OM—06519—02
November 12, 2013

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WITH PARTS LIST

GORMAN-RUPP PUMPS

SM SERIES PUMPS

MODELS

SM3B65—X6
ALL VOLTAGES

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

Register your new
Gorman-Rupp pump online at
www.grpumps.com

Valid serial number and e-mail address required.

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: _____

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INTRODUCTION

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

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for every aspect of each specific application. Therefore, it is the responsibility of the owner/installer of the pump to ensure that applications not addressed in this manual are performed **only** after establishing that neither operator safety nor pump integrity are compromised by the installation. Pumps and related equipment **must** be installed and operated according to all national, local and industry standards.

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

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901—1217
Phone: (419) 755—1011
or:
Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631—2870

For information or technical assistance on the power source, contact the power source manufacturer's local dealer or representative.

HAZARD AND INSTRUCTION DEFINITIONS

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

DANGER!

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

WARNING!

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

CAUTION

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

NOTE

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

SAFETY – SECTION A

This information applies to SM Series submersible motor driven pumps.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.

WARNING!

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).**

WARNING!

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

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections. Make certain that the pump and enclosure are properly grounded. 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.

WARNING!

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

WARNING!

All electrical connections must be in accordance with MSHA Schedule 2G. If there is a conflict between the instructions provided and MSHA specifications, MSHA specifications shall take precedence. All electrical equipment supplied with this pump was in conformance with MSHA 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.

WARNING!

This pump is not designed to pump vol-

atile, explosive, or flammable materials. Refer to the chart in Installation, Section B for the basic materials of construction for each pump covered in this manual. Do not attempt to pump any liquids for which your pump is not approved, or which may damage the pump or endanger personnel as a result of pump failure. Consult the factory for specific application data.

WARNING!

Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Do not attempt to lift this pump by the motor or control cables, or the piping. Attach proper lifting equipment to the lifting bail fitted on the pump. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.

WARNING!

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

WARNING!

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.

WARNING!

Do not open the control box in an explosive atmosphere. When sealed, the control box is explosion proof to prevent the ignition of combustible gases. Opening the box in an explosive atmosphere could result in fire or explosion.

INSTALLATION – SECTION B

Review all SAFETY information in Section A.

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

All functions performed by the customer on the pump or control must be done in accordance with MSHA schedule 2G regulations to ensure the explosion-proof integrity. No alterations of original design may be made without the consent of the Gorman-Rupp Company and MSHA.

CAUTION

To retain "Permissibility" of this equipment, the following conditions shall be satisfied:

1. **GENERAL SAFETY.** FREQUENT INSPECTION SHALL BE MADE. ALL ELECTRICAL PARTS, INCLUDING THE PORTABLE CABLE AND WIRING, SHALL BE KEPT IN A SAFE CONDITION. THERE SHALL BE NO OPENINGS INTO THE CASINGS OF THE ELECTRICAL PARTS. A PERMISSIBLE DISTRIBUTION BOX SHALL BE USED FOR CONNECTION TO THE POWER CIRCUIT UNLESS CONNECTION IS MADE IN FRESH INTAKE AIR. THE MACHINE FRAME SHALL BE EFFECTIVELY GROUNDED. THE POWER WIRES SHALL NOT BE USED FOR GROUNDING. THE OPERATING VOLTAGE MUST MATCH THE VOLTAGE RATING OF THE MOTOR(S) 10%.
2. **SERVICING.** EXPLOSION-PROOF ENCLOSURES SHALL BE RESTORED TO THE STATE OF ORIGINAL SAFETY WITH RESPECT TO ALL FLAME ARRESTING PATHS, LEAD ENTRANCES, ETC., FOLLOWING DISASSEMBLY FOR REPAIR OR REBUILDING, WHETHER BY THE OWNER OR AN INDEPENDENT SHOP.
3. **FASTENING.** ALL BOLTS, NUTS, SCREWS, AND OTHER MEANS OF FASTENING, AND ALSO THREADED COVERS, SHALL BE IN PLACE, PROPERLY TIGHTENED AND SECURED.
4. **RENEWALS AND REPAIRS.** INSPECTIONS, REPAIRS, OR RENEWALS OF ELECTRICAL PARTS SHALL NOT BE MADE UNLESS THE PORTABLE CABLE IS DISCONNECTED FROM THE CIRCUIT FURNISHING POWER, AND THE CABLE SHALL NOT BE CONNECTED AGAIN UNTIL ALL PARTS ARE PROPERLY REASSEMBLED. SPECIAL CARE SHALL BE TAKEN IN MAKING RENEWALS OR REPAIRS. LEAVE NO PARTS OFF. USE REPLACEMENT PARTS EXACTLY LIKE THOSE FURNISHED BY THE MANUFACTURER. WHEN ANY LEAD ENTRANCE IS DISTURBED, THE ORIGINAL LEADS OR EXACT DUPLICATES THEREOF SHALL BE USED AND STUFFING BOXES SHALL BE REPACKED IN THE APPROVED MANNER.
5. **CABLE REQUIREMENTS.** A FLAME-RESISTANT PORTABLE CABLE BEARING A MSHA-ASSIGNED IDENTIFICATION NUMBER, ADEQUATELY PROTECTED BY AN AUTOMATIC CIRCUIT-INTERRUPTING DEVICE, SHALL BE USED. SPECIAL CARE SHALL BE TAKEN IN HANDLING THE CABLE TO GUARD AGAINST MECHANICAL INJURY AND WEAR. SPLICES IN PORTABLE CABLES SHALL BE MADE IN A WORKMANLIKE MANNER, MECHANICALLY STRONG, AND WELL INSULATED. ONE TEMPORARY SPLICE MAY BE MADE IN ANY TRAILING CABLE. SUCH TRAILING CABLE MAY ONLY BE USED FOR THE NEXT 24-HOUR PERIOD. NO TEMPORARY SPLICE SHALL BE MADE IN A TRAILING CABLE WITHIN 25 FEET OF THE MACHINE, EXCEPT CABLE REEL EQUIPMENT. CONNECTIONS AND WIRING TO THE OUTBY END OF THE CABLE SHALL BE IN ACCORDANCE WITH RECOGNIZED STANDARDS OF SAFETY.

GORMAN−RUPP MSHA PUMP INSPECTION FORM

INSPECTOR_____ **DATE**_____

MODEL NO._____ **SERIAL NO.**_____

UNIT ELECTRICAL RATING:

H.P._____, VOLTS_____, PUMP AMPS_____, HERTZ_____

STARTER X/P NO: XP3026−1 (CONTROL WITHOUT FLOAT)

OR

18−XPA040007−0 (CONTROL WITH FLOAT)

MOTOR CABLE:

___No. 12; 7 Conductor; Type SPC; .89 ± .03 O.D.; Heavy Jacketed; Royal − MSHA 122;
___No. 8; 9 Conductor; Type SPC; 1.05 ± .03 O.D.; Heavy Jacketed; Royal − MSHA 122;
___No. 6; 9 Conductor; Type SPC; 1.25 ± .04 O.D.; Heavy Jacketed, Royal − MSHA 122;

Length_____

ITEM	AREA OF INSPECTION	ACC.	REJ.	CORRECTED
1.	Are lock washers (or equivalent) provided for all explosion proof enclosure fastenings?			
2.	Are all plane joints securely fastened so that a .005−inch feeler gauge cannot be inserted?			
3.	Is motor plug secured with lock clip?			
4.	Are all electrical connections secure?			
5.	Are all electrical connections insulated where necessary and per appropriate drawing?			
6.	Are packing glands properly packed so that 1/8−inch clearance remains between packaging nut and stuffing box?			
7.	Are packing nut and cable grip secured with lock wire and lead seal?			
8.	Was pump leak tested?			
9.	Was pump and control electrically tested?			
10.	Was pump water tested?			
11.	Are pump, cable, and control assembled together properly per appropriate drawing?			

Comments:

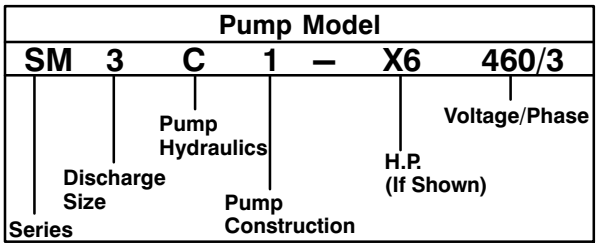
NOTE: Fill out form completely and “rejections” must be corrected and re−inspected. Inspector must initial and date when corrective action was taken. 10/9/87

Form CD GL−02128 Rev 6/05
Doc# 152708

This form not to be revised without approval of MSHA.

Pump Model Designation

Following is a description of the model numbering system for SM Series pumps. These submersible pumps are available in a range of sizes. Refer to the following chart to identify the size for your specific pump model.



Review all SAFETY information in Section A.

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

PREINSTALLATION INSPECTION

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

a. Inspect the pump assembly for cracks, dents, damaged threads, and other obvious damage.

b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.

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

d. Inspect the control box for cracks, dents, and other obvious damage.

e. Check that all control box components are securely attached to their mounting surfaces, and that the electrical connections are tight and free of corrosion.

f. Compare the amperes, phase, voltage and hertz indicated on the motor nameplate to the ratings indicated for the control box.

g. Carefully read all tags, decals, and markings on the pump assembly and the control box, and perform all duties as indicated.

h. Check the pump and motor for any oil leaks. An oil leak may indicate a cut O□ring or other damage.

i. If the pump and control box have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

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

Lubrication

This pump series utilizes one lubrication cavity, located just behind the seal plate. It is filled with premium quality submersible pump oil which lubricates two shaft seals. The motor operates in air and requires no lubrication.

The lower shaft seal prevents liquid from entering the lubrication cavity, while the upper shaft seal prevents oil leakage into the motor. The upper seal also acts as backup protection in the event of lower seal failure.

The lubrication cavity was fully lubricated when shipped from the factory. Check the oil level before installing the pump (see **LUBRICATION** in **MAINTENANCE AND REPAIR**). An additional quart of oil has been provided with the pump to “top off” the oil cavity. If the oil level is abnormally low, determine the cause before putting the pump into service.

PUMP INSTALLATION

Pump Specifications

See Tables B–1 and B–2 for pump specifications.

Table B–1. Pump Specifications

Model	Voltage/ Phase	Motor Horse-power	Pump Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
SM3B	460/3 575/3	60	3450	10.8 8.6	4.0 3.2	56 45	3 INCH

Table B–2. Additional Specifications

Pump Model	Voltage/ Phase	Approximate Weight Lbs. (kg)		Seal Cavity	
		Pump	50Ft. Cable	Oil Capacity Ounces (Liters)	Filling Position (H)orizontal (V)ertical
SM3B	460/3 575/3	105 (47,6)	23 (10,4)	16 (0,47)	H

Pump Dimensions

WARNING!

When installing or servicing the pump or controls, follow all requirements for the installation of wiring or electrical equipment as outlined in the National Electric Code. Follow all MSHA safety requirements. Failure to observe these requirements could result in injury or death to personnel.

CAUTION

Do not allow the free end of the power cable to enter the liquid being pumped. The free end of the cable **must** be kept dry to prevent liquid from wicking through the cable and into the motor.

NOTE

Refer to the performance curve in Section E, ***MAINTENANCE AND REPAIR*** *when determining the most efficient piping installation.*

Table B—3. MSHA Specifications And Approval Data

Model No.	MSHA No	Cable P/N	Trailing Cable	Motor Cable
SM3B65-X6 460/3 SM3B65-X6 575/3	XP—3185—1 XP—3185—1	47351—011 47351—011	No. 8, 3 Conductor, Type G-GC, 0.97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max. MSHA Flame Resistance, 600/2000 Volt, 90°C. **Max. Length**: 500 Ft. - Customer Furnished Note: Instantaneous Trip Amps Set At 200 Amps Max.	G-R P/N 47351—011. #12 AWG., 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA Flame Resistant, **Max. Cable Length**: — Combined Trailing Cable And Pump Motor Cable Not To Exceed 500 Ft.

Lifting

Pump unit weights can vary depending on the material of construction and length of cable on the unit. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.

Refer to Table B—2 for the approximate maximum weight for each pump.

WARNING!

Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Do not attempt to lift this pump by the motor or control cables, or the piping. Attach proper lifting equipment to the lifting bail fitted on the pump. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.

