



# **S SERIES PUMPS**

## **S8D**

**All Materials And Voltages**

**MANUAL**  
**PART 3 of 3**

**MAINTENANCE**  
**AND**  
**REPAIR**  
**WITH**  
**TROUBLESHOOTING**

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**RECORD YOUR PUMP MODEL AND SERIAL NUMBER**

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

Pump Model: \_\_\_\_\_  
Serial Number: \_\_\_\_\_

## INTRODUCTION

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

A set of three manuals accompanies your pump. The Installation/Operation Manual contains essential information on installing and operating the pump, and on making electrical connections. The Parts List Manual provides a performance curve, a pump model cross-section drawing, and parts list for your pump.

This Maintenance and Repair Manual provides troubleshooting and maintenance instructions required to properly diagnose operational problems, and to service the pump components. Pump motor maintenance may be performed **only** by a Gorman-Rupp authorized Submersible repair facility, or the factory. Otherwise, the pump warranty will be negated, and damage to the pump, and injury or death to personnel can result. Contact the factory for the authorized repair facility closest to you.

As described on the following page, this manual will alert personnel to known procedures which re-

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

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

**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**

## CONTENTS

### SAFETY – SECTION A

#### TROUBLESHOOTING – SECTION B

ELECTRICAL TESTING .....	PAGE B – 3
Test Equipment .....	PAGE B – 3
Voltage Imbalance .....	PAGE B – 3
Motor and Power Cable Continuity .....	PAGE B – 4
Insulation Resistance .....	PAGE B – 4

#### PUMP MAINTENANCE AND REPAIR – SECTION C

GENERAL INFORMATION .....	PAGE C – 1
Lifting .....	PAGE C – 1
TYPICAL PUMP ASSEMBLY .....	PAGE C – 2
PUMP ASSEMBLY PARTS IDENTIFICATION LIST .....	PAGE C – 3
TERMINAL HOUSING AND CABLE ASSEMBLY .....	PAGE C – 4
TERMINAL HOUSING AND CABLE ASSEMBLY PARTS IDENTIFICATION LIST .....	PAGE C – 5
PUMP END DISASSEMBLY .....	PAGE C – 6
PUMP END REASSEMBLY .....	PAGE C – 9
MOTOR DISASSEMBLY .....	PAGE C – 14
MOTOR REASSEMBLY .....	PAGE C – 17
FINAL ASSEMBLY .....	PAGE C – 23
VACUUM TESTING .....	PAGE C – 24
LUBRICATION .....	PAGE C – 25

**RECORDING MODEL AND SERIAL NUMBERS**

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

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

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

Voltage: \_\_\_\_\_

Phase: \_\_\_\_\_

**WARRANTY INFORMATION**

The warranty provided with your pump is part of Gorman-Rupp’s support program for customers

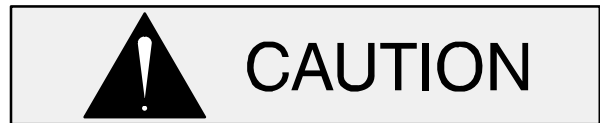
who operate and maintain their equipment as described in this and the other accompanying literature. The integral electric motor must be operated through the control furnished with the pump as standard equipment. Please note that should the equipment be abused or modified to change its performance beyond the original factory specifications, the warranty will become void and any claim will be denied.

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

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



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



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



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

**NOTE**

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

## SAFETY – SECTION A

The following information applies throughout this manual to Gorman-Rupp S Series submersible motor driven pumps.

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

This manual contains essential information on troubleshooting and maintaining the pump. In addition to this manual, see the separate literature covering installation and operation, pump parts, and any optional equipment shipped with the pump.



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 completely cool if overheated.

4. Close the discharge valve (if used).



This pump is not designed to pump volatile, explosive, or flammable materials. Do not attempt to pump any liquids for which 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.



Before connecting any cable to the control box, be sure to ground the control box. Refer to the Control Box manual for the suggested grounding methods.



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



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 substitu-

tion of electrical parts not supplied or approved by the manufacturer, can result in severe injury or death and void warranty.



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



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 the 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.

## TROUBLESHOOTING – SECTION B

Review all SAFETY information in Section A.



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

1. Familiarize yourself with this manual and with all other literature shipped with the pump.
2. Lock out incoming power to the pump or control box to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates or plugs.
5. Close the discharge valve (if used).



The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to troubleshoot, test and/or service the electrical components of this pump.

### NOTE

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

Table 1. Trouble Shooting Chart

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO START, OVERLOAD UNIT NOT TRIPPED (MANUAL MODE)	Power source incompatible with control box.	Correct power source.
	No voltage at line side of circuit breaker.	Check power source for blown fuse, open overload unit, broken lead, or loose connection.
(AUTOMATIC MODE)	Open circuit in motor windings or power cable.	Check continuity.
	Defective motor power cable.	Replace cable.
	Motor defective.	Check for and replace defective unit.
	Liquid level device or control circuits improperly connected to main control box.	Check wiring diagrams; correct or tighten connections.
	Level sensing device(s) improperly positioned.	Position device(s) at proper level.
	Level sensing device(s) fouled with mud or foreign material.	Clean sensing device(s).

Table 1. Trouble Shooting Chart (cont.)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
<b>(AUTOMATIC MODE) (CONT'D.)</b>	Float type sensing device(s) tangled or obstructed.	Check installation for free movement of float.
	Defective liquid level sensing device(s) or control panel.	Repair or replace defective unit(s).
<b>OVERLOAD UNIT TRIPS</b>	Low or high voltage, or excessive voltage drop between pump and control box.	Measure voltage at control box. Check that wiring is correct type, size, and length. (See <b>Field Wiring Connections</b> , Section B).
	Defective insulation in motor windings or power cable; defective windings.	Check insulation resistance; check continuity.
	Impeller jammed due to debris or insufficient clearance.	Disassemble pump and check impeller.
	Bearing(s) frozen.	Disassemble pump and check bearing(s).
<b>MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE</b>	Discharge head too high.	Reduce discharge head, or install staging adaptor and additional pump.
	Low or incorrect voltage.	Measure control box voltage, both when pump is running and when shut-off.
	Discharge throttling valve partially closed; check valve is installed improperly.	Open discharge valve fully; check piping installation.
	Discharge line clogged or restricted; hose kinked.	Check discharge lines; straighten hose.
	Liquid being pumped too thick.	Dilute liquid by heating if possible.
	Strainer screen or impeller clogged.	Clear clog(s). Stop pump; back flow may flush away debris.
	Insufficient liquid in sump or tank.	Stop pump until liquid level rises.
	Worn impeller vanes; excessive impeller clearance.	Check impeller and clearance. See <b>PUMP END DISASSEMBLY</b> .
Pump running backwards.	Check direction of rotation and correct by interchanging any two motor leads at control box. (See <b>Pump Rotation</b> , Section C).	



Table 1. Trouble Shooting Chart (cont.)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
<b>PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION</b>	Pumping entrained air.	Check liquid level in sump; check position of pump and liquid level sensing device(s).
	Damaged or unbalanced impeller.	Replace impeller.
	Discharge piping not properly supported.	Check piping installation.
	Impeller jammed or loose.	Check impeller.
	Motor shaft or bearings defective.	Disassemble pump and check motor and bearings.
	Pump cavitation.	Reduce discharge head, or restrict flow on low head applications.

**ELECTRICAL TESTING**

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

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

**WARNING!**

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

**CAUTION**

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

**Test Equipment**

A volt/amp/ohmmeter and 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.

**Voltage Imbalance**

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

- a. Use a voltmeter, amprobe, or equivalent meter to read the voltage across terminals 1 & 2, 2 & 3, and 1 & 3 in the control box. All three measured voltages must be the same, as accurately as the meter will read. If possible, measure the voltage with the pump off, with the pump running but out of the water, and with the pump running in the water at full load. All the measured voltages at each condition must be the same.
- b. Use an amprobe or equivalent meter to measure the current draw of each phase while the pump is running at full load and at no load. All three amperage readings must

be the same at each condition, as accurately as the meter will read. Nominal amperage values are listed in Table 1, but these apply only when the actual voltage at the site is the nominal voltage listed.

