



# S SERIES SUBMERSIBLE PUMPS

**MANUAL  
PART 1 of 3**

# INSTALLATION AND OPERATION

**GORMAN-RUPP PUMPS**

[www.grpumps.com](http://www.grpumps.com)

# INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp S 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 as standard equipment. If the motor is dual-voltage, the pump is shipped from the factory wired **only** for the voltage shown on the nameplate. If desired to have the voltage changed, return the pump to the factory or to a Gorman-Rupp authorized submersible repair facility.

The pump motor **must** be operated through an appropriate control box matching the voltage, phase and other characteristics of the motor. The control box must be approved by Gorman-Rupp for the

application and environment intended, and must also provide for proper operation of the motor protection devices, such as the integral moisture and thermal switches. Control boxes and other control devices not integral to the pump are **not** covered in this manual.

Pump construction may be aluminum with ductile iron or steel wearing parts, or stainless steel fitted, or completely stainless steel. The pump may be operated fully or partially submerged. Neither the pump nor the control box are explosion-proof, and should not be operated in a hazardous atmosphere.

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: \_\_\_\_\_

**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.

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



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



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



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

**NOTE**

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

## SAFETY – SECTION A

This information applies to the S 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 completely cool if overheated.
5. Close the discharge valve (if used).



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



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



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



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



The electrical power used to operate this pump is high enough to cause injury or death. Make certain that the control handle on the control box is in the OFF

position and locked out, or that the power supply to the control box has been otherwise cut off and locked out, before attempting to open or service the pump assembly. Tag electrical circuits to prevent accidental start-up.



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



All electrical connections must be in accordance with The National Electric Code and all local codes. If there is a conflict between the instructions provided and N.E.C. Specifications, N.E.C. Specifications shall take precedence. All electrical equipment supplied with this pump was in conformance with N.E.C. requirements in effect on the date of manufacture. Failure to follow applicable specifications, or substitution of electrical parts not supplied or approved by the manufacturer, can result in severe injury or death and void warranty.



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.



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



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 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. Al-

low the pump to completely cool before servicing.



Do not attempt to lift the pump by the motor power cable or the piping. Attach proper lifting equipment to the lifting device fitted to the pump. If chains or cable are wrapped around the pump to

lift it, make certain that they are positioned so as not to damage the pump, and so that the load will be balanced.



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

## INSTALLATION – SECTION B

### GENERAL INFORMATION

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

Since pump installations are seldom identical, this section is intended only to summarize general recommendations and practices required to inspect, position, and arrange the pump and piping. If there are any questions concerning your specific installation, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Liquid level devices are available from Gorman-Rupp as optional equipment. For information on installing and operating these items, refer to the literature accompanying them.

#### Pump Model Designation

Following is a description of the model numbering system for S 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						
S	3	C	1	–	E 6.2	230/3
Series	Discharge Size	Pump Hydraulics	Pump Construction		H.P. (If Shown)	Voltage/Phase

### PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, check 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 loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at the mating surfaces.
- Inspect the power cable for cuts or any other obvious damage.
- Check that amperes, phase, voltage and hertz indicated on the name plate match the

ratings on the control box and incoming power.

- Carefully read all tags, decals, and markings on the pump, and perform all duties indicated.
- Check for oil leaks. If there is any indication of an oil leak, see **LUBRICATION** at the end of this manual.

### PUMP SEAL

S Series pumps utilize one of the following sealing methods.

- There are two shaft seals in the pump. The lower seal prevents liquid from entering the intermediate cavity at the impeller end. The upper seal prevents oil leakage from the motor housing cavity and acts as back-up protection in the event of lower seal failure.
- The pump is equipped with one double-faced seal assembly. It is designed to prevent the liquid being pumped from entering the intermediate cavity at the impeller end, and to prevent moisture from entering the motor housing cavity at the motor end.

Regardless of which sealing method is used, the seal is lubricated by premium quality submersible pump oil.

### LUBRICATION

S series pumps are lubricated in one of the following methods.

- Some pumps utilize two lubrication cavities. The motor housing cavity provides lubrication to the motor assembly and bearings, while the intermediate cavity provides lubrication to the pump seal.
- Some pumps utilize one lubrication cavity, located just behind the seal plate. It is filled with premium quality submersible pump oil which lubricates the pump seal. The motor operates in and is cooled by air, therefore it requires no lubrication.

All S Series pumps are fully lubricated when shipped from the factory. However, lubrication levels **must be checked** before installing the pump

(see **LUBRICATION** in the **MAINTENANCE AND REPAIR MANUAL**). An additional quart (0,9 liter) of oil is provided to “top off” the oil level in the pump motor cavity, if so required. If the oil level is abnormally low, determine the cause before putting the pump into service.

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 for oil capacities and positions for filling the seal cavity in each pump. Motor cavities requiring lubrication should always be positioned vertically for filling. Refer to **LUBRICATION**, Section C for lubrication specifications and intervals.

## PUMP INSTALLATION

### Pump Motor Specifications

See Table B-1 for pump specifications.