Positioning the Pump

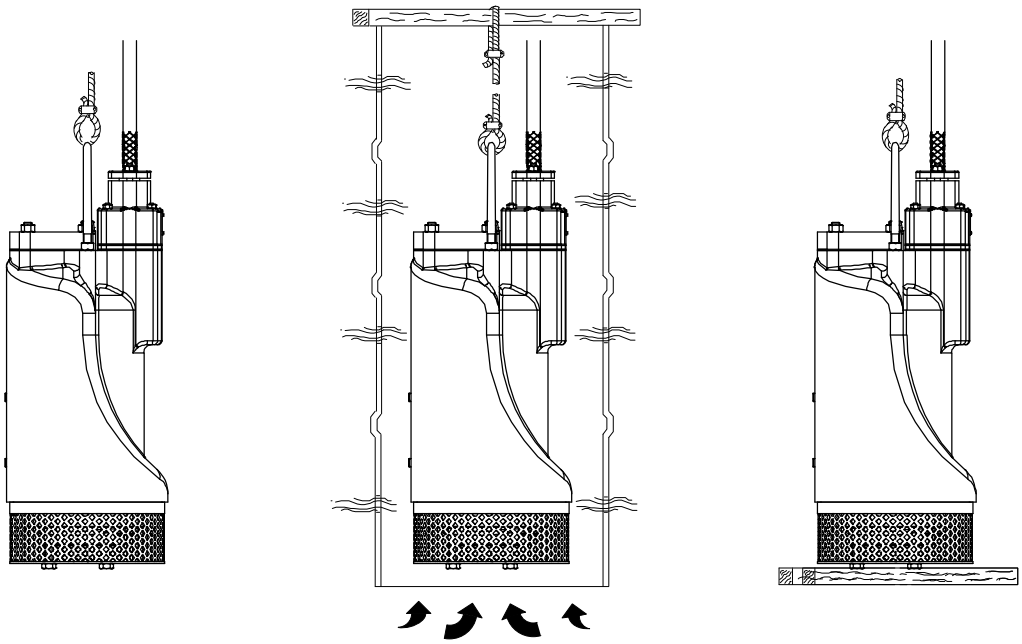
NOTE

*Before installing and operating the pump, check the direction of impeller rotation to ensure that the pump is properly wired at the control box. See **IMPELLER ROTATION**, Section C.*

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

The pump will operate if positioned on its side, but this is not recommended because the motor torque could cause the pump to roll during operation.

The pump should be independently secured and supported by the lifting device fitted on the pump. If the application involves a lot of debris, protect the pump from excessive wear and clogging by suspending it in a perforated barrel or culvert pipe. If the bottom is heavily sludge¿covered, rest the pump on support blocks or suspend it from a raft or similar device near the surface of the liquid. See Figure B—1 for typical pump installations.



BY BAIL IN PERFORATED CULVERT PIPE ON SUPPORTS

Figure B—1. Typical Pump Installations

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

PIPING

No suction piping is required in a standard submerged application.

SM Series pumps are provided with a suction strainer to prevent large solids from clogging the impeller. On high discharge head applications, the strainer can be removed, and the pump suction "staged" to the discharge of another pump, allowing one pump to feed the other.

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

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

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

CONTROL BOX

This pump is driven by an integral 60 hertz, 6 HP motor. It is designed to operate through the control box furnished with the pump.

WARNING!

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

Enclosure

The control box is a NEMA type 10, MSHA certified enclosure. **The enclosure is not designed to be**

watertight, and should not be submerged. See Figure B−2 for enclosure dimensions and callouts.

Secure the control box vertically on a level surface, above flood level. The box should be easily accessible to the operator, and located close enough to the pump to avoid excessive voltage drop due to cable length (see **Pump Power Cable Connections**). After the box is installed, make certain the front cover latches properly.

CAUTION

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

Table B−4. Control Box Specifications

Model	Voltage/ Phase	Control Box Part No.	Mtg. Plate Part No.	Relay Rating (Amps)	Hold Amps	Trip Amps	MSHA Cert. No.
SM3B	460/3	47631−148	47882−005	13.0	14.3	17.6	XP−3185−1
SM3B	575/3	47631−149	47882−006	10.4	11.4	14.3	XP−3185−1

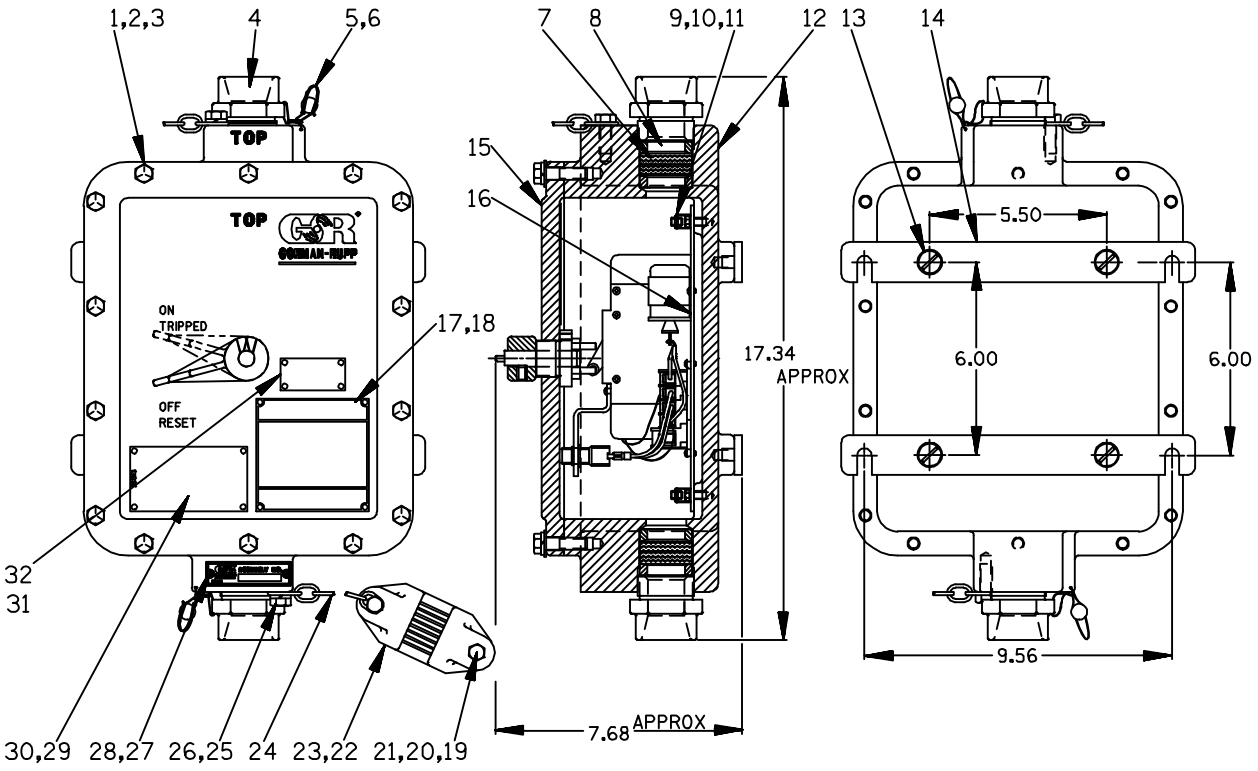


Figure B−2. Control Box Assembly

PARTS LIST − EXTERNAL PARTS
47631−148 (460V) AND 47631−149 (575V) CONTROL BOXES
(See Figure 3 For Internal Control Box Parts)

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		HEX HD CAPSCREW	21632−597	−−−−−	14
2		LOCKWASHER	J06	15991	14
3		FLAT WASHER	KE06	15991	14
4		PACKING GLAND NUT	31874−017	13045	2
5	✳	LEAD SEAL	21188−002	−−−−−	2
6	✳	WIRE − 14 INCH	31311−004	17990	2
7	✳	ROPE PACKING	31313−010	22120	1
8	✳	PACKING WASHER	31133−109	13150	4
9		GROUND LUG	27222−004	−−−−−	2
10		HEX HD CAPSCREW	B0402	15991	4
11		LOCKWASHER	J04	15991	4
12		ENCLOSURE	38383−001	13045	1
13		FL HD MACH SCREW	Y0602	15991	4
14		MOUNTING BRACKET	33657−002	13090	2
15	✳	ENCL COVER ASSY	42114−074	−−−−−	1
		−ENCLOSURE COVER	38383−401	13015	1
	✳	−ON/OFF HANDLE	38421−012	13040	1
	✳	−HANDLE SETSCREW	GA0501 1/2	15990	1
	✳	−SHAFT ASSY	41881−276	24150	1
	✳	−SHAFT BUSHING	31513−031	13155	1
	✳	−BUSHING SETSCREW	GA#10−01S	15990	1
		−WIRING DECAL	2613GM	−−−−−	1
16		MTG PLT ASSY (460V)	47882−005	−−−−−	1
		MTG PLT ASSY (575V)	47882−006	−−−−−	1
17		MSHA CERT PLATE	2613GL	17020	1
18		DRIVE SCREW	BM#04−03	17000	4
19		HEX HD CAPSCREW	B0608	15991	4
20		LOCKWASHER	J06	15991	4
21		HEX NUT	D06	15991	4
22		CABLE CLAMP	38116−603	13040	4
23		RUB BRKT PROTECTOR	33573−001	19990	4
24		CHAIN − 3/16 X 12	41158−009	15991	2
25		HEX HD CAPSCREW	B0604	15991	2
26		LOCKWASHER	J06	15991	2
27		ASSEMBLY PLATE	2613GG	17020	1
28		DRIVE SCREW	BM#04−03	17000	2
29		MSHA APPROVAL PLATE	2613ES	17020	1
30		DRIVE SCREW	BM#04−03	17000	2
31		PENN DOER APPL PLATE	2613FL	17020	1
32		DRIVE SCREW	BM#04−03	17000	4

✳ INDICATES PARTS RECOMMENDED FOR STOCK

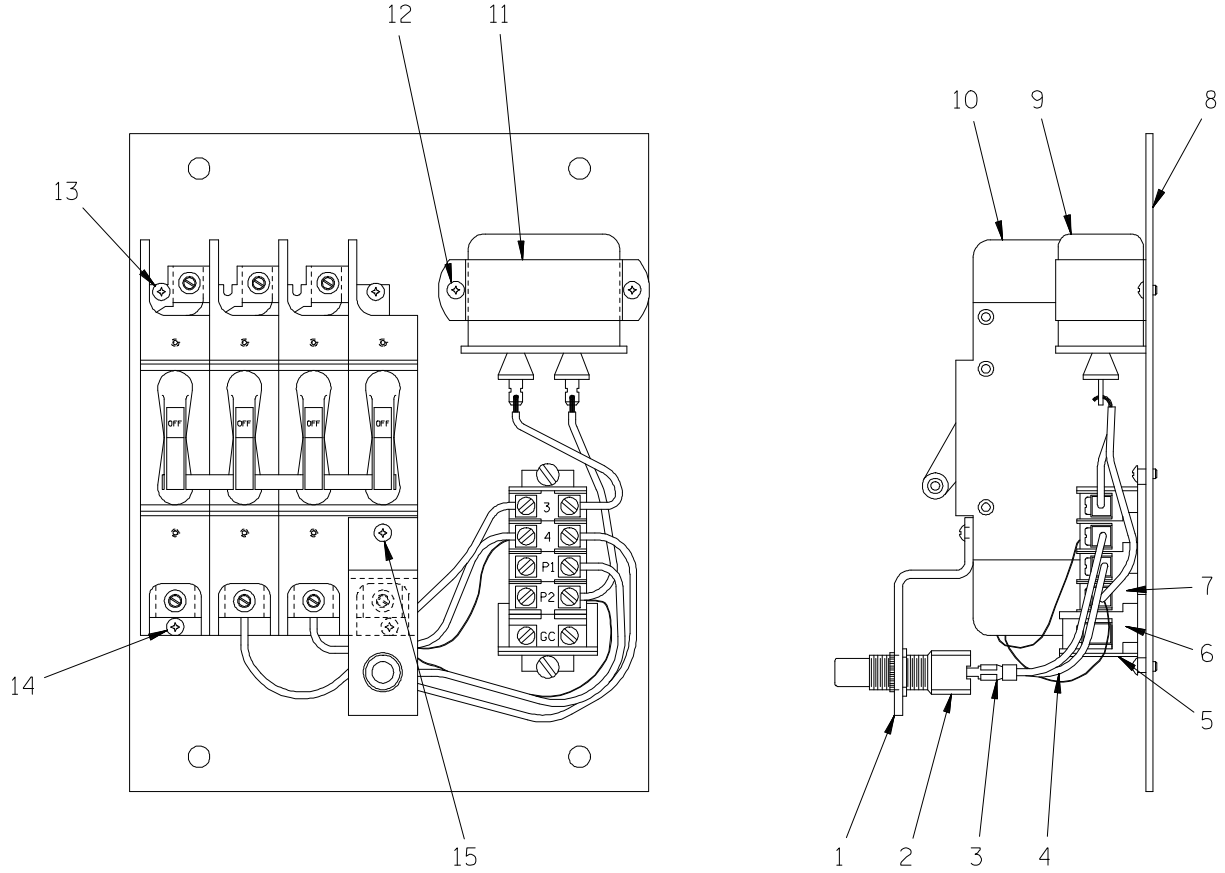


Figure B−3. Electrical Mounting Plate Assembly

PARTS LIST
47882−005 (460V) AND 47882−006 (575V) MOUNTING PLATE ASSEMBLIES

(See Figure 2 For External Control Box Parts)

