



**S SERIES PUMPS**  
**S2D3'S**

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

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

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

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## 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**

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### RECORDING MODEL AND SERIAL NUMBERS

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

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

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

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

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

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

### 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. 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.



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

#### NOTE

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

## SAFETY – SECTION A

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. Unplug the pump at the receptacle or shutdown and lock it out 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).



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



Make certain that the pump power cable is fitted with the proper type of grounded plug (see Section B), and that the plug receptacle is grounded. If the power cable is wired into an optional manual starting switch or control box, make sure that the enclosure is grounded. See Installation And Operations Manual for recommended grounds.



The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the pump power cable plug is disconnected from the power supply before performing any service or maintenance on the pump. If the power cable is wired into an optional manual starting switch or control box, make sure that these devices are OFF and the power LOCKED OUT. 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 electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections.



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



All electrical connections must be in accordance with The National Electric Code and all local codes. If there is a conflict between the instructions provided and N.E.C. Specifications, N.E.C. Specifications shall take precedence. All electrical equipment supplied with this pump was in conformance with N.E.C. requirements in effect on the

date of manufacture. Failure to follow applicable specifications, or substitution of electrical parts not supplied or approved by the manufacturer, can result in severe injury or death and void warranty.



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



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



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



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

## 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.
2. Unplug the pump at the receptacle or shutdown and lock it out 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)  (AUTOMATIC MODE)	Power source incompatible with pump motor.	Correct power source.
	No voltage at line side of power cable connection.	Check power source for blown fuse, open breaker, broken lead, or loose connection.
	Open circuit in motor windings or power cable.	Check continuity.
	Defective motor.	Check for and replace defective unit.
	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).	
Float type sensing device(s) tangled or obstructed.	Check installation for free movement of float.	

Table 1. Trouble Shooting Chart (cont.)

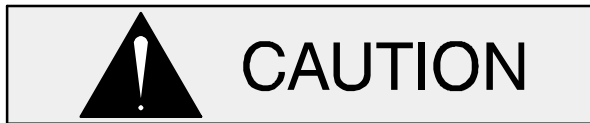
TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
(AUTOMATIC MODE) (CONT'D.)	Defective liquid level sensing device(s) or control panel.	Repair or replace defective unit(s).
OVERLOAD UNIT TRIPS	Low or high voltage, or excessive voltage drop between pump and control box.  Defective insulation in motor windings or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

## ELECTRICAL TESTING

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



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



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

### Test Equipment

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

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

### Motor And Motor Power Cable Continuity

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

- a. Disconnect the power cable plug from the receptacle, or lock out incoming power and disconnect the power cable leads to the op-

ditional manual switch or automatic control box.

- b. Connect the test leads to any two of 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 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.
- c. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **MAINTENANCE AND REPAIR**). The **entire** motor power cable must be replaced; splicing or other means of repair are not recommended.
- d. If the power cable appears undamaged, see **Head and Power Disassembly**, separate the pump head from the motor housing, and disconnect the power cable Amp-lock cap from the Amp-lock plug. Separately test each of the cable leads, (including the green ground lead) for continuity through the AMP-Lock cap. If any of the power cable leads do not check out for continuity, replace the entire power cable.
- e. If no break is found in the power cable, connect the test leads to the power contacts (not to the ground wire contact) of the Amp-lock plug. If the test reading indicates an open or broken circuit, there is an open circuit in the motor.

### NOTE

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

- f. Be certain to reconnect the Amp-lock plug and cap before reassembling the pump head to the motor housing.

If insulation resistance is to be checked, do not assemble the pump head to the motor housing at this time.

## Insulation Resistance

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

- a. Disconnect the power cable plug from its receptacle, or lock out incoming power and disconnect the power cable leads to the optional manual switch or automatic control box.
- b. Connect one test lead to the power cable plug grounding prong (or to the green ground lead), and touch the other test lead to each of the two power prongs (or power leads) in turn.
- c. The reading obtained will indicate resistance values in both the power cable and the motor windings. If the resistance reading is infinity (1), the insulation is in good condition. If the reading is between infinity (1) and 1 megohm, the insulation is acceptable but should be rechecked periodically. If the reading is less than 1 megohm, the insulation should be checked more closely. A reading of zero indicates that the power cable or the motor is grounded.
- d. To determine whether the power cable or the motor is grounded, separate the pump head from the motor housing (see **Head and power Cable Disassembly/Reassembly** in **MAINTENANCE AND REPAIR** section) and disconnect the Amp-lock plug and cap. Test the power cable leads and motor leads separately.
- e. Be certain to reconnect the Amp-lock plug and cap before reassembling the pump head on the motor housing.

## Automatic Control (Auto-Start Models)

If the on-off liquid level control features of the pump fail to operate in response to rising and falling water levels, make the following checkout and test to determine if the automatic control unit is at fault.



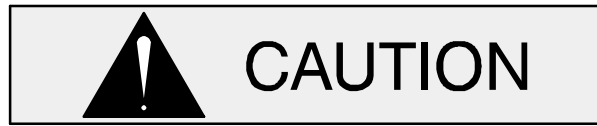
**Part of automatic control testing involves the application of live power which can cause death or severe injury. This test should be performed only by qualified personnel in a clean well-equipped shop. Refer to the pump wiring diagram in the Installation And Operations manual when applying power to the pump. Be certain to apply 115V 1P power ONLY.**

- a. Disconnect the power cable plug from its receptacle, or lock out incoming power and disconnect the power cable leads to the optional manual switch.
- b. See **Head And Power Cable Disassembly**, and remove the head.
- c. Remove the control circuit board and mounted automatic control assembly.
- d. Check the printed circuit paths for cracks. Use solder and a soldering iron or gun to make repairs.
- e. Check for broken wire connections. Solder if necessary.
- f. Check the circuit board components for looseness or damage. When soldering loose connections, take care to prevent excessive heating of components. Use a heat sink between the solder connection and the part being soldered to minimize transfer of heat to the components. If soldering fails to correct troubles, replace the control unit.
- g. Disconnect the two Amp-lock caps from the Amp-lock plugs, and disconnect the socket housing from the pin housing. (This will leave the leads of the plugs and pin housing connected to the automatic control assembly.)
- h. Apply 115V 1P power to the red and yellow contacts of the pump power cable plug, and use an insulated jumper to ground the green contact; the relay must pull in as power is applied.

- i. Using an insulated jumper, connect the white contact in the pin housing to the green contact of the pump power cable plug; the relay contacts must move to the deenergized position.
- j. With the white-to-green insulated jumper installed as in Step i., install a second insulated jumper between the green contact of the pump power cable plug and the gray contact in the pin housing. Remove the white-to-green jumper; the relay should remain in the deenergized position.
- k. Remove the gray-to-green jumper; the relay must move to the pulled-in position of Step h.
- l. Disconnect the power; the relay contacts must move to the deenergized position.
- m. If the automatic control fails to perform at any stage of Steps h through l, refer to Steps d through f for remedial action.
- n. With all power disconnected, reinstall the circuit board and mounted automatic control assembly. Reconnect the Amp-lock caps and plugs, and the socket and pin housing.
- o. Reinstall the head and secure it to the motor housing.

