

Please read and save this Manual along with the Performance, Specifications and Repair Manual. Read this manual and the Performance, Specifications and Repair Manual carefully before attempting to assemble, install, operate or maintain the product described. Observe all safety information to protect yourself and others. The General Safety Instructions are contained in this manual and the Specific Safety Instructions are in the Performance, Specifications and Repair Manual. Failure to comply with the safety instructions included with this product could result in personal injury and/or property damage! Keep all instructions for future reference.

SHURflo Close-Coupled Electric Motor-Driven Pumps

Refer to Performance, Specifications and Repair Manual for product specific information.

Safety Terms and Definitions

Information in this manual must be read and understood. The intent of this information is for SAFETY and for PREVENTATIVE CUSTOMER EQUIPMENT PROBLEMS. The following symbols are used to identify this information:

⚠ DANGER Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

NOTE: Indicates important information which, if not followed, may cause damage to equipment.

Packaging Inspection

When the unit is received, look for any product damage as you unpack the item. Some of the most common shipping issues to look for include: damaged package, loose or missing parts, damaged product or parts. The Repair Manual can be used to identify missing parts, if any, and the name of damaged parts. **If any damage is present or parts are missing, do not attempt to operate pump. Use the Repair Manual to determine that all parts are properly installed. If you are in doubt, do not operate the pump.**

General Safety Information

1. The pump application, limitations, and potential hazards must be known.

⚠ WARNING Pump should only be used with fluids compatible with pump component materials.



Do not use to pump flammable or explosive liquids such as gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres. When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

2. Ensure that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and safety shielding around moving parts.
4. Disconnect power before inspecting or servicing. If the power disconnect is out of sight, lock in the open position and mark or tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pump and line pressure within the system before servicing any component.
6. Drain liquids from the system before inspecting or servicing. If liquids are hazardous, handle environmentally and safely.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Make certain that all connections are secure. Check piping and hoses for weak or worn condition before each use.
9. Inspect pump and system components periodically. Perform

routine maintenance as required (See Maintenance section).

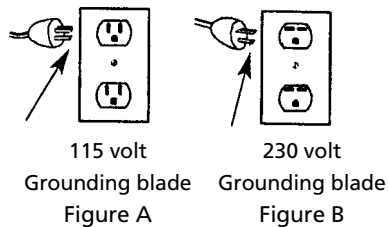
10. For pumps whose discharge line can be shut off or obstructed, provide a means of pressure relief.
11. **Personal Safety:**
 - a. Wear a face shield and proper apparel when pumping hazardous chemicals.
 - b. Wear safety glasses at all times when working on pumps.
 - c. Keep visitors at a safe distance from the work area.
 - d. Keep work area clean, uncluttered, and properly lighted; replace all unused tools and equipment.
 - e. Make the workshop childproof – with locks, master switches, and by removing starter keys.
12. The motor is designed to be used in a clean, dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. This unit is not weatherproof nor is it able to be submersed in water.
13. Follow all electrical and safety codes when wiring an electrically-driven pump, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

⚠ WARNING Risk of electric shock!

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General Safety Information (Continued)

14. **SINGLE-PHASE MOTORS:** ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN and installed in accordance with the National Electric Code, local codes and ordinances. These units can be wired for either portability, with flexible 3-wire cord, or permanent installation using a supply with a ground. To reduce the risk of electric shock, the motor must be securely and adequately grounded! This can be accomplished by either (A) Inserting plug (portable) directly into a properly installed and grounded 3-prong grounding-type receptacle (as shown in Figure A for 115 volt, or Figure B for 230 volt); or



(B) Other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.

To ensure a proper ground, the grounding means must be tested by a qualified electrician.

- 15. All wiring should be performed by a qualified electrician.
- 16. Use only 3-wire extension cords that have 3-prong grounding-type plugs and 3-pole receptacles that accept the equipment plug.
- 17. Use wire of adequate size to minimize voltage drop at the motor.
- 18. Protect electrical cord from sharp objects, hot surfaces, oil, and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.

- 19. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
- 20. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.
- 21. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.

