
**INSTALLATION, OPERATION,
AND MAINTENANCE MANUAL**
WITH PARTS LIST



SUBMERSIBLE PUMPS

MODELS	
JT4F60-E13 230/3	JT4F60-E13 460/3

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

www.grpumps.com

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

Valid serial number and e-mail address required.

RECORD YOUR PUMP MODEL AND SERIAL NUMBER

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

Pump Model: _____

Serial Number: _____

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INTRODUCTION

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

The manual applies **only** to the submersible pump models listed on the cover and in **MAINTENANCE AND REPAIR – SECTION E**. Refer to the nameplate on your pump to determine the **specific** model, voltage, and horsepower.

These J Series pumps are driven by a waterproof submersible electric motor. The motor may be dual-voltage, but is shipped from the factory wired **only** for the voltage shown on the nameplate. **Contact the factory before attempting to change to the alternative voltage.**

The pump motor is designed to be operated through an appropriate control box matching the voltage and other characteristics of the motor. The control box 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 other than those integral to the pump motor are **not** covered in this manual. Refer to other literature accompanying the pump.

Pump construction is cast iron, with stainless steel shaft and hardware. These J Series pumps are designed to operate fully or partially submerged in a wet well; they will handle raw, unscreened sewage and effluents with solids up to 3.15 inches (80 mm) in diameter.

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

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901—1217
Phone: (419) 755—1011

or:

Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631—2870

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.



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

NOTE

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

SAFETY – SECTION A

This information is specific to the Gorman-Rupp J Series Submersible pumps listed on the cover and in **MAINTENANCE AND REPAIR – SECTION E**. It applies throughout this manual to the instructions contained in the pages which follow.

In addition to this manual, see the separate literature covering the control box and other control accessories which will be used with this pump. This literature contains essential information on installing and operating the pump, and on making electrical connections.



Before attempting to install, operate, or service this pump, familiarize yourself with this manual, and with all other literature shipped with the pump. Unfamiliarity with all aspects of pump operation covered in this manual could lead to destruction of equipment, injury, or death.



This pump is designed to handle raw sewage and industrial wastes at temperatures of 104°F (40°C); do not apply at higher temperatures. Do not attempt to pump volatile, flammable, or corrosive liquids which may damage the pump or endanger personnel as a result of pump failure.



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.



230/460 Volt versions of this pump are dual voltage. Your pump was wired at the factory only for the voltage and phase shown on the nameplate. Do not attempt to change the voltage in the field. If desired to have the voltage changed, return the pump to the factory or to an authorized Gorman-Rupp repair facility only; otherwise, damage to the pump and injury or death to personnel can result.



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 and that the incoming power matches the requirements of the pump and controls. Install and operate the control box in accordance with the National Electric Code and all local codes. Failure to follow the instructions in this warning could result in injury or death to personnel.



Do not attempt to lift this pump by the motor power cable or the piping. Attach proper lifting equipment to the lifting handle, and make certain that the hook of the lifting device is securely positioned in the apex of the handle. If

chains or cables 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.



After the pump has been installed, make certain that the pump and all piping or hose connections are secure before operation. Loose connections can result in damage to equipment and serious injury to personnel.



The following precautions should be

taken before attempting to open or service the pump; otherwise, injury or death could result.

1. Lock out the power to the control panel to ensure that the pump will remain inoperative.
2. Allow the pump to cool if overheated.
3. Close the discharge valve (if used).



If this pump is used to handle sewage, take necessary precautions during maintenance and repair to prevent personal contamination which could result in illness.

INSTALLATION – SECTION B

Review all SAFETY information in Section A.

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

Automatic liquid level controls are available from Gorman-Rupp as options. For information on installing and operating these controls, see the technical data accompanying them.

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:

- a. Inspect the pump assembly for cracks, dents, damaged threads, and other obvious damage.
- b. Check for loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- c. The standard pump is provided with 26 ft. (8 m) of power cable. Inspect the cable for cuts or damage.
- d. Check that amperes, phase, voltage, and Hertz indicated on the motor name plate match the ratings on the control box.
- e. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated.
- f. Check for any oil leaks. If there is any indication of an oil leak, see **LUBRICATION** in **MAINTENANCE AND REPAIR – SECTION E**.

LUBRICATION

These pumps are equipped with a mechanical double seal. The lower seal prevents liquid being pumped from entering the seal housing cavity from the pump end. The upper seal prevents oil from escaping from the seal housing into the motor housing, and acts as back-up protection in the event of lower seal failure.

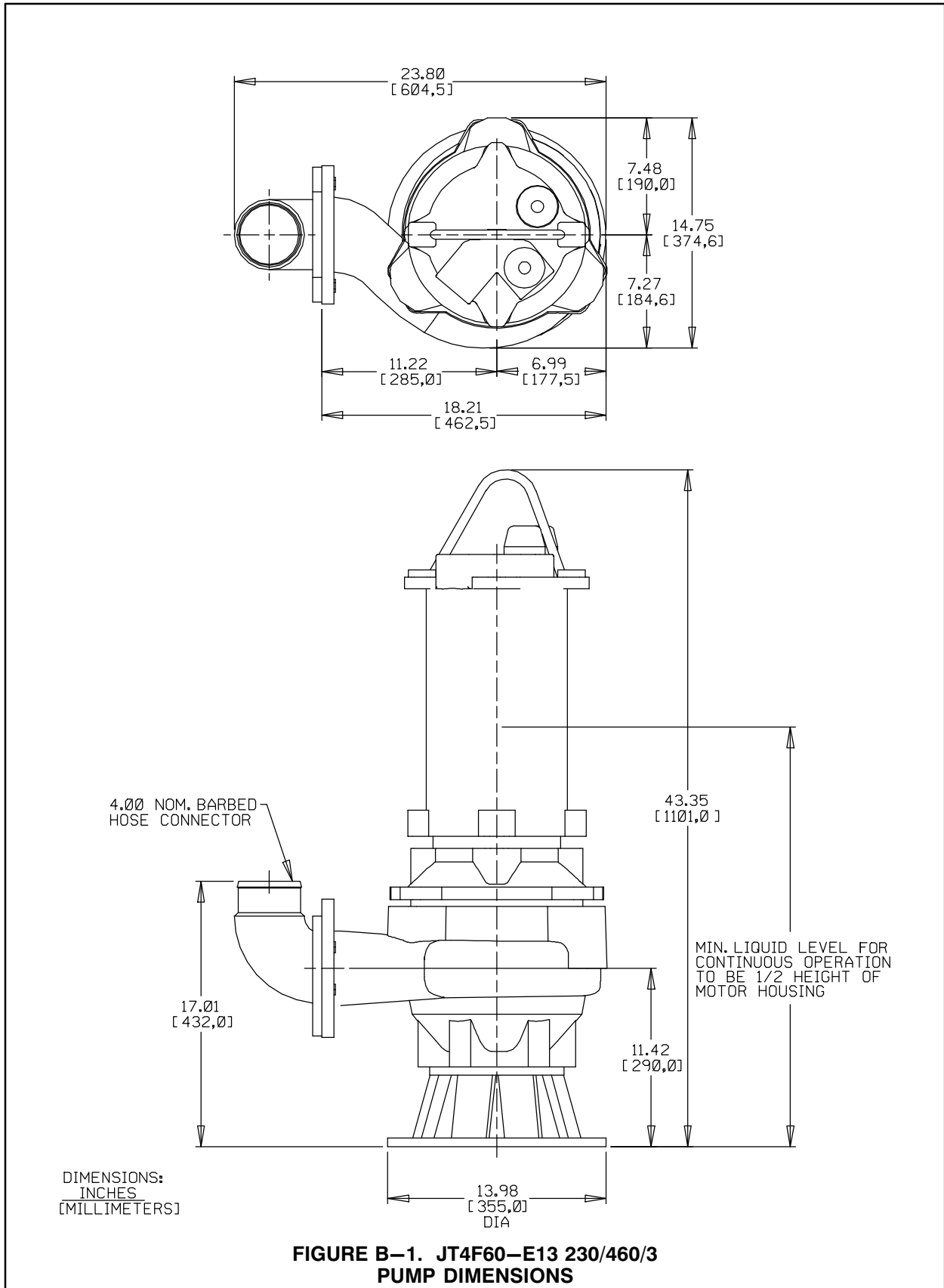
Both ends of the shaft seal are lubricated by oil in the seal housing (see **LUBRICATION** in **MAINTENANCE AND REPAIR – SECTION E**).

The shaft bearings are grease lubricated.

There is no other lubrication in the pump.

Pump Dimensions

See Figure B-1 for the approximate physical dimensions of this pump.



Pump Motor Specifications

The motor furnished with this pump is a single voltage, 60 Hz., Squirrel Cage, Induction Start, G-R Frame Size No. 4; Class F Insulation Rated 155°C

(311°F), 40°C (104°F) ambient, plus 115°C (239°F) temperature rise.

See Table B-1 for motor specifications.

TABLE B-1. PUMP MOTOR SPECIFICATIONS							
MODEL NUMBER	VOLTAGE /PHASE	SIZE	H.P.	MOTOR RPM	MAX LOAD	NO LOAD	LOCKED ROTOR
JT4F60-E13	200/3	4"	13	1750	41.4A	11.7A	259.9A
JT4F60-E13	230/3	4"	13	1750	36.0A	10.3A	226.0A
JT4F60-E13	460/3	4"	13	1750	18.0A	5.1A	113.0A

PUMP INSTALLATION

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.

Positioning the Pump

NOTE

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

This pump is provided with a 4-inch hose connection.

Secure a discharge hose to the pump discharge connection, and use a suitable lifting device attached to the lifting handle to lower the pump into the wet well. **The recommended maximum submergence depth is 65 feet (20 meters).**

Make certain that the pump and stand sit level in the wet well.

Reel in any slack control cable so that it is not dragged into the pump suction.

The submersible motor is cooled by the liquid being pumped. To minimize the chance of over-heating when installed in a **simplex** application, it is recommended that at least one-third of the motor remain immersed in the liquid.

When installed in a standard **duplex** application, where one pump runs while the other is shut down, the pump may be operated continuously until fully exposed because the shut down cycle provides sufficient time for the motor to cool.

Piping

NOTE

*Refer to **PERFORMANCE CURVES in OPERATION – SECTION C** when determining the most efficient piping installation.*

No suction piping is required in a standard submerged operation.

If rigid discharge piping is installed, line must be independently supported to avoid vibration and strain on the pump. For maximum pumping capacity, keep the line as short and straight as possible. Elbows and fittings used in a discharge line increase friction losses; 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.

Field Wiring Connections (Incoming Power)

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-2.

TABLE B-2. MOTOR VOLTAGE LIMITS			
NOMINAL VOLTAGE	PHASE	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
230	3	210	250
460	3	420	500
575	3	630	520

Use conduit cable clamps to secure the incoming field wiring to the control box. Make certain all connections are tight. If necessary, support the cable weight to prevent excessive strain on cable clamps and cable.

Dual Voltage



230/460 Volt versions of this pump are dual voltage. Your pump was wired at the factory only for the voltage and phase shown on the nameplate. Do not attempt to change the voltage in the field. If desired to have the voltage changed, return the pump to the factory or to an authorized Gorman-Rupp repair facility only; otherwise, damage to the pump and injury or death to personnel can result.

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.

Connect one lead of lamp, bell or similar testing device to motor cable green/yellow ground lead. Connect second test 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.

Conductor Identification

The conductors in the pump cable are labeled when shipped from the factory. If the conductors are shortened in the field, resulting in loss of identification markers, they can still be identified by their location relative to the ground wire.