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		SWITCH BRACKET	34512−027	−−−−−	1
2	✳	CUTLER HAMMER SWITCH	27341−211	−−−−−	1
3		TERMINAL	S1790	−−−−−	2
4		WIRE ¿ 14 GA. X 36.5 IN. LG.	38746−027	−−−−−	1
5		TERMINAL BLOCK END	27233−021	−−−−−	1
6		TERMINAL BLOCK	NOT REQUIRED	−−−−−	
7		TERMINAL BLOCK	27233−203	−−−−−	5
8		MOUNTING PLATE	33287−011	−−−−−	1
9	✳	G¿E CAPACITOR	27571−332	−−−−−	1
10	✳	RELAY/SHUNT TRIP (460V)	27541−483	−−−−−	1
	✳	RELAY/SHUNT TRIP (575V)	27541−495	−−−−−	1
11		CAPACITOR BRACKET	27581−904	−−−−−	1
12		RD PHILLIP MACH SCREW	21771−551	−−−−−	2
13		RD PHILLIP MACH SCREW	21771−552	−−−−−	4
14		RD PHILLIP MACH SCREW	21771−553	−−−−−	2
15		RD PHILLIP MACH SCREW	21771−542	−−−−−	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

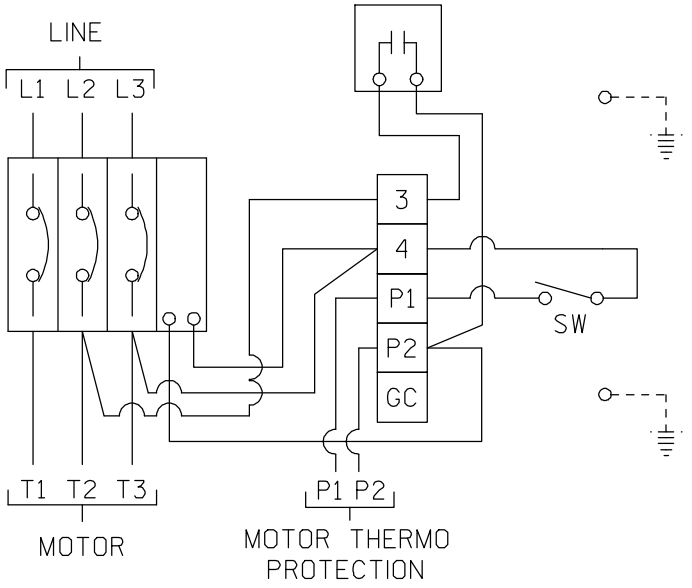


Figure B—4. Mounting Plate Wiring Schematic

Grounding Methods

Electrically ground the installation before before connecting the field wiring to the control box. Install a grounding terminal to the enclosure and connect it to a properly embedded electrode.

The material used for the electrode **must** be an excellent conductor of electricity, such as copper. If iron or steel is used, it must be galvanized or otherwise metal plated to resist corrosion. **Do not** coat the electrode with any material of poor conductivity, such as paint or plastic.

The electrode must conform to the recommendations of N.E.C. ARTICLE 250. Follow all installation requirements of the N.E.C., and all applicable codes. See Figure B—5 for some suggested grounding methods.

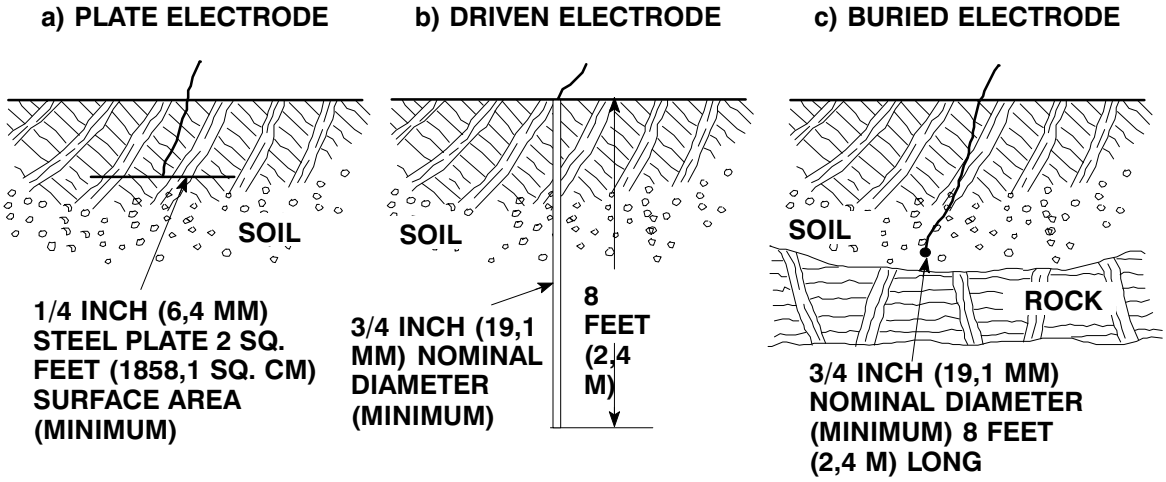


Figure B—5. Suggested Grounding Methods

a. **Plate Electrode:** An iron or steel plate, 1/4 inch (6,4 mm) thick, completely impeded in the ground. The plate must present a surface area of at least 2 square feet (1858,1 sq. cm).

b. **Driven Electrode:** A rod or pipe, 3/4 inch (19,1 mm) in diameter minimum, 8 feet (2,4 m) long, completely driven into the ground.

c. **Buried electrode:** If rock or stone prevents embedding the full 8 foot (2,4 m) length of the ground rod, bury it horizontally in a trench.

Space the ground rod or plates at least 6 feet (1,8 m) from any other electrode or ground rod, such as those used for signal circuits, radio grounds, lightning rods, etc.

The earth surrounding the ground rod or plate **must** contain enough moisture to make a good electrical connection. In dry or sandy areas, pour water around the rod, or consult qualified personnel to devise a method of improving the connection.

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the control box is properly grounded after installation.

Field Wiring Connections (Incoming Power)

The trailing cable from the power source to the control box must be furnished by the customer. The cable must be flame¿resistant, protected by an instantaneous circuit breaker, and meet the specifications indicated in Table B—2 in this section.

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections. Make certain that the pump and enclosure are properly grounded; never use gas pipe as an electrical ground. Be sure that the incoming power matches the voltage and phase of the pump and control before connecting the power source. Do not run the pump if the voltage is not within the limits.

WARNING!

Do not open the control box in an explosive atmosphere. When sealed, the control box is explosion proof to prevent the ignition of combustible gases. Opening the box in an explosive atmosphere could result in fire or explosion.

The pump control is designed to regulate a 460 or 575 volt, 3 phase, 60 hertz power supply (see Table 4 for control box specifications). The field wiring must be properly sized to ensure an adequate voltage supply. The voltage available **at the motor** must be within the range indicated in Table B—5.

To calculate the voltage available at the motor, proceed as follows:

a. Measure the incoming voltage across lines 1 & 2, 2 & 3, and 1 & 3 **while the pump is operating at full capacity.** See the wiring diagrams in this section for power supply connections.

b. Next, subtract the motor cable voltage drop (see Table 6, **Pump Power Cable Specifications**).

c. Do not continue to operate the pump if this voltage is not within the recommended limits. Obtain the services of a qualified electrician to determine the correct field wiring size and other details to insure an adequate voltage supply to the pump.

Table B—5. Pump Motor Voltage Limits

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

Use the packing gland nuts to secure and seal the incoming field wiring to the control box. make certain all connections are tight and that cable entry points are rainproof. Support the cable weight, if required, to prevent excessive strain on cable clamps and cable.

NOTE

After the power cables have been connected to the

control box, the packing gland nuts must be wired and sealed before operation. See ***Terminal Housing And Power Cable Reassembly*** *in Section E for instructions.*

Pump Power Cable Connections

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qualified electrician to make all electrical connections. Make certain that incoming power to the control box is in the off position and locked out, or that the power supply to the control box has been otherwise cut off and locked out, before connecting power or accessory cables.

The standard pump is provided with a 50 foot (15,2 meters) power cable (see table 6 for power cable specifications). If a longer cable is required, an optional cable assembly **must** be ordered from the factory. Splicing of the power cable is **not** recommended by the Gorman-Rupp Company due to safety and warranty considerations.

WARNING!

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

Table B—6. Pump Power Cable Specifications Model SM3C65

Pump Model	Voltage/ Phase	AWG Cable Size	Cable O.D. Inches (mm)	Conductor Dia. Inches (mm)	Amp Rating (See Note below)	Cable Type	DC Resistance (ohms) at 25°C (77°F) per 1000 ft. (305 m)	Voltage Drop per 100 ft. (30,5m) at Max. Load
SM3B	460/3 575/3	12	0.89 (22,6)	.10 (2,5)	30	SPC	1.72	3.72 2.96

NOTE: *Amp Rating at 30°C (86°F). Applies only to type SPC cable. Refer to manufacturer's specifications for other cable.
****Amp Rating at 40°C (104°F). Applies only to type SPC cable. Refer to manufacturer's specifications for other cable.**

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

Connect the pump power cable to the control box as shown Figure B—6. Use conduit or cable clamps to secure the power and accessory cables to the control box. Make certain that all connections are tight and that cable entry points are rainproof.

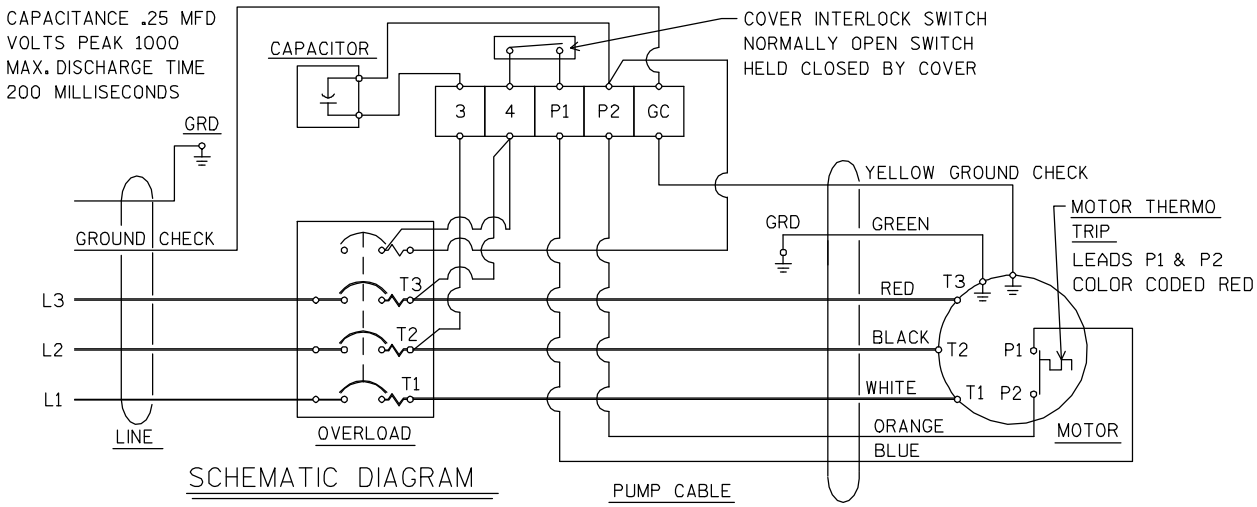


Figure B—6. Pump Power Cable Connection Diagram (All Models)

PUMP POWER CABLE CONNECTION INSTRUCTIONS

1. Run the pump cable through the packing gland nuts and washers (the concave side of the washer should toward the packing) at the bottom of the control.