Table B-1. Pump Specifications

Model	Voltage/ Phase	Dual Voltage	Pump HP/ KW	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S2A	115/1	NO	2 HP	3450	28	14	82	2 INCH
	230/1				14	7	44	
S2B	115/1	NO	2 HP	3450	28	9	85	2 INCH
	230/1	YES			12	4.2	38	
	200/3	NO			8.3	4.6	57.5	
	230/3	YES	7.2	4	50			
	460/3		3.6	2	25			
	575/3	NO	2.9	1.6	20			
S2E	380/3	NO	1.4 KW	2900	2.5	2	25	2 INCH
	200/3	NO	3.5 HP	3450	10.4	1.8	23	
	230/3	YES			9.0	4	50	
	460/3				4.5	2	25	
	575/3	NO	3.6	1.6	20			
380/3	NO	1.4 KW	2900	3.8	2	25		
S2F	115/1	YES	1 HP	3450	15	9.7	54	2 INCH
	230/1				7.5	4.9	36	
	200/3	NO			5	3.7	24	
	230/3	YES			4.3	3.2	21	
	460/3		2.2	1.6	10.5			
	575/3	NO	1.8	1.3	8.4			
	110/1	YES	1.1 KW	2900	12	9.8	54	
	220/1				6	5.6	36	
380/3	NO	1.8			1.5	10.5		
S3A	230/1	NO	5 HP	3450	28	5	125	2 INCH
	200/3	NO			18	9	75	

Table B-1. Pump Specifications (continued)

Model	Voltage/ Phase	Dual Voltage	Pump HP/ KW	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S3A	230/3	YES	5 HP	3450	16	8	65	3 INCH
	460/3				8	4	35	
	575/3	NO	3 KW	2900	6.5	3.2	28	
	380/3	NO			5.4	3.5	35	
S3B	230/1	NO	6 HP	3450	34	8	95	3 INCH
	200/3	NO			26.5	13.8	115	
	230/3	YES			23	12	100	
	460/3		11.5	6	50			
	575/3	NO	9.2	4.8	40			
	380/3	NO	4 KW	2900	12.4	6	50	
S3C	230/1	NO	6 HP	3450	34	8	95	3 INCH
	200/3	NO			26.5	13.8	115	
	230/3	YES			23	12	100	
	460/3		11.5	6	50			
	575/3	NO	9.2	4.8	40			
	380/3	NO	4 KW	2900	8	6	50	
S3D	230/1	NO	5 HP	3450	28	5	125	3 INCH
	200/3	NO			18	9	75	
	230/3	YES			16	8	65	
	460/3		8	4	35			
	575/3	NO	6.5	3.2	28			
	380/3	NO	3 KW	2900	5.4	4	35	
S4A	230/3	NO	25 HP	1750	160	10	204	4 INCH
	460/3				30	5	102	
	575/3		24	4	82			
	380/3		12 KW	1450	21	5	102	
S4B	230/3	NO	50 HP	1750	124	30	400	4 INCH
	460/3				62	15	200	
	575/3		50	12	160			
	380/3		25 KW	1450	46	11	137	
S4C	200/3	NO	10 HP	3450	39	8	170	4 INCH
	230/3	YES			34	7	148	

Table B-1. Pump Specifications (continued)

Model	Voltage/ Phase	Dual Voltage	Pump HP/ KW	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S4C	460/3	YES	10 HP	3450	17	3.5	74	4 INCH
	575/3	NO			13.6	2.8	60	
	380/3	NO	6.7 KW	2900	11.5	3.5	74	
S4D	200/3	NO	10 HP	3450	39	8	170	4 INCH
	230/3	YES			34	7	148	
	460/3				17	3.5	74	
	575/3	NO	6.7 KW	2900	13.6	2.8	60	
	380/3	NO			11.5	3.5	74	
S4E	460/3	NO	20 HP	3450	26	4.4	170	4 INCH
	575/3				20.8	3.5	136	
S4F	460/3	NO	20 HP	3450	26	4.4	170	4 INCH
	575/3				20.8	3.5	136	
S4G	460/3	NO	30 HP	3450	38.5	7.5	213	4 INCH
	575/3				30.8	6	170	
S4H	200/3	NO	10 HP	3450	39	8	276	4 INCH
	230/3	YES			34	7	240	
	460/3				17	3.5	120	
	575/3	NO	6.7 KW	2900	13.6	2.8	96	
	380/3	YES			11.5	3.5	145	
S4J	460/3	NO	60 HP	3450	66	11	500	4 INCH
	575/3				52.8	8.8	400	
S4K	460/3	NO	15 HP	3450	17	3.5	100	4 INCH
	575/3				13.6	2.8	80	
S6A	230/3	NO	60 HP	1750	130	30	574	6 INCH
	460/3				65	15	287	
	575/3		26 KW	1450	52	12	230	
	380/3				47	12	200	
S6B	230/3	NO	95 HP	1750	210	70	930	6 INCH
	460/3				105	35	465	
	575/3				84	28	372	
	380/3		41 KW	1450	76	20	287	
	500/3				58	15	264	

Table B-1. Pump Specifications (continued)

Model	Voltage/ Phase	Dual Voltage	Pump HP/ KW	Motor Speed (RPM)	Full Load Amperes	No Load Amperes	Locked Rotor Amperes	Discharge Size (NPT)
S6C	230/3	NO	35 HP	1750	80	14	274	6 INCH
	460/3				40	7	137	
	575/3		15 KW	1450	32	5.5	110	
	380/3				28	6	102	
S6D	460/3	NO	30 HP	3450	38.5	7.5	213	6 INCH
	575/3				30.8	6	170	
S6E	460/3	NO	60 HP	3450	66	11	500	6 INCH
	575/3				52.8	8.8	400	
S8A	230/3	NO	95 HP	1750	210	70	930	8 INCH
	460/3				105	35	465	
	575/3		44 KW	1450	84	28	372	
	380/3				82	20	287	
S8B	460/3	NO	100 HP	1750	125	35	465	8 INCH
	575/3				100	28	372	
	380/3		51 KW	1450	96	20	287	
S8C	460/3	NO	140 HP	1750	165	50	697	8 INCH
	575/3				132	40	558	
	380/3		65 KW	1450	115	24	465	
S8D	460/3	NO	275 HP	1750	353	69	1750	8 INCH
	575/3				282	55	1400	
S12A	460/3	NO	140 HP	1750	160	50	697	12 INCH
	575/3				128	40	558	