Refer to FIGURE B-4; as seen from the free end of the cable, the conductor immediately adjacent to and clockwise from ground (green/yellow) is assigned number T1 (T4), the next clockwise conductor T2 (T5), etc.

The conductors labeled P1 and P2 are for thermal and moisture sensor connections, respectively.

If the conductors are re-labeled, they should be identified with wire markers from the factory.

Control Box Connections

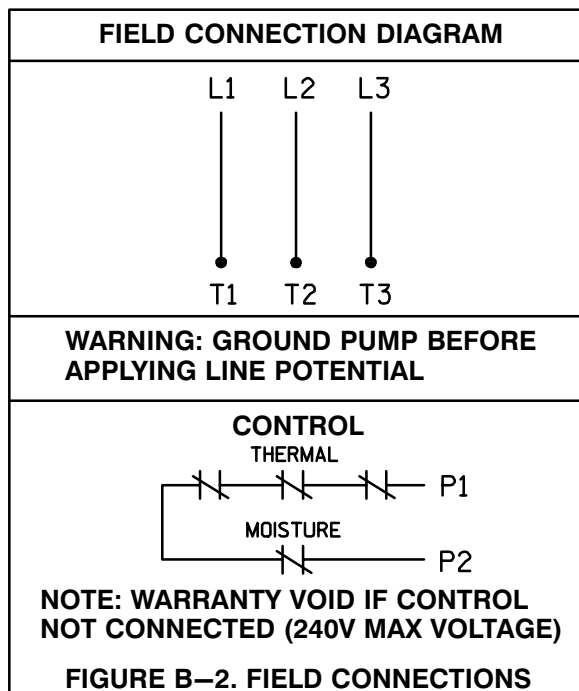


The Pump warranty is void if the motor is not operated through a control box approved by Gorman-Rupp.

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

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

Refer to FIGURE B-2, and connect the pump motor cable to the control box.



Control leads P1 and P2 provide the motor with moisture and thermal protection. Note that thermal protection is supplementary **only**; separate Class 10 overload relays are required for motor running protection.

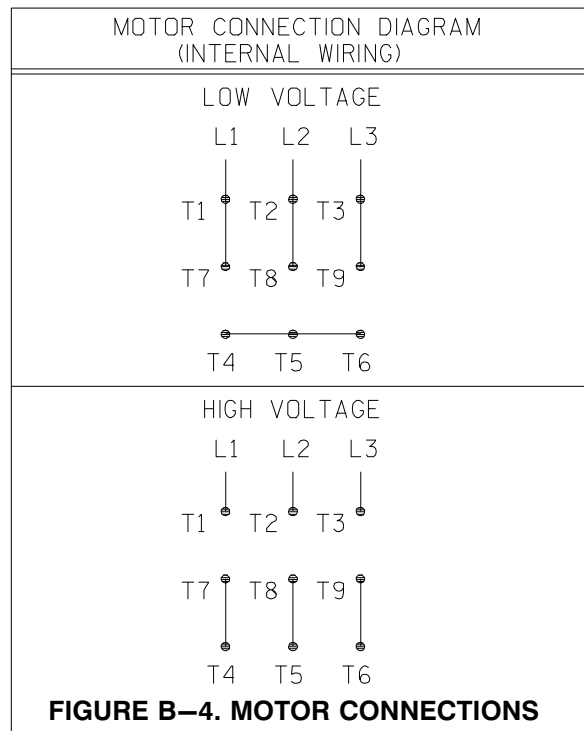


The thermal protection contacts will automatically reclose when the motor cools to the established safe operating temperature. Whenever automatic restarting is not desirable, connect only to controls which are wired for manual restart.

Wiring Diagrams

The motor wiring diagram is shown in FIGURE B-3.

Complete schematic diagrams for the motor wiring for each pump are shown in FIGURE B-4.



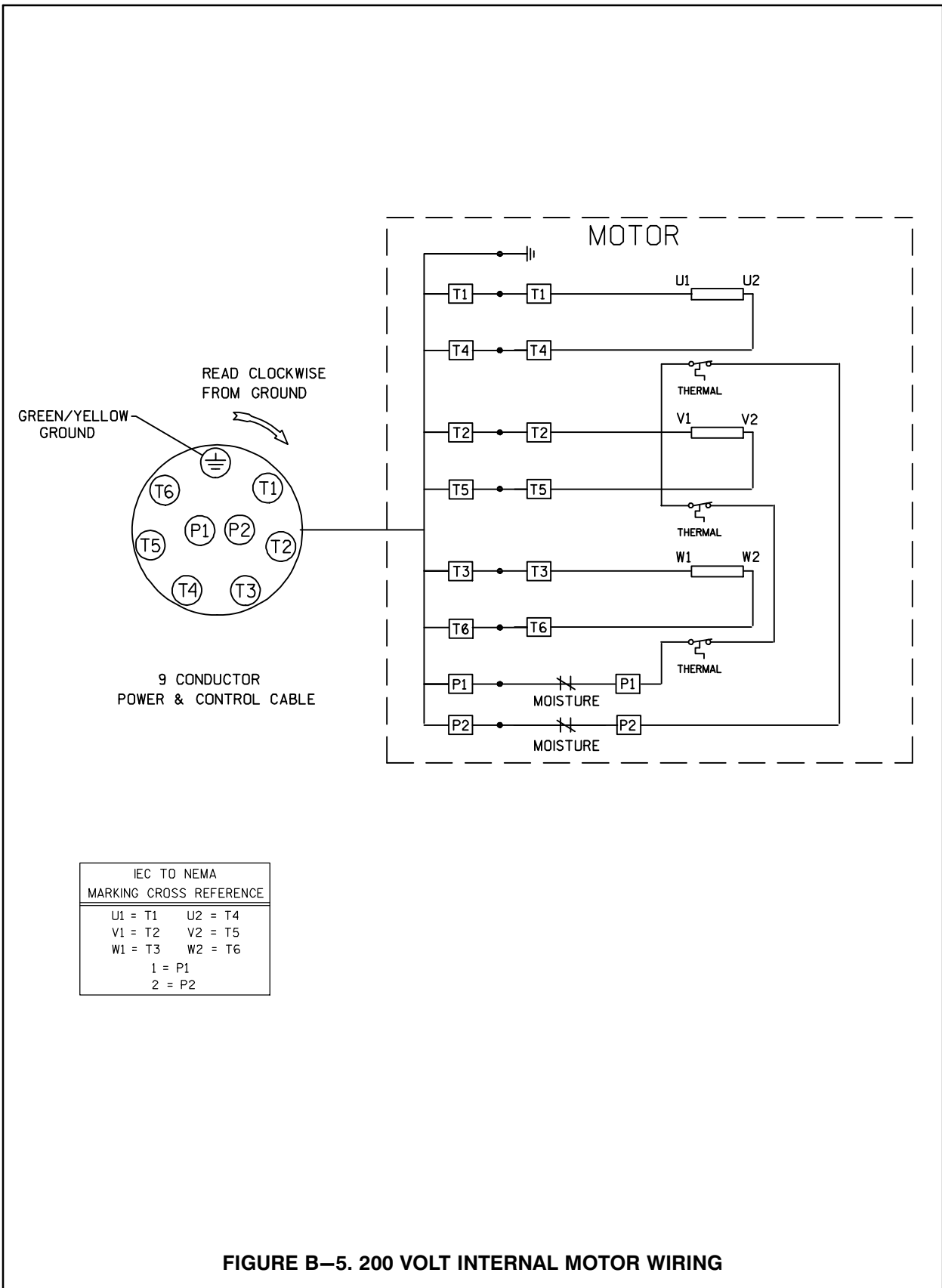
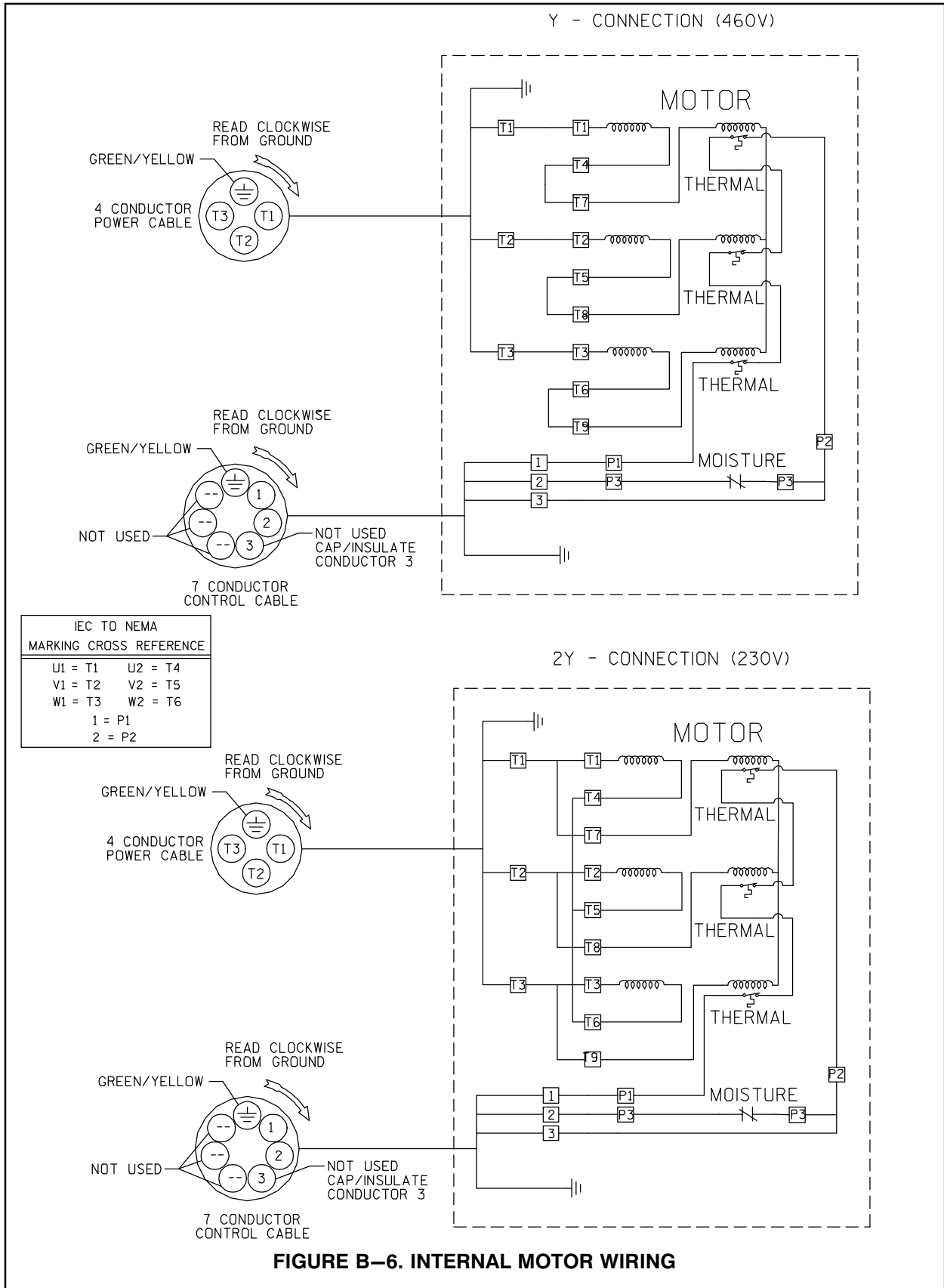
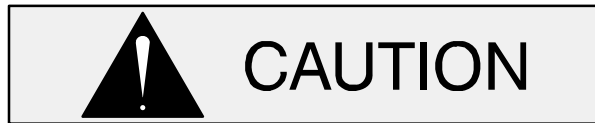


FIGURE B-5. 200 VOLT INTERNAL MOTOR WIRING



Liquid Level Devices

Optional controls available from Gorman-Rupp may provide a means to automatically regulate the liquid level. These control boxes may be connected to the following sensing devices which perform **either** filling or dewatering functions (see FIGURE B-7).