2. Connect the white, black, and red power leads to terminals “T1”, “T2”, and “T3”, respectively.

3. Connect the green ground lead to terminal “GRD”.

4. Connect the yellow ground check lead to terminal “GC”.

5. Connect the blue control lead to terminal “P1”.

6. Connect the orange control lead to terminal “P2”.

7. Install the packing in the gland with the washers on each side, and tighten the packing gland nut. With the nuts tight and the packing fully compressed, there must be a minimum space of 1/8 inch between the bottom of the nut and the enclosure.

8. Use the seal wire (P/N 31311—004) and lead seal (P/N 21188—002) to secure the packing gland nut to the enclosure. Use the hole in the hex nut and the hole at the top left of the enclosure to prevent loosening of the nut.

LIQUID LEVEL CONTROL

The standard pump is **not** furnished with a means to automatically regulate liquid level. However, the pump may be controlled to perform dewatering functions by using an optional control box available from the factory. The control utilizes a bulb-type sensing device, where a bulb raises or lowers (floats) with the liquid level, thus activating an enclosed miniature switch.

Refer to Figure B—7 for a typical bulb-type float installation.

CAUTION

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

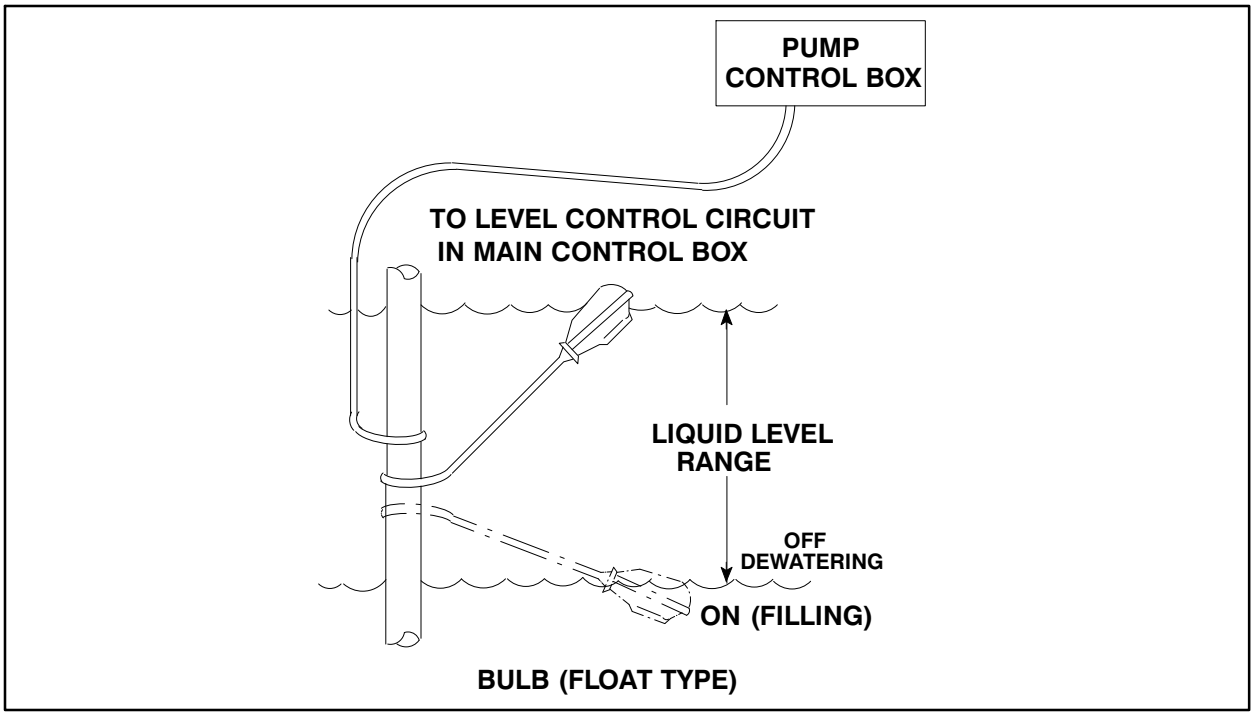


Figure B—7. Liquid Level Devices

OPERATION – SECTION C

Review all SAFETY information in Section A.

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

CONTROL BOX FUNCTION

A control box is provided to facilitate operation of the pump. It contains controls for starting and stopping the pump, and provides overload protection for the pump motor.

WARNING!

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

CAUTION

Since operation of the pump motor is dependent upon the quality and performance of the electrical controls, the pump warranty is valid only when controls have been specified or provided by the Gorman-Rupp Company.

Component Function

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

- **The control handle** operates the control box circuit breakers. In the OFF position, the control handle opens the circuit breakers to interrupt incoming power through the control box and prevent pump operation. In the ON position, it closes the circuit breakers to permit pump operation. The circuit breakers will open or "trip" automatically in the event of a short circuit overload current, or thermal excess within the pump motor or electrical system. When tripped, move the control handle to OFF and back to ON to reset the circuit breakers.

- The control box contains an integral safety switch which automatically "trips" the circuit breakers when the cover is removed. **Never** remove the cover in an explosive atmosphere. Make certain incoming power is **OFF** and **LOCKED OUT**.

- The motor is thermally protected by a thermostat within the stator. In the event of motor overheating, the thermostat will open and automatically "trip" the control box circuit breakers. The motor will not restart until the circuit breakers are reset.

NOTE

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

PUMP OPERATION

WARNING!

This pump is designed to handle most non-volatile, non-flammable liquids encountered in mine dewatering. Do not attempt to pump volatile, explosive, or flammable materials, or any liquids which may damage the pump or endanger personnel as a result of pump failure.

Liquid Temperature And Overheating

The maximum liquid temperature for this pump is 120°F (102.2°C). Do not apply the pump at higher operating temperatures.

WARNING!

Approach the pump cautiously after it has been running. Although the motor is cooled by the liquid being pumped, normal operating temperatures can be high enough to cause burns. The temperature will be especially high if operated against a closed discharge valve. Never operate against a closed discharge valve for long periods of time.

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

WARNING!

Overheated pumps can cause severe burns and injuries. If overheating of the pump occurs:

1. **Stop the pump immediately.**
2. **Ventilate the area.**
3. **Allow the pump to cool.**
4. **Check the temperature before servicing.**
5. **Vent the pump slowly and cautiously.**
6. **Refer to instructions in this manual before restarting the pump.**

Checking Pump Rotation

WARNING!

Do not open the control box in an explosive atmosphere. When sealed, the control box is explosion proof to prevent the ignition of combustible gases. Opening the box in an explosive atmosphere could result in fire or explosion.

Check the direction of pump rotation before operation to ensure that the impeller is rotating in the correct direction.

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

CAUTION

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

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

WARNING!

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

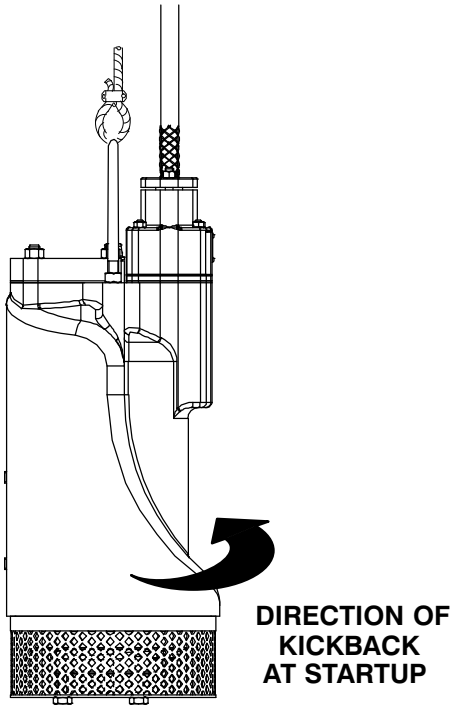


Figure C—1. Checking Pump Rotation

STARTING

After the pump and control box have been installed, start the pump as follows.

NOTE

*Before actual operation, check the direction of impeller rotation to ensure that the pump is properly wired. See **Checking Pump Rotation** in this section.*

CAUTION

Never start the pump more than 6 times per hour. If the pump motor does not cool between starts, it will overheat, resulting in damage to the motor windings or control box components.

Move the control handle to the ON position. The pump motor will start running, and pumping should begin. Since the pump is submerged, priming is not required.

STOPPING

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

This **does not** terminate incoming power through the field wiring connected to the control box.

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

NOTE

It is recommended that a check valve or throttling valve be installed in the discharge line if there is any possibility of siphoning or back flow when the pump is shut off.

OPERATIONAL CHECKS

Check the pump for proper operation when it is first started and periodically thereafter to identify minor problems.

Check the pump for unusual noises or excessive vibration while it is operating. If noise or vibration is excessive, stop the pump and refer to the troubleshooting chart for possible causes.

Check the pump strainer screen for clogging caused by stones, sticks, or other debris. Clean the strainer screen when required. In some cases, stopping the pump momentarily may back flush the strainer screen, purging most of the debris from it. If this fails to clean the screen, remove the pump from the sump and remove the debris manually (see **PUMP END DISASSEMBLY** in Section E).

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

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

COLD WEATHER PRESERVATION

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

If the pump freezes, move it into a warm area until completely thawed, or submerge it into the liquid. If the liquid is near freezing, the pump must be submerged for an extended period of time. Start the pump and check for shaft rotation. if still frozen, allow additional thawing time before attempting to restart.

WARNING!

Do not attempt to thaw the pump by using a torch or other source of flame. This could damage gaskets or heat the oil within the pump above the critical point and cause the pump to rupture or explode.

LUBRICATION

WARNING!

Do not remove plates, covers, gauges, pipe plugs or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to completely cool before servicing.

On a new pump, check the oil level in the seal cavity before initial startup, after the first two weeks of operation, and every month thereafter.

Before installing or removing the lubrication plug(s), always clean the area around the plug(s) to prevent contamination.

Draining Oil

Refer to the parts list in **MAINTENANCE AND REPAIR**, Section E for drain plug location.

Remove the drain plug slowly to release any pressure. Install a short pipe nipple in the hole. Place a clean container under the plug and using a hoist, tilt the pump at an angle of approximately 60°.

Condition of Oil

Check the condition of the oil drained from the pump. Clear oil indicates that the pump seal(s) are functioning properly. If the oil is milky or contains a small amount of water, it must be changed.

If the oil contains a large amount of water, it must be changed, and the seal(s) must be checked before the pump is put back in operation (refer to **MAINTENANCE AND REPAIR**, Section E).

Adding Oil

Refer to Table B−2 in **INSTALLATION** for the oil capacity and position for filling the seal cavity in the pump.

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

When lubricating the seal cavity, remove the lubrication plug as indicated in **Draining Oil**, and position the pump as indicated in Table B−2 in **INSTALLATION**. Add premium quality submersible pump oil (See Table C−1) through this plug hole. If the pump is to be positioned vertically or at an angle, fill the cavity to the bottom of the plug hole. If the pump is to be positioned horizontally, completely fill the cavity.

Install and tighten the lubrication plug.

Table C—1. 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

TROUBLESHOOTING – SECTION D

Review all SAFETY information in Section A.

WARNING!

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).**

WARNING!