- c. If the voltages are balanced with the pump off, but are unbalanced when the pump is running, a thorough check of the power source, all interconnecting cables, and the pump motor is required to isolate the defect.

### Motor And Motor Power Cable Continuity

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

- a. Disconnect the motor power cable leads from the control box and connect the test leads to any two of the three power cable leads (not to the green ground lead or yellow ground check lead). If there is a high resistance reading on the ohmmeter, there is an open or broken circuit caused by a break in the power cable or motor windings, or by a bad connection between the motor and the power cable. Switch one test lead to the third power lead, and test again.
- b. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **MAINTENANCE AND REPAIR**). If there is no apparent damage to the motor cable, remove the terminal housing (see **MAINTENANCE AND REPAIR**) and check the continuity of each power cable lead at the terminal posts.

#### NOTE

*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 re-*

*place 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 ( $\infty$ ), the insulation is in good condition. If the reading is between infinity ( $\infty$ ) and 1 megohm, the insulation is acceptable but should be rechecked periodically. If the reading is less than 1 megohm, the insulation should be checked more closely; a reading of zero indicates that the power cable or the motor is grounded.
- 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 C

### GENERAL INFORMATION

Review all SAFETY information in Section A.

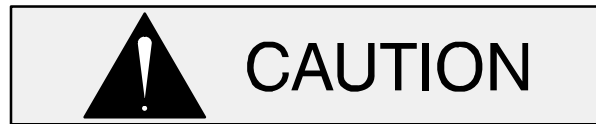


**Do not attempt to service the pump assembly unless all power to the motor has been shut off at the control box; otherwise, injury or death could result.**

**Use a lifting device with sufficient capacity. If slings or chains are used to move the pump or components, make sure that the load is balanced; otherwise serious personal injury or death could result.**

The maintenance and repair instructions in this manual are keyed to the sectional views, Figures C-1 and C-2, and the corresponding parts identification lists. Refer to the separate Parts List Manual for replacement parts.

Select a suitable location, preferably indoors, to perform required maintenance. All work must be performed by qualified personnel.



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

This Maintenance and Repair Manual provides troubleshooting and maintenance instructions required to properly diagnose operational problems, and to service the pump components. Pump motor maintenance may be performed **only** by a Gorman-Rupp authorized Submersible repair facility, or the factory. Otherwise, the pump warranty will be negated, and damage to the pump, and injury or death to personnel can result. Contact the factory for the authorized repair facility closest to you.

Check **TROUBLESHOOTING**, Section B to determine causes and remedies of pump problems. Disassemble the pump only as far as required.

#### Lifting

Use lifting equipment with a capacity of **at least five times the weight of the pump**, including the weight of any options or customer-installed accessories. Contact the factory or refer to the pump Specification Data Sheet for the weight of your pump. Discharge hose or piping **must** be removed before attempting to lift the pump.