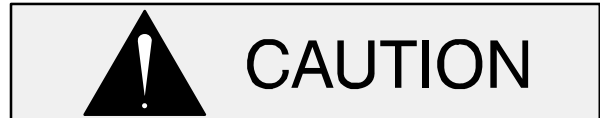
The internal wiring of the sensing devices are different for filling and dewatering functions. Be sure to follow the instructions included with the option before making connections.

- **Diaphragm Type:** two fixed-position sensors (upper and lower) each contain a dia-

phragm 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.

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



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

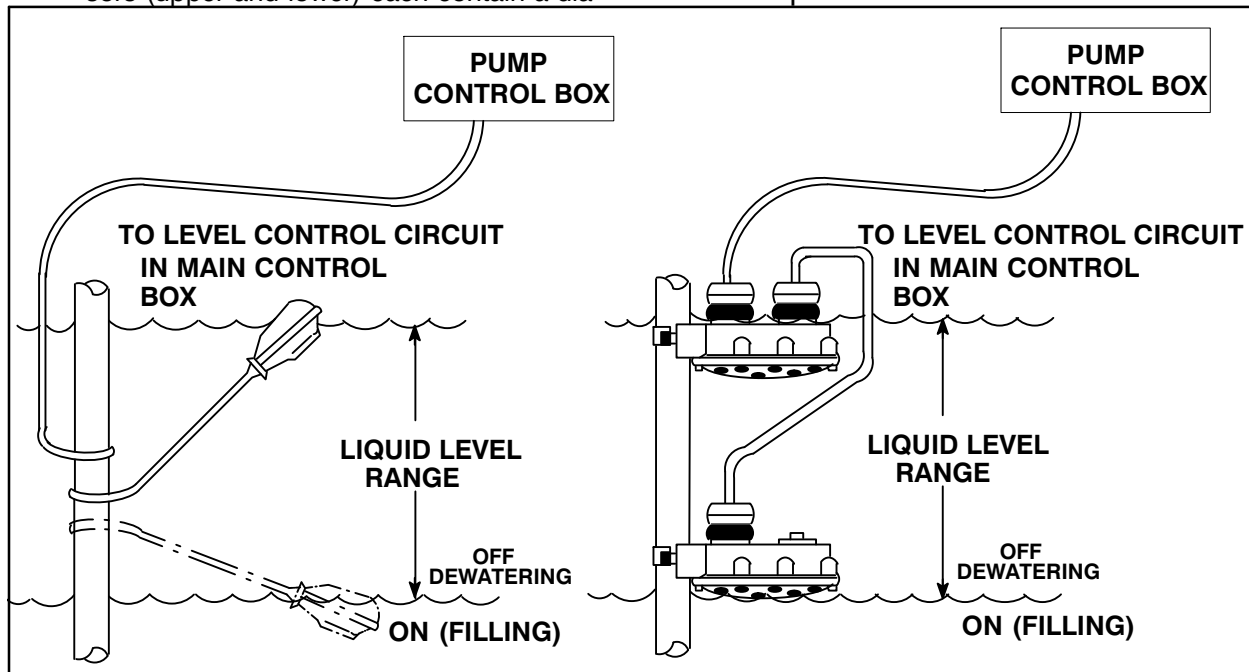


FIGURE B-7. LIQUID LEVEL DEVICES

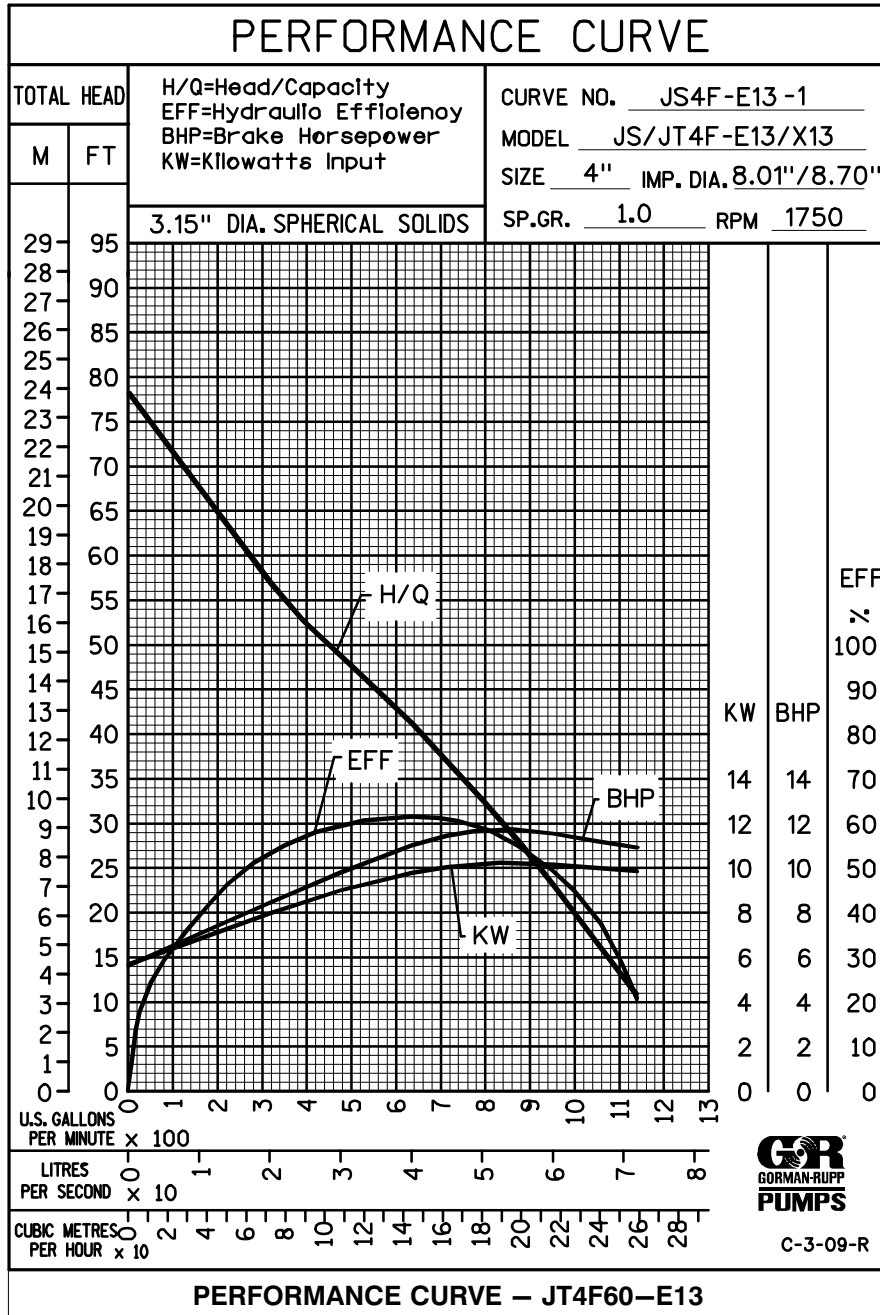
OPERATION – SECTION C

PERFORMANCE CURVE

In the following curve, performance is based on 70° F (21° C) clear water at sea level. The performance of your pump may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

NOTE

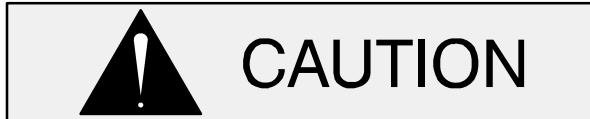
*This curve applies to standard production models. If your pump serial number is followed by an "N", your pump is **not** a standard production model. Contact the Gorman-Rupp Company to verify performance.*



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

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

PUMP OPERATION



The pump warranty is void if the motor is not operated through a control box approved by Gorman-Rupp.

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

Liquid Temperature and Overheating



Standard versions of this pump will handle liquids with temperatures up to 104°F (40°C) maximum. Do not install in service with higher liquid temperatures; otherwise, pump components and operation may be affected.



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

1. **Stop the pump immediately.**
2. **Allow the pump to cool.**
3. **Refer to instructions in this manual before restarting the pump.**

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.

The submersible motor is cooled by the liquid being pumped. To minimize the chance of over-heating when installed in a **simplex** application, it is recommended that at least one-third of the motor remain immersed in the liquid.



Do not start the pump more than 10 times per hour. If the motor does not cool between starts it will overheat, resulting in damage to the motor windings or control box components.

When installed in a standard alternating **duplex** application, where one pump runs while the other is shut down, the pump may be operated continu-

ously until fully exposed. The shut down cycle will provide sufficient time for the motor to cool.

Impeller Rotation

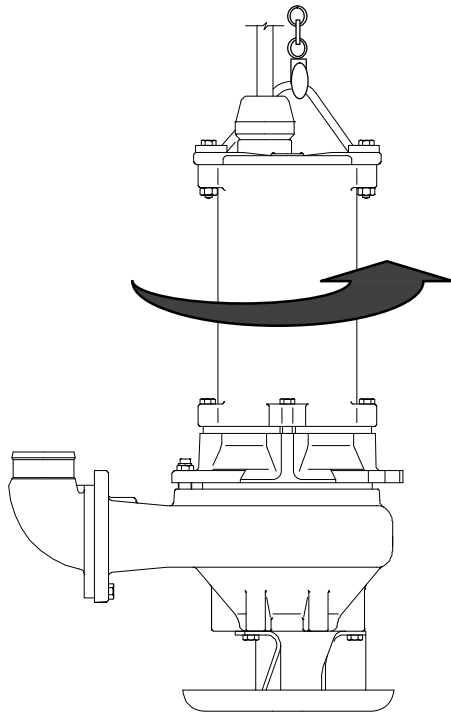


FIGURE C-1. PUMP ROTATION

Refer to Figure C-1, and check impeller rotation as follows before installing the pump in a wet well.



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

Suspend the pump by the lifting handle. Apply power **briefly** and note the direction of pump twist. As viewed from the top, the pump should twist in a counterclockwise direction; this will indicate that impeller rotation is correct.

If the pump twists in a clockwise direction, impeller rotation is incorrect. Have qualified personnel interchange the control box connections of any two

pump motor power leads. Recheck pump twist; it should now be in a counterclockwise direction.

STARTING, STOPPING, AND OPERATIONAL CHECKS

Starting



Do not attempt to operate the pump until impeller rotation has been checked; otherwise, the pump will be damaged.

Follow the control box manufacturer's instructions, start the pump, and run any recommended checks.

Stopping

Follow the control box manufacturer's instructions for stopping the pump.



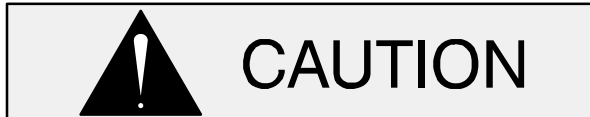
The integral thermal overload device will shut off the motor if the temperature rises above design limits. When the pump cools and the temperature falls below these limits, the motor will restart automatically. To avoid the hazards of an unexpected motor start-up, do not attempt to handle or service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

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.

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.



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 Section D.

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 wet well, **disconnect power**, 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 on the pump performance curves.