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

NOTE

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

Table B-1 Troubleshooting Chart

TROUBLE	CAUSE	REMEDY
PUMP FAILS TO START, CIRCUIT BREAKER NOT TRIPPED	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.
	Open circuit in motor windings or power cable.	Check continuity.
	Defective motor power cable.	Check for and replace defective unit.
CIRCUIT BREAKER TRIPS	Low or high voltage, or excessive voltage drop between pump and control box.	Measure voltage at control box. Check that wiring is correct type, size, and length. (See **Field Wiring Connections**, Operations And Maintenance Manual.
	Defective insulation in motor 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).

Table B-1 Troubleshooting Chart (continued)

TROUBLE	CAUSE	REMEDY
MOTOR RUNS, BUT PUMP FAILS TO DELIVER RATED DISCHARGE	Discharge head too high.	Reduce discharge head, or install staging adaptor and additional pump.
	Low or incorrect voltage.	Measure control box voltage, both when pump is running and when shut off.
	Discharge throttling valve partially closed; check that 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 if possible.
	Strainer screen or impeller clogged.	Clear clog(s). Stop pump; back flow may flush away debris.
	Insufficient liquid in sump or tank.	Stop pump until liquid level rises.
	Worn impeller vanes; excessive impeller clearance.	Check impeller and clearance. See **PUMP END REASSEMBLY**.
	Pump running backwards.	Check direction of rotation and correct by interchanging any two motor leads at control box. (See **Pump Rotation**, Section C).
PUMP RUNS WITH EXCESSIVE NOISE OR VIBRATION	Pumping entrained air.	Check liquid level in sump; check position of pump and liquid level sensing device(s).
	Damaged or unbalanced impeller.	Replace impeller.
	Discharge piping not properly supported.	Check piping installation.
	Impeller jammed or loose.	Check impeller.
	Pump cavitation.	Reduce discharge head, or restrict flow on low head applications.
	Motor shaft or bearings defective.	Disassemble pump and check motor and bearings.

ELECTRICAL TESTING

WARNING!

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

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.

CAUTION

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

Test Equipment

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

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

Voltage Imbalance

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

a. Use a voltmeter, amprobe, or equivalent meter to read the voltage across terminals 1 & 2, 2 & 3, and 1 & 3 in the control box. All three measured voltages must be the same, as accurately as the meter will read. If possible, measure the voltage with the pump off, with the pump running but out of the water, and with the pump running in the water at full load. All the measured voltages at each condition must be the same.

b. Use an amprobe or equivalent meter to measure the current draw of each phase while the pump is running at full load and at no load. All three amperage readings must be the same at each condition, as accurately as the meter will read. Nominal amperage values are listed in Table 1, but these apply only when the actual voltage at the site is the nominal voltage listed.

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

Motor And Motor Power Cable Continuity

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

a Disconnect the motor power cable leads from the control box and connect the test leads to any two of the three power cable leads (not to the green ground lead or yellow ground check lead). If there is a high resistance reading on the ohmmeter, there is an open or broken circuit cause a break in the power cable or motor windings, or by a bad connection between the motor and the power cable. Switch one test lead to the third power lead, and test again.

b. If an open or broken circuit is indicated, check the power cable for obvious damage, and replace as necessary (see **MAINTENANCE AND REPAIR)**. If there is no apparent damage to the motor cable, remove the terminal housing (see **MAINTENANCE AND REPAIR)** and check the continuity of each power cable lead at the terminal posts.

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 enters.

Insulation Resistance

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

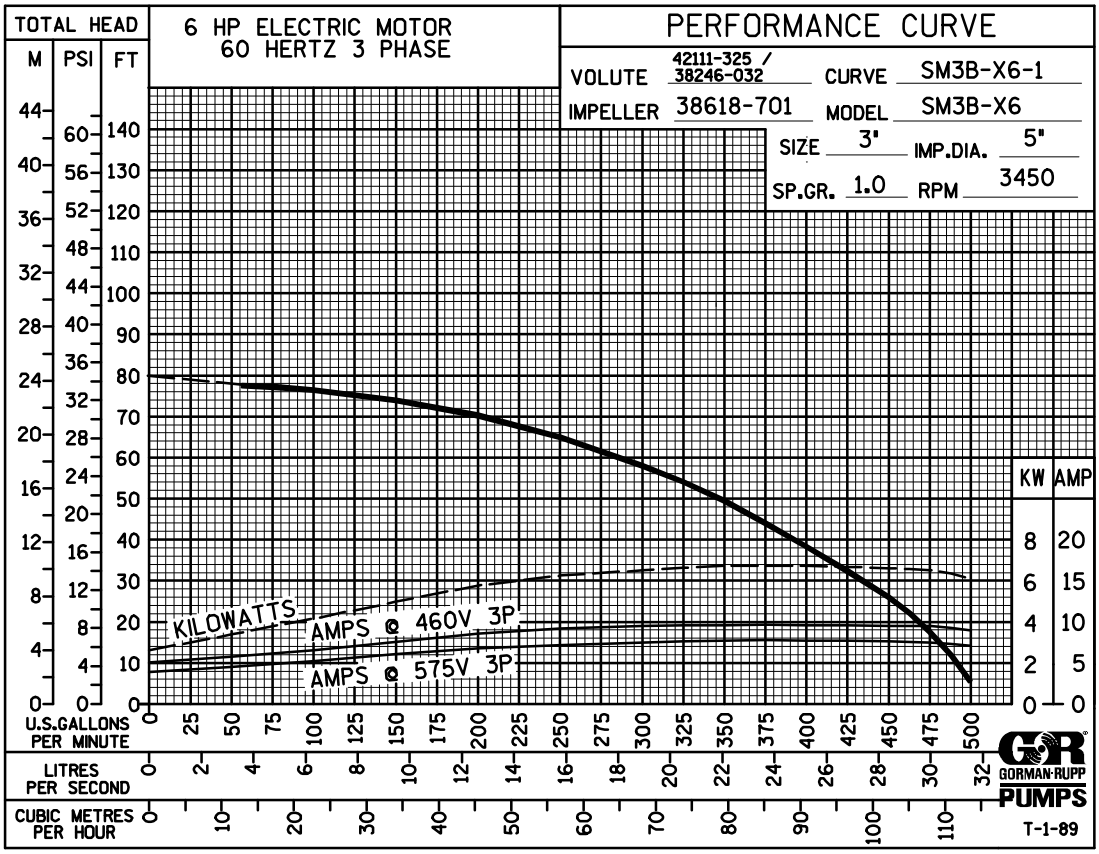
a. Disconnect the motor power cable leads from the control box. Connect one test lead to the power cable green ground lead, and touch the other test lead to each of the three power leads in turn.

b. The reading obtained will indicate resistance values in both the power cable and the motor windings. If the resistance reading is infinity (∞), the insulation is in good condition. If the reading is between infinity (∞) and 1 megohm, the insulation is acceptable but should be rechecked periodically. If the reading is less than 1 megohm, the insulation should be checked more closely; a reading of zero indicates that the power cable or the motor is grounded.

c. To determine whether the power cable or the motor is grounded, remove the terminal housing (see **MAINTENANCE AND REPAIR**), disconnect the motor leads from the motor terminals, and test the power cable leads and motor leads separately.

PUMP MAINTENANCE AND REPAIR — SECTION E

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



✳ STANDARD PERFORMANCE FOR PUMP MODEL SM3B65—X6 (All Voltages)

✳ Based on 70°F (21°C) clear water at sea level. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

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

ILLUSTRATION

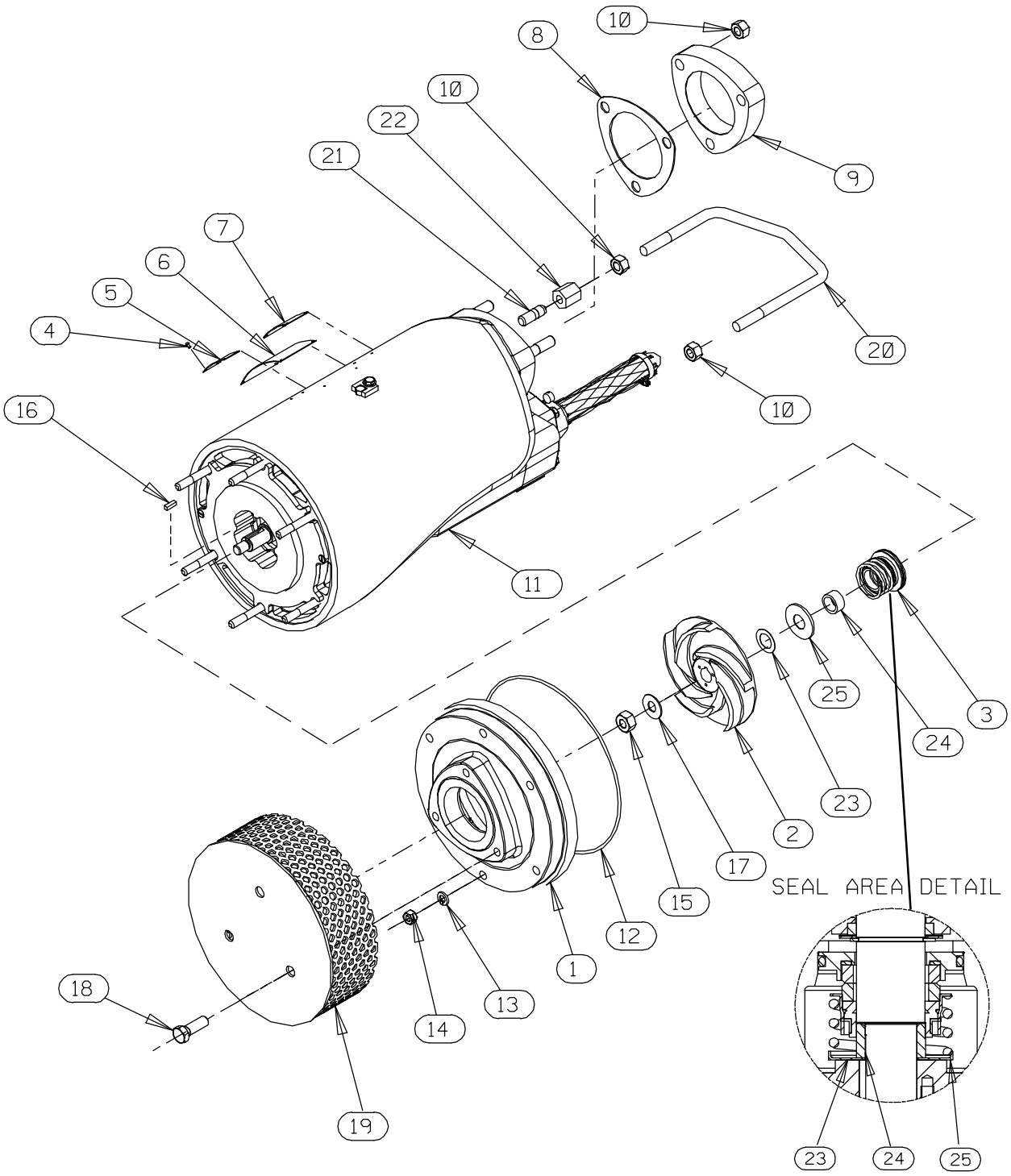


Figure E–1. Pump Model SMBC65–X6 (All Voltages)

PARTS LIST
Pump Model SM3B65−X6 (All Voltages)
(From S/N 1612132 Up)

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		SUCTION HEAD	38246−032	1718H	1
2		IMPELLER	38618−701	1718H	1
3	✳	SEAL ASSEMBLY	46512−071	−−−	1
4		DRIVE SCREW	BM#04−03	17090	16
5		CW OF PA APPROVAL PLATE	2613FL	17040	1
6		MSHA APPROVAL PLATE	2613ES	17040	2
7		NAMEPLATE	2613DD	17040	1
8	✳	FLANGE GASKET	38687−045	19370	1
9		DISCHARGE FLANGE	38641−006	17070	1
10		HEX NUT	D08	17090	5
11		SUBMERSIBLE MOTOR ASSEMBLY:			
		460V	47111−094	−−−	1
		575V	47111−095	−−−	1
12	✳	O-RING	25154−270	−−−	1
13		LOCK WASHER	J06	17090	6
14		HEX NUT	D06	17090	6
15		HEX NUT	22561−165	−−−	1
16		KEY	N0302−1/2	17090	1
17		FLAT WASHER	KB08	17090	1
18		NYLOCK CAP SCREW	BT0806	17090	3
19		STRAINER SCREEN ASSEMBLY	46611−010	24170	1
20		HOISTING BAIL	31926−009	17130	1
21		STUD	C0806	17090	1
22		COUPLING NUT	31811−019	17130	1
23		IMP ADJ SHIM SET	2Y	17090	REF
24	✳	SHAFT SLEEVE	13878	17090	1
25	✳	SPRING RETAINER	8793	17090	1
NOT SHOWN:					
		460V CONTROL BOX	47631−148	−−−	1
		575V CONTROL BOX	47631−149	−−−	1
OPTIONAL:					
		STAGING ADAPTOR KIT	48272−015	−−−	1
		460V FLOAT CONTROL BOX	47631−171	−−−	1
		575V FLOAT CONTROL BOX	47631−172	−−−	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