SECTION DRAWING

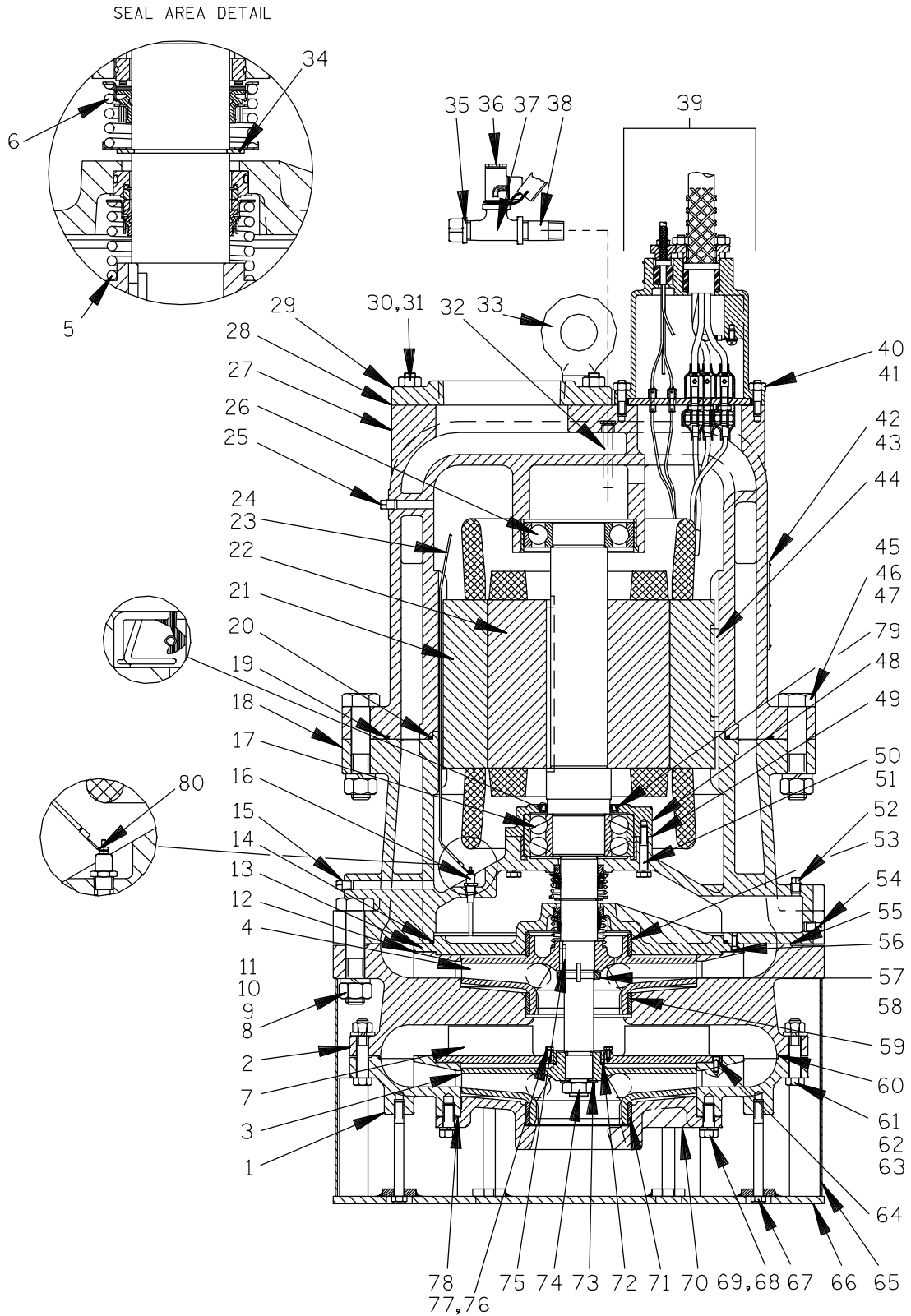


Figure C-1. Typical S8D Series Pump Assembly

### Typical S8D Series Pump Assembly Parts Identification List

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME	ITEM NO.	PART NAME
1	1ST STAGE DIFFUSER	41	DEFORM HEX NUT
2	2ND STAGE DIFFUSER	42	NAME PLATE
3	1ST STAGE IMPELLER	43	DRIVE SCREW
4	2ND STAGE IMPELLER	44	KEY
5	LOWER SEAL ASSEMBLY	45	HEX HEAD CAPSCREW
6	UPPER SEAL ASSEMBLY	46	LOCKWASHER
7	VANE PLATE	47	HEX NUT
8	HEX HEAD CAPSCREW	48	BEARING CAP
9	STUD	49	BEARING CAP GASKET
10	LOCKWASHER	50	HEX HEAD CAPSCREW
11	HEX NUT	51	LOCKWASHER
12	DIFFUSER GASKET	52	PIPE PLUG
13	SEAL PLATE	53	WEAR RING
14	SEAL PLATE O-RING	54	PIPE PLUG
15	PIPE PLUG	55	INTERMEDIATE GASKET
16	MOISTURE DETECTOR	56	SOCKET HEAD CAPSCREW
17	LOWER BALL BEARING	57	LOCK NUT
18	INTERMEDIATE	58	LOCKWASHER
19	MOTOR HOUSING O-RING	59	WEAR RING
20	MOTOR HOUSING O-RING	60	DIFFUSER GASKET
21	STATOR	61	HEX HEAD CAPSCREW
22	ROTOR/SHAFT ASSEMBLY	62	LOCKWASHER
23	MOISTURE PROBE WIRE	63	HEX NUT
24	TERMINAL	64	SOCKET HEAD CAPSCREW
25	PIPE PLUG	65	STRAINER SCREEN
26	UPPER BALL BEARING	66	BASE ASSEMBLY
27	MOTOR HOUSING	67	HEX HEAD CAPSCREW
28	FLANGE GASKET	68	HEX HEAD CAPSCREW
29	DISCHARGE FLANGE	69	LOCKWASHER
30	STUD	70	SUCTION HEAD
31	HEX NUT	71	WEAR RING
32	FILL TUBE ASSEMBLY	72	WEAR RING
33	EYE BOLT	73	IMPELLER WASHER
34	RETAINING RING	74	IMPELLER NUT
35	PIPE CAP	75	IMPELLER KEY
36	PRESSURE RELIEF VALVE	76	HEX HEAD CAPSCREW
37	STREET TEE ASSEMBLY	77	LOCKWASHER
38	HEAVY PIPE NIPPLE	78	SUCTION HEAD GASKET
39	TERMINAL HOUSING AND CABLE ASSEMBLY	79	OIL SEAL
40	STUD	80	MALE TAB

SECTION DRAWING

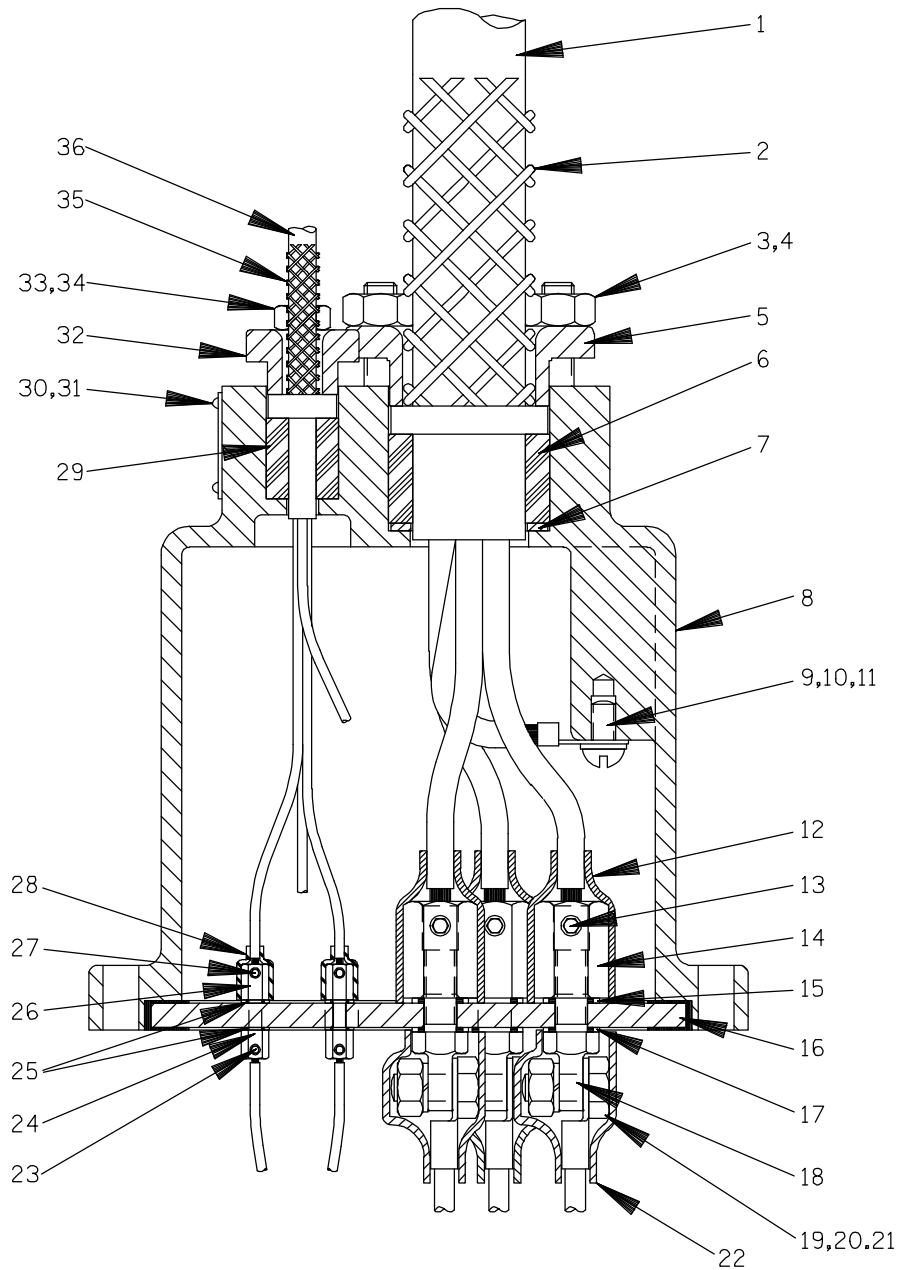


Figure C-2. Terminal Housing And Cable Assembly

## Terminal Housing And Cable Assembly Parts Identification List

Refer to the separate Parts List Manual for serviceable parts, part numbers and quantities.

ITEM NO.	PART NAME
1	#2/0 POWER CABLE – 50 FT.
2	CABLE GRIP
3	STUD
4	HEX NUT
5	TERMINAL GLAND
6	GLAND BUSHING
7	TERMINAL WASHER
8	TERMINAL HOUSING
9	#2/0 WIRE TERMINAL
10	ROUND HEAD MACHINE SCREW
11	T-TYPE LOCKWASHER
12	HEAT-SHRINK TUBE
13	ALLEN HEAD SETSCREW
14	TERMINAL COLLAR
15	DYNA-SEAL WASHER
16	TERMINAL PLATE ASSEMBLY
17	DYNA-SEAL WASHER
18	TERMINAL POST
19	HEX HEAD CAPSCREW
20	LOCKWASHER
21	HEX NUT
22	HEAT-SHRINK TUBE
23	ALLEN HEAD SETSCREW
24	TERMINAL POST
25	DYNA-SEAL WASHER
26	TERMINAL COLLAR
27	ALLEN HEAD SETSCREW
28	HEAT-SHRINK TUBE
29	GLAND BUSHING
30	INFORMATION PLATE
31	DRIVE SCREW
32	TERMINAL GLAND
33	STUD
34	HEX NUT
35	CABLE GRIP
36	#14 CONTROL CABLE–50 FT.

## PUMP END DISASSEMBLY

References are to Figure C-1 and Figure C-2.

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

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

The following maintenance and repair instructions are keyed to the Pump Model sectional view (Figure C-1) and the Terminal Housing sectional views (Figure C-2), and the accompanying parts lists. Refer to the Parts List manual for the part number and quantity required.

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

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



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



**The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the control handle on the control box is in the OFF position and locked out, or that the power supply to the control box has been otherwise cut off and locked out, before attempting to open or service the pump**

**assembly. Tag electrical circuits to prevent accidental start-up.**

Use the lifting device fitted on the pump to remove the pump from the wet well or sump, and move it to a location where the discharge line can be removed. It is not necessary to disconnect a flexible discharge hose before removing the pump. If rigid discharge piping is used, disconnect the piping before attempting to move the pump.



**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.**

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

If the problem is electrical, complete disassembly may not be required. Refer to **Electrical Testing** in **TROUBLESHOOTING**, Section B, and have a qualified electrician check the control box, cable and 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 in the Parts List manual.