Table B-2. Additional Specifications

Pump Model	Voltage/Phase	Approximate Weight – Lbs. (kg)		Oil Capacity Ounces (Liters)		Seal Cavity Filling Position (H)orizontal (V)ertical *(A)ngle
		Pump	50 Ft. Cable	Seal Cavity	Motor Cavity	
S2A	115/1	62 (28)	18 (8)	8 (0,2)	32 (1)	A
	230/1	57 (26)	12 (5)			
S2B	115/1	56 (25)	18 (8)	8 (0,2)	32 (1)	V
	230/1		12 (5)			
	200/3					
	230/3					
	460/3					
	575/3					
	380/3					
S2E	200/3	73 (33)	12 (5)	8 (0,2)	32 (1)	V
	230/3					
	460/3					
	575/3					
	380/3					
S2F	115/1	44 (20)	12 (5)	8 (0,2)	32 (1)	V
	230/1					
	200/3					
	230/3					
	460/3					
	575/3					
	110/1					
	220/1					
	380/3					
S3A	230/1	55 (25)	18 (8)	24 (0,6)	32 (1)	A
	200/3				56 (1,7)	
	230/3					
	460/3					
	575/3					
	380/3					

\* Position Pumps at Approximately 30° off Vertical

Table B-2. Additional Specifications (continued)

Pump Model	Voltage/ Phase	Approximate Weight – Lbs. (kg)		Oil Capacity Ounces (Liters)		Seal Cavity Filling Position (H)orizontal (V)ertical *(A)ngle
		Pump	50 Ft. Cable	Seal Cavity	Motor Cavity	
S3B	230/1	77 (35)	18 (8)	16 (0,5)	80 (2,4)	H
	200/3				96 (2,8)	
	230/3					
	460/3					
	575/3					
	380/3					
S3C	230/1	102 (46)	18 (8)	16 (0,5)	80 (2,4)	H
	200/3				96 (2,8)	
	230/3					
	460/3					
	575/3					
	380/3					
S3D	230/1	102 (46)	18 (8)	24 (0,7)	32 (1)	H
	200/3				56 (1,7)	
	230/3					
	460/3					
	575/3					
	380/3					
S4A	230/3	423 (192)	43 (20)	96 (2,8)	352 (10,4)	V
	460/3					
	575/3					
	380/3					
S4B	230/3	741 (336)	80 (36)	160 (4,7)	256 (7,6)	V
	460/3		43 (20)			
	575/3					
	380/3					

\* Position Pumps at Approximately 30° off Vertical

Table B-2. Additional Specifications (continued)

Pump Model	Voltage/ Phase	Approximate Weight – Lbs. (kg)		Oil Capacity Ounces (Liters)		Seal Cavity Filling Position (H)orizontal (V)ertical *(A)ngle
		Pump	50 Ft. Cable	Seal Cavity	Motor Cavity	
S4C	200/3	173 (78)	33 (15)	20 (0,6)	96 (2,8)	H
	230/3					
	460/3					
	575/3					
	380/3					
S4D	200/3	167 (76)	33 (15)	20 (0,6)	96 (2,8)	H
	230/3					
	460/3					
	575/3					
	380/3					
S4E	460/3	302 (137)	38 (17)	32 (1)	---	H
	575/3					
S4F	460/3	339 (154)	38 (17)	32 (1)	---	H
	575/3					
S4G	460/3	588 (267)	38 (17)	112 (3,3)	---	V
	575/3					
S4H	200/3	167 (76)	33 (15)	20 (0,6)	96 (2,8)	H
	230/3					
	460/3					
	575/3					
	380/3					
S4J	460/3	666 (302)	53 (24)	144 (4,3)	---	V
	575/3					
S4K	460/3	248 (113)	38 (17)	32 (1)	---	H
	575/3					
S6A	230/3	705 (320)	80 (36)	176 (5,2)	832 (24,6)	V
	460/3	743 (337)	43 (20)			
	575/3					
	380/3			160 (4,7)	256 (7,6)	

\* Position Pumps at Approximately 30° off Vertical

Table B-2. Additional Specifications (continued)

Pump Model	Voltage/ Phase	Approximate Weight – Lbs. (kg)		Oil Capacity Ounces (Liters)		Seal Cavity Filling Position (H)orizontal (V)ertical *(A)ngle
		Pump	50 Ft. Cable	Seal Cavity	Motor Cavity	
S6B	230/3	865 (392)	150 (68)	176 (5,2)	576 (17)	V
	460/3		69 (31)			
	575/3					
	380/3					
	500/3					
S6C	230/3	435 (197)	80 (36)	96 (2,8)	288 (8,5)	V
	460/3	473 (214)	43 (20)			
	575/3					
	380/3					
S6D	460/3	538 (244)	33 (15)	112 (3,3)	---	V
	575/3					
S6E	460/3	765 (347)	53 (24)	144 (4,3)	---	V
	575/3					
S8A	230/3	870 (395)	150 (68)	176 (5,2)	576 (17)	V
	460/3		80 (36)			
	575/3					
	380/3					
S8B	460/3	1175 (533)	105 (48)	224 (6,6)	768 (22,7)	V
	575/3		80 (36)		864 (25,6)	
	380/3					
S8C	460/3	1210 (549)	150 (68)	208 (6,2)	576 (17)	V
	575/3	1255 (569)			768 (22,7)	
	380/3					
S8D	460/3	3462 (1570)	150 (68) each, 2 cables required	461 (13,6)	1709 (50,5)	V
	575/3					
S12A	460/3	1441 (654)	150 (68)	102 (3)	592 (17,5)	V
	575/3		105 (48)			

