the motor housing studs (47) to prevent shaft rotation.

Remove the impeller nut (52) and flat washer(51).

Remove the piece of wood from between the vanes of the impeller. Install the impeller puller supplied with the pump, and pull the impeller from the shaft. Use caution when removing the impeller from the shaft, tension on the seal spring will be released. Retain the impeller key (53).

Remove the impeller shim set (16). For ease of reassembly, tie and tag the shims or measure and record their thickness.

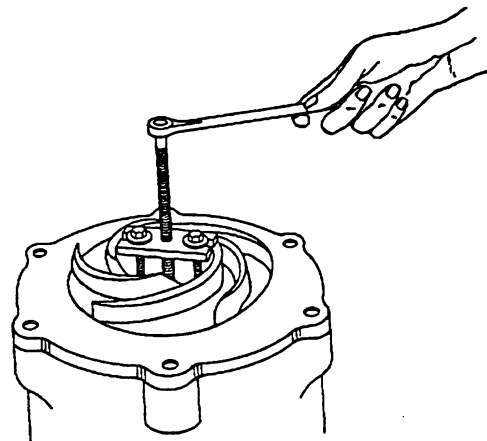


Figure 3. Removing Impeller With Puller

Lower Seal Removal

(Figures 1 and 4)

Carefully remove the spring retainer (17) and spring. Remove the shaft sleeve (15) and work oil under the bellows assembly. Use a stiff wire with a hooked end to pull the rotating portion of the seal from the shaft.

To remove the stationary portion of the seal, remove the flat head machine screws (7) and pull the seal plate (5) off the rotor shaft. Remove and discard the seal plate O-ring (46). Place a **clean** cloth on a flat surface to protect the seal face of the stationary element, and place the seal plate on the cloth with the impeller side down. Use a drift pin or screwdriver to

press on alternate sides of the stationary seat until the stationary element, seat, and O-rings are removed.

Upper Seal Removal

(Figures 1 and 4)

Unless cracked or otherwise worn, it is not necessary to remove the intermediate (43) for access to the upper seal assembly (4).

Remove the seal retaining ring (18) with snap ring pliers. Use caution when removing the snap ring; tension of the seal spring will be released. Remove the seal spring retainer and spring. Lubricate the rotor shaft adjacent to the seal and work oil under the bellows. Use a stiff wire with a hooked end to pull the rotating portion of the seal from the shaft.

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

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

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 end components at this time.*

PUMP END REASSEMBLY

NOTE

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

Cleaning And Inspection Of Pump Parts

(Figure 1)

With the pump inverted, stuff a clean tissue into the stationary seal seat bore of the intermediate (43) or wrap a small rag around the shaft to prevent foreign material from entering the motor cavity.

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

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



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Inspect the rotor shaft for damaged threads, scoring, or nicks. Remove nicks and burrs with a fine file or hand honing stone 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 not be reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