Check the pump for overheating. Overheating can occur if the pump is misapplied, required to start repeatedly, if the control box fails to provide over-

load 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 10 times per hour. If the motor does not cool between starts it will overheat, resulting in damage to the motor windings or control box components.

Cold Weather Preservation

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 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.



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

TROUBLESHOOTING – SECTION D

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

NOTE

*Many of the probable remedies listed in the **TROUBLESHOOTING CHART** require use of electrical test instruments; for specific procedures, see **ELECTRICAL TESTING** at the end of the chart.*

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO START.	NO POWER TO MOTOR.	CHECK FOR BLOWN FUSE OR OPEN CIRCUIT BREAKER
	IMPELLER JAMMED.	CHECK IMPELLER; DISASSEMBLE AND REPAIR AS NECESSARY.
	MOTOR, VOLTAGE OR CONTROL BOX INCOMPATIBLE; DEFECTIVE CONNECTIONS	CHECK RATINGS ON PUMP NAMEPLATE AND CONTROL BOX; CHECK INCOMING VOLTAGE; CHECK CONNECTIONS.
	MOTOR CABLE DAMAGED	CHECK PER ELECTRICAL TESTING .
	CONTROL BOX CURRENT INTERRUPTING OR MOISTURE-SENSING DEVICES TRIPPED.	CHECK CONTROL BOX; CHECK FOR LEAKING SHAFT SEALS, CUT O-RINGS, OR MOISTURE WICKING THROUGH CABLE.
	OPEN CIRCUIT IN MOTOR WINDINGS OR CABLE.	CHECK CONTINUITY PER ELECTRICAL TESTING .
	MOTOR OVERHEATED, THERMAL SWITCHES TRIPPED.	ALLOW MOTOR TO COOL.
MOTOR RUNS BUT DOES NOT DELIVER RATED DISCHARGE.	PUMP RUNNING BACKWARD.	CHECK IMPELLER ROTATION (SEE SECTION C).
	VOLTAGE TOO LOW OR TOO HIGH; EXCESSIVE VOLTAGE DROP BETWEEN PUMP AND CONTROL BOX.	CHECK INCOMING VOLTAGE; CHECK WIRING SIZE, TYPE AND LENGTH. (SEE INSTALLATION – SECTION B).
	DISCHARGE HEAD TOO HIGH.	REDUCE DISCHARGE HEAD, OR INSTALL STAGING ADAPTER AND ADDITIONAL PUMP.
	DISCHARGE THROTTLING VALVE PARTIALLY CLOSED; CHECK VALVE IMPROPERLY INSTALLED.	OPEN DISCHARGE VALVE FULLY; CHECK PIPING INSTALLATION.
	IMPELLER OR DISCHARGE LINE CLOGGED.	CLEAR
	LIQUID BEING PUMPED TOO THICK.	DILUTE LIQUID IF POSSIBLE.
	IMPELLER WORN OR DAMAGED.	REPLACE.
(CONT.)		

TROUBLESHOOTING CHART (cont'd)

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
(CONT.) MOTOR RUNS, BUT DOES NOT DELIVER RATED DISCHARGE.	INSUFFICIENT LIQUID IN WET WELL.	STOP PUMP UNTIL LIQUID LEVEL RISES.
	IMPELLER ROTATING IN WRONG DIRECTION.	CHECK IMPELLER ROTATION (SEE SECTION C).
PUMP STARTS THEN SHUTS OFF.	CLOGGED SUCTION PORT OR IMPELLER CAUSING MOTOR OVERLOAD.	CLEAR BLOCKAGE; RESET OVERLOAD DEVICE IN CONTROL BOX.
	MOTOR OVERHEATED; THERMAL SWITCH TRIPPED.	ALLOW PUMP TO COOL.
	MOISTURE SENSING DEVICE TRIPPED.	DISASSEMBLE PUMP AND LOCATE LEAK.
	MOTOR BEARINGS DEFECTIVE.	DISASSEMBLE PUMP AND CHECK
	MOTOR CABLE DAMAGED.	CHECK PER ELECTRICAL TESTING .
	INSUFFICIENT LIQUID IN WET WELL.	STOP PUMP UNTIL LIQUID LEVEL RISES.
EXCESSIVE NOISE OR VIBRATION.	PUMP OPERATING OUTSIDE DESIGNED OPERATING RANGE.	CHECK DISCHARGE HEAD AND FLOW; ADJUST AS REQUIRED TO MEET PERFORMANCE SPECIFICATIONS.
	IMPELLER CLOGGED.	CLEAR BLOCKAGE
	IMPELLER LOOSE OR DAMAGED.	CHECK IMPELLER; REPLACE IF NECESSARY.
	MOTOR SHAFT OR BEARINGS DEFECTIVE.	REPLACE
	PUMPING ENTRAINED AIR.	CHECK WET WELL LIQUID LEVEL.

ELECTRICAL TESTING

Make the electrical checks which follow to determine if pump malfunctions are being caused by problems in the motor or in the motor cable.

Test Equipment

A volt/amp/ohmmeter and megohmmeter of adequate range and quality are required to conduct the electrical

tests which follow. use the commercial equipment listed below, or equivalent substitutes.



Refer to the wiring diagram(s) accompanying the motor and control box before reconnecting any electrical leads which have been disconnected. Connections to the wrong terminals may damage the motor and/or control devices.

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

Voltage Imbalance

Use a voltmeter to read each phase of the incoming 3 phase power. Each phase must balance with the other two as closely as can be measured with a commercial instrument. If the phases are out of balance, contact your power company. If the phases are balanced, check out the motor as described in the following steps:

- a. Use a voltmeter, Amprobe, or equivalent instrument to read the voltage of incoming power lines 1 and 2, 2 and 3, and 1 and 3 at the control box. Voltage must match as closely as can be measured. If possible, measure the voltage at the control box with:
 - 1. The pump shut off.
 - 2. The pump running in air.
 - 3. The pump submerged and running under full load.

The voltage measured under each condition must be the same.

- b. If voltage is balanced when the pump is off but is imbalanced when the pump is running, thoroughly check the power source, all interconnecting cables, and the pump motor to isolate the defect.
- c. Use an Amprobe or equivalent instrument to measure the current draw (amperage) of each phase while the pump is running under full load, and with no load. In each condition, the amperage readings for all three phases must match as closely as can be measured. Normal amperage values are listed in Table 1,

Section B; these values apply only when the voltage at the site is the normal voltage listed.

Motor and Power Cable Continuity

Set the megohmmeter at R x 1 scale and zero-balance it. Test as follows:

- a. Shut off incoming power to the control box, and disconnect the motor power cable leads. Connect the megohmmeter test leads to any two power cable leads, and note the megohmmeter reading. A high resistance reading indicates an open or broken circuit in the power cable or motor windings, or a bad connection between the motor and cable.
- b. Repeat Step a. with each set of leads. The three readings shall be as close as can be measured.
- c. If readings indicate that continuity problems exist in the motor or motor cable, the motor must be returned to the factory or to a U/L-approved facility.

Insulation Resistance

Set the megohmmeter at R x 100, and zero-balance it. Test as follows:

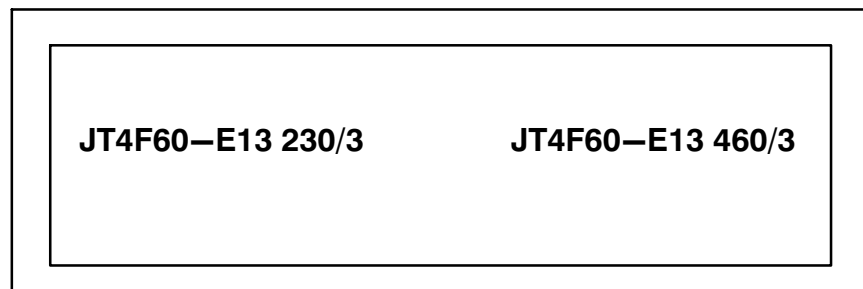
- a. Shut off incoming power to the control box, and disconnect the motor power cable leads. Connect one megohmmeter test lead to the motor cable green/yellow ground lead. Touch the other test lead to each of the motor cable leads in turn. Note the readings.
- b. Readings will indicate resistance values in both the power cable and motor windings. If resistance reads infinity (∞), insulation is good. If resistance reads between infinity (∞), and 1 megohm, insulation is acceptable but should be rechecked regularly. If resistance reads less than 1 megohm, insulation should be checked more closely and frequently.
- c. If readings indicate that a ground exists, test the stator and motor power cable separately. Replace as required.

MAINTENANCE AND REPAIR – SECTION E

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

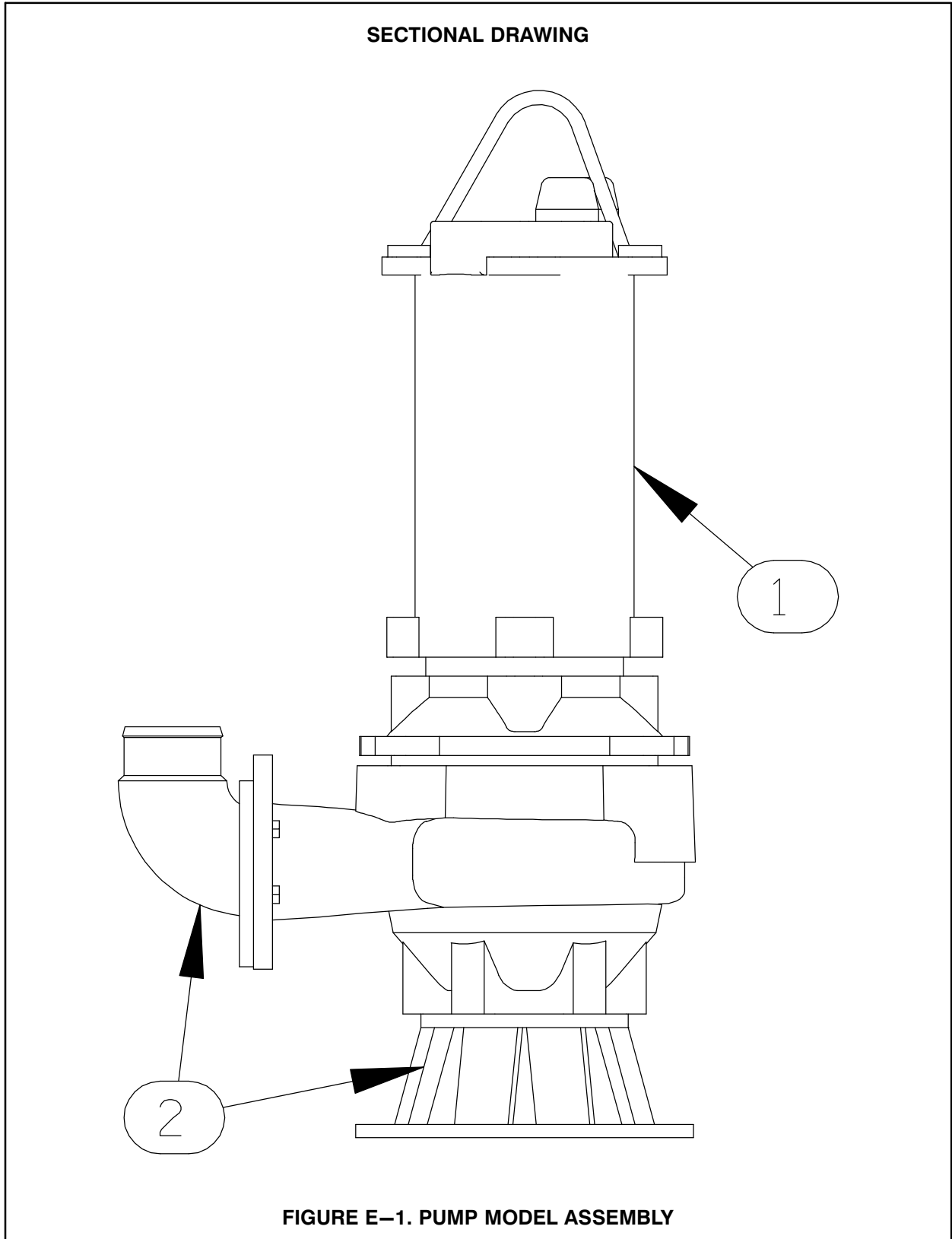
PUMP MODELS

THE FOLLOWING PUMP MODELS, FROM SERIAL NO. **1446236** UP, ARE COVERED IN THIS SECTION.