### Capacitor

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



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

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

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

## PUMP MAINTENANCE AND REPAIR – SECTION C

### GENERAL INFORMATION

Review all SAFETY information in Section A.

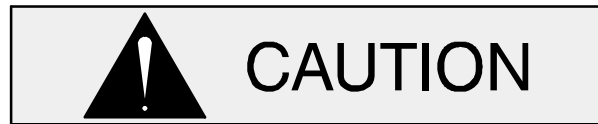


**Do not attempt to service the pump assembly unless all power to the motor has been shut off at the control box; otherwise, injury or death could result.**

**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 or 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. Discharge hose or piping **must** be removed before attempting to lift the pump.

SECTION DRAWING

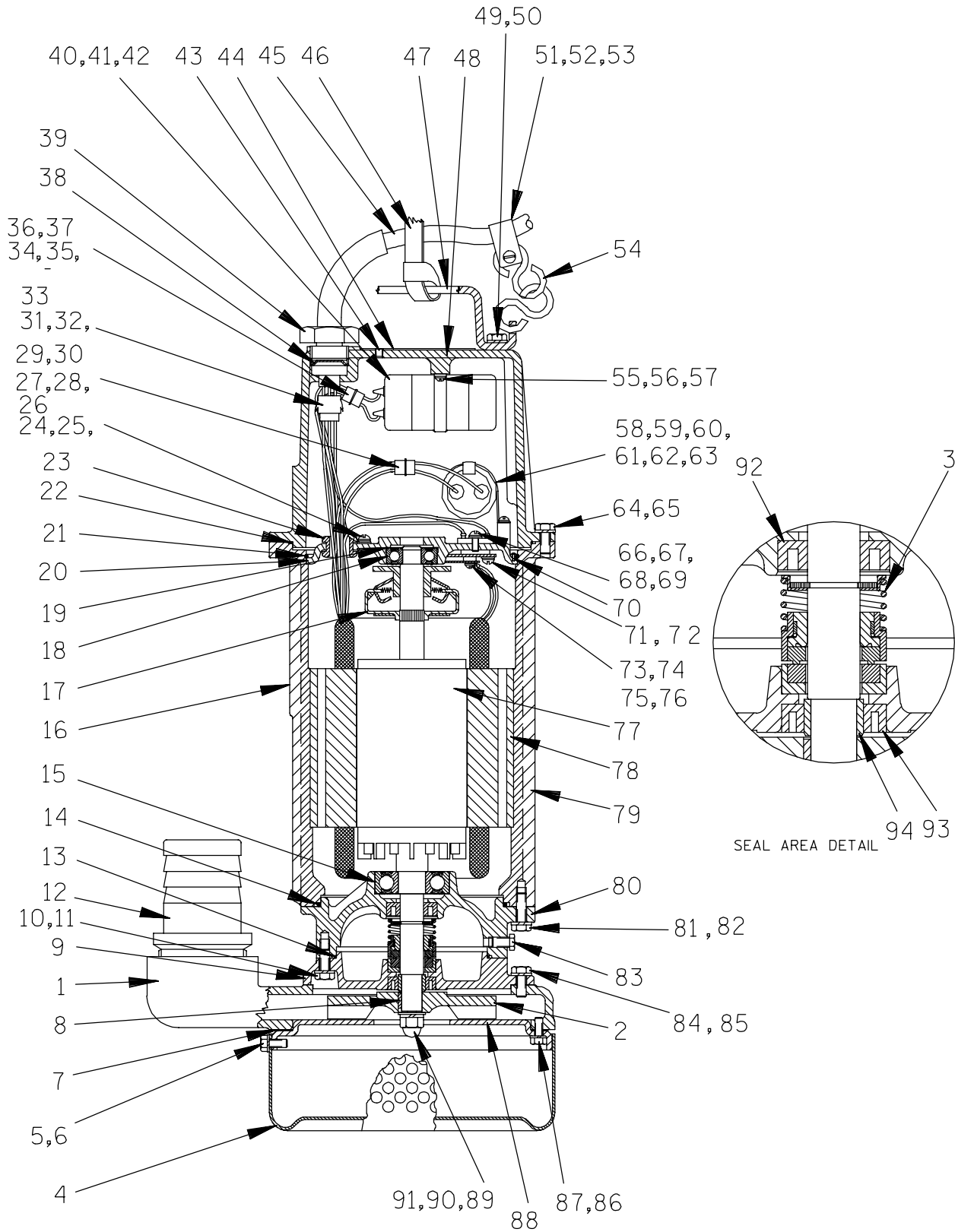


Figure C-1. Typical S2D3 Series Pump Assembly

### Typical S2D3 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	PUMP CASING	48	HEAD
2	IMPELLER	49	ROUND HEAD CAPSCREW
3	SEAL ASSEMBLY	50	– LOCKWASHER
4	STRAINER	51	CABLE BAND
5	HEX HEAD PHILLIP SCREW	52	ROUND HEAD PHILLIP SCREW
6	– LOCKWASHER	53	HEX NUT
7	IMPELLER COVER GASKET	54	CABLE CHAIN
8	IMPELLER KEY	55	HEX HEAD PHILLIP SCREW
9	SEAL CHAMBER	56	– LOCKWASHER
10	HEX HEAD CAPSCREW	57	CAPACITOR HOLDER
11	– LOCKWASHER	58	STARTING CAPACITOR
12	HOSE ADAPTOR	59	– LEAD WIRE
13	SEAL CHAMBER O-RING	60	– RUBBER CAP
14	LOWER MOUNTING PLATE O-RING	61	CAPACITOR HOLDER
15	BALL BEARING	62	ROUND HEAD PHILLIP SCREW
16	PUMP SPECIFICATION PLATE	63	– LOCKWASHER
17	CENTRIFUGAL SWITCH ACTUATOR	64	HEX HEAD CAPSCREW
18	BALL BEARING	65	– LOCKWASHER
19	BEARING SHIM	66	ROUND HEAD PHILLIP SCREW
20	MOUNTING PLATE	67	– LOCKWASHER
21	RING CLAMP	68	FLAT WASHER
22	HEAD O-RING	69	OVERLOAD PROTECTOR
23	GROMMET	70	ROUND HEAD PHILLIP SCREW
24	ROUND HEAD PHILLIP SCREW	71	ROUND HEAD PHILLIP SCREW
25	– LOCKWASHER	72	– LOCKWASHER
26	FLAT WASHER	73	CENTRIFUGAL SWITCH CONTACT
27	SOCKET LOCK	74	TERMINAL
28	PIN LOCK	75	LOCKWASHER
29	HOUSING PIN	76	ROUND HEAD PHILLIP SCREW
30	SOCKET HOUSING	77	ROTOR WITH SHAFT
31	CONTACT	78	STATOR
32	AMP-LOCK PLUG	79	MOTOR HOUSING
33	AMP-LOCK CAP	80	LOWER MOUNTING PLATE
34	SOCKET LOCK	81	HEX HEAD CAPSCREW
35	PIN LOCK	82	– LOCKWASHER
36	HOUSING PIN	83	SEAL CAVITY DRAIN/FILL PLUG
37	SOCKET HOUSING	84	HEX HEAD CAPSCREW
38	BEVELED WASHER	85	– LOCKWASHER
39	CABLE LOCKNUT	86	HEX HEAD PHILLIP SCREW
40	RUNNING CAPACITOR	87	– LOCKWASHER
41	– LEAD WIRE	88	IMPELLER COVER
42	– RUBBER CAP	89	IMPELLER WASHER
43	PRESSURE TEST PLUG	90	LOCKWASHER
44	IDENTIFICATION PLATE	91	IMPELLER LOCKNUT
45	POWER CABLE	92	OIL SEAL
46	LIFTING ROPE	93	DUST SEAL
47	HANDLE	94	SHAFT SLEEVE