### Strainer Removal

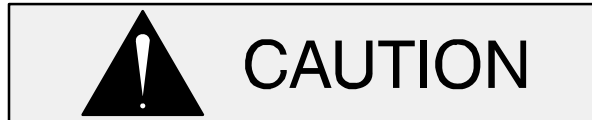
#### (Figure C-1)

To remove the strainer screen (65), raise the pump slightly, or lay it on its side and disengage the hardware (67) securing the base plate (66) and strainer assembly to the 1st stage diffuser (1). Remove the base plate and strainer screen. If the impeller (3) is clogged, the debris can usually be removed without further disassembly.

### Draining Oil From Seal And Motor Cavity

#### (Figure C-1)

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



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

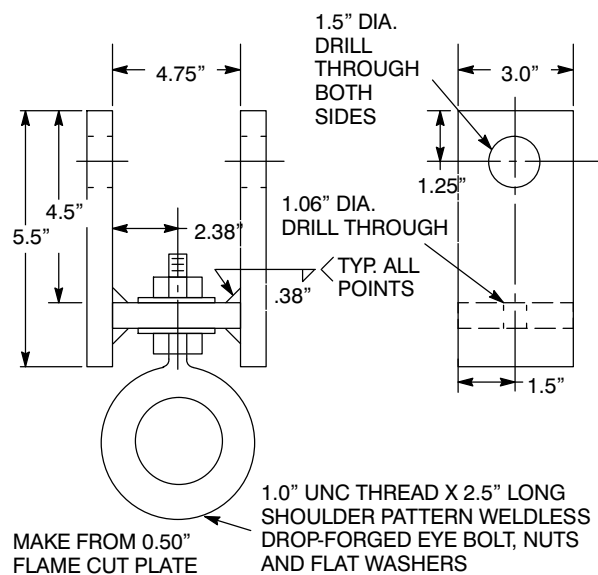
Lay the pump on its side with the pipe plugs (15 and 54) facing up. Clean any dirt from around the plugs. Remove the seal cavity drain plug (54), and install a short 3/8-inch NPT nipple in the hole. Tip the pump and drain the seal oil into a **clean** container. Inspect the oil for water, dirt, or cloudy condition which could indicate lower seal failure or poor gasket seal.

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

### Positioning Pump For Disassembly

#### (Figure C-1)

It is recommended that the pump be positioned upside-down during disassembly. To hold the pump in the inverted position, rest the pump securely on blocks. Two brackets with lifting eyes may be fabricated for this purpose as shown in Figure C-3. Be careful not to damage the terminal housing and cable assembly (31) 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.



**Figure C-3. Lifting Brackets With Eyes**

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

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



Use caution not to damage the terminal housing and cable assembly when invert-

ing the pump for disassembly. Use wood blocks to support and level the pump while performing maintenance, and leave the lifting device attached if possible.

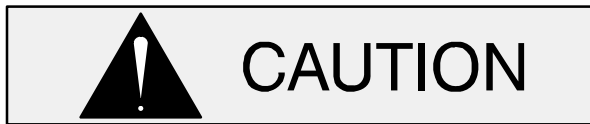
Use a lifting device of suitable capacity to raise the pump **just high enough** to be rotated to the inverted position. Rest the pump securely on blocks positioned across the discharge flange. Be careful not to damage the terminal housing (39) or cable while in this position.

### Suction Head And Wear Ring Removal

#### (Figure C-1)

Remove the hardware (68 and 69) securing the suction head (70) to the first stage diffuser (1). Remove the suction head, and remove and discard the suction head gasket (78).

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



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

### First Stage Impeller Removal

#### (Figure C-1)

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

### First Stage Diffuser And Vane Plate Removal

#### (Figure C-1)

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

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

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

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

### Second Stage Diffuser and Wear Ring Removal

#### (Figure C-1)

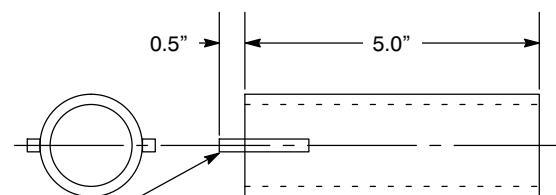
Disengage the hardware (8, 10 and 11) and separate the second stage diffuser (2) and gaskets (12 and 55) from the seal plate (13) and intermediate (18).

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

### Second Stage Impeller Removal

#### (Figure C-1)

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



2 PIECES OF 0.25" SQUARE X 1.5" LONG KEYSTOCK  
– POSITION 180° APART AND WELD

MAKE FROM STANDARD 2.75" O.D. 16 GA. TUBING

### Figure C-4. Impeller Locknut Tool

Wedge a steel rod between the vanes of the impeller (1) and one of the studs (9) to prevent shaft rotation. Straighten the taps on the impeller lockwasher (58), and position the locknut removal tool over

the shaft so the keystone engages the slots in the locknut. Use a pipe wrench to turn the tool and remove the locknut and washer.

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

### Lower Seal Removal

(Figures C–1 and C–5)

Carefully remove the seal spring. Lubricate the rotor shaft (22) and work oil under the bellows assembly. Slide the hooked ends of two stiff wires along the shaft and pull the rotating portion of the seal from the shaft.

To remove the stationary portion of the seal, remove the socket head capscrews (56), and slide the seal plate (13) from the shaft. Remove and discard the seal plate O-ring (14). Place a **clean** cloth on a flat surface 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 and seat are removed.

#### NOTE

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

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

### Upper Seal Removal

(Figures C–1 and C–5)

Unless cracked or otherwise worn, it is not necessary to remove the intermediate (18) for access to the upper seal assembly (6).



If the intermediate must be removed, see

the procedure under **Motor Disassembly** in this section. **Do not** attempt to loosen the hardware (45, 46, 47, 50 and 51) securing the intermediate or bearing cap (48) before referring to this section; otherwise, the rotor shaft and bearings could be damaged.

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

Lubricate the rotor shaft (22) and work oil under the bellows. Position a screwdriver or other suitable device on each side of the bellows retaining flange, and pry the bellows upward until the rotating portion is off the shaft. Slide the hooked ends of two stiff wires along the shaft and under the stationary seal seat. Hook the back side of the seat and pull it from the intermediate bore.

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

### Cleaning And Inspection Of Pump Parts

(Figure C–1)

With the pump inverted, stuff a clean tissue into the stationary seal seat bore of the intermediate (18) 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. Use a clean cloth lightly dampened with solvent to clean the motor housing, suction head, diffuser and seal plate. **Do not** allow the solvent to enter the motor.



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

Inspect the rotor shaft (22) 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 (5 or 6) should be reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an **emergency, carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

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

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

Install the shaft seals as illustrated in Figure C-5.

