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# SM SERIES SUBMERSIBLE PUMPS

**MANUAL  
PART 1 of 3**

# INSTALLATION AND OPERATION

**GORMAN-RUPP PUMPS**

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# INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp SM Series 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.

A set of three manuals accompanies your pump. Each set consists of three parts; the Installation/Operation Manual contains essential information on installing and operating the pump, and on making electrical connections. However, since pump installations are seldom identical, some of the information only summarizes general recommendations and practices required to inspect, position, and arrange the pump and piping.

The Parts List Manual provides performance curve(s), a pump model cross-section drawing, and parts list for your pump.

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

The integral electric motor must be operated through the control box furnished with the pump. The pump and control comply with MSHA sched-

ule 2G regulations. Control boxes and other control devices are **not** covered in this manual.

Pump construction may be aluminum or stainless steel. The pump may be operated fully or partially submerged, since the integral air-filled electric motor is thermally protected and cooled by the liquid being pumped.

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 which are not covered in this manual or in other literature accompanying the unit, please contact your Gorman-Rupp distributor or the Gorman-Rupp Company:

**The Gorman-Rupp Company**  
**P.O. Box 1217**  
**Mansfield, Ohio 44901-1217**  
 or:  
**Gorman-Rupp of Canada Limited**  
**70 Burwell Road**  
**St. Thomas, Ontario N5P 3R7**

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## RECORDING MODEL AND SERIAL NUMBERS

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

Pump Model: \_\_\_\_\_  
 Serial Number: \_\_\_\_\_  
 Voltage: \_\_\_\_\_  
 Phase: \_\_\_\_\_

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



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



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

## WARRANTY INFORMATION

The warranty provided with your pump is part of Gorman-Rupp's support program for customers who operate and maintain their equipment as described in this and the other accompanying literature. Please note that should the equipment be abused or modified to change its performance beyond the original factory specifications, the warranty will become void and any claim will be denied.



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.*

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## SAFETY - SECTION A

This information applies to SM Series Submersible motor driven pumps and control boxes.

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.



Before attempting to open or service the pump:

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



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



The electrical power used to operate this pump is high enough to cause injury or death. Obtain the services of a qu-

alified electrician to make all electrical connections. Make certain that the pump and enclosure are properly grounded. Be sure the incoming power matches the voltage and phase of the pump and control before connecting the power source. Do not run the pump if the voltage is not within the limits.



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



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.



This pump is not designed to pump volatile, explosive, or flammable materials.

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



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.



After the pump has been installed, make

certain that the pump and all piping or hose connections are secure before operation.



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



Do not 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.



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

## INSTALLATION – SECTION B

### Review all SAFETY information in Section A.

Since pump installations are seldom identical, 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.



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 incoming voltage must match the voltage rating of the motor.
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 re-

pair 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 out by 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 lockwashers (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:

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**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

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.

Pump Model						
SM	3	C	1	—	X6	460/3
Series	Discharge Size	Pump Hydraulics	Pump Construction		H.P. (If Shown)	Voltage/Phase

### 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:

- Inspect the pump assembly for cracks, dents, damaged threads, and other obvious damage.
- Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- The standard pump is furnished with 50 feet of power cable. Inspect the cable for cuts or damage.
- Inspect the control box for cracks, dents, and other obvious damage.
- Check that all control box components are securely attached to their mounting surfaces, and the electrical connections are tight and free of corrosion.

- Compare the amperes, phase, voltage and hertz indicated on the motor nameplate to the ratings indicated for the control box.
- Carefully read all tags, decals, and markings on the pump assembly and the control box, and perform all duties as indicated.
- Check the pump and motor for any oil leaks. An oil leak may indicate a cut O-ring or other damage.
- 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 SPECIFICATIONS

See Tables B-1 and B-2 for pump specifications and motor data.