SECTION DRAWING

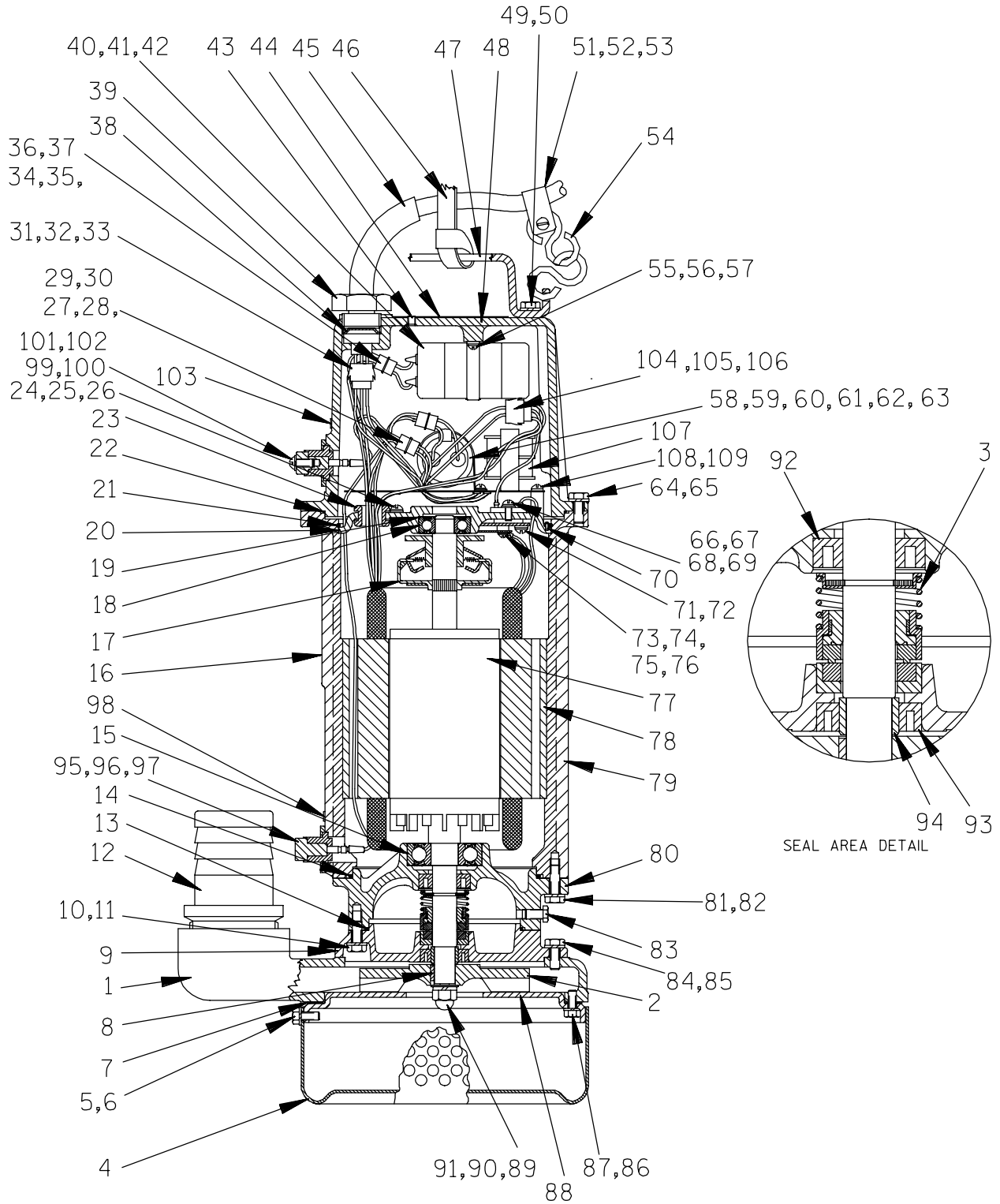


Figure C-2. Typical S2D3A Series Pump Assembly

### Typical S2D3A 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	PUMP CASING	56	–LOCKWASHER
2	IMPELLER	57	CAPACITOR HOLDER
3	SEAL ASSEMBLY	58	STARTING CAPACITOR
4	STRAINER	59	–LEAD WIRE
5	HEX HEAD PHILLIP SCREW	60	–RUBBER CAP
6	–LOCKWASHER	61	CAPACITOR HOLDER
7	IMPELLER COVER GASKET	62	ROUND HEAD PHILLIP SCREW
8	IMPELLER KEY	63	–LOCKWASHER
9	SEAL CHAMBER	64	HEX HEAD CAPSCREW
10	HEX HEAD CAPSCREW	65	–LOCKWASHER
11	–LOCKWASHER	66	ROUND HEAD PHILLIP SCREW
12	HOSE ADAPTOR	67	–LOCKWASHER
13	SEAL CHAMBER O-RING	68	FLAT WASHER
14	LOWER MOUNTING PLATE O-RING	69	OVERLOAD PROTECTOR
15	BALL BEARING	70	ROUND HEAD PHILLIP SCREW
16	PUMP SPECIFICATION PLATE	71	ROUND HEAD PHILLIP SCREW
17	CENTRIFUGAL SWITCH ACTUATOR	72	–LOCKWASHER
18	BALL BEARING	73	CENTRIFUGAL SWITCH CONTACT
19	BEARING SHIM	74	TERMINAL
20	MOUNTING PLATE	75	LOCKWASHER
21	RING CLAMP	76	ROUND HEAD PHILLIP SCREW
22	HEAD O-RING	77	ROTOR WITH SHAFT
23	GROMMET	78	STATOR
24	ROUND HEAD PHILLIP SCREW	79	MOTOR HOUSING
25	–LOCKWASHER	80	LOWER MOUNTING PLATE
26	FLAT WASHER	81	HEX HEAD CAPSCREW
27	SOCKET LOCK	82	–LOCKWASHER
28	PIN LOCK	83	SEAL CAVITY DRAIN/FILL PLUG
29	HOUSING PIN	84	HEX HEAD CAPSCREW
30	SOCKET HOUSING	85	–LOCKWASHER
31	CONTACT	86	HEX HEAD PHILLIP SCREW
32	AMP-LOCK PLUG	87	–LOCKWASHER
33	AMP-LOCK CAP	88	IMPELLER COVER
34	SOCKET LOCK	89	IMPELLER WASHER
35	PIN LOCK	90	LOCKWASHER
36	HOUSING PIN	91	IMPELLER LOCKNUT
37	SOCKET HOUSING	92	OIL SEAL
38	BEVELED WASHER	93	DUST SEAL
39	CABLE LOCKNUT	94	SHAFT SLEEVE
40	RUNNING CAPACITOR	95	OFF-POINT ASSEMBLY
41	–LEAD WIRE	96	ROUND HEAD PHILLIP SCREW
42	–RUBBER CAP	97	–LOCKWASHER
43	PRESSURE TEST PLUG	98	OFF-POINT LABEL
44	IDENTIFICATION PLATE	99	ON-POINT ASSEMBLY
45	POWER CABLE	100	ROUND HEAD PHILLIP SCREW
46	LIFTING ROPE	101	ROUND HEAD PHILLIP SCREW
47	HANDLE	102	–LOCKWASHER
48	HEAD	103	ON-POINT LABEL
49	ROUND HEAD CAPSCREW	104	CONTACT
50	–LOCKWASHER	105	AMP-LOCK PLUG
51	CABLE BAND	106	AMP-LOCK CAP
52	ROUND HEAD PHILLIP SCREW	107	AUTO CONTROL DEVICE
53	HEX NUT	108	ROUND HEAD PHILLIP SCREW
54	CABLE CHAIN	109	–LOCKWASHER
55	HEX HEAD PHILLIP SCREW		

## PUMP END DISASSEMBLY

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

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

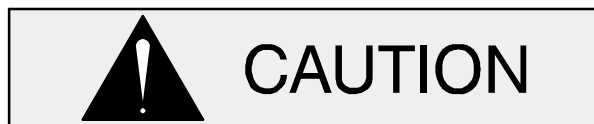
Follow the instructions on all tags, label and decals attached to the pump.

The following maintenance and repair instructions are keyed to the Pump Model sectional views Figure C-1 and 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 optional control box, terminate the power supply to the control box and pump. Close any valves in the discharge line.



The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the plug on the pump power cable is disconnected from its receptacle. If the pump power cable is wired into an optional control box, make certain the switch is in the OFF or STOP position, or that the power supply to the control box has been otherwise cut off and locked out. Tag electrical circuits to prevent accidental start-up.



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

Use the lifting rope (46, Figure C-1 or C-2) to remove the pump from the wet well or sump, and move it to a location where the discharge line can be removed. It is not necessary to disconnect the discharge hose before removing the pump.



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

Select a suitable location, preferably indoors, to perform the degree of maintenance required. If the motor housing is to be opened, the work must be done in a clean, well-equipped shop. All maintenance 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 head. If the problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY**, followed by **MOTOR DISASSEMBLY**. Otherwise, see **Head And Power Cable Disassembly**.