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

plete seal; **never mix old and new seal parts.**

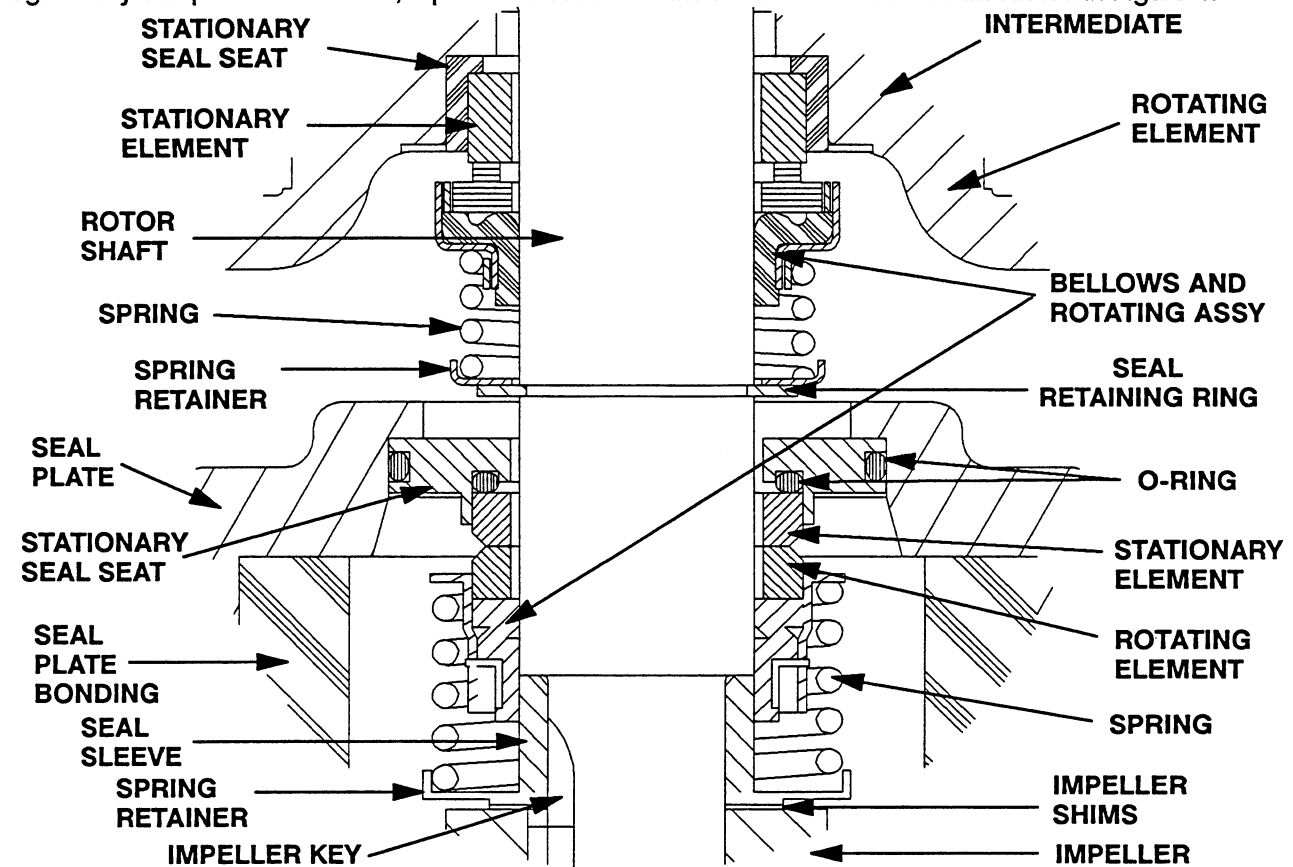
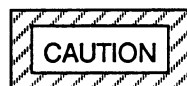


Figure 4. Seal Assemblies 25277-345 And S1832



THIS SEAL IS NOT DESIGNED FOR OPERATION AT TEMPERATURES ABOVE 122° F (50° C). DO NOT USE AT HIGHER OPERATING TEMPERATURES.

Upper Seal Reassembly

(Figures 1 and 4)

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

Clean the rotor shaft and seal cavity area of the intermediate (43). Be sure the area is dry and free of lint and dirt. Check the seal bore for burrs or nicks that might prevent a good seal. Apply a **light** coating of oil to the bore.

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.

Lightly lubricate the O.D. of the stationary seat, and subassemble the stationary element in the seat. Position this subassembly in the intermediate bore with the sealing face up and cover the seal face with a clean tissue. Use your thumbs to press the assembly into the bore. Apply equal pressure on opposite sides until the subassembly 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. Because the rotating element may not stay in the bellows retainer when turned upside down, place a **small** amount of grease at equal spaces on the back of the element and position it in the bellows retainer. The grease should hold the ele-

ment in position until the seal is installed. Assemble the drive grooves of the rotating element into the drive lugs of the bellows retainer.

Slide the seal rotating portion onto the lubricated shaft with the seal face down. Apply firm, steady pressure on the seal retainer until it slides down the shaft and the seal faces contact.

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.

Slide the seal spring over the shaft and bellows retainer, and install the spring retainer. Compress the spring and install the seal retaining ring (17). See Figure 4 for proper order of seal assembly.

Lower Seal Reassembly

(Figures 1 and 4)

Clean and inspect the seal plate (5) for cracks, distortion or erosion and replace if defective. Lightly oil the O-ring (46), and install it on the seal plate. Lay the seal plate on a clean, flat surface with the impeller side facing up.

Unpack the stationary seat, and check that the O-rings are properly installed (see Figure 4). Apply a light coating of oil to the outer O-ring O.D.. Keep the sealing face dry.

Subassemble the stationary element in the stationary seat. Position the subassembly in the seal plate bore, and cover it with a clean tissue. Use your thumbs to press the seat into the bore. Apply equal pressure on opposite sides of the seat until it 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.