Table B-1. Pump Specifications

Model	Voltage/ Phase	Motor Horsepower	Pump Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
SM2E	460/3 575/3	3.5	3450	4.5 3.6	2 1.6	25 20	2 INCH
SM2F	460/3 575/3	1	3450	2.0 1.6	1.5 1.2	10.5 8.4	2 INCH
SM3B	460/3 575/3	6	3450	10.8 8.6	4 3.2	56 45	3 INCH
SM3C	460/3 575/3	6	3450	10.8 8.6	4 3.2	56 45	3 INCH
SM4C	460/3 575/3	10	3450	17 13.6	3.5 2.8	76 61	4 INCH
SM4D	460/3 575/3	10	3450	17 13.6	3.5 2.8	76 61	4 INCH
SM4E	460/3 575/3	20	3450	26 20.8	4.4 3.5	170 136	4 INCH
SM4F	460/3 575/3	20	3450	26 20.8	4.4 3.5	170 136	4 INCH
SM4G	460/3 575/3	30	3450	38.5 30.8	7.5 6	213 170	4 INCH
SM4H	460/3 575/3	10	3450	17 13.6	3.5 2.8	76 61	4 INCH
SM4J	460/3 575/3	60	3450	66 52.8	11 8.8	500 400	4 INCH
SM4K	460/3 575/3	15	3450	18 14.4	3.5 2.8	125 100	4 INCH
SM6D	460/3 575/3	30	3450	38.5 30.8	7.5 6	213 170	6 INCH
SM6E	460/3 575/3	60	3450	66 52.8	11 8.8	500 400	6 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
SM2E1 SM2E18 SM2E65	460/3 575/3	57 (26) 57 (26) 84 (38)	23 (10,4)	8 (0,2) ONLY NOTE: DO NOT OVER FILL	H
SM2F1	460/3 575/3	43 (20)	23 (10,4)	8 (0,2) ONLY NOTE: DO NOT OVER FILL	H
SM3B1 SM3B18 SM3B65	460/3 575/3	106 (48) 109 (49) 205 (93)	23 (10,4)	16 (0,5)	H

Table B-2. Additional Specifications (continued)

Pump Model	Voltage/ Phase	Approximate Weight Lbs. (kg)		Seal Cavity	
		Pump	50Ft. Cable	Oil Capacity Ounces (Liters)	Filling Position (H)orizontal (V)ertical
SM3C1 SM3C18 SM3C65	460/3 575/3	106 (48) 109 (49) 205 (93)	23 (10,4)	16 (0,5)	H
SM4C1 SM4C18 SM4C65	460/3 575/3	183 (83) 188 (85) 303 (137)	23 (10)	20 (0,6)	H
SM4D1 SM4D18 SM4D65	460/3 575/3	173 (79) 173 (79) 281 (128)	23 (10)	20 (0,6)	H
SM4E1	460/3 575/3	302 (137)	38 (17)	32 (1)	H
SM4F1	460/3 575/3	302 (137)	38 (17)	32 (1)	H
SM4G1	460/3 575/3	541 (245)	38 (17)	112 (3,3)	V
SM4H1	460/3 575/3	183 (83)	23 (10)	20 (0,6)	H
SM4J1	460/3 575/3	774 (351)	53 (24)	144 (4,3)	V
SM4K1	460/3 575/3	253 (115)	23 (10)	32 (1)	H
SM6D1	460/3 575/3	538 (244)	38 (17)	112 (3,3)	V
SM6E1	460/3 575/3	765 (347)	53 (24)	144 (4,3)	V

### Pump Dimensions

For the approximate physical dimensions of your pump, refer to the pump specification data sheet or contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

### PUMP INSTALLATION



**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.**



**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 the Parts List Manual when determining the most efficient piping installation.*