⚠ WARNING All single-phase pump motors are equipped with a thermal protector that when reset will restart the motor which can be unexpected (resets can be automatic or manual). Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage, inadequate wiring, incorrect motor connections, high viscosity or a defective motor or pump.

22. **THREE-PHASE MOTORS:** ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN. These units are for permanent installation using a power supply with a ground. To reduce the risk of electric shock, electric motor must be adequately grounded to a metal raceway system, or by using a separate grounding wire connected to bare metal on the motor frame, or to the grounding screw located inside motor terminal box, or by other suitable means. Refer to the most recent National Electrical Code (NEC) Article 250 (Grounding) for additional information.

On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance. Only use three-phase frequency control drives with the drive manufacturer's recommendations for speed and horsepower.

⚠ WARNING Risk of electric shock! Never connect the green (or green and yellow) wire to a live terminal! Clockwise rotation when facing pump inlet will destroy the motor. Incorrect wiring is not covered under the Limited Warranty.

⚠ WARNING Do not handle a pump or pump motor with wet hands, when standing on a wet or damp surface or in water.



Installation

⚠ WARNING Failure to follow any warning can result in personal injury and/or property damage. The pumps should not be used in flammable or explosive atmospheres. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids. For installations where property damage might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) should be used.

LOCATION

- **Totally-Enclosed Motor**
 - A. Harsher environments where damp and dirty conditions may exist.
 - B. Totally enclosed motors are not waterproof.
 - C. Totally enclosed motors must be located where there is adequate ventilation and the air temperature does not exceed the recommendations of the motor manufacturer.
- **Open Drip-proof Motor**
 - A. Clean dry locations with access to an adequate supply of cooling air.

NOTE: The following applies to both Motor Types:

- A. Temperature around the motor should not exceed 104°F (40°C). Minimum temperature is -20°F (29°C).
- B. If the motor nameplate indicates "Air-Over, Cont. A.O.," etc., the motor must be mounted in the air stream of an air-moving device.

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- Use only UL-listed Hazardous Location motors for service in Hazardous Locations as defined in Article 500 of the NEC.

Installation

1. The pump should be located as close to the fluid source as possible, thus making the inlet line direct and short.

CAUTION Place the unit where the motor and electrical components are protected from weather and extremes of heat, cold and humidity.

2. Connect piping inlet line to inlet and piping discharge line to discharge outlet. Inlet piping layout should avoid looped sections that create air entrapment. All fittings must be airtight.

IMPORTANT: Reinforced fabric or plastic-type hose should be of a reinforced type so as not to collapse when used for inlet piping. The inlet piping should be one size larger than the discharge piping.

3. Mount the piping independently of the pump to avoid universal or excessive stresses on the pump casing, which would cause impeller misalignment and possible pump failure.
4. Union and a gate valve (not furnished) should be installed on the discharge side of the pump for service convenience.

CAUTION Do not use a restricting or globe type of valve at the discharge. Globe valves seriously restrict the capacity of the pump; however, restricting the discharge of a centrifugal pump will not overload the drive motor.

5. **SELF-PRIMING PUMPS:** To assure quick priming, it is recommended that a foot valve be used on the inlet line and that a suitable inlet

strainer be attached to the inlet line so that large pieces of foreign material are not drawn into the pump.

6. **WIRING:** Make sure the connections are correct for the voltage being supplied to the motor. For proper electrical connections, refer to the diagram located on the nameplate or inside the terminal of the motor. Connections should be made with flexible conduit to minimize vibration transmission. Whenever possible, the pump should be powered from a separate branch circuit of adequate capacity to keep voltage drop to a minimum during starting and running. For longer runs, increase wire size in accordance with standard electrical practice. Check motor wiring to verify which voltage the motor is currently wired for.

Select the voltage and hertz to be used, either:

- a. Single phase - 115V or 230V
- b. Three phase - 230V or 460V
- c. Some motors can run at both 50 or 60Hz, others are 60Hz only (check motor nameplate).

If the wiring must be changed to conform to a specific voltage requirement, then the motor should be wired according to recommendations of wiring diagrams located on motor nameplate or wiring compartment cover. Make sure unit is properly grounded. A motor to be used with single-phase power cannot be used with three-phase power and vice versa. If unsure about the above information or the wiring diagrams, consult an electrician familiar with motor wiring.