IF YOUR PUMP SERIAL NUMBER IS FOLLOWED BY AN “**N**”, YOUR PUMP IS **NOT** A STANDARD PRODUCTION MODEL. CONTACT THE GORMAN-RUPP COMPANY TO VERIFY PART NUMBERS.

PERFORMANCE CURVES FOR THESE PUMPS ARE SHOWN AT THE BEGINNING OF **OPERATION – SECTION C.**



**PUMP MODEL ASSEMBLY
PARTS LIST**

ITEM NO.	PART NAME	PART NUMBER	QTY
1	SUBMERSIBLE SUBASSEMBLY	SEE FIGURE 2	1
2	INSTALLATION KIT	26827-910	1
	STAND	26827-301	1
	O-RING	26824-154	1
	HOSE CONNECTOR	26827-304	1
	M16 X 40 X 2 CAPSCREW	22645-585	8
	NOT SHOWN:		
	ROTATION DECAL	38815-023	1
	CAUTION DECAL	38816-182	1
	WARNING DECAL	38816-228	1
	MOTOR VOLTAGE TAG (230V)	38816-098	1
	MOTOR VOLTAGE TAG (460V)	38816-460	1
	INSTRUCTION TAG	388186-254	1
	NAME PLATE	38818-055 17000	1
	DRIVE SCREW	BM#04-03 17000	4

SECTIONAL DRAWING

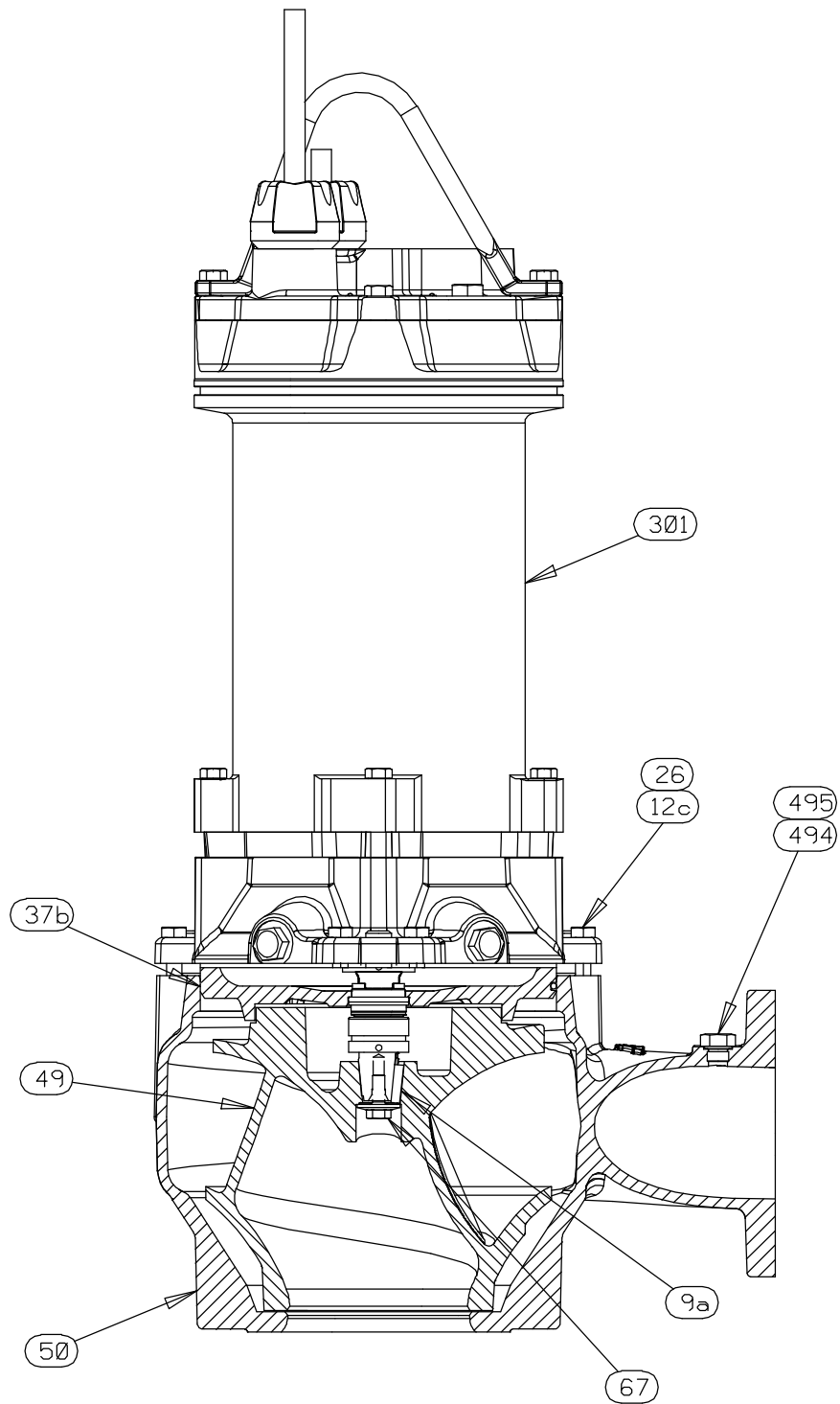
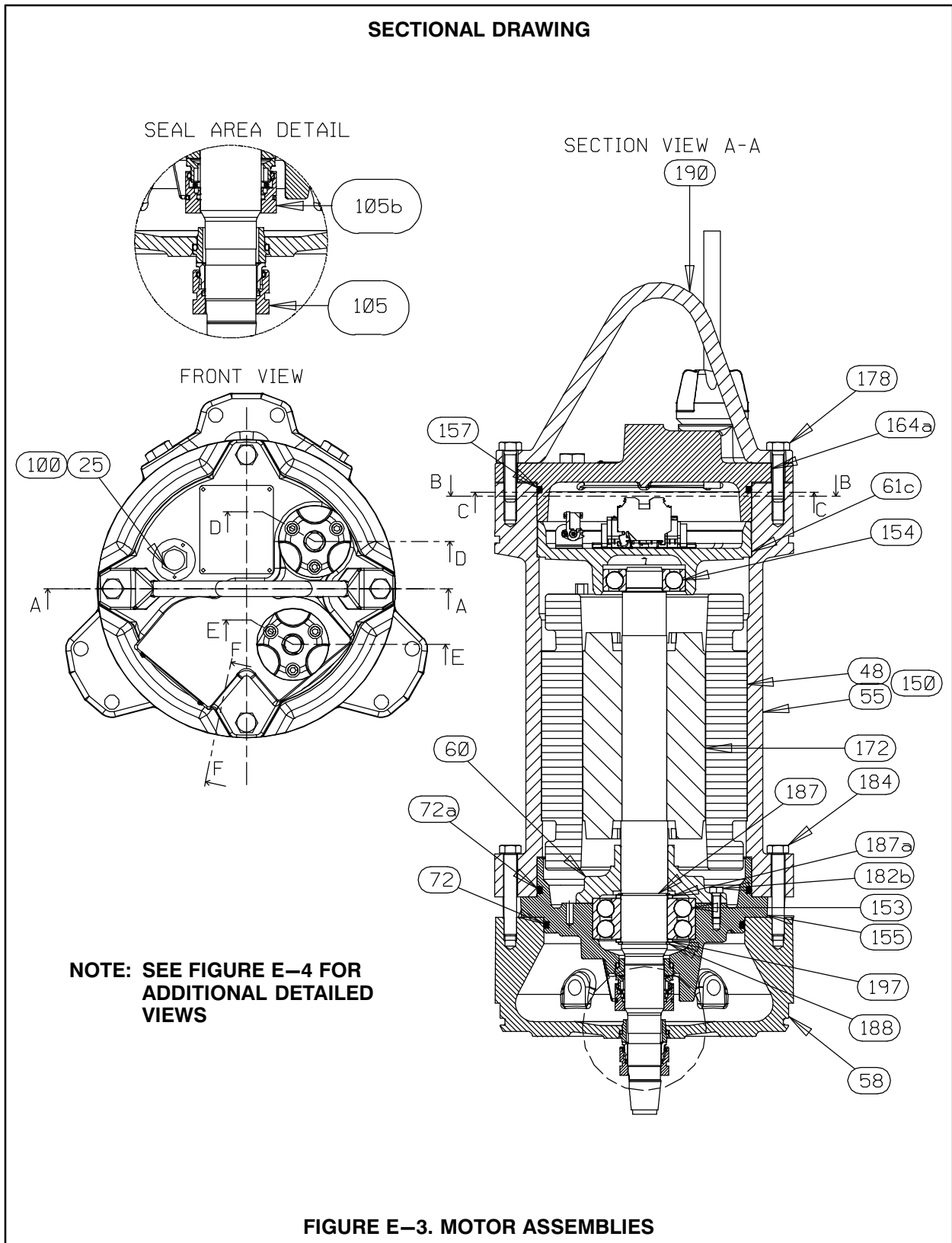