Table B-3. MSHA Specifications And Approval Data

MSHA Approval Number (All Models) ..... 2G-3971A-0 Commonwealth of Pennsylvania Approval Number (As Noted)					
Model	MSHA No.	Motor G-R P/N	Trailing Cable	Motor Cable	PA No.
SM2E1-X3.5 460/3 SM2E1-X3.5 575/3 SM2E18-X3.5 460/3 SM2E18-X3.5 575/3 SM2E65-X3.5 460/3 SM2E65-X3.5 575/3	XP-3142-0 XP-3142-0 XP-3142-1 XP-3142-1 XP-3142-1 XP-3142-1	47111-100 47111-101 47111-070 47111-071 47111-068 47111-069	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG, 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length</b> 460V - 1400 Ft., 575V - 3000 Ft.	BFE-637-77
SM2F1-X1 460/3 SM2F1-X1 575/3	XP-3862-0 XP-3862-0	16368 16368	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG, 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length</b> 460V - 3500 Ft., 575V - 4000 Ft.	N/A
SM3B1-X6 460/3 SM3B1-X6 575/3 SM3B18-X6 460/3 SM3B18-X6 575/3 SM3B65-X6 460/3 SM3B65-X6 575/3	XP-3185-0 XP-3185-0 XP-3185-1 XP-3185-1 XP-3185-1 XP-3185-1	47111-104 47111-105 47111-082 47111-083 47111-086 47111-087	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG, 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length</b> 460V - 850 Ft., 575V - 1400 Ft.	BFE-637-77
SM3C1-X6 460/3 SM3C1-X6 575/3 SM3C18-X6 460/3 SM3C18-X6 575/3 SM3C65-X6 460/3 SM3C65-X6 575/3	XP-3185-0 XP-3185-0 XP-3185-1 XP-3185-1 XP-3185-1 XP-3185-1	47111-106 47111-107 47111-084 47111-085 47111-088 47111-089	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG, 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length</b> 460V - 850 Ft., 575V - 1400 Ft.	BFE-637-77
SM4C1-X10 460/3 SM4C1-X10 575/3 SM4C18-X10 460/3 SM4C18-X10 575/3 SM4C65-X10 460/3 SM4C65-X10 575/3	7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0	16772 16772 16772 16772 16772 16772	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG., 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length</b> 460V - 450 Ft., 575V - 850 Ft.	BFE-637-77

Table B-3. MSHA Specifications And Approval Data (continued)

MSHA Approval Number (All Models) ..... 2G-3971A-0					
Commonwealth of Pennsylvania Approval Number (As Noted)					
Model	MSHA No.	Motor G-R P/N	Trailing Cable	Motor Cable	PA No.
SM4D1-X10 460/3 SM4D1-X10 575/3 SM4D18-X10 460/3 SM4D18-X10 575/3 SM4D65-X10 460/3 SM4D65-X10 575/3	7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0	16772 16772 16772 16772 16772	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG., 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 450 Ft., 575V - 850 Ft.	BFE-637-77
SM4E1-X20 460/3 SM4E1-X20 575/3	XP-3691-0 XP-3691-0	15951 15951	No. 6, 3 Conductor, Type G-GC, 1.05" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 260 Amps Max., For 460V Motors And 210 Amps Max. For 575V Motors MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47325-010. #8 AWG., 9 Conductor Type SPC, 1.05" ± 0.03" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 800 Ft., 575V - 1400 Ft.	BFE-33-13
SM4F1-X20 460/3 SM4F1-X20 575/3	XP-3691-0 XP-3691-0	15951 15951	No. 6, 3 Conductor, Type G-GC, 1.05" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 260 Amps Max., For 460V Motors And 210 Amps Max. For 575V Motors MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47325-010. #8 AWG., 9 Conductor Type SPC, 1.05" ± 0.03" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 800 Ft., 575V - 1400 Ft.	BFE-36-13

Table B-3. MSHA Specifications And Approval Data (continued)

MSHA Approval Number (All Models) ..... 2G-3971A-0		Commonwealth of Pennsylvania Approval Number (As Noted)			
Model	MSHA No.	Motor G-R P/N	Trailing Cable	Motor Cable	PA No.
SM4G1-X30 460/3 SM4G1-X30 575/3	XP-3690-0 XP-3690-0	15952 15952	No. 6, 3 Conductor, Type G-GC, 1.05" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 385 Amps Max., For 460V Motors And 310 Amps Max. For 575V Motors MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished Note: Instantaneous Trip Amps Set At 385 Amps Max. For 460V, and 310 Amps Max. for 575V To Allow For Motor Starting Current.	P-122-MSHA. G-R P/N 47325-010. #8 AWG., 9 Conductor Type SPC, 1.05" ± 0.03" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 400 Ft., 575V - 850 Ft.	BFE-34-13
SM4H1-X10 460/3 SM4H1-X10 575/3 SM4H18-X10 460/3 SM4H18-X10 575/3 SM4H65-X10 460/3 SM4H65-X10 575/3	7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0 7J-97016-0	16772 16772 16772 16772 16772 16772	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG., 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 450 Ft., 575V - 850 Ft.	BFE-37-13
SM4J1-X60 460/3 SM4J1-X60 575/3	XP-3689-0 XP-3689-0	15953 15953	No. 4, 3 Conductor, Type G-GC, 1.19" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 660 Amps Max., For 460V Motors And 530 Amps Max. For 575V Motors, MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished Note: Instantaneous Trip Amps Set At 660 Amps Max. For 460V, and 530 Amps Max. for 575V To Allow For Motor Starting Current.	P-122-MSHA. G-R P/N 47325-012. #6 AWG., 9 Conductor Type SPC, 1.25" ± 0.04" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 350 Ft., 575V - 700 Ft.	BFE-35-13