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 com-

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

Position the seal plate and stationary subassembly on the rotor shaft so that the seal plate seats against the motor housing (14), and secure with the flat head machine screws (7).

Clean and inspect the shaft sleeve (15) and replace it if there are nicks or cuts on either end. Lightly oil the sleeve and install it on the shaft with the chamfered end toward the shaft shoulder

Unpack the rotating portion of the seal. Be certain the seal face of the rotating element is free of grit or surface damage. Because the rotating element may not stay in the bellows retainer when turned upside down, place a small amount of grease at equal spaces on the back of the element and position it in the bellows retainer. The grease should hold the element in position until the seal is installed. Assemble the drive grooves of the rotating element into the drive lugs of the bellows retainer.

Slide the seal rotating portion onto the lubricated shaft sleeve with the seal face toward the stepped end. Apply firm, steady pressure on the seal retainer until it slides down the sleeve and the seal faces contact.

Install the seal spring over the shaft and bellows retainer, and install the spring retainer (17).

Impeller Installation

(Figure 1)

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

Install the same thickness of impeller adjusting shims (16) as previously removed. Install the impeller key (53) in the rotor shaft keyway, align the impeller keyway, and push the impeller onto the shaft until it seats firmly against the adjusting shims.

NOTE

The clearance between the face of the impeller and the suction head can only be measured after the impeller and suction head are fully installed.

Coat the threads of the rotor shaft with 'Loctite Threadlocker No. 242' or equivalent compound. Install the impeller washer (51) and nut (52). Wedge a block of wood between the impeller vanes and the motor housing studs to prevent shaft rotation, and torque the impeller nut to 60 ft. lbs. (720 in. lbs., 8,3 m. kg.).

Remove the block of wood and turn the impeller to check for free rotation. Check front clearance after installing the suction head (1).

NOTE

After the impeller has been properly positioned, check for free rotation. Correct any scraping or binding before further reassembly.

Suction Head Installation

(Figure 1)

Inspect and thoroughly clean the suction head (1) and its O-ring surface. Lubricate and install the O-ring (6).

Install the suction head over the motor housing studs (47). Apply 'Never-Seez' or equivalent compound to the threads of the studs. Install the hardware (48 and 49) and torque the nuts (49) to 20 ft. lbs. (240 in. lbs., 2,8 m. kg.).

Impeller Clearance

(Figure 1)

There should be a clearance of .008 to .015 inches (0,2 to 0,38 mm) between the suction head and the face of the impeller. Reach into the suction head with a feeler gauge to measure this clearance.

If the impeller clearance is not within specified limits, remove the suction head and the impeller, then add or remove impeller adjusting shims (16) as required. Reinstall the impeller and suction head, and recheck clearance.

Strainer Installation

(Figure 1)

Inspect the strainer (50) for cracks, distortion or erosion, and replace if defective.

Install the strainer squarely against the shoulder of the suction head. Align the holes for the capscrews (54) in the strainer with those in the suction head (7) and secure with the nylock capscrews (54).

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.



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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 1)

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 cable may be serviced without disassembling the motor housing or pump end.

Secure the pump in an upright position. To remove the terminal housing, disengage the hardware (33 and 34) securing the terminal housing assembly (31) to the motor housing (14).

(Figure 2)

Carefully raise the terminal housing from the motor housing until the terminal posts (18) are accessible. Loosen the allen head setscrews (19), and disconnect the motor leads from the terminal posts. Separate the terminal housing (8) and power cable assembly (11) from the motor housing. Remove the lower terminal housing gasket (1).

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

To separate the power cable (11) from the terminal housing, remove the nuts (13) securing the terminal cap (10) to the terminal housing. Slide the cap back along the power cable.

Compress the wire mesh of the cable grip (9) and move it back along the power cable. Oil the gland bushing (14) and terminal housing bore, and push firmly on the cable. (Allow the oil to leak in around the bushing by agitating the cable in the bore.) After the bushing has been loosened, it should be possible to pull the cable out far enough to expose the gland bushing. Apply oil on the cable jacket and slide the bushing back along the cable. Pressure exerted on the bushing may deform the cable jacket. If this occurs, additional oil and effort will be required to remove the bushing.

NOTE

Sometimes pressure exerted on the gland bushing (6) will deform the power cable jacket. If this occurs,

additional oil and effort will usually free the power cable. If the cable cannot be separated from the gland bushing, it may be necessary to cut the bushing into small pieces or cut the cable.