WARNING Failure to follow the above warning can result in property damage and/or personal injury. Always wire the motor with a three-wire system, ensuring that a ground wire runs to a good electrical ground such as a grounded water system or conduit. A wrong connection can burn out the pump motor, cause an electrical short, or produce an electrical shock. Connections should be made with flexible conduit to minimize vibration transmission. Also, ensure that a good electrical ground is provided at the supply end of the line.

7. Do not operate pump dry. Mechanical seal damage will result.
8. Install any auxiliary components (e.g., pressure switch).

Operation

NON-PRIMING PUMPS

1. The inlet piping and casing must be filled with fluid before the unit can begin pumping. In order to completely fill casing with fluid, entrapped air in casing must be vented. This is accomplished by momentarily loosening or removing the top drain plug located on the casing.

CAUTION Do not run pump dry as permanent damage to the mechanical seal will result.

2. Start the unit.

IMPORTANT: Proper Rotation - Power supply should be applied momentarily to the pump at first and the direction of rotation checked. When viewing the front of the pump, the motor shaft (impeller) should be rotating counterclockwise. If it is not, disconnect power and re-check wiring to motor. (See Installation section.)

To change rotation on three-phase models, interchange any two incoming line (power) leads. For other models, consult driver information that came with the driver.

NOTE: Never shut off discharge or restrict suction flow while the pump is operating.

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Operation (Continued)

⚠ CAUTION *The proper impeller (motor) rotation is CCW facing the front of the pump. Wrong rotation will give low performance, low head, and could damage unit and/or injure personnel.*

3. On initial start-up (after 15 minutes running time), check power consumption to be sure motor is not overloaded.
4. If motor is overloaded, install a valve on discharge to increase back pressure. Close the valve until pump motor is below full nameplate, or within Service Factor (SF) amps.

SELF-PRIMING PUMPS

Prime the pump before initial start-up. This is mandatory. Prime the pump by filling the casing with liquid through the top fill plug, the discharge port, or by installing a pipe tee at the discharge of the pump. (When installing a tee, use the horizontal leg of the tee as the pump discharge and place a pipe plug in the vertical leg. This procedure will help facilitate priming later.)

NOTE: It may take up to 5 minutes for a **SELF-PRIMING** pump to prime if long horizontal/vertical lines are used. If pump has not picked up prime in 2 minutes, re-prime piping and casing after letting unit cool down for 5 minutes. Re-check all suction connections making sure pipe compound has sealed all connections. Initial priming may take 2 to 3 tries to prime successfully.

Maintenance

⚠ WARNING *Make certain that the unit is disconnected from the power source before attempting to service or remove any components!*

NOTE: If unit is not going to be used for any prolonged length of time, always flush pump thoroughly after use to prevent crystallization and/or damage to seal and pump.

ROUTINE

1. Clean the suction line strainer at regular intervals.
2. Properly selected and installed electric motors are capable of operating for years with minimal maintenance. Periodically clean dirt accumulations from open-type motors, especially in and around vent openings, preferably by vacuuming (avoids imbedding dirt in windings).
3. Pump should be drained when subjected to freezing temperatures. A drain plug is provided on the pump casing.
4. Pump should be checked daily, weekly, monthly, etc. for proper operation. If anything has changed since unit was new, unit should be removed and repaired or replaced. Only qualified electricians or service personnel should attempt to repair this unit. Improper repair and/or assembly can cause an electrical shock hazard.
5. Periodically check to see if electrical connections are tight.