\* Position Pumps at Approximately 30° off Vertical

### 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 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. **The recommended maximum submergence depth is 65 feet.**

#### Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and 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 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 **Only Genuine Gorman-Rupp** replacement parts. Failure to do so may create a hazard and damage the pump or diminish optimal pump performance. Any such hazard, damage or diminished performance is not covered by the warranty.

#### NOTE

When appropriate recycling facilities are available, the user should recycle components and fluids when doing any routine maintenance / repairs and also at the end of the pump's useful life. All other components and fluids shall be disposed of according to all applicable codes and regulations.

#### 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.

The pump is designed to operate fully or partially submerged. The rotating parts are oil lubricated, and the motor is cooled by a constant flow of liquid or air discharged through internal passages.

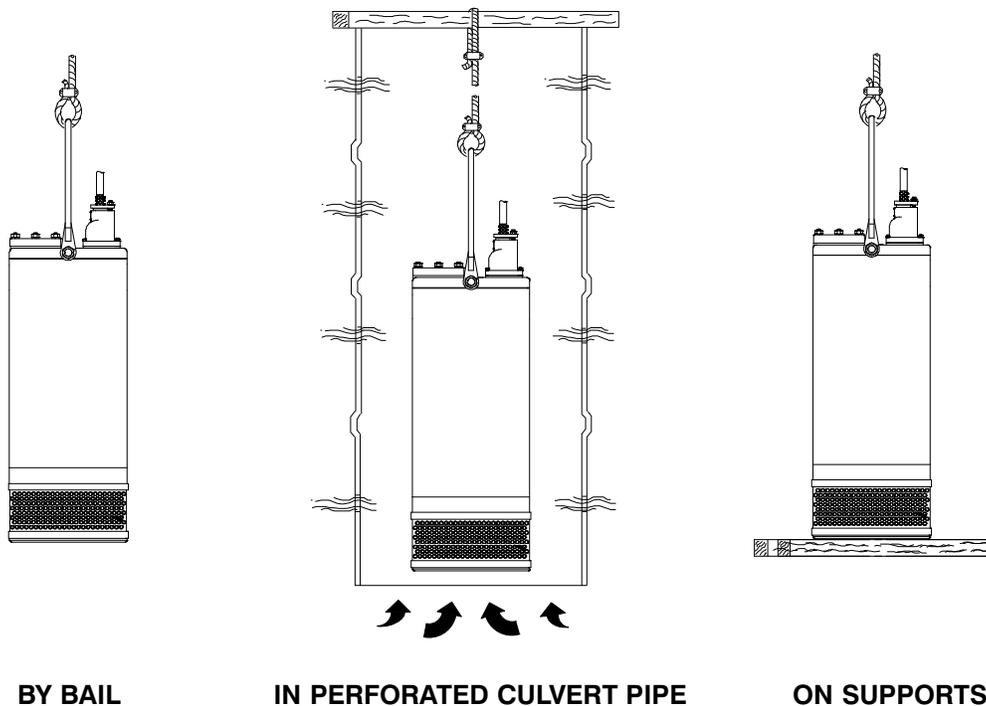
As a safeguard against rupture or explosion due to heat, models equipped with oil-lubricated motors are fitted with a pressure relief valve which will open if vapor pressure within the pump motor reaches a critical point.

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

tion.

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.

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



**Figure B-1 Typical Pump Installations**

### Piping

No suction piping is required in a standard installation.

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

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 rainproof enclosure with a padlockable front cover. **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 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 Connection**). 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.

### Dual Voltage Usage

Some pumps are powered by a dual-voltage motor for utilization with high or low voltage. The motor was originally wired and shipped from the factory for use with the voltage indicated as “Factory Wired” on the pump’s name plate. The name plate also indicates the dual voltage pertaining to this motor. If the alternate voltage must be utilized, control box modifications and/or certain wiring changes are required.

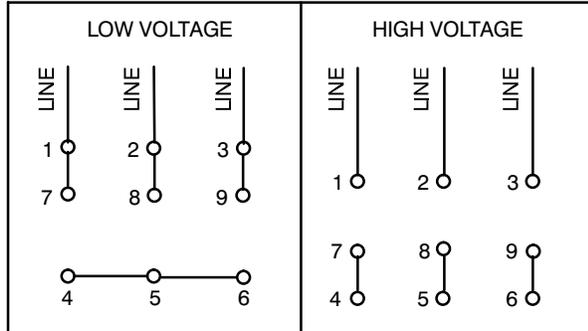
The control box assembly provided with this pump has been designed to accommodate **only** the voltage indicated on the front of the box. This voltage coincides with the “Factory Wired” voltage of the motor. If the alternate voltage is utilized, the control box must be replaced with another box designed for the appropriate voltage. Alternate voltage control boxes are shown in the Parts List Manual under Pump Options.