Push approximately 6 inches (152,4 mm) of power cable into the terminal housing so that the terminal plate (17) comes free of the terminal housing. This should permit access to the power cable connections in the terminal plate.

To disconnect the power cable, remove the hardware (4 and 5) securing the ground lead. Reinstall the hardware.

When shipped from the factory, the connections between the power cable leads and the terminal posts (18) were encapsulated in heat-shrink tubing (15) and bonded to the terminal plate with hot-melt adhesive. (In service, the heat-shrink tubing may have been replaced by potting compound during previous repair.) Cut away the tubing and adhesive (or potting) and remove the upper hex nut (3). Disconnect the power cable leads from the terminal posts, and separate the terminal plate (17) from the terminal housing (8).

Pull the power cable out of the terminal housing. The gland bushing (14), cable grip (9) and terminal cap (10) can now be removed from the cable.

It is not necessary to remove the heat-shrink tubing from the power cable leads unless the terminals require replacement. If replacement is required, carefully cut the tubing from around the leads and terminals.

If it is necessary to replace the terminal plate (17) or terminal components, unscrew the hex nuts (2), and remove the terminal posts and dyna seal washers (20). Remove and discard the upper terminal plate gasket (16).

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

Rotor Removal

(Figure 1)

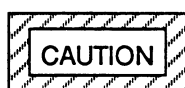
See **PUMP END DISASSEMBLY**, and remove all pump end and seal components.

With the pump end disassembled and the motor cavity drained, grasp the threaded end of the rotor

shaft (40) and pull the shaft and assembled intermediate (43), rotor, and ball bearings (10 and 38) out of the motor housing (14). (Use caution to prevent the rotor (40) from falling on the stator windings.) If necessary, screw on the impeller locknut and use a commercial slide hammer puller to remove the assembly. Remove the intermediate, motor bushing (9), and discard the intermediate O-ring (8).

Reach into the motor housing and remove the spring washer (37) from the upper bearing bore.

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



TO PREVENT DAMAGE DURING REMOVAL FROM THE SHAFT, IT IS RECOMMENDED THAT BEARINGS BE CLEANED AND INSPECTED **IN PLACE**. IT IS **STRONGLY** RECOMMENDED THAT THE BEARINGS BE REPLACED **ANY TIME** THE SHAFT AND ROTOR ASSEMBLY IS REMOVED.

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



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

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

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

It is not necessary to remove the snap ring (11) unless replacement is required. Use snap ring pliers to remove the ring.

Stator Removal

(Figure 1)

Do not remove the stator (39) 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**.

Remove the pipe plug (42) located in the motor housing, and loosen the allen head setscrew (41) located underneath the pipe plug.

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.

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

Relief Valve

(Figure 1)

It is recommended that the relief valve assembly (30) be replaced at each overhaul, or at any time the pump motor overheats and activates the valve. Never replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

When installing the relief valve, use 'Loctite Pipe Sealant With Teflon No. 592' or equivalent compound on the threads.

Hoisting Bail

(Figure 1)

If the hoisting bail (19) requires replacement, loosen the jam nut (25) and coupling nut (24) securing the bail to the stud. Loosen the jam nut (20) and unscrew the bail from the motor housing.

MOTOR REASSEMBLY



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

Stator Installation

(Figure 1)

NOTE

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

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



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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.

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

Heat the motor housing (14) with a torch to expand it enough for the stator (39) 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 ter-

minal opening. Carefully lower the stator into the motor housing until fully seated against the housing shoulder. Be careful not to damage the stator lead insulation during reassembly. If the stator "cocks" in the motor housing, remove it and try again.

After the stator is fully and squarely seated on the upper motor housing shoulder, remove the expandable disc tool. Use 'Never-Seez' on the threads of the allen head setscrew (41) and secure the stator in place by torquing the setscrew to 20 ft. lbs. (1240 in. lbs. or 2,77 m. kg.).

Coat the threads of the pipe plug (42) with 'Loctite Pipe Sealant With Teflon No. 592' or equivalent sealant, and install the plug over the allen head setscrew. Untape or remove the protective sleeve from the stator leads.