Carefully inspect any O-rings or gaskets before removal and cleaning to determine if a proper seal and compression existed prior to disassembly. If sealing was faulty or questionable, the cause must be determined and corrected before reassembly. All gaskets and most O-rings **must** be replaced if disturbed. Repair gaskets and O-rings are listed in the Parts List manual.

## PUMP END DISASSEMBLY

### Strainer And Impeller Cover Removal

(Figure C--1 or C--2)

To remove the strainer (4), disengage the hardware (5 and 6) securing the strainer to the impeller cover (88). To remove the impeller cover, remove the hardware (86 and 87) securing it to the pump casing (1). Remove the cover gaskets (7).

#### NOTE

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

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

### Draining Oil From Seal Cavity

(Figure C--1 or C--2)

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



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

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

### Positioning Pump For Disassembly

(Figure C--1 or C--2)

It is recommended that the pump be positioned upside-down during disassembly. To hold the pump in the inverted position, rest the pump securely on blocks. Be careful not to damage the head (48) and power cable (45) while in this position.

### Impeller Removal

(Figure C--1 or C--2)

Wedge a piece of wood between the vanes of the impeller (2) and the pump casing to prevent shaft rotation. Remove the impeller hardware (89, 90 and 91).

Remove the wood and use a suitable puller to pull the impeller off the shaft. Retain the impeller key (8).

### Seal Removal

(Figures C--1, C--2 and C--3)

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

Remove the hardware (10 and 11) securing the seal chamber to the lower mounting plate (80). Carefully remove the seal chamber; tension on the seal spring will be release.

Remove the seal chamber O-ring (13).

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

Lubricate the rotor shaft (77) adjacent to the bellows assembly, and use two stiff wires with hooked ends to pull the bellows and rotating seal element from the shaft.

Remove the seal spring and spring retaining ring.

Remove the snap ring from the rotor shaft, and inspect the oil seal (92) in the bore of the lower mounting plate (80). Replace the seal as required.

It is not necessary to remove the lower mounting plate unless the motor requires disassembly.

### NOTE

*Do not disassemble the motor unless it is necessary and a clean, well-equipped shop is available. If the motor housing components are to be serviced, see **MOTOR DISASSEMBLY** in this section. Do not reassemble the pump end components at this time.*

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

### Liquid Level Sensing Assemblies

(Figure C--2)

### NOTE

*It is not necessary to disassemble any part of the motor to disassemble the liquid level sensing devices.*

The on-point assembly (99) can be removed by removing the hardware (100, 101 and 102) securing the assembly to the head (48). Disconnect the twist connector of the white assembly lead and remove the assembly.

The off-point assembly (95) can be removed by removing hardware (96 and 97) securing the assembly to the motor housing (79). Disconnect the twist connector of the gray assembly lead and remove the assembly.

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

## PUMP END REASSEMBLY

### NOTE

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

## Cleaning And Inspection Of Pump Parts

(Figure C--1 or C--2)

With the pump inverted, stuff a clean tissue into the stationary seal seat bore of the motor housing (79) or wrap a small rag around the shaft to prevent foreign material from entering the motor cavity.