FIGURE E-2. SUBMERSIBLE SUBASSEMBLY

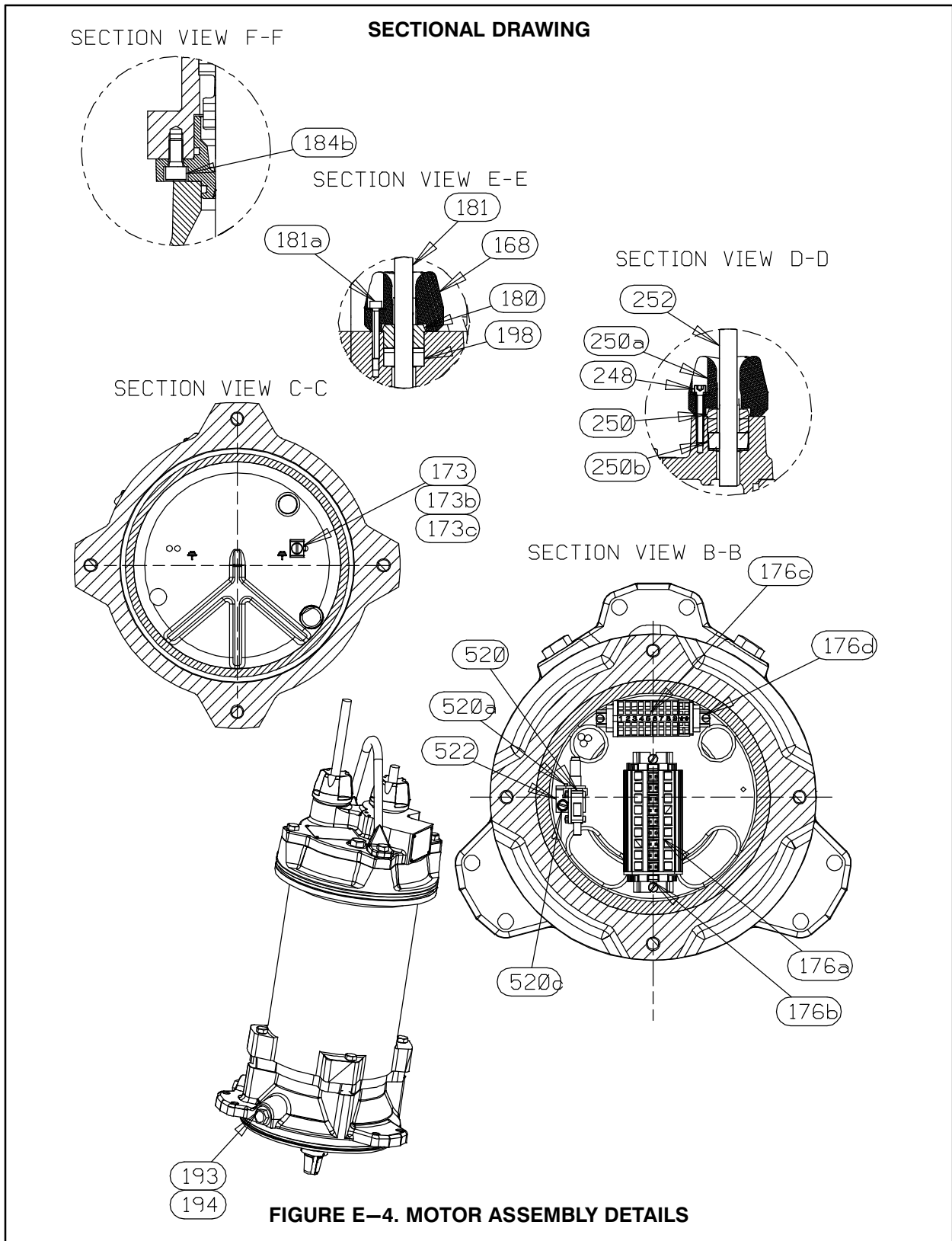
**SUBMERSIBLE SUBASSEMBLY
PARTS LIST**

ITEM NO.	PART NAME	PART NUMBER	QTY
9a	* KEY	26824-173	1
12c	ADJUSTING SCREW	26824-381	3
26	HEX HD CAPSCREW	26824-355	6
37b	O-RING	26824-146	1
49	* IMPELLER	26823-896	1
50	VOLUTE	26827-321	1
67	* IMPELLER SCREW	26824-379	1
301	MOTOR ASSEMBLY (230V)	47111-703	1
	MOTOR ASSEMBLY (460V)	26827-324	1
494	PLUG	26824-261	1
495	* O-RING	26824-122	1
	* INDICATES PARTS RECOMMENDED FOR STOCK		



**MOTOR ASSEMBLIES
PARTS LIST**

ITEM NO.	PART NAME	PART NUMBER	QTY
25	PLUG	26824-261	1
58	SEAL HOUSING	26823-554	1
60	BEARING BRACKET COVER	26827-331	1
61c	UPPER BEARING BRACKET	26827-331	1
72	* O-RING	26824-129	1
72a	* O-RING	26824-125	1
100	* O-RING	26824-122	1
105	* LOWER SEAL ASSEMBLY	26824-095	1
105b	* UPPER SEAL ASSEMBLY	26824-085	1
150	STATOR/HOUSING PACKAGE	26827-332	1
48	-STATOR	26825-648	1
55	-MOTOR HOUSING	26827-373	1
153	* LOWER BALL BEARING	S1034	1
154	* UPPER BALL BEARING	26823-732	1
155	LOWER BEARING BRACKET	26827-333	1
157	* O-RING	26824-125	1
164a	MOTOR COVER	26827-334	1
168	CABLE INLET	26827-335	1
172	ROTOR/SHAFT ASSEMBLY	26827-336	1
173	SCREW	26824-369	1
173b	GROUND TERMINAL	26824-309	1
173c	GROUND WASHER	26824-321	1
176a	CONNECTOR PLATE	26827-337	1
176b	SCREW	26824-386	2
176c	CONNECTOR PLATE	26827-338	1
176d	SCREW	26827-339	2
178	SCREW	26824-356	4
180	CABLE CLAMP	26827-340	1
181	* CABLE	26827-341	1
181a	SCREW	26824-371	3
182b	SCREW	26824-416	3
184	SCREW	26824-361	4
184b	ALLEN SCREW	26824-445	4
187	RETAINING RING	26824-217	1
187a	WASHER	26824-302	1
188	RETAINING RING	26824-217	1
190	LIFTING HANDLE	26827-342	1
193	PLUG	26824-261	2
194	* PLUG O-RING	26824-122	2
197	WASHER	26824-302	1
198	* RUBBER SEAL	26827-343	1
248	SCREW	26824-371	3
250	CABLE CLAMP	26827-344	1
250a	CABLE INLET	26823-341	1
250b	* RUBBER SEAL	26827-345	1
252	* CABLE	26827-372	1
520	* MOISTURE SWITCH	26823-301	1
520a	SCREW	26824-413	1
520c	SCREW	26824-368	1
522	MOISTURE SWITCH HOLDER	26824-832	1
	* INDICATES PARTS RECOMMENDED FOR STOCK		



**MOTOR ASSEMBLIES
PARTS LIST**

ITEM NO.	PART NAME	PART NUMBER	QTY
25	PLUG	26824-261	1
58	SEAL HOUSING	26823-554	1
60	BEARING BRACKET COVER	26827-331	1
61c	UPPER BEARING BRACKET	26827-331	1
72	* O-RING	26824-129	1
72a	* O-RING	26824-125	1
100	* O-RING	26824-122	1
105	* LOWER SEAL ASSEMBLY	26824-095	1
105b	* UPPER SEAL ASSEMBLY	26824-085	1
150	STATOR/HOUSING PACKAGE	26827-332	1
48	- STATOR	26825-648	1
55	- MOTOR HOUSING	26827-373	1
153	* LOWER BALL BEARING	S1034	1
154	* UPPER BALL BEARING	26823-732	1
155	LOWER BEARING BRACKET	26827-333	1
157	* O-RING	26824-125	1
164a	MOTOR COVER	26827-334	1
168	CABLE INLET	26827-335	1
172	ROTOR/SHAFT ASSEMBLY	26827-336	1
173	SCREW	26824-369	1
173b	GROUND TERMINAL	26824-309	1
173c	GROUND WASHER	26824-321	1
176a	CONNECTOR PLATE	26827-337	1
176b	SCREW	26824-386	2
176c	CONNECTOR PLATE	26827-338	1
176d	SCREW	26827-339	2
178	SCREW	26824-356	4
180	CABLE CLAMP	26827-340	1
181	* CABLE	26827-341	1
181a	SCREW	26824-371	3
182b	SCREW	26824-416	3
184	SCREW	26824-361	4
184b	ALLEN SCREW	26824-445	4
187	RETAINING RING	26824-217	1
187a	WASHER	26824-302	1
188	RETAINING RING	26824-217	1
190	LIFTING HANDLE	26827-342	1
193	PLUG	26824-261	2
194	* PLUG O-RING	26824-122	2
197	WASHER	26824-302	1
198	* RUBBER SEAL	26827-343	1
248	SCREW	26824-371	3
250	CABLE CLAMP	26827-344	1
250a	CABLE INLET	26823-341	1
250b	* RUBBER SEAL	26827-345	1
252	* CABLE	26827-372	1
520	* MOISTURE SWITCH	26823-301	1
520a	SCREW	26824-413	1
520c	SCREW	26824-368	1
522	MOISTURE SWITCH HOLDER	26824-832	1
	* INDICATES PARTS RECOMMENDED FOR STOCK		

PUMP AND MOTOR DISASSEMBLY AND REASSEMBLY

Review all SAFETY information in Section A.



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

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

The following maintenance and repair instructions are keyed to the sectional views, FIGURES E-1 through E-4, and their accompanying parts lists.

Select a suitable location, preferably indoors, to perform required maintenance. All work must be performed by qualified personnel. Recommended spare parts are shown on the parts lists.

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

If a maintenance problem is electrical, see **ELECTRICAL TESTING** in **TROUBLESHOOTING**, Section D.

PUMP AND MOTOR DISASSEMBLY



If necessary to pry components apart to separate them, use levers on both sides of the component, and apply pressure evenly. Be careful not to mar mating surfaces. When removing parts from the rotor/shaft

assembly, be careful not to mar the surface or tapered end of the shaft.

PUMP END DISASSEMBLY

Except as noted, all references are to FIGURE E-2.

NOTE

The volute casing and impeller may be removed without draining the oil from the pump.

Volute Casing Removal

1. Use a suitable lifting device to support the pump in a vertical position. Remove the screws securing the volute casing to the stand. Use the lifting device to raise the pump off the stand. Reposition the pump no more than one inch (25,4 mm) above the working surface.

NOTE

If the impeller (49) is to be removed, do not remove the volute casing until the impeller screw (67) has been loosened. Insert a wood block or metal bar through the discharge opening to block impeller rotation while loosening the impeller screw. After loosening the impeller screw, remove the wood block or bar, and proceed with volute casing removal.

2. If desired, remove the attaching hardware and separate the hose connector from the volute casing. Remove the connector O-ring.
3. Loosen the screws (26) securing the volute casing to the motor assembly (301) one-half turn in sequence. The adjusting screws (12c) will remain in place. Separate the motor assembly from the volute casing.
4. Lay the pump in a horizontal position on a workbench or other suitable surface.

Impeller Removal

1. Block impeller rotation as described above, and remove the screw (67) securing the impeller (49) to the motor shaft.
2. Use a suitable puller to remove the impeller. Retain the impeller key (9a).

NOTE

An alternate method of removing the impeller is to position two wedges opposite each other behind the impeller, and tap the wedges carefully in turn until the impeller comes free of the shaft.

Lower Seal Removal

All references are to FIGURES E-4 and E-5.



To maintain peak operating efficiency, it is **strongly** recommended that the seal be replaced if the pump is disassembled. In the event that the seal will be reused, handle seal parts with extreme caution to prevent damage. Use care not to contaminate the precision-finished faces; even fingerprints on the faces can shorten seal life.

1. Remove the drain/fill plugs and O-rings (193 and 194) and drain the seal and bearing cavities. Clean and reinstall the plugs and O-rings.

NOTE

Use caution in Step 2; tension on the seal spring will be released.

2. Loosen, but do not remove, the setscrews securing the seal retainer to the shaft. Slide the rotating portion of the seal off the shaft.
3. Slide a pair of stiff wires with hooled ends between the shaft and the stationary seat. Use the wires to hook the back side of the stationary

seat pull the stationary seat out of the housing. Remove the stationary seat O-ring.

NOTE

*If the upper seal assembly has leaked, the motor must be disassembled and the upper seal and lower bearing (153) must be replaced. Do not reassemble pump end components at this time if the upper bearing must be replaced. Refer to **MOTOR DISASSEMBLY** for upper seal replacement.*

4. Refer to **INSPECTION AND CLEANING** before reassembling the pump end components.

PUMP END REASSEMBLY

Except as noted, all references are to FIGURE E-2.

Lower Seal Installation

All references are to FIGURES E-4 and E-5.