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

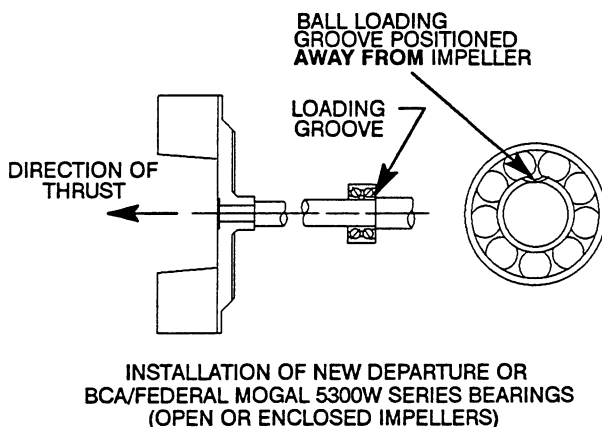
Shaft And Rotor Installation

(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).



TO PREVENT DAMAGE DURING REMOVAL FROM THE SHAFT, IT IS RECOMMENDED THAT BEAR-



INGS BE CLEANED AND INSPECTED IN PLACE. IT IS **STRONGLY RECOMMENDED** THAT THE BEARINGS BE REPLACED ANY TIME THE SHAFT AND ROTOR ASSEMBLY IS REMOVED.

If removed install the snap ring (11) in the groove on the shaft.

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

NOTE

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

Heat the bearings to a uniform temperature **no higher than 250°F (120°C)**. Slide the upper bearing (38) onto the shaft until it is fully seated against the shaft shoulder. This should be done quickly, in one continuous motion, to prevent the bearing from cooling and sticking on the shaft.



USE CAUTION WHEN HANDLING HOT BEARINGS TO PREVENT BURNS.

NOTE

Position the lower bearing (10) on the shaft as indicated by the following illustrations.

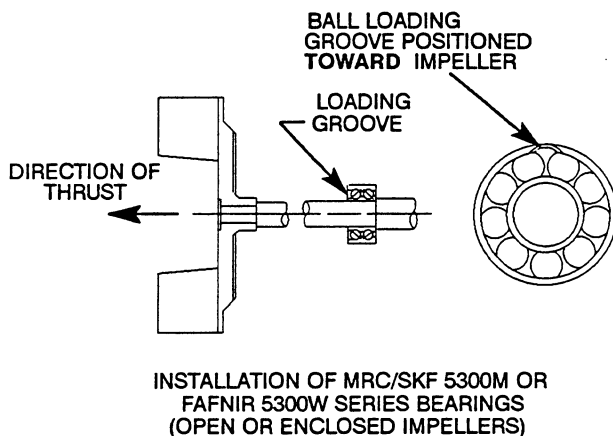


Figure 5. Bearing Installation

After the bearings have been installed and allowed to cool, check to ensure that they have not moved out of position in shrinking. If movement has occurred, use a suitable sized sleeve and a press to reposition the bearings.

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.



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 bore, and all gasket and O-ring surfaces of the intermediate (43) and the motor housing (14), completely removing any old gasket and cement material. Inspect the sealing surfaces for burrs, nicks and pits which could cause a poor seal. Repair or replace as require.



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.

Install the spring washer (37) in the motor housing bore.

Carefully ease the rotor and assembled bearings through the stator until the upper bearing (38) is firmly seated in the motor housing bearing bore.

Position the motor bushing (9) in the motor housing so one of the two drain holes is aligned with the motor cavity drain plug (44). Install the intermediate O-ring (8) and lubricate the I.D. of the intermediate bearing bore.

Position the bearing bore of the intermediate (43) over the lower ball bearing (10) and press the intermediate over the bearing until it seats squarely on

the motor bushing and the shoulder of the motor housing. Use caution not to cut the O-ring (8).

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

Terminal Housing And Power Cable Reassembly And Installation

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



NEVER ATTEMPT TO ALTER THE LENGTH OR REPAIR ANY POWER CABLE WITH A SPLICE. THE PUMP MOTOR AND CABLE MUST BE COMPLETELY WATERPROOF. INJURY OR DEATH MAY RESULT FROM ALTERATIONS.

Use oil to lightly lubricate the outside of the pump power cable (11), upper bore of the terminal housing (8), the rubber gland bushing (14), and the bores of the terminal cap (10) and cable grip (9) for ease of

assembly. Slide the terminal cap, cable grip, gland bushing and terminal housing onto the power cable in that order (see Figure 2 to recheck order of assembly).

Work the cable components up the cable, allowing approximately 3 ft. (0,9 m) of cable to extend below the terminal housing. Temporarily tape the green ground wires to the cable.