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

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



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

Inspect the rotor shaft (77) for damaged threads, scoring, or nicks. Remove nicks and burrs with a fine file or emery cloth to restore original contours. If the shaft is bent or severely damaged, the rotor and shaft must be replaced as an assembly (see **MOTOR DISASSEMBLY**).

### Seal Installation

(Figures C--1, C--2 and C--4)

The shaft seal assembly (3) should not be reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an **emergency**, carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate the preci-

sion finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a circular pattern to avoid scratching the faces.

Inspect the seal components for wear, scoring,

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

Install the shaft seal as illustrated in Figure C-3.

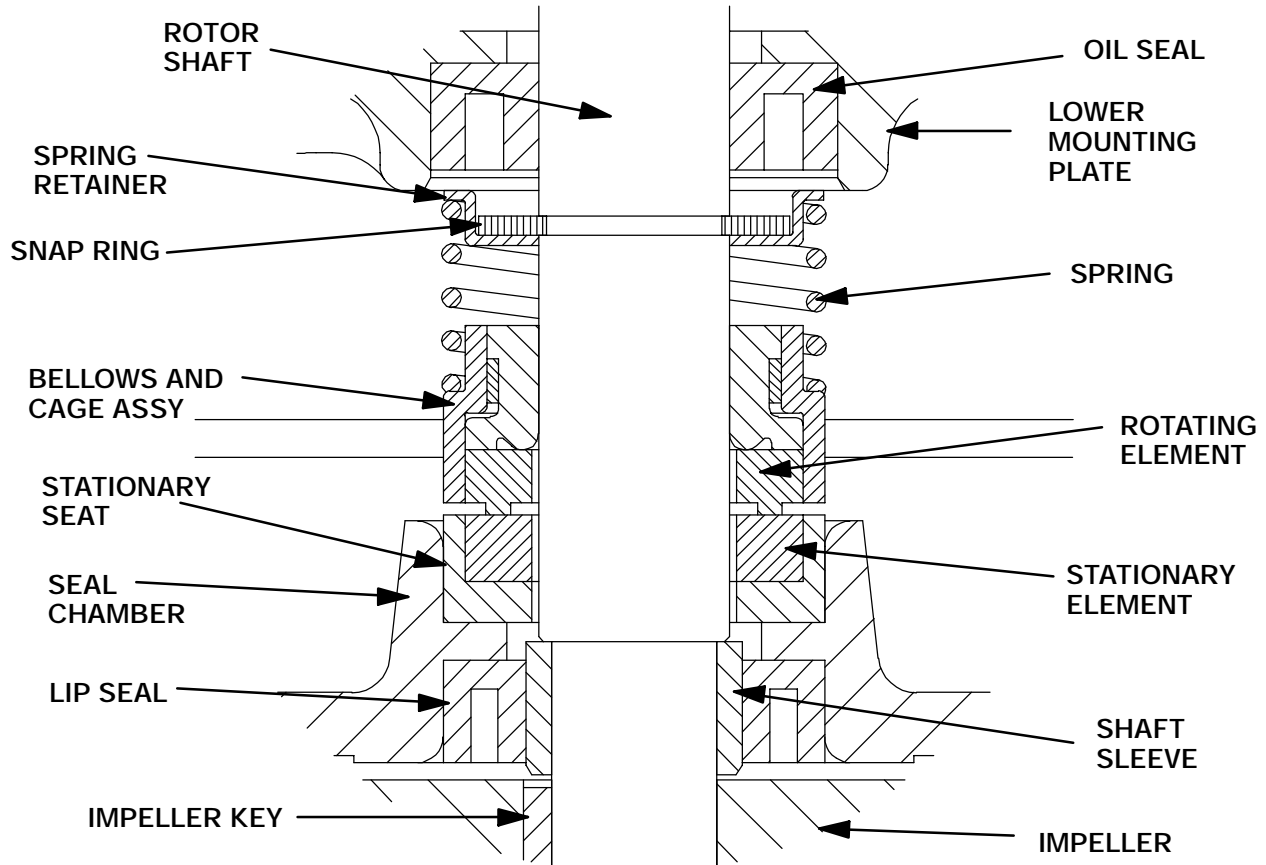
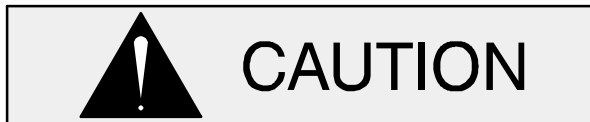


Figure C-3. Seal Assembly



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

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

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

Replace the lower mounting plate O-ring (14) and secure the lower mounting plate (80) to the motor housing (79) with the hardware (81 and 82)

Install the oil seal (92) in the mounting plate (80) with the lip positioned as shown in Figure C-1 or C-2.

#### 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.*

Install the snap ring on the rotor shaft just below the oil seal.

Unpack the stationary seat and stationary element. Place a clean tissue over the sealing face of the stationary element and subassemble the stationary seat so that the lugs in the seat engage the grooves in the element.

Apply a **light** coating of oil to the seal seat bore in the seal chamber (9). Position the subassembly in the seal chamber bore with the sealing face up and cover the seal face with a clean tissue. Use your thumbs to press the assembly into the bore. Apply equal pressure on opposite sides until the seat contacts the bore shoulder. Remove the tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use clean tissue to wipe **lightly** in a concentric pattern. After cleaning, apply a drop light oil to the seal face.

Unpack the seal spring retaining ring, seal spring, bellows and rotating element. Be certain the seal face of the rotating element is free of grit or surface damage. Subassemble the drive grooves of the rotating element into the drive lugs of the bellows retainer.

Position the seal spring retaining ring over the snap ring on the rotor shaft.

Slide the seal spring over the shaft and the retaining ring.

Apply a **light** coating of oil to I.D. of the bellows. Slide the bellows and assembled rotating element on the shaft so that the bellows cage slips into the seal spring. The seal spring cannot be compressed and held in place until the seal chamber is installed.

Inspect the faces of the stationary and rotating elements to make certain that they are clean. If cleaning is necessary, use a clean tissue to wipe **lightly** in a circular pattern. After cleaning, apply a drop of light oil to the seal faces.

Lightly oil and install the seal chamber O-ring (13).

Install the seal chamber and the assembled seal stationary seat and element on the shaft and secure the chamber to the lower mounting plate with the hardware (10 and 11).

## Impeller Installation

### (Figure C--1 or C--2)

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 shaft sleeve (94) and the lip of the dust seal (93). Press the seal into the seal chamber with the lip positioned as shown in Figure C-3.

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

Install the impeller hardware (89, 90 and 91). Wedge a block of wood between the vanes of the impeller to prevent shaft rotation, and tighten the impeller lock nut (91).

Remove the block of wood and turn the impeller to check for free rotation. Check the front clearance after installing the impeller cover (88).