**Dual voltage pumps are wired at the factory only for the voltage shown on the name plate. Make certain that the control box voltage matches the pump voltage before using. If the pump voltage is changed, the pump name plate must be changed and a new control box must be installed. Do not run the pump if the voltages do not match; otherwise, the pump warranty will be negated, and damage to the pump, and injury or death to personnel can result.**

The motor wiring **must also** be changed before utilizing alternate voltage. For detailed instructions on disassembly and reassembly of the terminal housing, see **Terminal Housing and Power Cable Disassembly** and **Terminal Housing and Power**

**Cable Reassembly** in the Maintenance And Repair manual. Change the motor leads as indicated on the wiring diagram plate affixed to the side of the terminal housing (see Figure B-2). **Be sure** to tag the revised voltage on the pump.



Field Wiring Connections (Incoming Power)



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



Do not connect the pump motor directly to the incoming power lines. The pump motor is designed to operate through a Gorman-Rupp approved control box which provides overload protection and power control; otherwise, the pump warranty will be voided. Make certain that the pump and control box are properly grounded. Install and operate the control box in accordance with the Na-

**tional Electric Code and all local codes. Failure to follow these could result in injury or death to personnel.**

Field wiring is **not** provided with the 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-3.

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

- Measure the voltage across the incoming lines (1 & 2 for single phase, 1 & 2, 2 & 3, and 1 & 3 for three phase) **while the pump is operating at full capacity**. Refer to the literature supplied with the control box for power supply connections.
- Next, subtract the motor cable voltage drop (see Table 4, **Pump Power Cable Specifications**).
- Do not continue to operate the pump if this voltage is not within the recommended limits. Obtain the services of a qualified electrician to determine the correct field wiring size and other details to ensure an adequate voltage supply to the pump.

Table B-3. Pump Voltage Requirements

NOMINAL VOLTAGE	PHASE	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
115	1	110	120
230	1	220	240
230	3	210	250
460	3	420	500
575	3	520	630
380	3	345	415

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.

#### 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 N.E.C. ARTICLE 250. Follow all installation requirements of the N.E.C., and all applicable codes. See Figure B-3 for some suggested grounding methods.

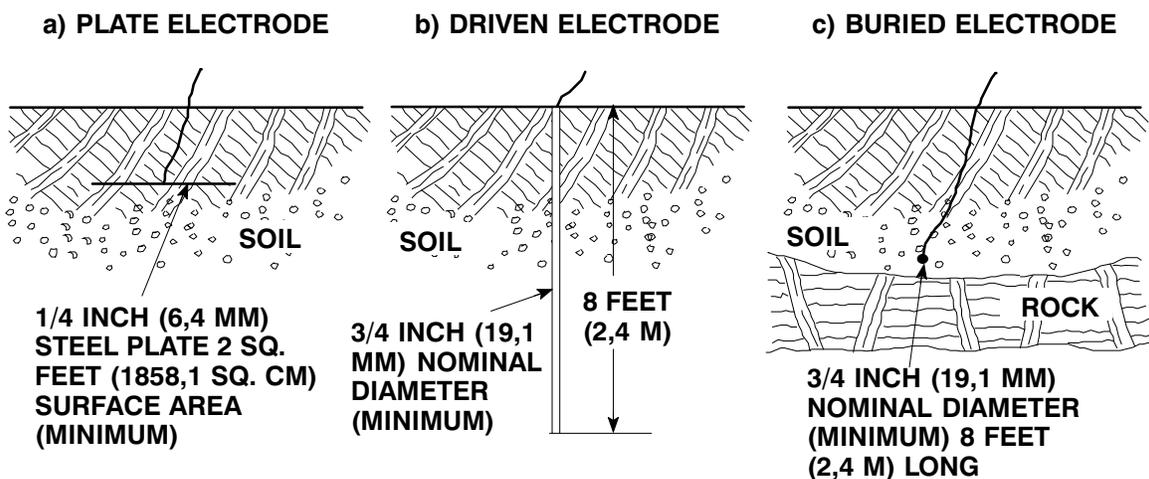


Figure B-3. Suggested Grounding Methods

- 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.).
- 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.
- 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) 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 connections.



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.

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 pump is provided with a 50 ft. (15,2 m) power cable (see Table B-4 for standard power cable specifications). If a longer cable is required, an optional cable assembly **must** be ordered from the factory. Splicing of the power cable is **not** recommended by the Gorman-Rupp Company due to

safety and warranty considerations.



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

Table B-4. Pump Power Cable Specifications

Pump Model	Voltage/Phase	A.W.G Cable Size	Cable O.D. Inches (mm)	Conductor Dia. Inches (mm)	Amp Rating (See Note Below)	Cable Type	DC Resistance (ohms) at 225°C (77°F) per 1000 ft. (305 m)	Voltage Drop per 100 ft. (30,5m) at Max. Load
S2A	115/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	6.22
	230/1	14	0.61 (16)	0.075(2)	15*		2.73	7.64
S2B	115/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	2.73	6.22
	230/1	14	0.61 (16)	0.075(2)	15*			6.55
	200/3							4.53
	230/3							3.93
	460/3							1.96
	575/3							1.58
	380/3							1.37
S2E	200/3					14	0.61 (16)	0.075(2)
	230/3	5.90						
	460/3	2.95						
	575/3	2.35						
	380/3	2.07						
S2F	115/1	14	0.61 (16)	0.075(2)	15*	◆ SO	2.73	8.19
	230/1							4.10
	200/3							2.73
	230/3							2.36
	460/3							1.20
	575/3							0.98
	110/1							6.44
	220/1							3.28
	380/3							0.98
S3A	230/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	6.22
	200/3							4.00
	230/3							3.55
	460/3							1.78
	575/3							1.44
	380/3							1.20