1. Unwrap the seal components. Check that the seal faces are clean and undamaged. If necessary to clean, use a clean tissue and wipe in a concentric pattern.
2. Lightly lubricate the seal stationary seat O-ring, place a clean tissue over the sealing face of the stationary seat, and press the stationary seat and O-ring into the seal housing (155) until fully seated. **Make sure** the slot in the stationary seat is positioned the lug in the seal housing to prevent rotation.
3. Lightly oil both seal faces. Slide the rotating portion of the seal onto the shaft until the seal faces contact. Replacement seals are provided with a plastic ring to establish the correct spring tension on the seal faces. Insert the edge of the ring between the shoulder on the retainer and shoulder on the back of the rotating element. Use a suitably sized sleeve to push against the retainer until the ring gauge is lightly squeezed, then tighten the retainer drive screws to secure the rotating portion of the seal to the shaft. Remove the ring gauge.

NOTE

See **Seal Testing** before installing the pump end components.

4. After the pump is fully assembled, lubricate the seal housing as indicated in **LUBRICATION** at the end of this section.

Impeller Installation

1. Check the impeller (49) for broken vanes, cracks, or excessive wear. Replace as necessary.
2. Oil the end of the motor shaft and the keyway. Install the impeller key (9a) in the shaft keyway. Position the impeller on the shaft, and engage the key in the impeller keyway. Use a soft-faced mallet to tap the impeller onto the shaft until fully seated.

NOTE

The volute casing (50) must be installed and secured to the seal housing in order to tighten the impeller screw (67). With the volute casing installed, insert a wood block or metal bar through the discharge opening to block impeller rotation. After installing and tightening the impeller screw as described below, remove the wood block or bar, and proceed with pump reassembly.



The threads of the impeller screw (67) and its mating surfaces **must** be lubricated to reduce friction and prevent corrosion.

3. Lubricate the threads of the screw (67) and its mating surfaces with SAE 10W 30 oil; install the screw, and torque to 65 ft. lbs. (780 in. lbs. or 9 m. kg.)

Volute Installation and Impeller Clearance

1. If the hose connector was removed at disassembly, install the connector O-ring and secure the connector to the volute casing with the previously removed hardware.
2. Use a suitable lifting device to position the pump on the stand and secure it with the previously removed hardware.

NOTE

Impeller clearance should always be adjusted when the volute casing or impeller have been removed from the pump.

3. The clearance between the impeller and the inner edge of the volute casing should measure between 0.02 and 0.035 inches (0,5 and 0,9 mm). Use a feeler gauge to measure the impeller clearance at different positions. To adjust the clearance, loosen but do not remove the screws (26) securing the volute casing to the motor assembly (301). Establish the correct clearance by tightening or loosening the adjusting screws (12c).
4. After the impeller clearance has been established, retighten the attaching screws (26).
5. See **LUBRICATION** before returning the pump to service.

MOTOR DISASSEMBLY

All references are to FIGURES E-3 and E-4.

Upper Seal Removal

All references are to FIGURES E-3 and E-5.

NOTE

Use caution in Step 1; tension on the retainer springs will be released.

1. With the pump end components and lower seal assembly removed, remove the screws (184) securing the seal housing (58) to the motor

housing (55). Carefully pry the seal housing off the lower bearing bracket (155).

2. Lightly oil the shaft. Loosen, but do not remove, the drive screws securing the seal retainer to the shaft. Slide the rotating portion of the seal off the shaft as a unit.
3. Remove the allen head screws (184b) and carefully pry the assembled lower bearing bracket, rotor and shaft assembly (172), and bearings (153 and 154) from the motor housing (55).
4. Remove the capscrews (182b) securing the bearing bracket cover (60) to the lower bearing bracket. Slide the lower bearing bracket and stationary portion of the seal off the shaft.
5. Press the stationary seat and O-ring out of the bearing housing from the back side.
6. Remove and discard the O-rings (72 and 72a) from the grooves in the lower bearing bracket.

If no further disassembly is required, refer to **INSPECTION AND CLEANING**, followed by **Upper Seal Installation** and **PUMP END REASSEMBLY**.

Bearing Removal

NOTE

Because bearings can be damaged while being removed, it is recommended that they be inspected in place.

*If the bearings will not be replaced, it is also recommended that they be cleaned in place (see **INSPECTION AND CLEANING**).*

1. With the seal housing and lower bearing housing removed, rotate the bearings (153 and 154) by hand to check for roughness or binding; replace as necessary.
2. To remove the upper bearing (154), lightly oil the upper end of the rotor/shaft (48) and use a

suitable puller to remove the bearing from the shaft.

3. To remove the lower bearing (153), remove the lower retaining ring (188) and washer (197). Lightly oil the shaft and use a suitable puller to remove the bearing from the shaft; the upper washer (187a) will become a free part.
4. To remove the bearing cover (60), remove the upper retaining ring (187) and slide the cover off the shaft.

Motor Cover Removal and Disassembly

NOTE

If desired, the motor cover (164a) may be removed and disassembled without disassembling the pump end components.

1. Remove the hardware (178) securing the lifting handle (190) and motor cover (164a) to the motor housing (55). Remove the lifting handle.
2. Tap the motor cover lightly with a soft-faced mallet to break the seal with the motor housing. Raise the motor cover enough to expose the wiring connections .

NOTE

Unless desired to replace the motor cover and/or power or control cables (181 and 252), do not disconnect the wiring between the motor cover and the stator (48). The thermal protection and moisture detection leads are insulated against wicking; if disconnected, this insulation must be re-established.

3. To remove the motor cover, disconnect the power and control cable leads at the connection plates (176a and 176c). Remove the screw and washer (173 and 173c) securing the ground terminal (173b). Disconnect the control cable lead from the moisture switch (520).
4. Remove the motor cover.

- To remove the moisture switch, remove the screw (520c) securing the holder (522) to the upper bearing bracket (61c).

NOTE

Unless absolutely necessary, do not remove the power or control cables (181 and 252) from the motor cover, or move or remove the components in the cable inlets (168 and 250a). When these components are installed, they deform the cables, and the cables will have to be trimmed if they are moved.

- To remove the power or control cables, cable inlets, cable clamps (180 and 250) and rubber seals (198 and 250b) as assemblies, remove the screws (248 and 181a), and pull the assembled cables and cable inlet components out of the motor cover.
- If desired to separate the parts removed in Step 6, lubricate the cables to ease removal.

NOTE

In the stator/motor housing (150), the stator (48) is a hot shrink fit in the motor housing (55). No instructions are given in this manual for separating the stator/motor housing. It is strongly recommended that the stator/motor housing be returned to the factory or an authorized Gorman-Rupp repair facility if any of these components require service.

INSPECTION AND CLEANING

Carefully inspect all O-ring seating areas to determine if they formed a proper seal. If sealing was faulty, determine the cause before reassembling

the pump. After inspection, remove and discard all O-rings.



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

Bearings

- It is recommended that bearings be cleaned in place on the shaft.
- Clean bearings thoroughly in **fresh** cleaning solvent; dry with filtered compressed air.
- Coat external surfaces with light oil to ease reassembly; these bearings are permanently sealed and require no additional lubrication.
- Cover the bearings with clean cloth to keep external surfaces free of all dirt and foreign material; **failure to do so could damage the bearings or their mating surfaces.**

Other Reusable Parts (Except Seal Assemblies)

- Thoroughly clean all reusable parts.
- Inspect all mating surfaces and the rotor/shaft assembly for nicks or burrs, and restore to original contours with a honing stone or fine file.
- If the surface cannot be restored, replace the part.

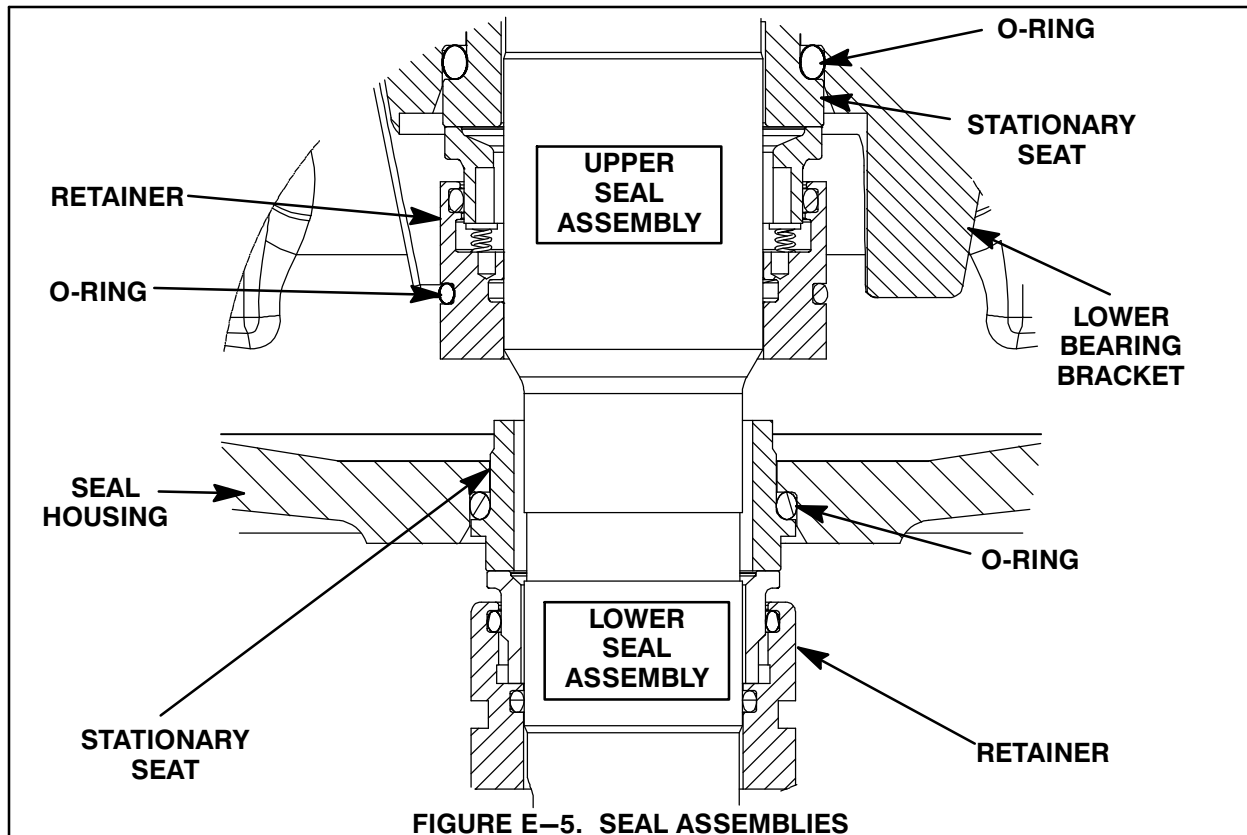
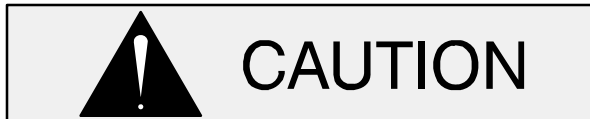


FIGURE E-5. SEAL ASSEMBLIES

Cleaning Seal Assemblies



Seal faces are precision finished and subject to wear patterns which cannot be realigned during assembly. The seal assembly should be replaced completely at each overhaul to ensure trouble-free operation. If necessary to use an old seal in an emergency, **never** mix old and new seal parts; seal performance will be severely affected.

1. Inspect the seal assemblies for wear, scoring, grooves, and other damage that might cause leakage.
2. Wash all seal parts in fresh cleaning solvent and allow to dry thoroughly. Reinspect the parts after cleaning.