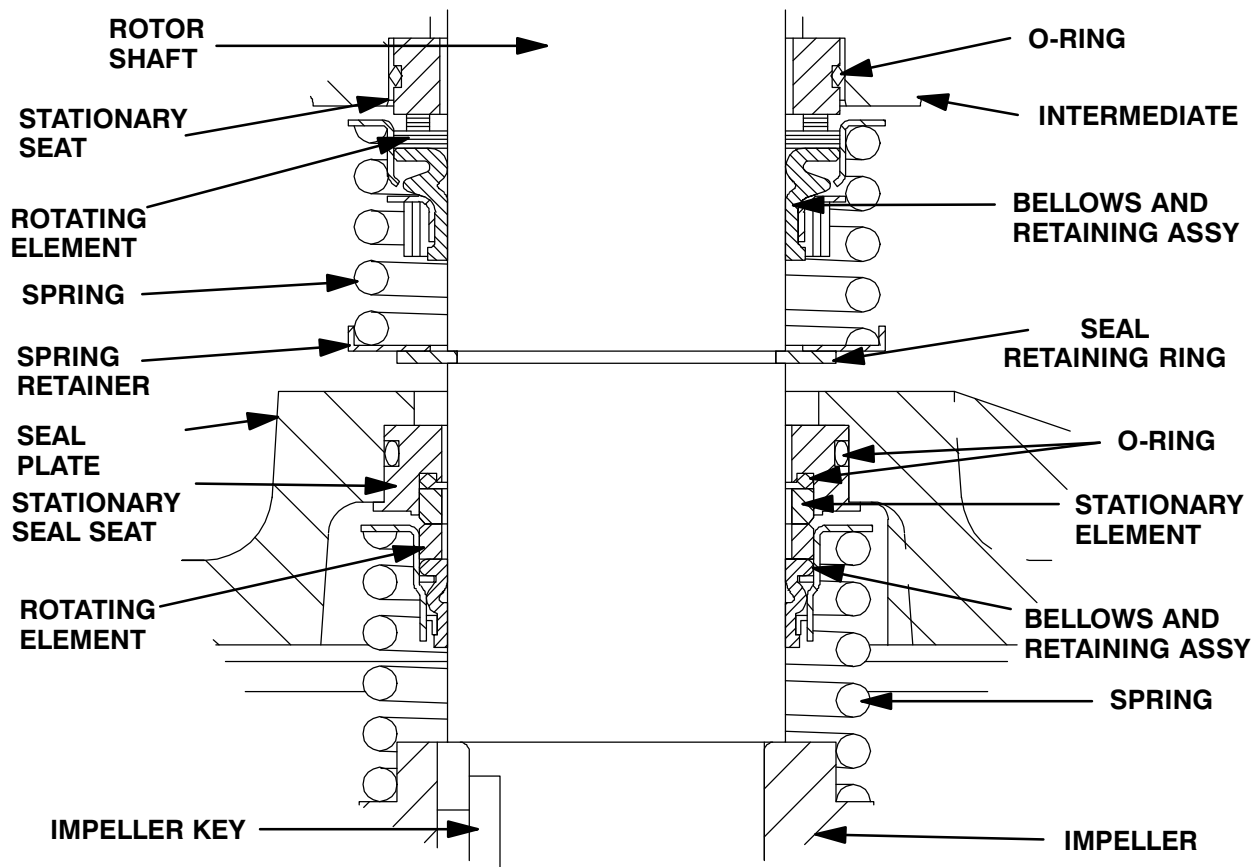


Figure C-5. Upper And Lower Seal Assemblies



This seal is not designed for operation at temperatures above 122° F (50° C). Do not use at higher operating temperatures.

#### Upper Seal Installation

(Figures C-1 and C-5)

**Do not** unwrap a new seal assembly until time of installation. Cleanliness of seal components is critical, especially the seal faces.

Clean the rotor shaft (22) and seal cavity area of the intermediate (18). 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 and a nicked or damaged keyway. Remove them with a fine file or hand honing stone to restore original contours. If the shaft is bent or damaged, the complete rotor and shaft must be replaced as an assembly. Apply a **light** coating of oil to the bore of the intermediate.

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

#### NOTE

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

Subassemble the stationary element in the stationary 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 seat contacts the bore shoulder. Remove the tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use clean tissue to wipe **lightly** in a circular 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 element in position until the seal is installed. Assemble the drive grooves of the rotating element into the drive lugs of the bellows retainer.

Apply a **light** coating of oil to the seal seating surface on the shaft, the groove for the retaining ring (34), and I.D. of the bellows. Inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use a clean tissue to wipe in a circular pattern. Slide the seal rotating portion onto the lubricated shaft as shown in Figure C-5. Apply firm, steady pressure on the seal retainer until it slides down the shaft. This step should be done in one continuous motion to prevent the bellows from sticking or rolling as it passes over the retaining ring groove.

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

### Lower Seal Installation

(Figures C-1 and C-5)

Thoroughly clean the O-ring surfaces and seal bore of the seal plate (13). The seal bore must be free of burrs and nicks which could damage the seal. Inspect the seal plate for cracks, distortion, or erosion and replace it if defective.

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

### NOTE

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

Unpack the stationary seat, and check that the O-rings are properly installed (see Figure C-5). Press the stationary element into the seat, making sure that the grooves in the element engage the lugs on the seat. Apply a **light** coating of oil to the

seal plate bore and the outer O-ring. Keep the sealing face dry.

Position the seal plate on a clean flat surface with the impeller side up.

Unpack the stationary seat and element. Subassemble the stationary element in the stationary seat. Apply a **light** coating of oil to the seal plate bore and the O.D. of the seal seat and O-ring. Keep the sealing face dry.

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 circular pattern.

### NOTE

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

Lubricate the seal plate O-ring (14) and install it on the seal plate. Lightly oil the O-ring seating surface on the intermediate and carefully position the seal plate and stationary seal components on the rotor shaft and against the intermediate. **Be careful** not to damage the stationary element already installed.

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. Apply a **light** coating of oil on the shaft and the I.D. of the bellows.

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

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

### Second Stage Impeller Installation

#### (Figure C-1)

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

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

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

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

### Second Stage Diffuser and Wear Ring Installation

#### (Figure C-1)

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

#### NOTE

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

Thoroughly clean the gasket surfaces, and the I.D. of the wear ring (59). Install the gaskets (12 and 55), and position the diffuser against the intermediate (18). Apply 'Never-Seez' or equivalent compound to the threads of the capscrews and studs

(8 and 9), and secure the diffuser to the intermediate by torquing the hardware (8 and 11) evenly in a cross sequence to 300 ft. lbs. (3600 in. lbs. or 41,5 m. kg.).

### First Stage Diffuser and Vane "Plate" Installation

#### (Figure C-1)

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

#### NOTE

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

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

Secure the vane plate to the first stage diffuser (1) with the socket head capscrews (64). Install the gasket (60) and position the first stage diffuser against the second stage diffuser. Apply 'Never-Seez' or equivalent compound to the capscrews (61), install the hardware (61, 62 and 63), torquing the capscrews evenly in a cross sequence to 120 ft. lbs. (1440 in. lbs. or 16,6 m. kg.).

### First Stage Impeller Installation

#### (Figure C-1)

Inspect the first stage impeller (3) 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. Be sure the impeller bore and the shaft are free of oily film and completely dry.

Push the impeller onto the shaft until seated firmly against the shaft shoulder. Install the impeller washer (73) on the rotor shaft (22).

#### NOTE

*If the impeller is not fully seated and binds against the diffuser, the shaft and lower bearing have been driven out of position during impeller removal. If this occurs, the lower bearing must be pressed back*

into place (see **MOTOR DISASSEMBLY** and **MOTOR REASSEMBLY**).

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

### Suction Head And Wear Ring Installation

(Figure C-1)

If the wear ring (71) was removed, position the replacement ring in the suction head with the chamfered end toward the bore shoulder. Press the wear ring into the suction head until fully seated.

#### NOTE

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

Install the suction head gasket (78). Position the suction head (70) on the first stage diffuser. Apply 'Never-Seez' or equivalent compound on the threads of the capscrews (68) and secure the suction head with the hardware (68 and 69). Torque the capscrews in a cross sequence to 120 ft. lbs. (1440 in. lbs or 16,6 m. kg.).

### Strainer Installation

(Figure C-1)

Inspect the strainer screen (65) for cracks, distortion or erosion, and replace it if defective.

Install the strainer screen and the base plate (66). Apply 'Loctite Threadlocker No. 242' or equivalent compound on the threads of the capscrews (67), and secure the complete strainer assembly to the first stage diffuser. Tighten the nuts just enough to draw the strainer screen down tightly, but not tight enough to distort it. Make certain that the strainer seats properly against the shoulder of the diffuser.

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

## MOTOR DISASSEMBLY

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

#### NOTE

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



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

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

### Terminal Housing And Power Cable Removal And Disassembly

(Figure C-1)

Total disassembly of the terminal housing and power cable (39) 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 assembly (39) may be serviced without disassembling the motor housing or pump end.



Secure the pump in an upright position. Remove the deformed locknuts (41) securing the terminal housing assembly to the motor housing assembly (27).

**(Figure C-2)**

Carefully raise the terminal housing (8) from the motor housing until the terminals (18 and 24) are accessible. Loosen the allen head setscrews (23), and disconnect the motor leads from the terminal posts.