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

◆ Canada Use Type SOW Cable

Table B-4. Pump Power Cable Specifications (Continued)

Pump Model	Voltage/Phase	A.W.G Cable Size	Cable O.D. Inches (mm)	Conductor Dia. Inches (mm)	Amp Rating (See Note Below)	Cable Type	DC Resistance (ohms) at 225°C (77°F) per 1000 ft. (305 m)	Voltage Drop per 100 ft. (30,5m) at Max. Load
S3B	230/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	7.55
	200/3							5.88
	230/3							5.10
	460/3							2.55
	575/3							2.04
	380/3							1.78
S3C	230/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	7.55
	200/3							5.88
	230/3							5.10
	460/3							2.55
	575/3							2.04
	380/3							1.78
S3D	230/1	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	6.22
	200/3							4.00
	230/3							3.55
	460/3							1.78
	575/3							1.44
	380/3							1.20
S4A	230/3	6	1.01 (26)	0.21 (5)	79**	GGC	0.45	5.40
	460/3							2.70
	575/3							2.16
	380/3							1.89
S4B	230/3	2	1.34 (34)	0.34 (9)	138**	GGC	0.17	4.22
	460/3	6	1.01 (26)	0.21 (3)	79**		0.45	5.58
	575/3						4.50	
	380/3						1.05 (27)	4.14
S4C	200/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	4.80
	230/3							4.85
	460/3							2.42
	575/3	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	3.20

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

◆ Canada Use Type SOW Cable

Table B-4. Pump Power Cable Specifications (Continued)

Pump Model	Voltage/Phase	A.W.G Cable Size	Cable O.D. Inches (mm)	Conductor Dia. Inches (mm)	Amp Rating (See Note Below)	Cable Type	DC Resistance (ohms) at 225°C (77°F) per 1000 ft. (305 m)	Voltage Drop per 100 ft. (30,5m) at Max. Load
S4C	380/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	2.04
S4D	200/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	4.80
	230/3							4.85
	460/3							2.42
	575/3	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	3.02
	380/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	1.63
S4E	460/3	8	1.05 (27)	0.17 (4)	59**	SPC	0.71	3.69
	575/3							2.95
S4F	460/3	8	1.05 (27)	0.17 (4)	59**	SPC	0.71	3.69
	575/3							2.95
S4G	460/3	8	1.05 (27)	0.17 (4)	59**	SPC	0.71	5.47
	575/3							4.37
S4H	200/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	4.80
	230/3							4.85
	460/3							2.42
	575/3	10	0.75 (19)	0.12 (3)	25*	◆ SO	1.11	3.02
	380/3	8	0.97 (25)	0.17 (4)	59**	GGC	0.71	1.63
S4J	460/3	6	1.25 (32)	0.21 (5)	79**	SPC	0.45	5.94
	575/3							4.75
S4K	460/3	12	.89 (23)	0.10 (3)	30*	SPC	1.72	5.85
	575/3							4.68
S6A	230/3	2	1.34 (34)	0.34 (9)	138**	GGC	0.173	4.42
	460/3	6	1.01 (26)	0.21 (5)	79**			0.45
	575/3						4.68	
	380/3						1.05 (27)	

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

◆ Canada Use Type SOW Cable

Table B-4. Pump Power Cable Specifications (Continued)

Pump Model	Voltage/Phase	A.W.G Cable Size	Cable O.D. Inches (mm)	Conductor Dia. Inches (mm)	Amp Rating (See Note Below)	Cable Type	DC Resistance (ohms) at 225°C (77°F) per 1000 ft. (305 m)	Voltage Drop per 100 ft. (30,5m) at Max. Load
S6B	230/3	2/0	1.75 (44)	0.48 (12)	215**	GGC	0.09	3.78
	460/3	2	1.34 (34)	0.34 (9)	138**		0.17	3.57
	575/3							2.86
	380/3							2.58
	500/3	6	1.05 (27)	0.12 (5)	79**		0.45	5.22
S6C	230/3	2	1.34 (34)	0.34 (8)	138**	GGC	0.17	2.72
	460/3	6	1.01 (26)	0.21 (5)	79**		0.45	3.60
	575/3							2.88
	380/3		1.05 (27)					2.52
S6D	460/3	8	1.05 (27)	0.17 (4)	59**	SPC	0.71	5.47
	575/3							4.37
S6E	460/3	6	1.25 (32)	0.21 (5)	79**	SPC	0.45	5.94
	575/3							4.75
S8A	230/3	2/0	1.75 (45)	0.48 (12)	215**	GGC	0.09	3.78
	460/3	2	1.34 (34)	0.34 (9)	138**		0.17	3.57
	575/3							2.86
	380/3							2.75
S8B	460/3	1	1.51 (38)	0.38 (10)	161**	GGC	0.13	3.25
	575/3							2.60
	380/3	2	1.34 (34)	0.34 (9)	138**	0.17	3.26	
S8C	460/3	2/0	1.75 (45)	0.48 (12)	215**	GGC	0.09	2.97
	575/3	1	1.51 (38)	0.38 (10)	161**		0.13	3.43
	380/3							2.99
S8D	460/3	(2) 2/0	1.75 (45)	0.48 (12)	215**	GGC	0.09	2.88
	575/3							2.30
S12A	460/3	(2) 2/0	1.75 (45)	0.48 (12)	215**	GGC	0.09	3.04
	575/3	1	1.51 (38)	0.38 (10)	161**		0.13	3.52

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

◆ Canada Use Type SOW 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 in the wiring diagrams in the control box manual. Use conduit or cable clamps to secure the power cable to the control box. Make certain that all connections are tight and that cable entry points are rainproof.