ILLUSTRATION

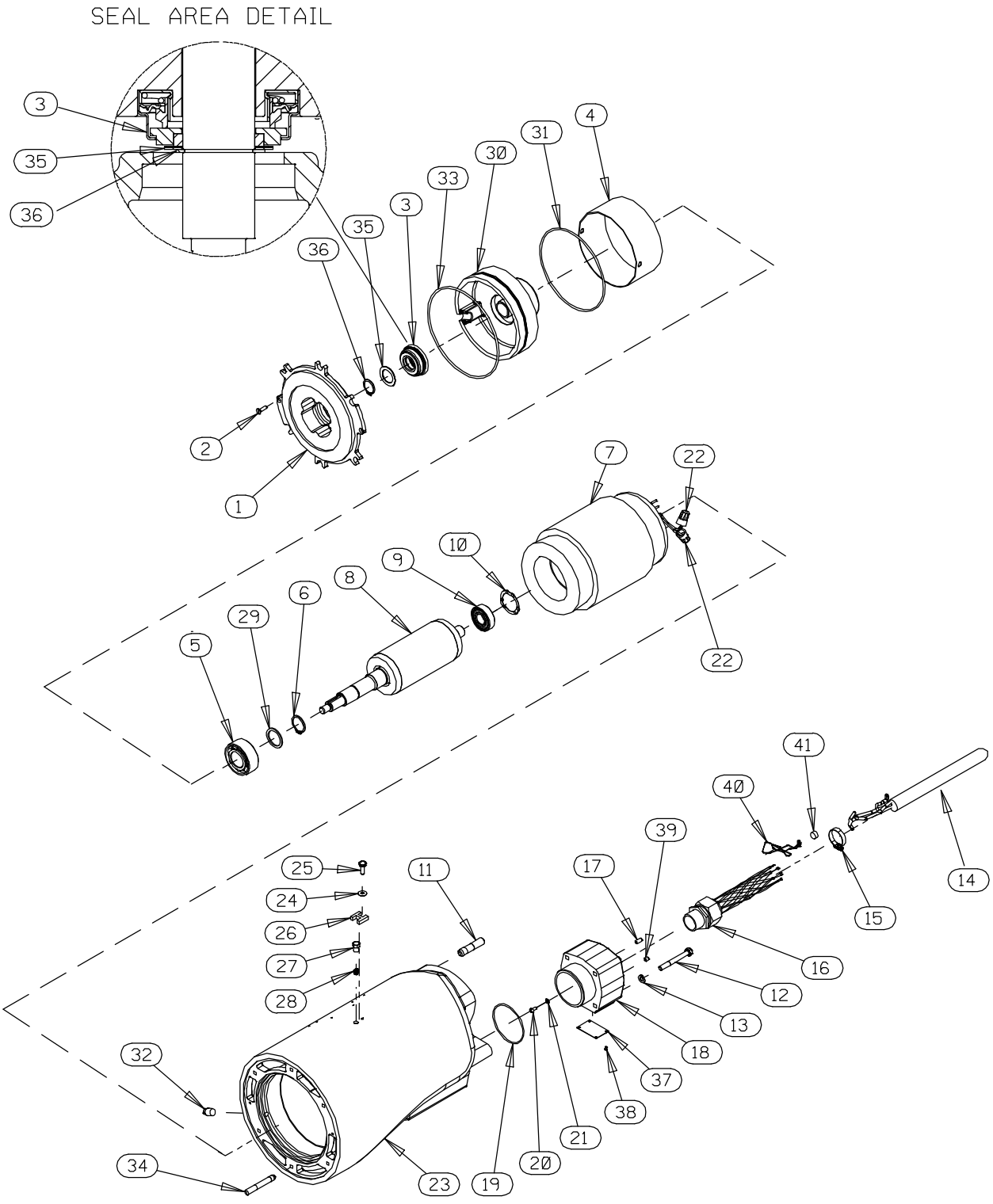


Figure E–2. Submersible Motor Assemblies

PARTS LIST
Submersible Motor Assemblies

ITEM NO.		PART NAME	PART NUMBER	MAT'L CODE	QTY
1		SEAL PLATE:	38272–351	1718H	1
2		FH MACH SCREW	Y#10–03	17090	2
3	✳	MECH SEAL	25276–031	–––	1
4		MOTOR BUSHING	31173–017	23010	1
5	✳	BALL BEARING	23425–007	–––	1
6		SNAP RING	S1831	–––	1
7		STATOR:			
		460V	47113–817	–––	1
		575V	47113–818	–––	1
8		ROTOR & SHAFT ASSY	47112–811	–––	1
9	✳	BALL BEARING	23257–009	–––	1
10		SPRING WASHER	S1554	–––	1
11		STUD	C0809	17090	3
12		HEX HEAD CAP SCREW	B0511	17090	4
13		LOCK WASHER	J05	17090	4
14	✳	SUB PUMP CABLE	47351–011	–––	1
15		HOSE CLAMP	26518–766	–––	1
16		CABLE GRIP ASSY	27111–816	–––	1
17		SET SCREW	GA0402	17090	1
18		TERMINAL HOUSING	38381–225	17040	1
19	✳	O-RING	25154–149	–––	1
20		MACHINE SCREW	X#10–01–1/2	14990	2
21		LOCK WASHER	AK#10	15991	2
22		WIRE CONNECTOR	S1718	–––	5
23		MOTOR HOUSING	38311–069	17040	1
24		FLAT WASHER	KB04	17040	1
25		NYLOCK CAP SCREW	BT0403	17040	1
26		LOCK CLIP	33645–008	17040	1
27		PIPE PLUG	38649–022	17090	1
28		ALLEN HD SET SCREW	GA0501–1/4	15990	1
29		BEARING SPACER	21161–401	–––	1
30		INTERMEDIATE	38261–024	13040	1
31	✳	O-RING	25152–258	–––	1
32		PIPE PLUG	P04	17090	1
33	✳	O-RING	S2194	–––	1
34		STUD	C0611	17090	6
35		ADJUSTING SHIM SET	2X	17090	1
36		RETAINING RING	24124–332	–––	1
37		CERTIFICATION PLATE	2613GX	17040	1
38		DRIVE SCREW	BM#04–03	17090	4
39		SET SCREW	GA0401	17090	1
40		14" LG SST WIRE	14964–103	–––	1
41		LEAD SEAL	21188–002	–––	1
NOT SHOWN:					
		DOW CORING SILICONE ADHESIVE (10.1 OZ.)			
			18771–106	–––	1

✳ INDICATES PARTS RECOMMENDED FOR STOCK

PUMP END DISASSEMBLY

Review all SAFETY information in Section A.

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

All functions performed by the customer on the pump or control must be done in accordance with MSHA, schedule 2G regulations to ensure the explosion-proof integrity. No alterations of original design may be made without the consent of the Gorman-Rupp Company and MSHA.

WARNING!

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

WARNING!

Do not open the control box in an explosive atmosphere. When sealed, the control box is explosion proof to prevent the ignition of combustible gases. Opening the box in an explosive atmosphere could result in fire or explosion.

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

WARNING!

Death or serious personal injury and damage to the pump or components can occur if proper lifting procedures are not observed. Make certain that hoists, chains, slings or cables are in good working condition and of sufficient capacity and that they are positioned so that loads will be balanced and the pump or components will not be damaged when lifting. Do not attempt to lift this pump by the motor or control cables, or the piping. Attach proper lifting equipment to the lifting bail fitted on the pump. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.

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

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

Check the chart in **TROUBLESHOOTING**, Section D 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 D, and have a qualified electrician check the control box, cable and terminal housing. If the problem is determined to be in the motor, proceed with **PUMP END DISASSEMBLY,** followed by **MOTOR DISASSEMBLY**. Otherwise, see **Terminal Housing And Power Cable Disassembly**.

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

Strainer and Suction Head Removal

(Figure E−1)

To remove the strainer (19), raise the pump slightly, or lay it on its side and disengage the hardware (18).

With the strainer removed, disengage the hardware (13 and 14). Pry the suction head (1) out of the motor assembly (11). Remove the suction head O-ring (12).

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

Draining Oil From Seal Cavity

(**Figure E−1)**

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

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

With the pump in a vertical position, clean any dirt from around the pipe plug (32, Figure E−2) and remove the plug. 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.

Positioning Pump For Disassembly

(Figure E−1)

It is recommended that the pump be positioned upside-down during disassembly. To hold the pump in the inverted position, screw a pipe into the discharge flange (9) and clamp it in a large vise, or remove the discharge flange and secure the flange studs to a bench or work stand. Be careful not to damage the terminal housing (18, Figure E−2) while in this position. Use adequate equipment and personnel to safely handle the pump until it is secured. If inverting the pump is not practical, lay the pump on its side and secure it to prevent rolling.

Impeller Removal

(Figure E−1)

Wedge a soft metal rod between the vanes of the impeller (2) and the studs (34, Figure E−2) to prevent shaft rotation. Remove the impeller nut (15) and washer (17). Remove the metal rod used to prevent shaft rotation.

Install three 10−32 UNC−2B by 2-inch long capscrews (not supplied) in the holes in the impeller. Use the capscrews and a suitable puller to pull the impeller from the shaft. Use caution when removing the impeller; tension on the seal spring will be released. Retain the impeller key (16).

Remove the impeller adjusting shim set (23). For ease of reassembly, tie and tag the shims or measure and record their thickness.

Lower Seal Removal

(Figures E−1 and E−3)

Remove the spring retainer (25) and seal spring. Carefully pull the sleeve (25) and rotating portion of the lower seal assembly off the shaft as a unit.

Remove the spring retainer (26), and seal spring. Carefully pull the sleeve (25) and rotating portion of the lower seal assembly off the shaft as a unit.

Lubricate the sleeve adjacent to the seal, and work oil up under the rubber bellows. Slide the rotating portion of the seal off the sleeve.

See Figure 2 and remove the flat head machine screws (2). Slide the seal plate (1) and the stationary portion of the lower seal assembly off the shaft as a unit. Remove the seal plate O-ring (33).

Position the seal plate on a flat surface with the impeller side down. Carefully press the stationary portion of the seal out of the seal plate from the back side.

The rotating and stationary seal elements are precision finished and subject to wear. The complete seal should be replaced with each overhaul to en-

sure trouble-free operation. However, if the old seal must be reused, wrap the seal faces individually in clean tissue paper to prevent damage to the sealing surfaces.

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

Upper Seal Removal

(Figures E—2 and E—3)

The intermediate (30) and upper seal assembly (3) must be removed as a unit to determine if the upper seal assembly is leaking, and to replace the seal if it is leaking.

Carefully pull straight up on the impeller end of the rotor shaft until the assembled intermediate, seal, bearings (5 and 9), and shaft and rotor assembly (8) are free from the motor housing (23).

Inspect the rotor, stator, and inside of the motor housing for evidence of upper seal leakage. If no leakage is observed, the seal can be reused. However, if leakage is apparent, the intermediate and seal assembly must be separated from the rotor and shaft assembly. Cover the motor housing with a clean cloth after inspection to prevent contamination.

If the seal assembly does not require replacement, proceed to **Cleaning And Inspection Of Pump Parts**, followed by **Upper Seal Installation**.

If seal replacement is required, place the intermediate, seal, bearings, and shaft and rotor assembly on a clean, dry work surface, and remove the retaining ring (36) using snap ring pliers. Use caution when removing the retaining ring; tension of the seal spring will be released. Remove the adjusting shims (35). Tie and tag the shims, or measure and record their thickness for ease of reassembly.