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

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

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

To disconnect the power and control cables (1 and 36) from the terminal housing, pull the terminal plate (16) away from the terminal housing. Remove the hardware (10 and 11) securing the green and yellow ground lead terminals (9 ). Reinstall the hardware. When shipped from the factory, the connections between the cable leads and the terminal collars (14 and 26) were encapsulated in heat-shrink tubing (12 and 28) and bonded to the terminal plate with silicone adhesive. (In service, the adhesive may have been replaced by potting compound during previous repair.)

**NOTE**

*Do not remove the heat shrink tubing from the power cable leads unless the terminals require replacement. If replacement is required, the connections between the leads and terminals **must be** sealed with heat shrink tubing before applying the silicone adhesive (see **Terminal Housing And Power Cable Reassembly**).*

If terminal replacement is required, carefully cut away the tubing and adhesive, and loosen the allen head setscrews (13 and 27). Disconnect the

cable leads from the terminal collars, and separate the terminal plate (16) from the terminal housing (8).

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

To disconnect the power and control cables, remove the nuts (4 and 34) securing the terminal glands (5 and 32) to the terminal housing (8). Slide the gland back along the power cable.

Compress the wire mesh of the cable grips (2 and 35) and move it back along the power cable. Oil the gland bushings (6 and 29) and terminal housing bore and pull firmly on the cable. (Allow the oil to leak in around the bushing by agitating the cable in the bore.) After the bushing has been loosened, the cable should pull out far enough to expose the gland bushing. Apply oil on the cable jacket and slide the bushing and washer (7) back along the cable. Pressure exerted on the bushing may deform the cable jacket. If such is the case, additional oil and effort will be required to remove the bushing.

**NOTE**

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

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

**Motor Housing Disassembly**

**(Figure C-1)**

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

With the pump end disassembled, secure the pump in an inverted position, remove the hardware (45, 46 and 47) securing the motor housing (27) to the intermediate. **Do not** remove the six capscrews (50) around the rotor shaft (22).

## Intermediate And Rotor Removal

### (Figure C-1)

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

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

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

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

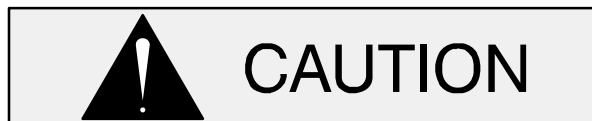
Remove the hardware (50 and 51) securing the bearing cap to the intermediate. Steady the rotor and shaft assembly, and separate the intermediate. If necessary, tap the impeller end of the shaft with a soft-faced mallet to loosen the seal between the lower ball bearing (17) and the intermediate bore.

Remove the bearing cap gasket (49).

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

## Bearing Removal

### (Figure C-1)



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and rotor assembly is removed.

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

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



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

Rotate the bearings by hand to check for roughness or binding and inspect the bearing balls. If rotation is rough or the bearing balls 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 bore. Replace the shaft and rotor (as an assembly), the motor housing or intermediate if the proper bearing fit is not achieved.

If replacement is required, use a bearing puller to remove the upper and lower ball bearings (17 and 26) from the rotor shaft. Use the bearing cap (48) and capscrews (50), in conjunction with a bearing puller, to remove the lower bearing from the shaft. Remove the lower bearing from the bearing cap. Press the oil seal (79) from the bearing cap.

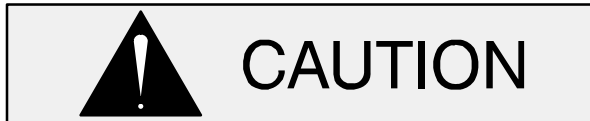
## Stator Removal

### (Figure C-1)

Do not remove the stator (21) 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**.

Position an expandable tool, such as a split disc, approximately 2 inches (51 mm) inside the stator, and expand it tightly and squarely on the I.D. Attach a lifting device to the lifting eye of the tool, and raise the assembly approximately 1 inch (25 mm) off the work surface.

The motor housing (27) must be heated with a torch to expand them 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.



Take care not to damage the stator end turns during removal from the motor housing.

After the stator has been removed, wrap it in clean, dry rags or other suitable material until reassembly. Remove the stator key (44). The stator **must** be kept clean and dry. When handling the stator, **do not** set it on the end windings; lay it on its side.



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

## MOTOR REASSEMBLY



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

## Stator Installation

(Figure C-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 O-ring surfaces, completely removing any old gasket and cement material. Inspect the sealing surfaces for burrs, nicks and pits which could cause a poor seal, and replace defective parts as required.

Thoroughly clean the inside of the motor housing (27) with fresh solvent. The interior **must** be dry and free of dirt or lint.



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

After the motor housing is thoroughly cleaned, position it on a flat surface with the discharge end down. Do not unwrap the stator (21) 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 B, to ensure that no damage has occurred during transit or handling.

**NOTE**

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

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

**NOTE**

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

---

Heat the motor housing (27) with a torch to expand it enough for the stator (21) 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 housings; excessive heat is not required.

When the motor housing is sufficiently heated, position the stator so that the leads are in line with the terminal opening. Install the key (44), and carefully lower the stator into the motor housing until fully seated against the housing shoulder. Be careful not to damage the stator lead insulation during re-assembly. If the stator “cocks” in the motor housing, remove it and try again.

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

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

**Bearing Installation**

(Figure C-1)

Inspect the rotor shaft (22) for damaged threads, scoring in the seal area, and a nicked or damaged

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



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and rotor assembly is removed.

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

**NOTE**

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

---

Heat the bearings (17 and 26) to a uniform temperature **no higher than 250°F (120°C)**. When installing bearings, slide them onto the shaft until fully seated. This should be done quickly, in one continuous motion, to prevent bearings from cooling and sticking on the shaft.

Bearing lubrication: Use Lithium EP2 grease, lightly pack bearings ensuring all surfaces of balls and race are coated. Care should be taken to keep grease free of contamination.

Slide the upper bearing (26) onto the shaft until fully seated.



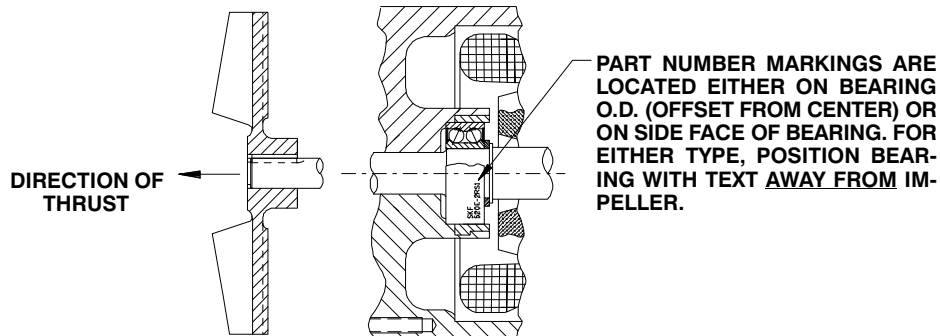
The bearing **must** be installed as indicated

in the instructions accompanying the bearing or as shown in Figure C-6. Improper installation can cause premature bearing failure and/or damage to the pump or motor.

Press the oil seal (79) into the bearing cap (48) with the lip positioned as shown in Figure C-1. Apply "Loctite Compound RC/609" or equivalent compound to the O. D. of the bearing (17) and bearing

cap (48). The bearing **must** be installed in the bearing cap before assembling the bearing on the shaft. Position the bearing as indicated in the instructions accompanying the bearing or as shown in Figure C-6 and slide it into the bearing cap. Heat the bearing and bearing cap assembly. With the impeller end of the shaft up, slide the bearing and bearing cap onto the shaft until it seats squarely against the shoulder. **Be careful** not to damage the oil seal.

#### INSTALLATION OF SKF 5200 AND 5300 SERIES BEARINGS

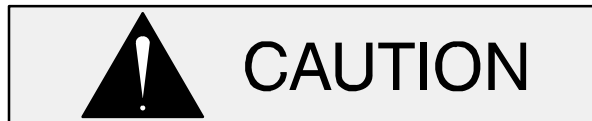


**NOTE:**  
THIS BEARING IS MANUFACTURED WITH TWO SEALS OR SHIELDS. WHEN INSTALLED ON THE SHAFT, THE MANUFACTURER'S PART NUMBER DESCRIPTION (LOCATED ON SIDE FACE OF BEARING OR BEARING O.D.) MUST BE LOCATED WITH THE TEXT AWAY FROM THE IMPELLER.