### NOTE

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

### Control Box Specifications



**Any control box used to operate the pump must be approved by 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 name plate, 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.*

### Liquid Level Devices

The standard pump is **not** furnished with a means to automatically regulate liquid level. However, the pump may be controlled to perform filling or dewatering functions by using **either** of the following optional sensing devices (see Figure B-4):

- **Diaphragm Type:** two fixed-position sensors (upper and lower) each contain a diaphragm which flexes with changes in liquid level, thus activating an enclosed miniature switch.
- **Bulb (Float) Type:** a bulb raises or lowers (floats) with the liquid level, thus activating an enclosed miniature switch.

Models under 6 horsepower require an additional control box to incorporate liquid level controls. For models over 6 horsepower, the circuitry may be prewired as a factory option, or easily added to the standard control box in the field by qualified personnel. The unit is complete except for the remote float switches. For installation and operation, see the detailed instructions included with the optional package.



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

Other types of liquid level devices may also be used. Consult the factory for the liquid level device best suited for your application.



If the pump requires liquid level devices, install the liquid level devices and connect them to the control box in accordance with the instructions accompanying the devices.

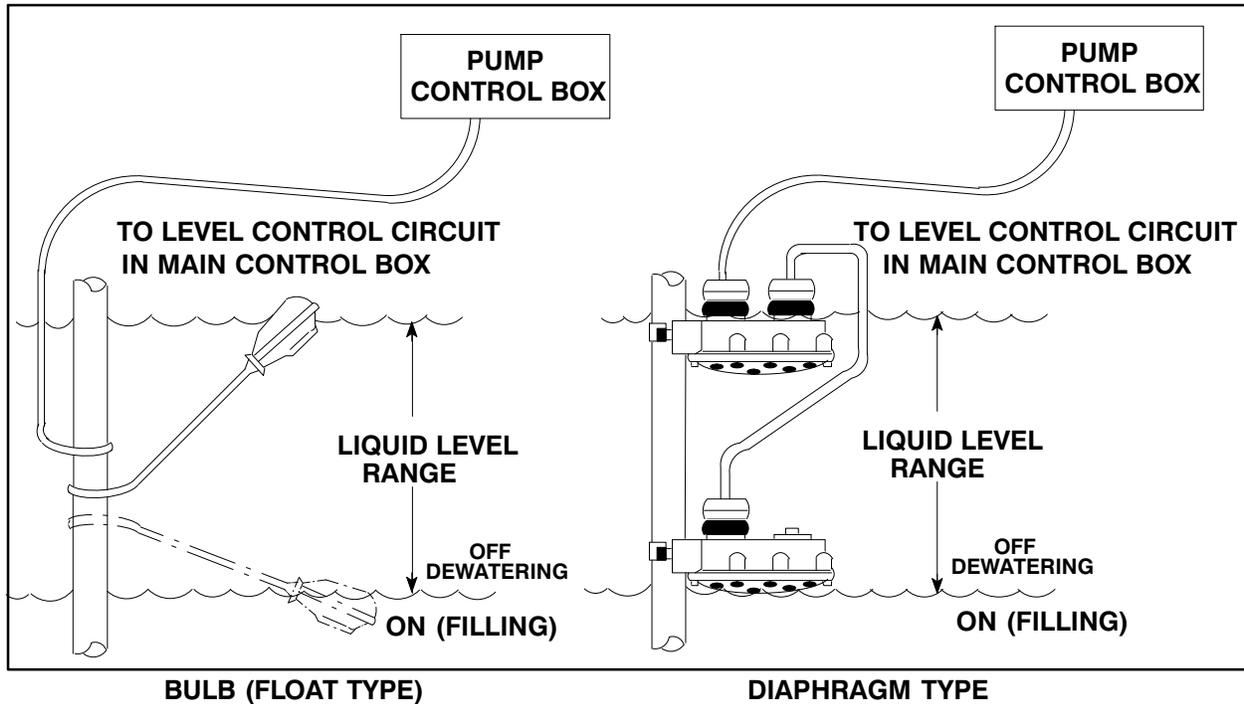


Figure B-4. Liquid Level Devices



The internal wiring of the sensing devices are different for filling and dewatering functions. Be sure to follow the instructions in-

cluded with the option before making wiring connections.

**WIRING DIAGRAMS**

Refer to the appropriate wiring diagram in the literature accompanying the control box when making electrical connections.

## OPERATION – SECTION C

### GENERAL INFORMATION

Review all SAFETY information in Section A.



This pump is designed to handle most non-volatile, non-flammable liquids. **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.**

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

#### Pump Performance



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.

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 control (for models 10 horsepower and up) may be equipped with an optional automatic liquid level sensing device, in which case those circuits are also contained within the control box. Pump models under 6 horsepower

require an additional control box to incorporate liquid level controls.



The pump motor and control box are not designed to be explosion-proof. Do not operate in an explosive atmosphere. Any control box used to operate the pump must be approved by the Gorman-Rupp Company for the application. Improper location of a non-explosion proof control box could result in destruction of equipment, injury or death to personnel.