Carefully slide the intermediate and seal assembly off the shaft as a unit. Use a hammer and punch (or other suitable tool) to tap the seal assembly out of the intermediate from the back side.

NOTE

The seal assembly will be damaged or destroyed during removal.

Remove the intermediate O-ring (31).

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

NOTE

If the motor housing components are to be serviced, see **MOTOR DISASSEMBLY** *in this section. Do not reassemble the pump end components at this time.*

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

PUMP END REASSEMBLY

NOTE

Reuse of old O-rings, gaskets, or shaft seal parts 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

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.

NOTE

The upper seal assembly will be damaged or destroyed if removed from the intermediate. If the seal was not removed from the intermediate, clean and inspect all pump end parts as follows, then reinstall the seal assembly and intermediate as a unit.

Thoroughly clean all reusable parts with a soft cloth soaked in cleaning solvent. Use a clean cloth lightly dampened with solvent to clean the lower end of the motor housing, intermediate, and seal plate. **Do not** allow the solvent to enter the motor.

WARNING!

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

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

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

Upper Seal Installation

(Figures E–2 and E–3)

If the upper seal assembly **was not removed** from the intermediate at disassembly, replace the intermediate O-ring (31) and lightly lubricate it with oil. Check to insure that the wavy washer (10) and motor bushing (4) are properly positioned, and slide the rotor and shaft assembly, bearings, intermediate and seal assembly into the motor housing until fully seated.

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

Clean the rotor shaft and seal cavity area of the intermediate (30). Be sure the area is dry and free of lint and dirt. **Do not** permit cleaning solvent or debris to fall into the motor cavity.

Install a new O-ring (31) in the groove in the intermediate and lightly lubricate it with oil. Carefully slide the intermediate over the shaft until it is fully seated over the lower bearing (5).

Check to insure that the wavy washer (10) and motor bushing (4) are properly positioned, and carefully lower the intermediate, bearings, and shaft and rotor assembly into the motor housing. Press the intermediate into the motor housing until fully seated against the motor bushing.

Install the shaft seals as illustrated in Figure E–3.

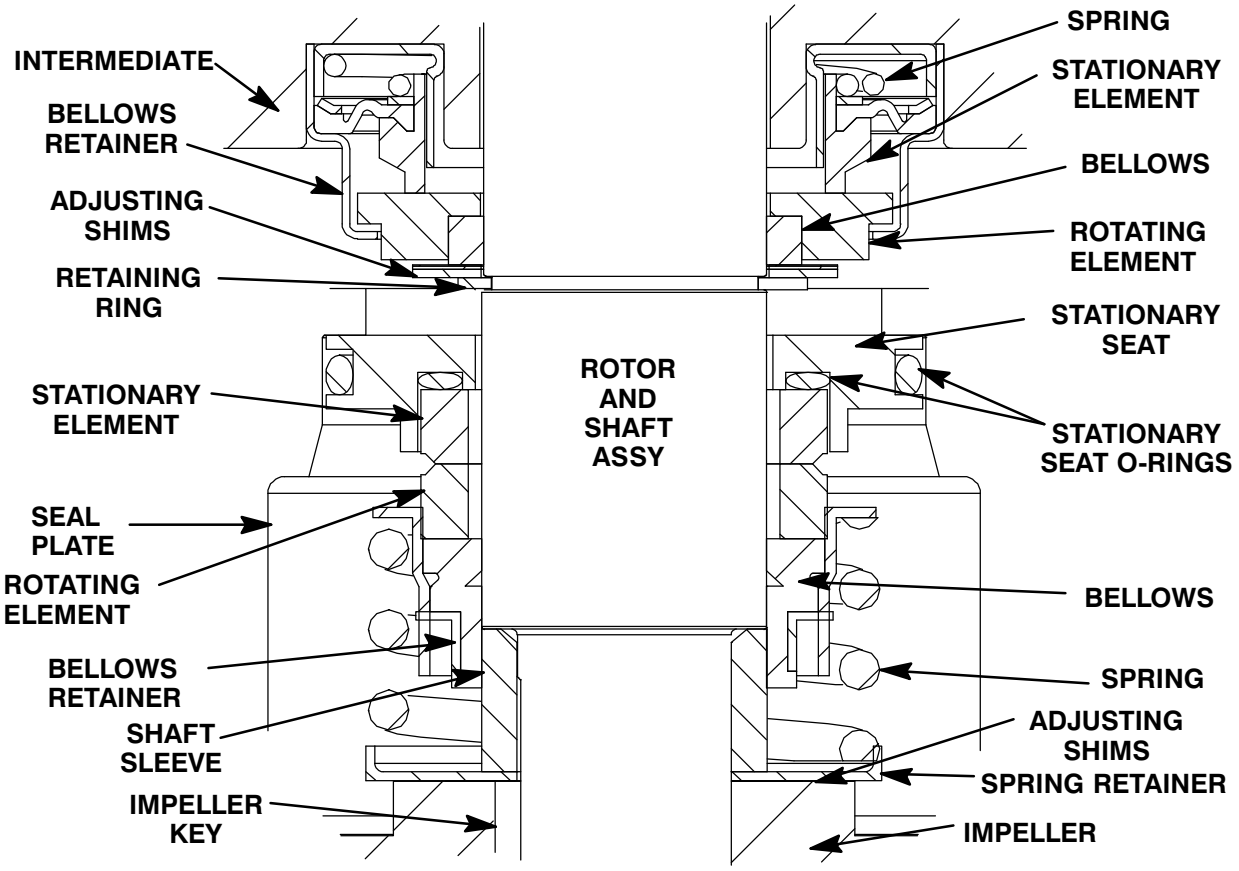


Figure E-3. Upper And Lower Seal Assemblies

CAUTION

The seals are not designed for operation at temperatures above 160°F (71°C). Do not use at higher operating temperatures.

If all of the original motor parts are being reused, the same thickness of shims (35) as previously removed may be installed. However, if new motor parts are being installed that will affect parts "stackup", or if the thickness of shims removed at disassembly is unknown, it will be necessary to measure the seal bore in the intermediate to determine the required shim thickness. This distance is measured from the bottom of the bore in the intermediate to the motor side of the retaining ring (36). Select the required combination of shims to obtain a seal working height of 0.720 to 0.780.

Lubricate the shaft and the outer edge of the seal assembly with a **light** coating of oil, and press the seal assembly into the intermediate bore until fully seated. Use a suitably sized sleeve which contacts **only** the outer metal edge to press the seal into place. Exert even pressure around the metal edge to prevent cocking or damage.

CAUTION

Press only on the outer edge of the seal assembly to prevent damage to the polished surfaces of the rotating and stationary seal faces.

Install the required thickness of shims (35) and secure with the retaining ring (36).

Seal Plate Installation

(Figure E—2)

Thoroughly clean the seal plate with cleaning solvent. The seal seat bore must be free of burrs and nicks which could damage the seal seat O-rings.

Coat the O-ring (33) with light oil and install it on the seal plate shoulder. Press the seal plate into the

motor housing until fully seated. Be careful not to damage the O-ring. Secure the seal plate to the intermediate with the flat head machine screws (2).

Lower Seal Installation

(Figures E−1 and E−3)

Thoroughly clean the sealing surfaces and seal bore of the the seal plate (1, Figure E−2). The seal bore must be free of burrs and nicks which could damage the seal.

NOTE

When installing seal components, use hand pressure only. A push tube cut from a length of plastic pipe will aid in installing seal components.

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

Be sure the bore in the seal plate (where the stationary seat fits) and rotor shaft are clean, dry, and free of dirt or lint. Inspect the bore for burrs or nicks that might cut the seal O-ring or prevent a good seal. Apply a **light** coating of oil to the shaft and seal plate bore.

The lower seal is not normally 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 precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non¿oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

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

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the bellows and O-rings with water or a very **small** amount of light lubricating oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as shown in Figure E−3.

NOTE

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

Unpack the stationary seal seat and element. Subassemble the element into the seat, and place a clean tissue over the seal face. Apply a **light** coat of oil to the seat O-ring, and use your fingers to press the seat and element into the bore. Apply equal pressure on opposite sides of the seat until the assembly bottoms against the bore shoulder. Remove the tissue and inspect the seal face to ensure that it is clean and dry. If cleaning is necessary, use a clean tissue to wipe lightly in a concentric pattern.

Position the seat in the bore with the sealing face up and cover it with a clean tissue. Use your thumbs to press the seat into the bore. Apply equal pressure on opposite sides of the seat until it contacts the bore shoulder. Remove the tissue and check the sealing face to ensure that it is clean and dry. If cleaning is necessary, use **clean** tissue to wipe lightly in a concentric pattern.

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

Apply a light coating of oil to the seal seating surface on the shaft sleeve and I.D. of the bellows. Position the rotating seal portion on the sleeve with the seal face toward the chamfered end of the sleeve. Apply firm, steady pressure, with clean hands, on the seal retainer until it slides down the sleeve.

Slide the sleeve and rotating portion of the seal over the shaft until the sleeve seats squarely against the shaft shoulder. Continue to press on the seal retainer until the seal slides over the shaft and the seal faces contact.

Slide the seal spring over the shaft and bellows retainer and install the spring retainer (25).

After the impeller is installed, lubricate the seal cavity as described in **Lubrication** at the end of this section.

Impeller Installation

(Figure E−1)

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

Install the same thickness of impeller adjusting shims (23) as previously removed onto the rotor shaft. Install the impeller key (16) in the rotor shaft keyway, align the impeller keyway and press the impeller onto the shaft until it seats firmly against the adjusting shims.

For maximum pump efficiency, there should be a clearance of .008 to .015 inch (.20 to .38 mm) between the impeller and the suction head (1). Install the suction head with a new O-ring (12). Apply 'Never-Seez' or equivalent compound to the suction head studs and secure the suction head by torquing the hardware (13 and 14) in an alternating pattern to 20 ft. lbs. (240 in. lbs. or 2.8 m. kg.). Use a feeler gauge to measure the clearance, then add or remove impeller adjusting shims as required.

NOTE

*The impeller and suction head **must** be fully seated to obtain an accurate face clearance measurement.*

After the impeller clearance has been set, coat the threads of the rotor shaft with 'Loctite Threadlocker No. 242' or equivalent compound. Install the impeller flat washer (17) and nut (25). Immobilize the impeller as described in **Impeller Removal** and torque the impeller nut to 60 ft. lbs. (720 in. lbs. or 8,3 m. kg.).

Strainer Installation

(Figure E−1)

Inspect the strainer screen for cracks or broken welds. Straighten or reweld as required. Inspect the studs in the motor housing for stripped threads and other damage. Replace and retighten before reassembly.

Install the strainer screen (19) and secure it with the capscrews (18). Tighten the capscrews just enough to draw the strainer screen down tightly, but not tight enough to distort it.

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

MOTOR DISASSEMBLY

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

NOTE

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

CAUTION

Motor repairs **must be** performed in accordance with MSHA specifications regarding the permissibility of this equipment. Refer to **Installation**, Page B−1.

WARNING!

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

attempting to open or service the pump assembly. Tag electrical circuits to prevent accidental start−up.

WARNING!

Do not remove the control box cover in an explosive atmosphere. When sealed, the control box is explosion proof to prevent the ignition of combustible gases. Opening the box in an explosive atmosphere could cause fire or explosion.

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 E−2)

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

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

WARNING!

Do not remove the terminal housing in an explosive atmosphere. The terminal housing and its O-Ring must remain intact to retain the permissibility of this equipment. Removing the housing in an explosive atmosphere could cause fire or explosion.

To remove the terminal housing, disengage the hardware (12 and 13) securing the terminal housing (18) to the motor housing (23). Carefully pull the terminal housing from the motor housing until the connectors (22) are accessible. Cut or unwrap the tape from around the connectors, then remove the connectors to disconnect the pump power cable leads from the motor leads.

Remove the O-ring (19) from the terminal housing. No further disassembly is required to test the stator or power cable.

To remove the power cable (14) and grip (16), disengage the hardware (20 and 21) and disconnect the green ground lead and the yellow ground check lead from the terminal housing. Cut the adhesive from around the power cable leads in the bottom of the grip body. Remove the setscrew (17) which locks the cable grip body in place in the terminal housing. Cut and remove the seal wire (40) which retains the cable grip to the terminal housing. Unscrew the cable and grip as an assembly from the terminal housing.