**Figure C-6. Double-Row Bearing Positioning**

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. Make certain that they are seated squarely against the shaft shoulders.

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



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

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

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

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

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

#### Rotor Installation

##### (Figure C-1)

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

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

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

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

### Terminal Housing And Power Cable Reassembly And Installation

(Figure C-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 to make electrical connections.

Clean the exterior of the power cable with warm water and mild detergent. 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 upper bore of the terminal housing (8), outside of the pump power cables (1 and 36), and the bores of terminal glands (5 and 32), cable grips (2 and 35), gland bushings (6 and 29) and terminal washer (7) for ease of assembly. Slide the terminal gland, cable grip, gland bushing, terminal washer and terminal housing onto the power cables, allowing approximately 3 ft. (1 m) of cable to extend beyond the terminal housing. Temporarily tape the green and yellow ground wires to the cables.

### Sealing Terminal Housing Connections With Silicone Adhesive

(Figure C-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 terminal collars (14 and 26) were encapsulated in heat-shrink tubing (12 and 28), and bonded to the terminal plate (16) with silicone 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 Manual 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 silicone adhesive 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 sealing method is used, refer to the instructions in **Seal-***

**ing 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 leads, terminal collars, and terminal plate. Inspect all parts for damage, and replace as required. If the rubber bonding material on the terminal plate (16) is severely worn or cracked, the terminal plate must be replaced. If the bonding material has been noticeably compressed, it should be supplemented with two gaskets contained in the overhaul gasket kit (see Options listed in the Parts List manual).

#### NOTE

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

Slide the terminal housing (8) up the power cables and temporarily secure it with the cable grips (2 and 35).

Assemble the terminal collars (14 and 26), dyna seal washers (15, 17 and 25), and the terminal posts (18 and 24) to the terminal plate as shown in Figure C-2.

#### NOTE

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

Slide a length of heat-shrink tubing (14) up over each of the power cable leads. Install the leads on the terminal posts as shown in Figure C-7 and secure them using the hex head nuts (4). Slide the tubing down each lead until the terminals are covered and the tubing contacts the terminal plate. The tubing **must** 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.

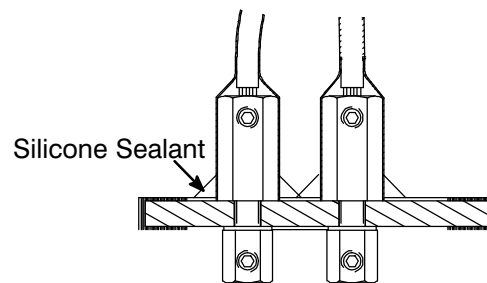


## CAUTION

Use **only** Dow-Corning 737 Silicone Adhesive (see the Parts List Manual for the part number) or potting compound for sealing terminal housing connections. Use of unapproved sealing products will void the pump warranty.

#### NOTE

**Do not** use a mold or reservoir with the silicone adhesive.



**Figure C-7. Silicone Adhesive Sealing**

See Figure C-8 and check terminal locations. Apply a 1/4 to 3/8 in. (6,4 to 9,7 mm) thick layer (maximum) of silicone adhesive around each of the terminal posts as shown in Figure C-7. Remove any adhesive from gasketed surfaces.



## WARNING!

**All air pockets, voids or gaps in the silicone sealant must be removed to ensure a water-tight seal in the terminal housing. Otherwise, moisture entering the terminal housing could cause a short circuit, resulting in pump damage and possible serious injury or death to personnel.**

Allow the adhesive to cure for at least one hour before securing the terminal housing to the motor housing.

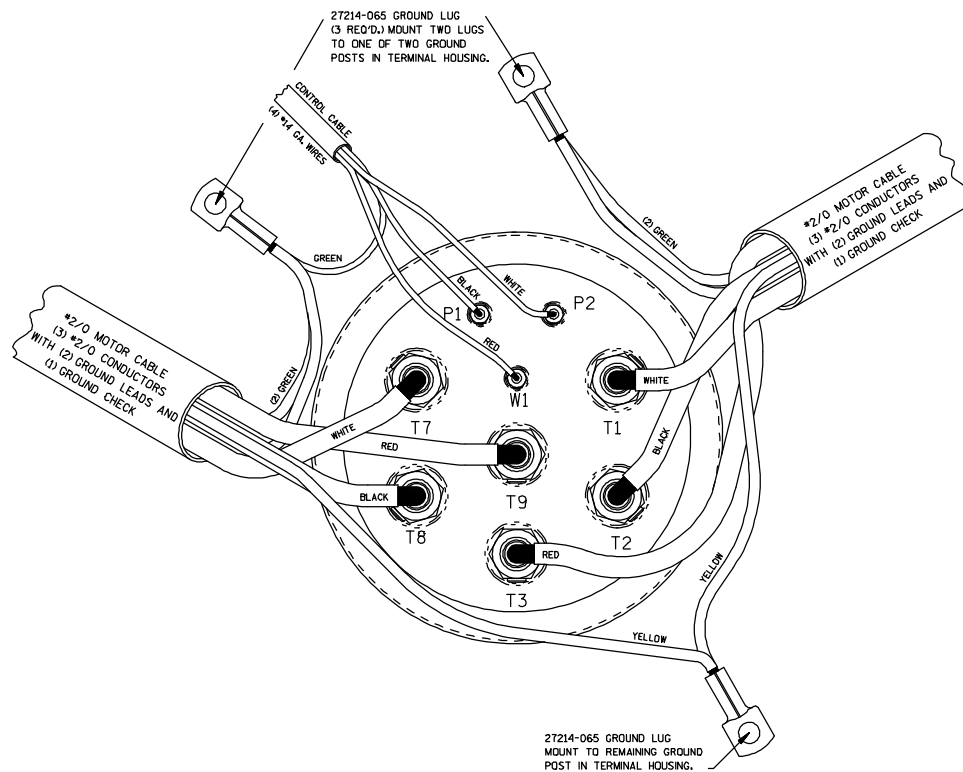


Figure C-8. Terminal Housing Wiring Connections

**Sealing Terminal Housing Connections With Potting Compound**

(Figure C-2)

Potting compound and silicone adhesive have the same electrical properties when correctly applied. Silicone 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 Silicone 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 collars. Slide the potting mold

up over the leads of the power cable and control cable.

Secure each cable lead as described in the previous section. Slide the potting mold down over the terminal collars 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.

### NOTE

*The potting compound must completely cover the terminal collar and lead connections.*

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

### Terminal Housing And Power Cable Installation

#### (Figure C-2)

After the terminal plate has been sealed, slide the terminal housing down the cable. Untape the ground leads. Refer to Figure C-7 and connect the green ground leads to two of the terminals (9), and connect the yellow ground check leads to the third terminal and secure them to the ground terminals with the hardware (10 and 11). **Be sure** the leads make good contact with the housing.

Pull gently on the 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 washer (7), bushing (6 and 29) and cable grip (2 and 35) into place. Slide the terminal gland (5 and 32) into place and install the nuts (4 and 34) finger tight. Do not fully tighten the nuts at this time.

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

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



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

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

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

#### (Figure C-1)

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

#### (Figure C-2)

Tighten the nuts (4 and 34) drawing the terminal glands (5 and 32) down into the terminal bore. **Do not** overtighten and damage the terminal gland or hardware.

### NOTE

*A .12 in. (3,05 mm) gap is required between the terminal gland cap flange and the terminal housing when tighten the nuts.*

See **FINAL ASSEMBLY** and **VACUUM TESTING**, followed by **LUBRICATION**.

### FINAL ASSEMBLY

#### (Figure C-1)

If removed, install the lifting eyes (33) in the motor housing.