Install the pump casing (1) and secure it to the seal chamber with the hardware (84 and 85).

Install two impeller cover gaskets (7). Position the impeller cover (88) over the pump casing (1) and secure the cover with the hardware (86 and 87).

## Impeller Clearance

### (Figure C--1 or C--2)

There should be a clearance of .010 to .020 inch (0,25 and 0,51 mm) between the impeller cover (88) and the face of the impeller. Use a feeler gauge to measure this clearance.

If the impeller clearance is not within specified limits, remove the impeller cover and remove one of the gaskets (7). Reinstall the impeller cover, and recheck clearance.

## Strainer Installation

### (Figure C--1 or C--2)

Inspect the strainer (4) for cracks, distortion or erosion, and replace it if defective.

Position the strainer squarely on the shoulder of the impeller cover (88) and secure with the hard-

ware (5 and 6). Make certain that the strainer seats properly against the shoulder of the impeller cover.

### Liquid Level Sensing Assemblies

(Figure C--2)

If the on-point assembly (99) has been removed, connect the twist connector of the white lead to the assembly. Secure the assembly to the head (48) with the hardware (100, 101 and 102).

If the off-point assembly (95) has been removed, connect the twist connector of the gray lead to the assembly. Secure the off-point assembly to the motor housing (79) with the hardware (96 and 97).

(Figure C--1 or C--2)

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

## MOTOR DISASSEMBLY

Disassembly of the motor is rarely required except to replace the rotor, stator, bearings or motor housing. The shaft and rotor assembly (77) may be serviced after disassembling only the pump end, however to service the stator (78) the pump end and motor components must be completely disassembled. Do not disassemble the motor unless it is necessary and a clean, well-equipped shop is available.

### NOTE

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



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

**control box make certain the switch is in the OFF or STOP position and locked out, or that the power supply to the control box has been otherwise cut off and locked out. Tag electrical circuits to prevent accidental start-up.**

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

### Head And Power Cable Removal

(Figure C--1 or C--2)

Total disassembly of the head (48) and power cable (45) is not always required. Disassemble and replace **only** the parts proven defective by inspection or testing. See **Electrical Testing** in **TROUBLESHOOTING**.

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

Secure the pump in an upright position. Remove the hardware (64 and 65) securing the head to the motor housing (79). Raise the head for access to the electrical connections.

(Figure C--1)

### S2D3 115V 1P

Disconnect the Amp-lock plug (32) from the cap (33). Disconnect the pin housing (36) from the socket housing (30). Remove the head, assembled power cable (45) and running capacitor (40).

To disconnect the power cable from the head, remove the hardware (52 and 53) securing the cable band (51) to the cable. Unscrew the cable locknut (39) and remove the beveled washer (38). Pull the cable and attached Amp-Lock cap through the bore of the head. To remove the Amp-lock cap (33), disconnect the cable leads from the contacts (31) and pull the cap off the cable.

Remove the hardware (55 and 56) securing the running capacitor holder (57) and remove the running capacitor (40). To remove the socket housing (37), disconnect the socket locks (34) from the housing.

If necessary, remove the hardware (49 and 50) securing the handle to the head.

Remove the head O-ring (22).

Disconnect the start capacitor socket housing (30) from the pin housing (29). Remove the pin locks (28) of the C1 blue leads from the pin housing.

Remove the C2 blue leads pin locks (35) from the running capacitor pin housing (36).

Remove the solder from the stator white lead at its point of connection to the overload protector (69).

Disconnect the red stator lead from the Amp-lock plug (32) at the plug contact (31).

Using caution not to strain any electrical leads, lift the mounting plate (20) from the shaft while guiding the electrical leads through the grommet (23).

If the rotor (77) is installed in the motor housing (79), and the upper ball bearing (18) remains on the rotor shaft, the bearing shim (19) will become a free part. If the bearing and shim remain in the bore of the mounting plate, remove them after the mounting plate has been completely freed from the motor housing.

Turn the mounting plate (20) over and remove the hardware (75 and 76) securing the terminals (74) of the short blue lead from the stator (78) to the centrifugal switch contact (73). It is not necessary to remove the C1 blue lead to the pin housing of the starting capacitor.

Remove the phillip screws (70) securing the ring clamp (21) to the mounting plate (20).

The mounting plate should be completely free; remove it while guiding the electrical leads through the grommet (23).

Remove the hardware (24, 25 and 26) securing the green ground wire to the mounting plate.

Remove the hardware (66, 67 and 68) to securing the overload protector (69) to the mounting plate.

Remove the hardware (75 and 76) securing the centrifugal switch contact (73) to the mounting plate.

#### NOTE

*The centrifugal switch actuator (17) is a press fit onto the rotor shaft and cannot be removed until the rotor is removed.*

---

Remove the hardware (62 and 63) securing the start capacitor holder (61) and start capacitor (58) to the mounting plate.

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

#### (Figure C--2)

#### S2D3A 115V 1P

Disconnect the Amp-lock plug (32) from the Amp-lock cap (33). Disconnect the pin housing (36) from the socket housing (37). Disconnect the twist lock white lead from the on-point assembly (99).

Separate the head, power cable and running capacitor (40) from the motor housing.

To disconnect the power cable (45) from the head, remove the hardware (52 and 53) securing the cable band (51). Unscrew the cable locknut (39) and remove the beveled washer (38). Disconnect the power cable leads from the contacts (31) in the Amp-lock cap (33) and remove the cap. Pull the cable through the bore of the head.

Remove the hardware (55 and 56) securing the running capacitor holder (57) and remove the running capacitor (40). To replace the socket housing (37), remove the socket locks (34) from the housing.

If necessary, remove the hardware (49 and 50) securing the handle (47) to the head.

Remove the head O-ring (22).

#### NOTE

*The rotor and shaft (77), assembled bearings (15 and 18) and centrifugal switch actuator (17) may be removed by disassembling the pump end and lower mounting (80). The head mounting plate (20) must be removed if the stator (78) is to be disassembled.*

---

Disconnect the starting capacitor socket housing (30) from the pin housing (29). Remove the pin locks (28) of the C1 blue leads from the pin housing.

Remove the pin locks (35) of the C2 blue leads from the run capacitor pin housing (36).

Remove the gray lead socket lock (27) from the on/off-point assemblies socket housing (30).

Remove the solder from the stator white lead at its point of connection to the overload protector (69).

Disconnect the Amp-lock cap (106) from the Amp-lock plug (105). Disconnect the red stator lead to the plug contact (104).

The starting capacitor (58) and automatic control system (107) are mounted on the circuit board; remove the hardware (108 and 109) securing the board to the mounting plate (20). Remove the board and attached capacitor and control. (The electrical connections and leads will remain attached to the automatic control.)

Remove the phillip screws (70) securing the ring clamp (21) to the mounting plate (20). Using caution not to strain any electrical leads, slowly lift the mounting plate from the rotor shaft while guiding the disconnected leads through the grommet (23).