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Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Motor will not start or run	<ol style="list-style-type: none"> 1. Improperly wired 2. Blown fuse or open circuit breaker 3. Loose or broken wiring 4. Stone or foreign object lodged in impeller 5. Motor shorted out 6. Thermal overload has opened circuit 7. Voltage too low at motor terminals due to line drop 	<ol style="list-style-type: none"> 1. Check wiring diagram on motor 2. Replace fuse or close circuit breaker after reason for overload has been determined and corrected 3. Tighten connections, replace broken wiring 4. Disassemble pump and remove foreign object 5. Replace 6. Allow the unit to cool. Restart after reason for overload has been determined 7. Consult local power company Increase wire size. Check for poor connections
Motor runs slowly; motor will not get up to speed	<ol style="list-style-type: none"> 1. Motor wired improperly 2. Capacitor burned out (single-phase units only) 3. Voltage too low at motor terminals 	<ol style="list-style-type: none"> 1. Check and recheck wiring diagram on motor as noted per wiring diagram Make internal wiring changes in wiring compartment 2. Replace capacitor 3. Increase wire size. Check for poor connections. Check for voltage unbalance (3-phase)
Motor overheats while running under load	<ol style="list-style-type: none"> 1. Dirt blocking ventilation openings 2. Unbalanced supply voltage 3. Faulty connection 4. High or low voltage 5. High viscosity 6. High flow 7. High specific gravity 	<ol style="list-style-type: none"> 1. Clean motor 2. Check for faulty connections Voltage on all three lines should be balanced within 1%. Excessive single phase loads 3. Clean, tighten, or replace 4. Check voltage at motor, should not be more than 10% above or below rated 5. Check horsepower adder for viscosity, correct if necessary 6. High flow conditions at low heads may require additional horsepower 7. Specific gravity — HP is proportionate to specific gravity. Increase motor size.
Pump will not prime	<ol style="list-style-type: none"> 1. No priming water in casing 2. Mechanical seal is leaking 3. Leak in suction line 4. Discharge line is closed and priming 5. Suction line (or valve) is closed 6. Pipe union was used on suction side instead of discharge 7. Pump is worn 	<ol style="list-style-type: none"> 1. Fill pump casing 2. Replace (See Maintenance) 3. Use thread sealant on piping, tighten, repair or replace 4. Open 5. Open 6. Remove union from suction side Replace with single section of pipe 7. Replace worn parts

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Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Little or no discharge	1. Casing not filled with water	1. Fill pump casing with liquid
	2. Total head too high	2. Shorten suction lift and/or discharge head
	3. Suction head too high	3. Lower suction head, install foot valve and prime
	4. Impeller plugged	4. Disassemble pump and clean impeller
	5. Rotation incorrect	5. Correct (See wiring diagram on motor)
	6. Hole or air leak in suction line	6. Repair or replace suction line
	7. Foot valve was too small	7. Match foot valve to piping or install one size larger foot valve
	8. Impeller damaged	8. Replace
	9. Foot valve or suction line not submerged deep enough in water	9. Submerge lower in water
	10. Suction piping too small	10. Increase to pump inlet size on pump
	11. Discharge piping too small	11. Match to discharge outlet size on pump
	12. Motor wired incorrectly	12. Check wiring diagram
	13. Casing gasket leaking	13. Replace
	14. Suction or discharge line valve closed	14. Open
	15. Single-phase, new installation	15. Check voltage of incoming power supply
	16. Mechanical seal is leaking	16. Replace (See Maintenance)
Loss of suction	1. Air leak in suction line	1. Use thread sealant on piping, tighten, repair or replace
	2. Suction lift too tight	2. Lower suction lift, install foot valve and prime
	3. Clogged foot valve or strainer	3. Clean
Pump vibrates and/or makes excessive noise	1. Mounting plate or foundation not rigid enough	1. Reinforce
	2. Foreign material in pump	2. Disassemble pump and clean
	3. Impeller damaged	3. Replace
	4. Worn motor bearings	4. Replace
	5. Suction lift too high	5. Decrease suction lift
	6. Cavitation present	6. Check suction line for proper size and be sure valve is open. Remove excessive loops in suction line