Table B-3. MSHA Specifications And Approval Data (continued)

MSHA Approval Number (All Models) ..... 2G-3971A-0					
Commonwealth of Pennsylvania Approval Number (As Noted)					
Model	MSHA No.	Motor G-R P/N	Trailing Cable	Motor Cable	PA No.
SM4K1-X15 460/3 SM4K1-X15 575/3	XP-3932-0 XP-3932-0	16521 16521	No. 8, 3 Conductor, Type G-GC, .97" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 200 Amps Max., MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished	P-122-MSHA. G-R P/N 47351-011. #12 AWG., 7 Conductor Type SPC, 0.89" ± 0.03" O.D., Heavy Jacketed 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 450 Ft., 575V - 800 Ft.	BFE-38-13
SM6D1-X30 460/3 SM6D1-X30 575/3	XP-3690-0 XP-3690-0	15952 15952	No. 6, 3 Conductor, Type G-GC, 1.05" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 385 Amps Max., For 460V Motors And 310 Amps Max. For 575V Motors MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished Note: Instantaneous Trip Amps Set At 385 Amps Max. For 460V, and 310 Amps Max. for 575V To Allow For Motor Starting Current.	P-122-MSHA. G-R P/N 47325-010. #8 AWG., 9 Conductor Type SPC, 1.05" ± 0.03" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 400 Ft., 575V - 850 Ft.	N/A
SM6E1-X60 460/3 SM6E1-X60 575/3	XP-3689-0 XP-3689-0	15953 15953	No. 4, 3 Conductor, Type G-GC, 1.19" ± .03" O.D., Protected By An Instantaneous Trip Circuit Breaker, Set At 660 Amps Max., For 460V Motors And 530 Amps Max. For 575V Motors, MSHA Flame Resistance, 600/2000 Volt, 90°C. <b>Max. Length:</b> 500 Ft. - Customer Furnished Note: Instantaneous Trip Amps Set At 660 Amps Max. For 460V, and 530 Amps Max. for 575V To Allow For Motor Starting Current.	P-122-MSHA. G-R P/N 47325-012. #6 AWG., 9 Conductor Type SPC, 1.25" ± 0.04" O.D., Yellow Jacket. 90°C 600/2000 Volt Royal - MSHA 122., Flame Resistant, <b>Max. Cable Length:</b> 460V - 350 Ft., 575V - 700 Ft.	N/A

**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.



**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 mo-**

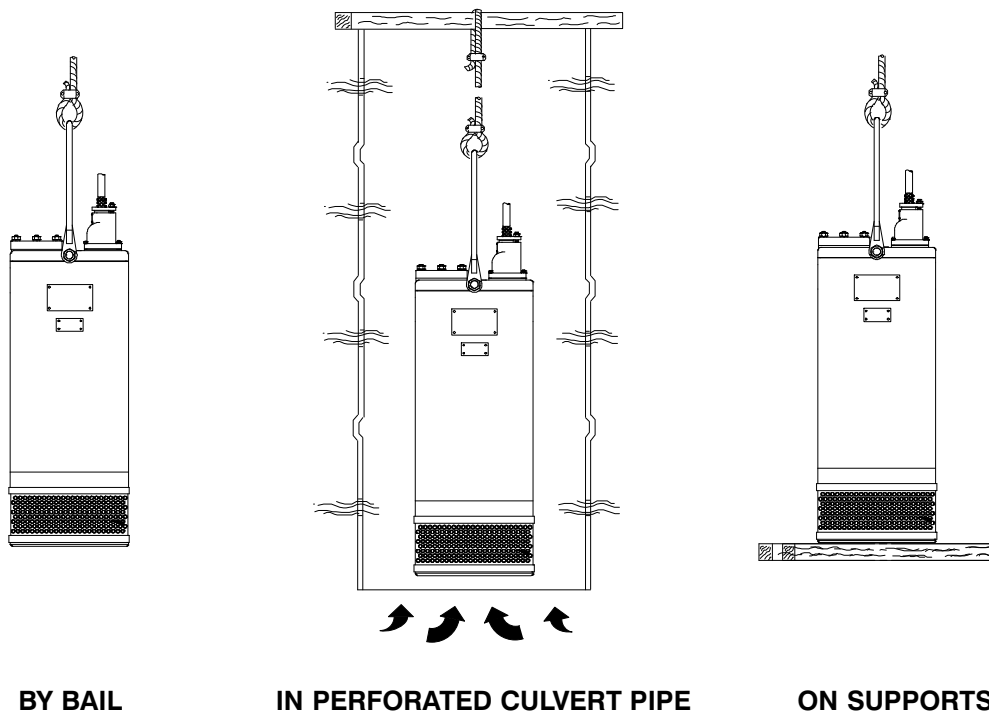
**tor or control cables, or the piping. Attach proper lifting equipment to the lifting bail fitted on the pump. Lift the pump or component only as high as necessary and keep personnel away from suspended objects.**