To remove the cable grip assembly from the power cable, remove the hose clamp (15) and unscrew the grip nut from the cable grip body. Pull the cable, cable grip mesh, and rubber grommet from the grip body.

Apply oil to the cable O.D. and work it up under the grommet. Slide the grommet off the cable. Compress the wire mesh of the cable grip and slide the mesh and grip nut off the cable.

Shaft And Rotor Removal

(Figure E−2)

See **PUMP END DISASSEMBLY**, and remove all pump end and seal components (including the intermediate, rotor and shaft assembly).

With the pump end disassembled and the terminal housing removed, secure the pump in an inverted position. To facilitate disassembly, disengage the hardware (10 and 22 Figure E−1) and remove the hoist bail (20) from the motor housing.

After removing the shaft and bearings, clean and inspect the bearings **in place** as follows.

CAUTION

To prevent damage during removal from

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

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

WARNING!

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

Rotate the bearings by hand to check for roughness or binding. If rotation is rough, replace the bearings.

CAUTION

These bearings are permanently sealed and require no additional lubrication except a coating of light oil on external surfaces to ease reassembly. External surfaces must be kept free of all dirt and foreign material. Failure to do so could damage the bearings or their mating surfaces.

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

If the bearings require replacement, use a suitable puller to remove them from the shaft. Remove the snap ring (6).

Remove the wavy spring washer (10) and motor bushing (4).

Stator Removal

(Figure E–2)

Do not remove the stator (7) 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 Removal and Disassembly.** Disengage the hardware (24 and 25) and remove the lock clip (26). Remove the pipe plug (27) and setscrew (28).

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

NOTE

It may be necessary to heat the motor housing to permit stator removal.

After the stator has been removed, wrap it in clean, dry rags or other suitable material. 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.

CAUTION

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

MOTOR REASSEMBLY

NOTE

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

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

Stator Installation

(Figure E—2)

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

WARNING!

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

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

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

Position an expandable tool, such as a split disc, approximately 2 inches (51 mm) down inside the stator, and expand it tightly and squarely on the I.D. Attach a lifting device to the lifting eye of the tool, and 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.

With the motor housing in an inverted position, position the stator so that the leads are in line with the terminal opening, and carefully lower the stator into the motor housing until it bottoms. If the stator "cocks" in the motor housing, remove it and try again. If necessary, heat the motor housing with a torch to expand it enough for the stator to be installed; when heating the motor housing, make certain that the stator is clear to avoid damage to the windings. Apply heat evenly to the inside of the motor housing; excessive heat is not required. Be careful not to damage the stator lead insulation during reassembly.

After the stator is fully and squarely seated on the motor housing shoulder, remove the expandable disc tool and untape or remove the protective sleeve from the stator leads. Install and tighten the setscrew (28) securing the stator in place. Torque the setscrew to 7.5 ft. lbs. (90 in. lbs. or 1 m. kg.). Apply 'Loctite Pipe Sealant With Teflon No. 592' on the threads of the pipe plug (27) and install it over the setscrew. Secure the pipe plug with the lock clip (26) and hardware (24 and 25).

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

Shaft And Rotor Installation

(Figure E—2)

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

Install the snap ring (6) in the groove on the shaft.

CAUTION

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. Bear-

ings should **never** be heated with a direct flame or directly on a hot plate.

NOTE

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

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

WARNING!

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 away from the shaft shoulders in shrinking. If movement has occurred, use a suitable sized sleeve and a press to reposition the bearings against the shaft shoulders.

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

CAUTION

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

Install the wavy spring washer (10) in the bottom of the motor housing bearing bore. Carefully lower the rotor and shaft and assembled bearings into the motor housing until the upper bearing (9) seats squarely against the wavy washer.

Refer to **Upper Seal Installation** in **PUMP END REASSEMBLY** for installation of the intermediate and upper seal assembly.

Terminal Housing And Power Cable Reassembly And Installation

(Figure E–2)

WARNING!

The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the control handle on the control box is in the off position and locked out, or that the power supply to the control box has been otherwise cut off and locked out, before attempting to open or service the pump assembly. Tag electrical circuits to prevent accidental startup. Obtain the services of a qualified electrician, and refer to the wiring diagram(s) in Installation, Section B, to make electrical connections.

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

WARNING!

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

Use oil to lightly lubricate the outside of the pump power cable (14) and the I.D. of the rubber cable grip bushing for ease of assembly. Slide the cable grip nut onto the cable. Compress the wire mesh on the cable grip, and slide it onto the cable, allowing approximately 1 ft. of cable to extend beyond the mesh. Slide the rubber cable grip bushing and cable grip body onto the cable. Apply ‘Loctite Pipe Sealant With Teflon No. 592’ or equivalent com-

pound on the tapered pipe threads of the cable grip body.

Feed the pump power cable leads into the terminal housing (18) and screw the cable grip body into the threaded housing bore until tight. Slide the cable grip bushing down the power cable into the tapered top of the grip body. **Be sure** there is sufficient cable lead length to permit wire connection, and that the trimmed end of the outer cable insulation is recessed approximately 1/8 inch (3.2 mm) in the bottom of the grip body. This creates a reservoir in the bottom of the cable grip into which the power cable sealant can be applied.

Compress the wire mesh of the cable grip assembly and slide it down the cable until it seats on top of the rubber bushing. Tighten the cable grip nut on the cable body.

Connect the green ground lead and the yellow ground check lead to the terminal housing and secure them with the hardware (20 and 21). These two wires **must** be connected to separate points in the terminal housing. Make sure each terminal makes good contact with the housing.

The cable leads **must** be sealed in the cable grip body to prevent moisture from entering the motor. When shipped from the factory, the power cable leads were sealed in the cable grip body and terminal housing with adhesive. If a replacement cable is being installed, the power cable must be resealed in the terminal housing.

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

To seal the power cable leads, secure the terminal housing upside-down, and use ‘Dow Corning Silicon Adhesive No. 737’ to seal around all leads where they enter the terminal housing. **Do not** allow any air pockets, voids or gaps. Do not apply more than a 1/4“ (6,3 mm) thick layer and allow the material a minimum of 1 hour to dry (or until a skin forms on the adhesive). This **must** be done before testing or final assembly.

Install a new O-ring (19) on the terminal housing. Refer to the wiring diagram in **INSTALLATION**, Section B, then connect the correct power cable leads to the stator leads with the connectors (22). **Be sure** the orange and blue cable leads are connected to the red coded (thermal overload) stator leads. After installing the connectors, wrap each connection with underwater tape (G-R part number 18666—068) to seal it and prevent the connector from working loose. Start the tape between the connectors and double back, then stretch the tape and wrap it around all of the leads and connectors.

Install the terminal housing in the motor housing and secure with the hardware (12 and 13). Be careful not to cut or damage the O-ring (19). Tighten the capscrews evenly and alternately around the terminal housing, and torque them to 11 ft. lbs. (132 in. lbs. or 1.5 m. kg.).

The cable grip must be retained to the terminal housing as follows to retain permissibility for this equipment. Failure to seal the parts as specified may result in explosion.

Make sure the cable grip body is tight in the terminal housing and secure it to the terminal housing as follows (see Figure E—4).

a. There are two tapped holes in the terminal housing located 90° apart. One hole will be used for installing the long locking setscrew (17); the other will be plugged with the short setscrew (39). Apply ‘Loctite Pipe Sealant With Teflon No. 592’ to **both** setscrews before installation.

   Make sure the cable grip body is tight in the terminal housing. Note the location of the tapped hole which is blocked by the hex body. Unscrew the hex body until the hole is clear, and install the small setscrew (39).

   Retighten the cable grip body, and install the longer setscrew (17) which locks the body in place.

b. Drill a 1/16 inch (1,6 mm) diameter hole (B) in the cable grip body approximately 45° counterclockwise from hole A in the terminal housing. If the old cable grip is being reused, the existing hole may be reused if it is in the correct location.

c. Insert the seal wire (40) through hole B and equalize the wire length. Twist the wire ends approximately 10 turns and insert one end of the wire through hole A. Draw tight and twist the wire ends approximately 10 turns.

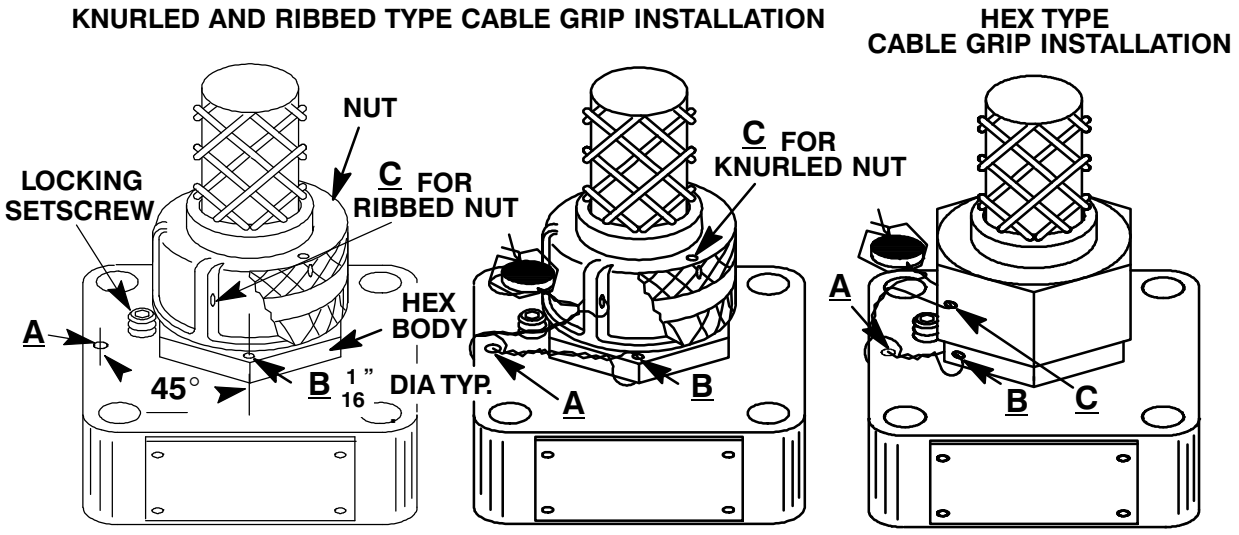


Figure E—4. Safety Seal Installation

d. **Make sure** the cable grip nut is tight. Drill a 1/16 inch (1,6 mm) diameter hole (C) through the flange on the cable grip adjacent to hole B in the hex body.

e. Insert one end of the twisted wire through hole C and draw tight. Twist the ends two turns and push them through the lead seal (41).

f. . Wrap the ends of the wires once around the twisted length from A to C from opposite directions, and push the wire ends through the lead seal again. Clamp the seal to secure the wire ends.

FINAL ASSEMBLY

(Figure E—1)

If the hoist bail (20) was removed, secure it to the motor housing with the hardware (10 and 22).

If the discharge flange (9) was removed from the motor housing, replace the discharge flange gasket (8). Apply 'Never-Seez' or equivalent compound on the flange studs, and torque the nuts (10) to 11 ft. lbs. (132 in. lbs. or 1.5 m. kg.).

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

LUBRICATION

Seal Cavity

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

WARNING!

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

To check the seal cavity oil, lay the pump on its side with the level plug up. Remove the plug, and screw

a short 1/4 inch NPT nipple into the hole. Plug the open end of the nipple with your finger. Tip the pump upright, drain off a small amount of oil into a transparent cup, and lay the pump on its side again. If the oil level is abnormally low, or the color milky or dark, refer to **Draining Oil From Seal Cavity** in this section for instructions and troubleshooting tips. If the oil is clear, remove the nipple, top off the seal cavity with oil, and reinstall the level plug.

When lubricating a dry (overhauled) pump, add approximately 1 US pint (0,47 liter) of lubricant (see Table 1 for lubricant specifications).

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

Table E—1. 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 Bearings

The motor bearings are permanently sealed, and no additional lubrication is required.

For Warranty Information, Please Visit
www.grpumps.com/warranty
or call:
U.S.: 419—755—1280
Canada: 519—631—2870
International: +1—419—755—1352