Sealing Terminal Housing Connections With Hot-Melt Adhesive

(Figure 2)



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 terminals (18) were encapsulated in heat-shrink tubing (15), and bonded to the terminal plate (17) 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 terminals, terminal posts, and ter-

minal plate. 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 power cable (11) and temporarily secure it with the cable grip (9). Slide the sealant reservoir (21) up over the cable.

Assemble the terminal posts (18), dyna seal washers (20), and terminal nuts (2) to the terminal plate as shown in Figure 2. Install the upper terminal plate gasket (16) and sealant reservoir (21).

NOTE

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

If the terminal ends were removed for replacement, crimp a new terminal on each power cable lead. Slide a length of heat-shrink tubing (15) up over each of the power cable leads. The tubing must cover the crimped part of the terminals 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.

After the tubing has shrunk and set, position the upper terminal plate gasket (16) on the terminal plate (17). Secure the power cable leads to the terminal (18) with the upper nuts (3).

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, hold the terminal

plate horizontally and slide the sealant reservoir down onto the plate. Center the ring around the terminals, then 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 fill the reservoir to **completely** insulate electrical connections. Allow the adhesive to cool before securing the terminal housing to the motor housing.



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

Trim the potting mold so it is just long enough to cover the terminal post studs (or use the adhesive reser-

voir. Slide the potting mold up over the leads of the power cable and control cable.

Position the upper terminal plate gasket (16) on top of the terminal plate (17), and secure each cable lead as described in the previous section. Slide the potting mold down over the terminal posts and onto 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.



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 Reassembly

(Figure 2)

After the heat-shrink tubing has been installed, untape the ground leads, and slide the upper terminal plate gasket (16) and terminal housing (8) down the cable. Secure the green ground lead to the ground terminal with the hardware (4 and 5). **Be sure** the lead makes good contact with the housing.

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

Lubricate the upper bore of the terminal housing, and slide the gland bushing (14) into place. Compress the wire mesh of the cable grip (9), and slide it down the cable, making sure it contacts the bushing. Slide the terminal cap (10) into place and engage the nuts (13) finger tight. Do not fully tighten the nuts at this time.

Position the lower gasket (1) against the terminal plate, then attach the motor leads to the terminal posts (18) using the nylock machine screws (19).

NOTE

A small amount of gasket adhesive may be used to hold the upper and lower terminal plate gaskets in place to ease assembly.

If required, rotate the terminal housing and twist the motor leads to remove excess slack. Coat the threads of the motor housing studs (32, Figure 1) with 'Never-Seez' or equivalent, and secure the terminal housing assembly to the motor housing with the hardware (33 and 34, Figure 1); torque the nuts to 11 ft. lbs. (132 in. lbs. or 1,5 m. kg.).

Tighten the nuts (13), drawing the terminal cap down into the terminal bore. **Do not** overtighten and damage the terminal gland or hardware.

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

FINAL ASSEMBLY

(Figure 1)

If the discharge flange (28) was removed from the motor housing, replace the discharge flange gasket (29). Apply 'Never-Seez' or equivalent compound on the flange studs (26), and secure the flange with the nuts (27).

If the hoisting bail (19) was removed, screw the bail into motor housing and tighten the jam nut (20).

Tighten the jam nut (25) and coupling nut (24) securing the bail to the stud (23).

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, lay the pump on its side with the seal cavity plug (45) up. Remove the seal cavity plug, and screw a short 1/4-inch NPT nipple into the hole. Plug the open end of the nipple with your finger. Tip the pump upright, drain off a small amount of oil into a transparent cup, and lay the pump on its side again. If the oil level is abnormally low, or the color milky or dark, refer to **Draining Oil From Seal Cavity** in this section for instructions and troubleshooting tips. If the oil is clear, remove the nipple and top off the seal cavity with oil. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plug, before reinstalling the plug.

When lubricating a dry (overhauled) pump, add approximately 16 ounces (0,5 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

Remove the pipe cap (21) and add the recommended grade of lubricant, approximately 3 quarts (2,8 liters), to the motor cavity. **Maintain the oil at this level.** Apply 'Loctite Pipe Sealant With Teflon

No. 592' or equivalent sealant to the threads of the heavy pipe nipple (22). Reinstall and tighten the cap. If the heavy pipe nipple was removed, coat the threads with 'Loctite Retaining Compound No. 680 or No. 620' or equivalent compound and reinstall it in the motor housing.

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