**Positioning the Pump**

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

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.



**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.

**NOTE**

*Before actual operation, check the direction of impeller rotation to ensure that the pump is properly wired to the con-*

trol box. See **Checking Pump Rotation** in **OPERATION**, Section C.

## PIPING

No suction piping is required in a standard submerged application.

The 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.

Either hose or rigid pipe may be used to make discharge connections. For maximum pumping capacity, keep the line as short and straight as possible. Elbows and fittings used in discharge lines increase friction loss; minimize their use.

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.

## ELECTRICAL CONNECTIONS



**Install and operate this pump in accordance with the National Electrical Code and all local codes. Have a qualified electrician perform all checks and connections in this section.**

**Never attempt to alter the length of the pump motor cable or to repair it with a splice. The power cable and pump motor must be kept completely waterproof. Serious damage to the pump and injury or death to personnel can result from any alteration to the cable.**

## Control Box Installation



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

The control box is a NEMA type 10, MSHA certified enclosure. **The enclosure is not designed to be watertight, and should not be submerged.** Refer to the control box manual for enclosure dimensions and parts.

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



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

### 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 the Table B-3.



**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.



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.

Field wiring is **not** provided with this pump, and must be supplied by the user. The field wiring must be of the proper size and type to ensure an adequate voltage supply to the pump. Voltage available **at the motor** must be within the range indicated in Table B-4.

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 B-5, **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-4. 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.

**Grounding Methods**

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

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

The electrode must conform to the recommendations of MSHA. Follow all installation requirements of MSHA, and all applicable codes. See Figure B-2 for some suggested grounding methods.

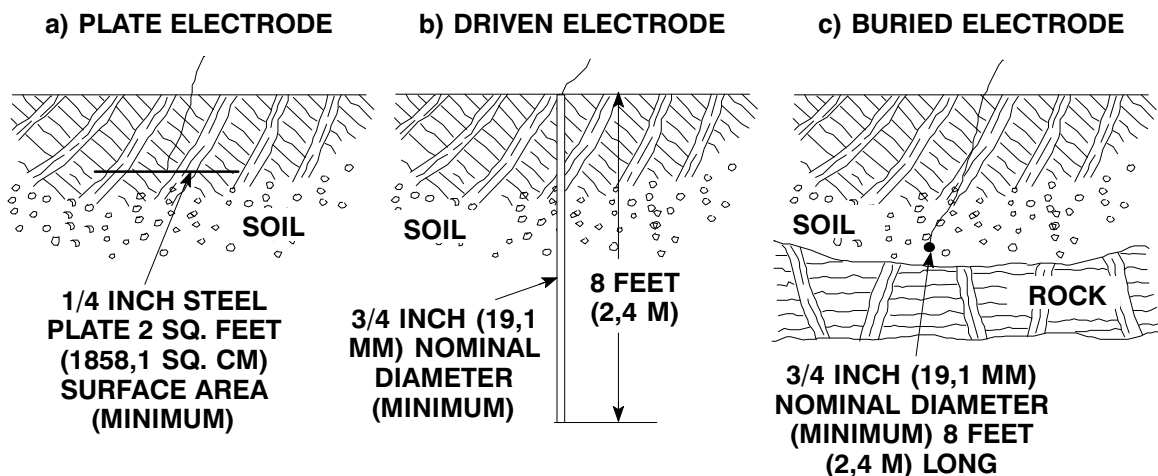


Figure B-2. Suggested Grounding Methods

- 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.

Refer to the literature accompanying the control box for field wiring connections.