If the discharge flange (29) was removed from the motor housing, replace the discharge flange gas-

ket (28). Apply 'Never-Seez' or equivalent compound on the flange studs (30), and secure the flange with the nuts (31).

Apply 'Loctite No. 680 or No. 609' or equivalent compound on both ends of the pipe nipple (38), and install the nipple, pressure relief valve (36), pipe cap (35), and street tee (37).

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

**VACUUM TESTING**

To ensure the water-tight integrity of the pump, it is recommended that the motor and seal cavities be vacuum tested any time the seal(s) and/or motor are serviced.

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

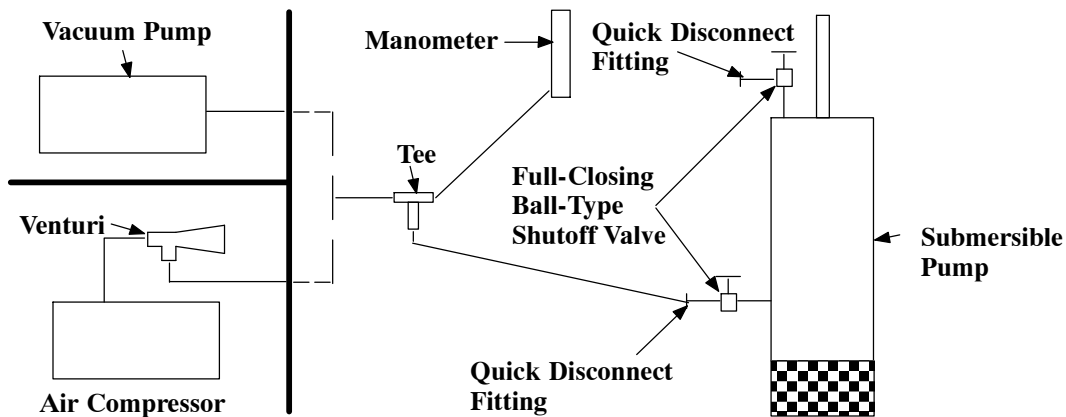
Use a manometer with a range of 30 to 0 to 30 inches of mercury to perform the test. **Do not** use a vac-

uum gauge. Vacuum gauges are not sensitive enough to detect minor leaks.

It is recommended that a vacuum pump be used to draw the vacuum on the cavities. If a vacuum pump is not available, a compressor/venturi system may be used. If the compressor/venturi cannot draw the higher vacuum level shown in Table C-1, draw the motor cavity vacuum down as far as the system will allow, then draw the seal cavity down so the differential between the two cavities is the same as the differential between the vacuum readings shown in the table.

Install full-closing ball-type shutoff valves with quick-disconnect fittings in the pipe plug holes in both the motor and seal cavities. Test the motor cavity for its full duration first, then use the shutoff valve to maintain the motor cavity vacuum while testing the seal cavity. The motor cavity vacuum **must** be higher than the vacuum in the seal cavity to prevent separation of the seal faces or unseating the stationary seal seat between the seal and motor cavities.

Figure C-9 shows a simple schematic for setting up either a vacuum pump or a venturi/compressor test system.



**Figure C-9. Vacuum Test System**

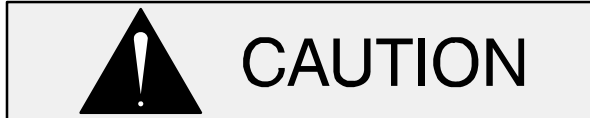
Table C-1 shows the vacuum to be drawn on each cavity, and the duration to maintain each vacuum reading. **Any** change in vacuum reading during

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

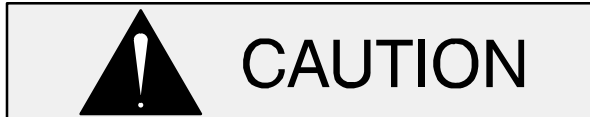
**Table C-1. Vacuum Test Data**

Pump Model	Motor Cavity Vacuum (In. Hg.)	Duration (Minutes)	Seal Cavity Vacuum (In. Hg.)	Duration (Minutes)
S8D	30	15	20	5

## LUBRICATION



Check the oil levels only when the pump is cool. If an oil level plug is removed when the pump is hot, pressure in the seal or motor cavity can cause hot oil to be ejected, which could result in injury to personnel.



Do not overfill the seal or motor cavities. Overfilling can cause excessive heat in the seal and/or motor cavities, resulting in damage to the pump. Fill the cavities as described in the following instructions to ensure proper lubrication.

**Seal Cavity**

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

To check the seal cavity oil, position the pump on its side with the seal cavity oil drain plug (54) facing up. Remove the plug and install a short, 3/8-inch pipe nipple in the hole. Using a clean container, roll the pump slightly until oil runs out.

If the oil level is abnormally low, or if the oil contains water, dirt, or appears cloudy, the lower seal or gaskets may require replacement. If the oil is clear, remove the pipe nipple previously installed and re-install the drain plug (54). **Reposition the pump upright.** Top off the seal cavity by adding oil through the hole for the fill plug (52) until oil runs out of the oil fill plug hole. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plugs before reinstalling.

To fill the seal cavity in a dry (overhauled) pump, position the pump upright and ensure the drain plug (54) is installed. See Tables C-2 and C-3 for the lubricant specifications and approximate quantity. Remove the fill plug (52) and add the recommended grade of submersible pump oil until oil runs out of the fill plug hole. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plug before reinstalling.



Never fill the seal cavity with the pump laying on its side. The pump must be positioned upright when adding oil to the seal cavity, otherwise the cavity could be overfilled, which could result in premature seal failure or other damage to the pump.

The grade of lubricant used is critical to the operation of this pump. Use premium quality hydraulic oil as specified in the Table C-2. Oil must be stored in a clean, tightly closed container in a reasonably dry environment.

**Table C-2. Approximate Oil Quantities**

Pump Model	Seal Cavity	Motor Cavity
S8D	3.6 gals. (13,6 liters)	13.4 gals. (50,5 liters)

Table C-3. Pump Oil Specifications

Specifications:	
Type .....	Premium high viscosity index, anti-wear hydraulic oil
Viscosity (SSU @ 104°F [40°C]) .....	110 to 155
Viscosity (SSU @ 210°F [100°C]) .....	40 to 50
Dielectric .....	26,000 (volts-min)
Recommended supplier:	
Gulf Oil Company .....	Gulf Harmony AW Hydraulic Fluid MG 32
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
BP (Also Boron) .....	Energol-HLP 32
Shell Oil Company .....	Tellus 32, Tellus T-23 or T32
ARCO .....	Duro 32
Exxon (Also Esso) .....	Nuto H 32
Petro-Canada .....	Harmony HVI 22

**Motor Housing Cavity**

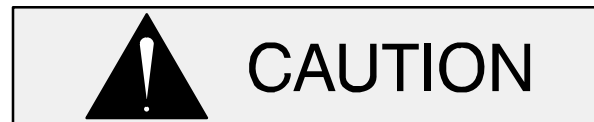
Check the oil level in the motor cavity before initial startup. Following this, check the motor lubrication level after the first two weeks of operation, every month thereafter, and any time the pressure relief valve is activated. **Drain and replace** the oil after the first 200 hours of operation and annually thereafter.

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

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

When lubrication is required, position the pump upright and remove the pipe nipple previously

installed. Remove the pipe cap (35) from the tee where the pressure relief valve is located, and add the recommended grade of submersible pump oil until oil runs out of the oil level pipe plug hole. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the tee (37) and pipe plug (25) before reinstalling.



Never fill the motor cavity with the pump laying on its side. The pump must be positioned upright when adding oil to the motor cavity, otherwise the cavity could be overfilled, which could result in premature bearing failure, overheating or other damage to the pump.

See Tables C-2 and C-3 for the lubricant specifications and approximate quantity when lubricating a dry (overhauled) pump.

**For Warranty Information, Please Visit  
[www.grpumps.com/warranty](http://www.grpumps.com/warranty)  
or call:  
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Canada: 519-631-2870  
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