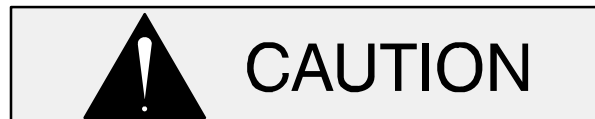
3. If needed, clean the seal faces with a clean, lint-free tissue. Wipe lightly in a concentric pattern to avoid scratching the faces.

MOTOR REASSEMBLY

Except as noted, all references are to FIGURES E-3 and E-4.

Motor Cover Reassembly and Installation

1. Clean the exterior of the power and control cables (181 and 252) with warm water and mild detergent, and inspect for obvious damage. (If required, see **ELECTRICAL TESTING** in **TROUBLESHOOTING, SECTION D.**)



Do **not** splice the cables. The waterproof integrity must be maintained. If repairs are required other than at either end, replace the entire cable.

NOTE

If the cable inlets (168 and 250a), cable clamps (180 and 250), and rubber seals (198 and 250b) have been moved or removed, lubricate the cables (181 and 252) to ease installation.

2. Install the inlets (168 and 250a) and clamps (180 and 250) on the cables (181 and 252). Discard the old rubber seals (198 and 250b) and install new ones. Locate the new seals above the deformation marks left on the cables by the old seals.
3. Cut the power and control cables above the seal deformation mark. Strip the cable outer insulation so that the individual leads are long enough to make connections; the ground lead in the power cable must be longer than the others.
4. Install new identification markers identical to those on the old leads on the new wire ends.
5. Pull the rubber seals down to within two inches (51 mm) of the end of the cable sheaths. Pull the cable clamps down until flush with the rubber seals. Lubricate the outside of the cable clamps, and pull the cable inlets down over the clamps until flush with the rubber seals.
6. Insert the cable leads into the motor cover (164a), making certain that the rubber seal bottoms in the cover, and that the cable clamps and cable inlets seat flush with the top of the cover. Secure the cable inlets and installed components with the screws (181a and 248).



Refer to the wiring diagrams in INSTALLATION, Section B, when connecting all motor leads. Misconnected leads could severely damage the motor, and cause injury or death to personnel.

7. Install the leads from the stator (48) and power cable in the connection plate (176a).

8. Install the leads from the stator and control cable in the connection plate (176c).
9. Secure the ground terminal (173b) with the screw and washer (173 and 173c).

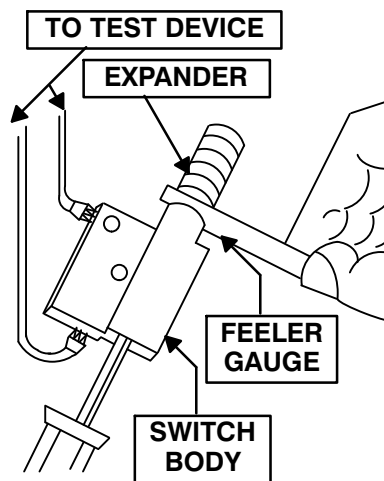
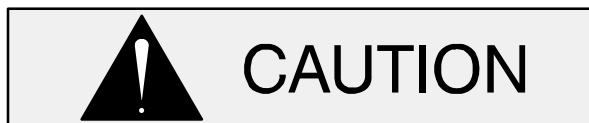


Figure E-6. Moisture Switch Check

10. The moisture switch (520) should be checked and, if required, adjusted any time the motor is opened for service.



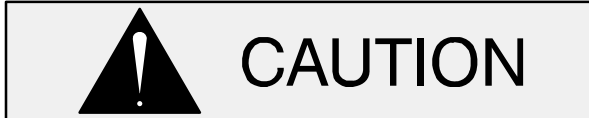
The switch is extremely sensitive to atmospheric moisture and contamination from handling; therefore, **make sure** hands are clean and dry before touching the switch. Do not remove a replacement switch from the air-tight plastic shipping bag until just prior to installation.

See FIGURE E-6, and install the switch in a simple bell circuit or other test circuit. Use a feeler gauge to check clearance between the expander and switch body; clearance should be 0.100 inches (2,5 mm).

11. After checking, secure the moisture switch holder (522) to the motor cover with the screw (520c). Reconnect the control cable lead to the moisture switch.

12. Lubricate a new O-ring (157) and install it in the motor cover. Secure the motor cover and lifting handle (190) to the motor housing with the hardware (178).

Bearing Installation



When installing bearings, **never** press or hit against the outer race, balls, or ball cage. Press **only** on the inner race. A metal or plastic sleeve with the same O.D. as the inner race is useful for installing bearings.

NOTE

*Heating the bearings will ease installation. **Bearings should never be heated by direct flame.** An induction heater, hot oil bath or electric oven may be used.*

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

1. Fill bearings with Shell Darina Grease R2 or equivalent. Do not fully pack the bearings; allow some room for expansion of grease when bearings are in operation.



Use tongs, insulated gloves, or other protective devices when handling heated bearings.

NOTE

Do not heat the bearings until ready to install. Heat to a uniform temperature no higher than 250°F (120°C), and slide onto the shaft in one continuous motion to prevent cooling and sticking.

2. Lightly oil both ends of the rotor/shaft assembly (172) and the I.D. and O.D. of the bearings.
3. Press the upper bearing (154) onto the shaft until it seats squarely against the shaft shoulder.
4. Position the bearing bracket cover (60) on the shaft.
5. Install the upper retaining ring (187) and upper washer (187a).
6. Press the lower bearing (153) onto the shaft until it seats flush against the upper washer.

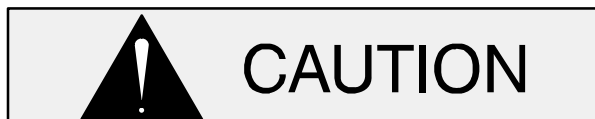
NOTE

After the bearings have cooled, check that they have not shrunk out of position. If the bearings have shifted, use a suitable sleeve and a press to reposition.

7. Install the lower washer (197) and secure the lower retaining ring (188) in the groove in the shaft.
8. Slide the bearing bracket cover (60) down over the lower bearing and secure it with the screws (182b).
9. Lubricate two new O-rings (72 and 72a) and install them in the grooves in the lower bearing bracket.
10. Guide the assembled shaft and bearings through the stator/motor housing until the upper bearing seats squarely in the motor cover and the lower bearing bracket is fully seated in the motor housing (55). Secure the lower bearing bracket to the motor housing with the allen screws (184b).

Upper Seal Installation

All references are to FIGURES E-3 and E-5.



If a new seal is being installed, do not un-

wrap it until ready to install; seal components **must** be kept clean. Handle seal parts with extreme caution to prevent damage. Use care not to contaminate the precision-finished faces; even fingerprints on the faces can shorten seal life.

NOTE

Use hand pressure only to install seal components. A push tube cut from plastic pipe approximately the same O.D. as the stationary seat is a useful aid when installing these components. It is recommended that the pump be inverted during seal assembly.

1. Inspect the end of the shaft for scoring or keyway damage. Remove nicks and burrs with a fine file or emery cloth and restore original contours. Clean the shaft of all grit and filings.
2. Lubricate the motor shaft and the seal cavity of the lower bearing bracket.
3. Unwrap the seal components. Check that the seal faces are clean and undamaged. If necessary to clean, use a clean tissue and wipe in a concentric pattern.
4. Lightly oil the seal stationary seat O-ring. Place a clean tissue over the stationary seat seal face and use thumb pressure to press it into the bearing housing until fully seated.
5. Lightly oil both seal faces. Slide the rotating portion of the seal onto the shaft until the seal faces contact. Replacement seals are provided with a plastic ring to establish the correct spring tension on the seal faces. Insert the edge of the ring between the shoulder on the retainer and shoulder on the back of the rotating element. Use a suitably sized sleeve to push against the retainer until the ring gauge is lightly squeezed, then tighten the retainer drive screws to secure the rotating portion of the seal to the shaft. Remove the ring gauge.

NOTE

See **Seal Testing** before assembling the remaining pump end components.

6. After the pump is fully assembled, lubricate the seal housing as indicated in **LUBRICATION** at the end of this section.

SEAL TESTING

All references are to FIGURE E—4.

The seal assemblies should be tested under pressure and submerged in water before the pump end components are assembled.



Compressed air used in testing **must be dry**. Moist air in the motor housing will cause the moisture switch to trip.

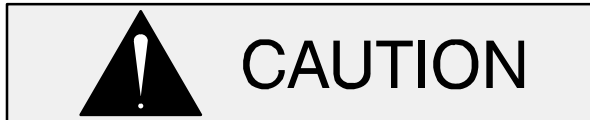
Test 1: Upper Seal Integrity



This test is conducted with the pump under power. Refer to the wiring diagram and observe all precautions outlined in INSTALLATION, Section B when connecting the motor cable to the control box; otherwise, the pump could be damaged, and personnel exposed to injury or death.

1. Remove either of the two drain/fill plugs and O-rings (193 and 194) in the seal housing (58).
2. Thread an air hose adapter into the plug hole; install an air hose.
3. Remove the test plug (25) from the motor housing.
4. Thread an air hose adapter into the plug hole; install an air hose.

5. Connect the motor cable leads to the control box. **Do not** apply power to the motor at this time.
6. Submerge the motor assembly horizontally so that both hose connections are covered.
7. Apply 14–15 psi pressure maximum to the **both** air hoses.



In the following steps **do not apply power for more than 10 seconds**. Otherwise, the unlubricated seal will overheat and may burn.

8. Briefly apply power to the motor and check for air bubbles.
9. If air bubbles appear, shut off power, then apply again. If air bubbles persist, the seal and/or motor cover are leaking.
10. Disassemble the seal housing and lower bearing bracket and find and correct the cause of the leak.
11. Re-run the test after corrective action has been taken.

Test 2: Lower Seal Integrity

1. Install air hoses as in Test 1.
2. Submerge the pump in water and apply 14–15 psi maximum to the **seal housing** air hose. Check for air bubbles.
3. If air bubbles appear, the seal is leaking. Disassemble the seal housing and find and correct the cause of the leak.
4. Re-run the test after corrective action has been taken.
5. After the seals have been tested, remove the air hoses. Install and tighten the test plug (25) in

the motor cover. Reinstall the drain/fill plug and O-ring (193 and 194) in the seal housing.

LUBRICATION

All references are to FIGURE E-3.

The seal assemblies (105 and 105b) are lubricated by a reservoir of oil in the seal housing. No other general lubrication is required.



The screw plug (25) in the **motor housing** is used for testing **only**; **do not** add oil through this plug.

Before installing or removing the drain/fill plugs and O-rings (193 and 194), always clean the area around the plugs to prevent contamination of the oil.

Discard the plug O-rings if the plugs are removed. Lubricate the new O-rings with oil (**not grease**) before installing them.

Draining Oil

1. Lay the pump flat on a work surface with one of the two drain/fill plugs (193) in the seal housing facing up.
2. Slowly open the uppermost plug to release any pressure in the seal housing.
3. Place a clean container under the lower plug, remove the plug, and roll the pump on its side to drain the seal housing.

Condition Of Oil

1. Check the condition of the oil drained from the pump.
2. If the oil is clear, it can be reused.
3. If the oil is milky or contains a small amount of water, it must be changed.

4. If the oil contains a large amount of water, it must be changed and the lower seal assembly must be checked before the pump is put back in operation.

Adding Oil

1. Lay the pump flat on a work surface with one of the two drain/fill plugs facing up.

2. Slowly open the uppermost plug to release any pressure in the seal housing.

3. Remove both fill/drain plugs and, through the top plug hole, add SAE 10W 30 motor oil until it escapes from the lower plug hole.

4. Lubricate and install new plug O-rings and install and tighten the plugs.

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