**Pump Power Cable Connections**



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

The standard pump is provided with a 50 foot power cable (see Table B-5 for 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.



**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.**



**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-5. Pump Power Cable Specifications**

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
SM2E	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	1.86 1.48
SM2F	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	.688 .550
SM3B	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	3.72 2.96
SM3C	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	3.72 2.96

**NOTE:** \*Amp Rating at 30°C (86°F)  
\*\*Amp Rating at 40°C (104°F)

Table B-5. Pump Power Cable Specifications (continued)

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
SM4C	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	5.85 4.68
SM4D	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	5.85 4.68
SM4E	460/3 575/3	8	1.05 (26,7)	.17 (4,3)	59**	SPC	.71	3.69 2.95
SM4F	460/3 575/3	8	1.05 (26,7)	.17 (4,3)	59**	SPC	.71	3.69 2.95
SM4G	460/3 575/3	8	1.05 (26,7)	.17 (4,3)	59**	SPC	.71	5.47 4.37
SM4H	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	5.85 4.68
SM4J	460/3 575/3	6	1.25 (31,8)	.21 (5,3)	79	SPC	.45	5.94 4.75
SM4K	460/3 575/3	12	.89 (22,6)	.10 (2,5)	30*	SPC	1.72	5.85 4.68
SM6D	460/3 575/3	8	1.05 (26,7)	.17 (4,3)	59**	SPC	.71	5.47 4.37
SM6E	460/3 575/3	6	1.25 (31,8)	.21 (5,3)	79**	SPC	.45	5.94 4.75

**NOTE:** \*Amp Rating at 30°C (86°F)  
\*\*Amp Rating at 40°C (104°F)

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

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

#### Control Box Specifications



**Any control box used to operate the pump must be approved by the MSHA and the Gorman-Rupp Company for the application.**

#### Motor Cable Grounding Test



**Do not connect the pump control cable to the control box or incoming voltage before verifying the pump ground; otherwise, personnel will be exposed to serious injury or death.**

Using a volt-ohm meter, connect one lead to the motor cable green/yellow ground lead. Connect the other lead to an **uninsulated** point on the pump body. The test circuit should close.

If the test circuit does not close, there is a defect in the cable or motor which must be corrected.

**Control Box Connections**

This pump is shipped completely wired for the voltage shown on the nameplate, and is ready for operation through an approved control box.

Ground and wire the control box in accordance with the instructions accompanying it.

**NOTE**

*For reference, internal motor wiring connections are shown in the Maintenance and Repair manual.*

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## OPERATION – SECTION C

Review all SAFETY information in Section A.



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.

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

### Pump Performance



Any control box used to operate the pump must be approved by the MSHA and the Gorman-Rupp Company for the application.

Refer to the pump Specification Data Sheet or the accompanying Parts List Manual for the specific performance for your pump.

### Control Box

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



The pump 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.**

See the operating instructions furnished with the control box before attempting to start the pump.

### PUMP OPERATION



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.

### Component Function

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

- **The control handle** operates the control box circuit breaker. In the OFF position, the control handle opens the circuit breaker to interrupt incoming power through the control box and prevent pump operation. In the ON position, it closes the circuit breaker to permit pump operation. The circuit breaker will open or “trip” automatically in the event of a short circuit overload current, or thermal excess within the pump motor. When tripped, move the control handle to OFF and back to ON to reset the circuit breaker.
- The control box contains an integral safety switch which automatically “trips” the circuit breaker 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 thermostats within the stator. In the event of motor

overheating, the thermostat will open and automatically “trip” the control box circuit breaker. The motor will not restart until the circuit breaker is 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**.*

### Liquid Temperature And Overheating

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



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

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

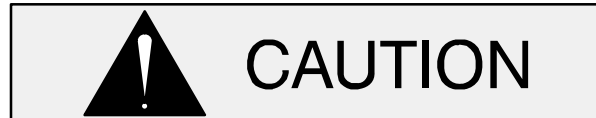


**Overheated pumps can cause severe burns and injuries. If overheating of the pump occurs:**

- 1. Stop the pump immediately.**
- 2. Ventilate the area.**
- 3. Allow the pump to completely 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.

Overheating can occur if the pump is misapplied, if it is started more than 6 times within one hour, if the temperature of the liquid being pumped exceeds the temperature for which the pump was designed, if the control box fails to provide overload or thermal protection, or if the pump is operated against a closed discharge valve for an extended period of time.