If the upper bearing (18) remains on the rotor shaft, the bearing shim (19) will become a free part. If the bearing and shim remain in the bore of the mounting plate, remove them after the mounting plate has been completely freed from the motor housing.

Turn the mounting plate (20) over and remove the hardware (12 and 13) securing the terminals (11) of the short blue lead from the stator (56) to the centrifugal switch contact (73). (It is not necessary to remove the C1 blue lead to the pin housing of the starting capacitor.)

Remove the mounting plate while guiding the electrical leads through the grommet (23).

Remove the hardware (24, 25 and 26) securing the green ground wire to the mounting plate.

To remove the starting capacitor (58), remove the hardware (62 and 63) securing the capacitor holder (61) to the automatic control circuit board.

Remove the hardware (66, 67 and 68) securing the overload protector (69) to the mounting plate.

Remove the hardware (75 and 76) securing the centrifugal switch contact (73) to the mounting plate.

The automatic control (107) is mounted on the circuit board. If desired to remove the control and circuit board, remove the hardware (108 and 109) securing the bracket to the mounting plate (20).

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

## Rotor Removal

### (Figure C--1 or C--2)

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

Remove the bearing shims (19) and the upper bearing (18).

## NOTE

*The upper bearing and bearing shims may have remained in the mounting plate (20) when it was removed.*

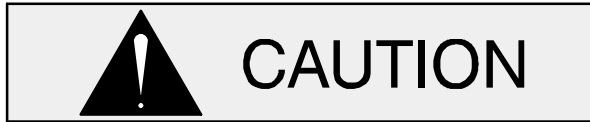
The centrifugal switch actuator (17) is a press fit onto the rotor shaft.

Carefully pull the rotor (77), switch actuator (17), and lower bearing (15) from the motor housing (79). Use caution to prevent the rotor from falling on the stator windings. If necessary, tap the impeller end of the rotor shaft with a block of wood or soft-faced mallet to loosen the seal between the bearing and the motor housing bore.

Remove the snap ring securing the switch actuator to the shaft. Use a felt tip ink marker to scribe the location of the actuator on the impeller side of the shaft. Hook two screwdrivers under the actuator and pull it carefully off the shaft.

## Bearing Removal

(Figure C--1 or C--2)



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) or the motor housing if the proper bearing fit is not achieved.

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

## Stator Removal

(Figure C--1 or C--2)

Do not remove the stator (78) unless it is defective (open windings, insulation resistance low, or stator core damaged). If the stator must be removed, re-

move the head as indicated in **Head And Power Cable Removal**.

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

The motor housing (79) 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.



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. The stator **must** be kept clean and dry. When handling the stator, **do not** set it on the end windings; lay it on its side.



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

## MOTOR REASSEMBLY

### NOTE

*Reuse of old O-rings, gaskets, shaft seal parts will result in premature leakage or reduce pump performance. It is strongly recommended that new*

*gaskets and shaft seal assemblies be used during reassembly (see the parts lists for numbers).*

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

Thoroughly clean the inside of the motor housing (79) with fresh solvent. The interior **must** be dry and free of dirt or lint.



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

### Stator Installation

(Figure C--1 or C--2)

#### NOTE

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

After the motor housing is thoroughly cleaned, position it on a flat surface with the discharge end down. Do not unwrap the stator (78) 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.*

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

#### NOTE

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

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

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

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

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

### Bearing Installation

(Figure C--1 or C--2)

Inspect the rotor shaft (77) 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 sepa-

rated, replace the shaft and rotor (a single assembly).

Press the centrifugal switch actuator (17) on the rotor shaft so that the actuator flange sits just flush with the snap ring groove. The lower side should align with the scribed mark on the shaft.



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.*

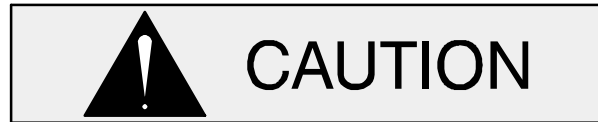
Heat the bearings (15 and 18) to a uniform temperature **no higher than** 250°F (120°C). Slide the bearings onto the shaft one at a time until they are fully seated against the shaft shoulder. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.



Use caution when handling hot bearings to prevent burns.

After the bearings have been installed and allowed to cool, check to ensure that they have not moved out of position in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings. Make certain that they are seated squarely against the shaft shoulders.

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



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

#### Rotor Installation

(Figure C--1 or C--2)

With the stator (78) installed and the motor housing upright, carefully ease the rotor and assembled bearings into the motor housing and through the stator so that the lower bearing (15) seats squarely in the motor housing bore.

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

#### Head And Power Cable Installation

(Figure C--2 or Figure C--3)



**The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the plug on the pump power cable is disconnected from its receptacle. If the pump power cable is wired into an optional control box make certain the switch is in the OFF or STOP position and locked out, or that the power supply to the control box has been otherwise cut off and locked out. Tag electrical circuits to prevent accidental start-up.**

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.**

(Figure C--1)

### S2D3 115V 1P

Install the centrifugal switch contact (73) on the mounting plate (20) with the hardware (71 and 72). Install the terminals (74) of the short blue stator lead to the centrifugal switch contact with the hardware (75 and 76). (The C1 blue lead from the contact to the starting capacitor pin housing (29) should already be installed on the contact.)

Inspect the mounting plate grommet (23), and replace if badly worn.

Feed the C1 blue lead from the centrifugal switch contact (73) and the C1 blue, two C2 blue, white and red leads from the stator (78) through the grommet (23) and mounting plate.

Position the bearing shim (19) on the upper bearing (18). Carefully press the mounting plate bore over the bearing shim and upper bearing. Make certain that the bearing seats squarely into the bore.

Install the ring clamp (21) on the mounting plate and secure it with the hardware (70).

Install the starting capacitor (58) in the capacitor holder (61) and secure to the mounting plate with the hardware (62 and 63). Test the capacitor for shorts and grounding (see **Electrical Testing** in the **Parts List Manual**).

Install the two C1 blue lead pin locks (28) in the pin housing (29). Connect the pin housing to the starting capacitor socket housing (30).

Connect the two C2 blue lead pin locks (35) to the starting capacitor pin housing (36).

Secure the overload protector (69) on the mounting plate with the hardware (66, 67 and 68). Solder the white stator lead to the overload protector. (The white lead from the Amp-lock plug should be already soldered to the protector.)

Install the red stator lead in the Amp-lock plug (32).

### NOTE

*Check wiring to make certain that all the leads from the motor housing area are now installed.*

Connect the terminal of the green ground wire to the mounting plate and secure with the hardware (24, 25 and 26). Make certain the terminal makes good contact with the plate.

Replace the head O-ring (22).