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Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump leaks at shaft	<ol style="list-style-type: none"> 1. Damaged or worn mechanical seal 2. Corrosion due to character of liquid pump 3. Abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them 4. Liquid not compatible with seal 5. Temperature too high 	<ol style="list-style-type: none"> 1. Replace (See Maintenance) 2. Discontinue pumping liquid and consult factory 3. Pump not designed for abrasives. Discontinue use 4. Consult factory. Operational seal may be available 5. Lower liquid temperature below temperature rating of pump, See Specifications.
Pinholes in the casting, liquid drips around seal area	<ol style="list-style-type: none"> 1. Cavitation caused by insufficient inlet pressure or suction head (NPSH) 	<ol style="list-style-type: none"> 1. Increase inlet pressure by adding a higher level of fluid to source, increasing inlet pressure, or remove piping restrictions (valves, loops, etc.) in suction line
Motor starts but pump doesn't rotate or partially rotates	<ol style="list-style-type: none"> 1. Impeller not properly mounted on shaft 2. Bearing seized 3. Foreign object jammed in impeller 	<ol style="list-style-type: none"> 1. Remount impeller 2. Replace motor 3. Remove foreign object
Pump runs but poor performance	<ol style="list-style-type: none"> 1. Check pump rotation to see if it is CCW as viewed from motor face. On three-phase motors, rotation must be checked prior to running pump under load. <p>⚠ WARNING <i>Failure to check rotation before pump is run can result in severe damage to the pump and motor unit.</i></p>	<ol style="list-style-type: none"> 1. On three-phase motors, switch any two motor wire leads to reverse rotation.

Limited Warranty on SHURflo Centrifugal Pumps

SHURflo warrants to the original purchaser of its products (the "Purchaser") that such products will be free from defects in material and workmanship under normal use for the period of one (1) year, and accessories will be free from defects in material and workmanship under normal use for the period of ninety (90) days.

"Normal use" does not include use in excess of recommended maximum speeds, pressures, vacuums and temperatures, or use requiring handling of fluids not compatible with component materials. This warranty does not cover freight damage, freezing damage, normal wear and tear, or damage caused by misapplication, fault, negligence, alterations, or repair that affects the performance or reliability of the product.

THIS WARRANTY IS EXCLUSIVE. SHURflo MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SHURflo's obligation under this warranty is, at SHURflo's option, to either repair or replace the product upon return of the entire product to the SHURflo factory in accordance with the return procedures set forth below. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

IN NO EVENT SHALL SHURflo BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, WHETHER FOR BREACH OF ANY WARRANTY, FOR NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

Only authorized distributors can return products for Warranty. Contact your distributor or visit www.shurfloindustrial.com to find a distributor for product support.

Distributors can obtain an RMA # and contact person's name by contacting SHURflo's customer service at 800-854-3218 (Ext. 6788 or Ext. 6651).

Return Procedures for Distributors

All pumps or products must be flushed of any chemical (ref. OSHA Section 0910.1200 (d)(e)(f)(g)(h) and hazardous chemicals must be labeled before being shipped* to SHURflo for service or warranty consideration. SHURflo reserves the right to request a Material Safety Data sheet from the Purchaser for any pump or product SHURflo deems necessary. SHURflo reserves the right to "disposition as scrap" pumps or products returned which contain unknown substances, or to charge for any and all costs incurred for chemical testing and proper disposal of components containing unknown substances. SHURflo requests this in order to protect the environment and personnel from the hazards of handling unknown substances.

Be prepared to give SHURflo full details of the problem, including the following information:

1. Model number, purchase date and from whom you purchased your pump.
2. A brief description of the pump problem, including the following:
 - Liquid pumped. State the pH and any non-soluble materials, and give the generic or trade name.
 - Temperature of the liquid and ambient environment.
 - Suction lift or vacuum (measured at the pump).
 - Discharge pressure.
 - Size, type, and mesh of the suction strainer.
 - Drive type (gas engine/electric motor; direct/belt drive; tractor PTO) and rpm of pump.
 - Viscosity (of oil, or other than water weight liquid).
 - Elevation from the pump to the discharge point.
 - Size and material of suction and discharge line.

SHURflo may request additional information, and may require a sketch to illustrate the problem. Distributors should contact the factory to receive a return material authorization before sending the product. All pumps returned for warranty work should be sent shipping charges prepaid to:

[RMA# and Contact Person]
SHURflo
375 Fifth Avenue NW
New Brighton, Minnesota 55112

*Carriers, including U.S.P.S., airlines, UPS, ground freight, etc., require specific identification of any hazardous materials being shipped. Failure to do so may result in a substantial fine and/or prison term. Check with your shipping company for specific instructions.