**Never start the pump more than 6 times per hour. If the pump motor does not cool between starts, it will over-heat, possibly resulting in damage to the motor windings.**

### Checking Pump Rotation



**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.



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

Suspend the pump from the lifting device fitted on the pump. Apply power briefly and note the direction of pump kickback. As viewed from the top, the pump should kick in a **counterclockwise** direction; this will indicate that impeller rotation is correct.

If the pump kicks in a **clockwise** direction, impeller rotation is incorrect. Since the pump is powered by a three-phase motor, have a qualified electrician in-

terchange the control box connections of any two pump motor power leads. Re-check pump kickback; it should now be in a counterclockwise direction.



**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.**

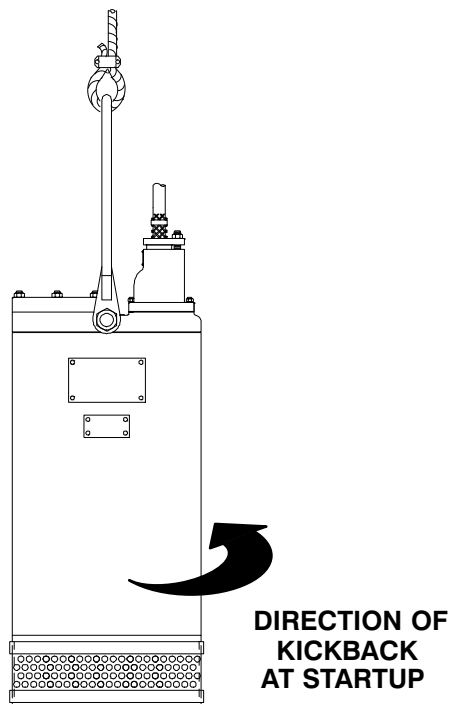


Figure C-1. Checking Pump Rotation

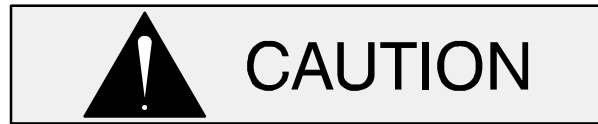
## STARTING, STOPPING, AND OPERATIONAL CHECKS

### Starting



Do not attempt to operate the pump until impeller rotation has been checked; improper rotation will affect pump performance and may damage the pump.

Follow the instructions accompanying the control box, start the pump, and run any recommended checks.



Never start the pump more than 6 times per hour. If the pump motor does not cool between starts, it will over-heat, possibly resulting in damage to the motor windings.

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.



To avoid serious damage to the pump, check for unusual noises or excessive vibration while the pump is running. If noise

or vibration is excessive, stop operation and refer to the troubleshooting chart in the maintenance and repair manual.

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 to remove a blockage. This could result in personal injury or damage to the equipment. If back-flushing is absolutely necessary, limit liquid pressure input to 50% of the maximum permissible operating pressure shown in the pump performance curve (refer to the accompanying Parts List Manual).**

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

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

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



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

## LUBRICATION



**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 Manual for drain plug location.

For the smaller pumps, lay the pump horizontal on a flat work surface with the seal cavity drain plug facing up. 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 roll the pump on its side to drain the seal housing.

For the larger pumps, 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 degrees.

### 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 the Maintenance and Repair Manual).

**Adding Oil**

Due to differences in pump design, the quantity of oil and manner in which oil is to be added to the seal cavity varies between pump models. Refer to Table B-2 in **INSTALLATION** for oil capacities and positions for filling the seal cavity in each pump.

The grade of lubricant used is critical to the operation of this pump. Use premium quality submers-

ible 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. Add premium quality submersible pump oil 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 @ 100°F (38°C) .....	110 to 155
Viscosity @ 210°F (99°C) .....	40 to 50
Dielectric .....	26,000 (volts-min)
Recommended supplier:	
Gulf Oil Company .....	Gulf Harmony HVI AW 26
Acceptable alternate suppliers:	
Gulf Oil Company .....	Gulf Harmony 32 AW
Texas Oil Company .....	Rando HD 32 or HD AZ 32
Sun Oil Company .....	Sunvis 816 or 916
British Petroleum Oil Company .....	Energol-HLP 32
Shell Oil Company .....	Tellus 32, Tellus T-23 or T32
ARCO .....	Duro 32
Exxon .....	Nuto H 32

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