See the operating instructions furnished with the control box, and with other optional accessories and controls, before attempting to start the pump.

### PUMP OPERATION

Liquid Temperature and Overheating.

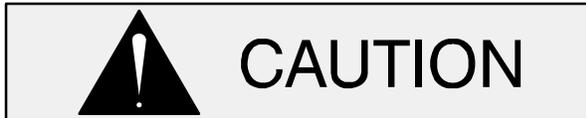


**Overheated pumps can cause severe burns and injury. If the pump becomes overheated:**

1. Stop the pump immediately.
2. Lock out the power to the control panel to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Close the discharge valve (if used).
5. 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 ex-

ceeds 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.



Do not start the pump more than 6 times per hour. If the motor does not cool between starts it will overheat, resulting in damage to the motor windings.

As a safeguard against rupture or explosion due to heat, models equipped with oil-lubricated motors are fitted with a pressure relief valve which will open if vapor pressure within the pump motor reaches a critical point. Always terminate power to the pump and control before investigating pump or control box problems.



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

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



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

1. **Stop the pump immediately.**

2. **Ventilate the area.**
3. **Allow the pump to 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.**

If so equipped, it is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump motor overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

#### Impeller Rotation

Check impeller rotation as follows before operation to ensure that the impeller is rotating in the correct direction.



While checking impeller rotation, secure the pump to prevent the power cable from coiling.

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. If the pump is powered by a three-phase motor, have a qualified electrician interchange the control box connections of any two pump motor power leads. Re-check pump kickback; it should now be in a counterclockwise direction.

If rotation is incorrect on a single-phase motor, contact the factory before installing the pump.

 **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.

 **CAUTION**

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

**Stopping**

Follow the instructions accompanying the control box for stopping the pump.

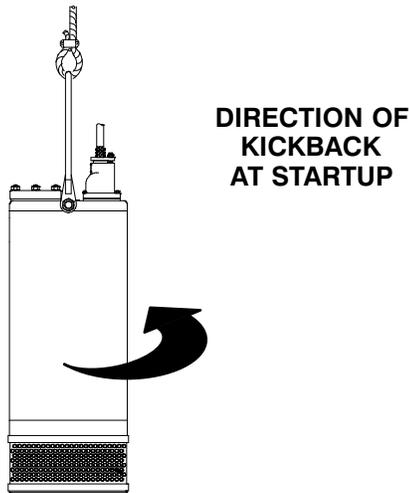


Figure C-1. Checking Pump Rotation

 **WARNING!**

On pumps equipped with a motor thermal protector, the integral thermal overload device will shut off the motor if the temperature rises above design limits. When the pump cools and the temperature falls below these limits, the motor will restart automatically. To avoid the hazards of an unexpected motor start-up, do not attempt to handle or service the pump unless all power to the motor has been shut off and locked out at the control box; otherwise, serious personal injury could result.

**STARTING, STOPPING, AND OPERATIONAL CHECKS**

**Starting**

During motor shutoff by the thermal overload device, control box circuits remain live. Do not attempt to service any control box components unless incoming power has been shut off.

 **CAUTION**

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

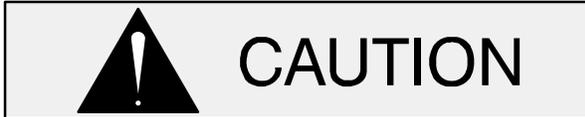
To stop the pump, turn the control handle OFF, thereby opening the circuit breakers. This **does not** terminate incoming power through the field wiring connected to the control box.

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

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

**Operational Checks**

To detect minor problems, check the pump for proper operation when it is first started, and at periodic intervals during operation.



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.

The suction inlet or impeller may become clogged with debris. In some cases, stopping the pump momentarily may backflush this blockage. If backflushing does not clear the debris, remove the pump from the sump or wet well and clear manually.



**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 backflushing 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. Overheating can occur if the pump is misapplied, required to start repeatedly, 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.



Do not start the pump more than 6 times per hour. If the motor does not cool between starts it will overheat, resulting in damage to the motor windings.

Check the oil level(s) as indicated in the following **LUBRICATION** section.

## COLD WEATHER PRESERVATION



**Do not attempt to thaw the pump by using a torch or other source of flame. This could damage gaskets, O-rings or heat the oil in the seal housing above critical temperatures, causing the pump to rupture or explode.**

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

If the pump does freeze while it is out of the liquid, submerge it until thawed; if the liquid is near freezing, the pump must be submerged for an extended period of time. Check thawing by starting the pump and checking that the shaft rotates freely. If the pump remains frozen, allow additional thawing time before attempting to restart.

If submerging does not thaw the pump, move it into a warm area until completely thawed.

## 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 both seal and motor cavities (if oil lubricated) before initial start-up, and drain and replace the oil after the first 200 hours of operation. Following this, check the oil level in the seal cavity after the first two weeks of op-

eration, and every month thereafter. Check the motor lubrication level any time the pressure relief valve is activated, and replace the oil annually.

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 pump, 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 pump, 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.

If the motor is oil-cooled, repeat the procedure for the motor housing oil.

### 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 be-

fore 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. Motor cavities requiring lubrication should always be positioned vertically for filling.

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. 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.

When lubricating the motor cavity, add oil through the hole for the pressure relief valve. If the pump is equipped with a motor lubricant level plug, remove this plug and fill the cavity until oil escapes through the hole. If the pump is not equipped with a motor lubricant level plug, fill the cavity to the top of the hole.

Reinstall the pressure relief valve.

**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
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

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