Install the running capacitor (40) and the attached socket housing (37) in the capacitor holder (57) and secure the holder to the head with the hardware (55 and 56).

Test the two capacitors for shorts and grounding (see **Electrical Testing** in **TROUBLESHOOTING**).

Install the beveled washer (38), cable locknut (39), cable band (51) and cable chain (54) on the power cable (45). Lubricate the bore of the head (48) and install the power cable through the bore. Tighten the locknut to secure the cable.

Connect the leads of the cable to the contacts (31) in the Amp-lock cap (33) to match the color coding in the Amp-lock plug (32). Connect the plug and cap.

Connect the running capacitor socket housing (37) to the pin housing (36).

### NOTE

*Check the wiring diagram in Section B of the Installation and Operations manual to make sure that all electrical leads are correctly installed and that the Amp-lock cap, both pin and socket housings, are securely connected.*

Position the head (48) on the motor housing (79) and secure with the hardware (64 and 65).

Secure the cable band (51) to the cable with the hardware (52 and 53). Secure the cable chain and

carrying handle (47) to the head with the hardware (49 and 50).

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

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

(Figure C--2)

### S2D3A 115V 1P

Install the centrifugal switch contact (73) on the mounting plate (20) with the hardware (71 and 72). Install the terminals (74) to the short blue stator lead and secure the terminals to the centrifugal switch contact with the hardware (75 and 76). The C1 blue lead from the contact to the starting capacitor in housing (29) should already be installed on the contact.

Inspect the mounting plate grommet (23), and replace if badly worn.

Feed the C1 blue lead from the centrifugal switch contact, the C1 blue, two C2 blue, white and red leads from the stator (56) and through the grommet (23) and mounting plate.

Position the bearing shim (19) on the upper bearing (18). Carefully press the mounting plate bore over the bearing shim and upper bearing. Make certain that the bearing seats squarely into the bore.

Install the ring clamp (21) on the mounting plate and secure it with the hardware (70).

Install the starting capacitor (58) in the capacitor holder (61) and secure to the control circuit board with the hardware (62 and 63).

Secure the control circuit board, mounted starting capacitor and automatic control system (107) to the mounting plate (20) with the hardware (108 and 109).

Install the two C1 blue lead pin locks (28) in the pin housing (29). Connect the pin housing to the starting capacitor socket housing (30).

Connect the two C2 blue lead pin locks (35) to the running capacitor pin housing (36).

Secure the overload protector (69) on the mounting plate with the hardware (66, 67 and 68). Solder the white stator lead to the overload protector. (The white lead from the Amp-lock plug should be already soldered to the protector.)

Install the red stator lead in the Amp-lock plug (32).

Install the gray lead socket lock (27) in the socket housing (30) and secure the socket housing to the pin housing (29).

### NOTE

*Check wiring to make certain that all the leads from the motor housing area are now installed.*

Connect the terminal of the green ground wire to the mounting plate with the hardware (24, 25 and 26). Make certain the terminal makes good contact with the plate.

Replace the head O-ring (22).

Install the running capacitor (40) and the attached socket housing (37) in the capacitor holder (57) and secure the holder to the head with the hardware (55 and 56).

Install the beveled washer (38), cable locknut (39), cable band (51) and cable chain (54) on the power cable (45). Lubricate the bore of the head (48) and install the power cable through the bore. Tighten the locknut to secure the cable.

Connect the cable leads to the contacts (31) in the Amp-lock cap (33) to match the color coding in the Amp-lock plug (32). Connect the plug and cap.

Connect the twist lock white lead to the on-point assembly (99). Connect the running capacitor socket housing (37) to the pin housing (36).

### NOTE

*Check the wiring diagram in Section B of the Installation and Operations manual to make sure that all electrical leads are correctly installed and that both Amp-lock cap and plugs, and all three pin and socket housings, are correctly and securely connected.*

Position the head (48) on the motor housing (79) and secure with the hardware (64 and 65).

Secure the cable band (51) to the cable with the hardware (52 and 53). Secure the cable chain and carrying handle (47) to the head with the hardware (49 and 50).

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

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

**FINAL ASSEMBLY**

**VACUUM/PRESSURE TESTING**

(Figure C--1 or C--2)

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

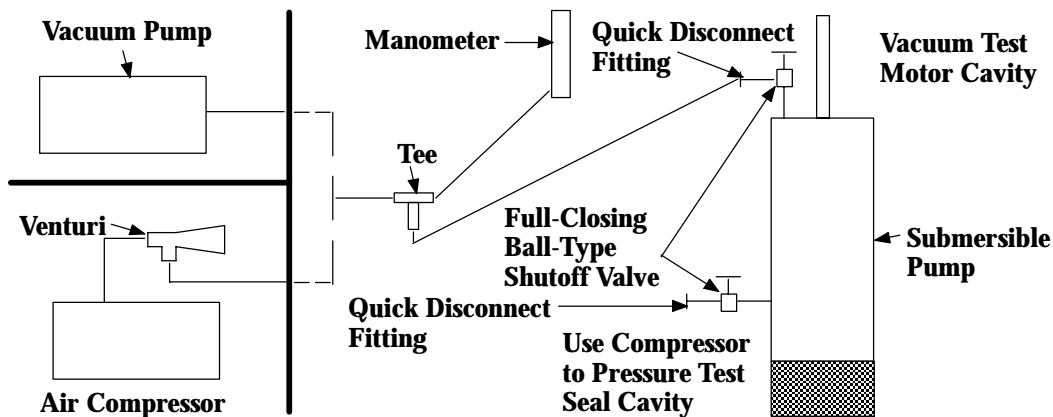
uum gauges are not sensitive enough to detect minor leaks.

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

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

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

Figure C-4 shows a simple schematic for setting up either a vacuum pump or a venturi/compressor test system.



**Figure C-4. Vacuum/Pressure Test System**

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

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

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

Pump Model	Motor Cavity Vacuum (In. Hg.)	Duration (Minutes)	Seal Cavity Pressure (PSI)	Duration (Minutes)
S2D3	30	1	15	1

## LUBRICATION

(Figure C--1 or C--2)

### Seal Cavity

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



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

To check the seal cavity oil, lay the pump on its side and remove the seal cavity drain/fill plug (83) in the motor housing. Tip the pump and drain off a small amount of oil into a transparent cup. If the oil level is abnormally low, or the color milky or dark, refer to **Draining Oil From Seal Cavity** in this section for instructions and troubleshooting tips.

To fill the seal cavity, remove the seal cavity drain/fill plug (83) and add 7 ounces (0,2 liter) of SAE No. 10 non-detergent oil. Refer to the **Installation and Operations** Manual for positioning of the pump during filling of the seal cavity. Apply 'Loctite Pipe Sealant With Teflon No. 592.' or equivalent to the threads of the pipe plug, before reinstalling the plug.

### Motor Cavity

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

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