

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 Electric Motor-Driven Positive Displacement Pumps

Refer to the specific model Repair Manual for details on performance, specifications, dimensions and parts.

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 the 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.

⚠ DANGER 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 that require discharge line shut off or may be obstructed, a pressure relief valve is required.
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

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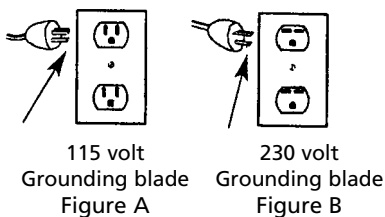
General Safety Information (Continued)

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!*

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 too high a pressure, too high of viscosity, too high of specific gravity, excessively high or low voltage, inadequate wiring, incorrect motor connections, too small a motor (sized incorrectly, not enough HP), 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! 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.*



SHURflo Electric Motor-Driven Positive Displacement Pumps

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.
- **Totally-Enclosed and Open Drip-Proof Motors**
 - 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.
 - Use only UL-listed Hazardous Location motors for service in Hazardous Locations as defined in Article 500 of the NEC.
 - Single and three-phase motors may be reversible and may be wired with a three-way switch for those cases that the pump may need to be run in either direction for pumps that are reversible. If

the pump is equipped with a pressure relief valve, it will not function in reverse.

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. For higher viscosity fluids, the inlet piping should be one size larger than the discharge piping except in situations where the pump is reversible.

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 can seriously restrict the discharge of a pump which can result in excessive discharge pressure and motor overload.*

- 5a. Gear pumps are inherently self-priming. To ensure that the pump primes quickly and performs without cavitation, the pump should be located as close to the source of fluid as possible using the same size pipe as the inlet port or, for viscous fluids, one pipe size larger. Pipe elbows, bends and long runs should be avoided. 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.

The maximum permissible speed for gear pumps is 1725 RPM. Higher speeds can result in cavitation, noisy operation and premature failure of the pump. A typical gear pump installation is shown in Figure 1. Drive options and accessories are shown in Figure 2 and 3. A foot valve is used to maintain fluid in the suction pipe thus providing quick delivery of fluid (reduces or eliminates priming time). A line strainer is added in the suction line to prevent foreign objects from entering and damaging the internals of the gear pump. A vacuum switch can also be added to shut the unit down when prime is lost. The pump is driven by a direct (long-coupled) drive electric motor using a coupling. A pressure gauge is on the discharge side of the pump. An external pressure relief valve is used to protect the pump against overpressure when the discharge line becomes blocked or restricted. In this case, the relief valve is ported back to the tank which allows extended use of the relief. Most gear pumps come with a built-in pressure relief valve on the cover plate. Standard from the factory, they are ported for internal relief. This can provide for short intervals of relief (30 seconds or less) to allow for such pressure overloads as may occur during the sequencing of valves, minor water hammer, etc. Internal relief is not intended for extended relief operation. Some series of gear pumps are capable of being ported either internally (standard) or externally. Check instructions. Note that although gear pumps are reversible,

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Installation (Continued)

the pressure relief valve operates in one direction only. The pressure relief valve on the cover of the pump should be located on the discharge side of the pump in most cases (check the specific operating instructions for the model selected).

CAUTION *Caution: When running a gear pump with a built-in pressure relief valve in reverse, the relief valve remains closed and does not provide protection. Also note that some gear pumps have limited pressure ratings when run in reverse.*

- b. Flexible impeller pumps may be run at speeds up to 3600 RPM. Many of the install guidelines for gear pumps also apply to flexible impeller pumps. Refer to Installation 5A. For flexible impeller pumps, a vacuum switch is recommended to prevent failure of the unit when loss of prime occurs. This will turn the pump off preventing dry run of the pump.

NOTE: The dry run of flexible impellers for more than fifteen seconds can result in the degradation of the impeller and premature failure. A pressure relief valve is recommended for a flexible impeller pump when the discharge is blocked for more than thirty seconds.

- c. Roller pumps should have a pressure relief valve installed if overpressure conditions are expected. Do not dry run a roller pump. Many of the install guidelines for gear pumps, apply to roller pumps. Refer to 5A.
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).

When selecting a pump motor combination for 50 Hz application, the flow is proportional to speed and the 50 Hz flow is reduced by about 17%.

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.

The following types of motors are used to drive standard positive displacement pumps:

- Carbonator motors—These are small (1/3 and 1/2 HP) motors with a slotted shaft and small pilot for attaching a “carbonator” pump with a “V”-clamp. They are open drip-proof motors. This particular mounting is compact and provides an economical package for low flow applications.
- 48 frame motors—These motors are of 1/3 and 1/2 HP and are used on

the plate-mounted gear pumps and for base-mounted, long-coupled and pulley applications.

- 56, 56C, 143/145, 143/145TC, 182/184 and 182/184TC electric motors — These motors are used for many positive displacement pumps. Pump and motor combinations are provided with motors equipped with thermal-overload protection (manual or automatic) for single-phase models and no overload protection for three-phase models. For three-phase models, proper protection must be provided by the user at the electrical box with breakers, etc. Note that most motors are reversible. Check wiring diagram for single-phase motors. For three-phase motors, switch any two leads to reverse rotation of motor. For reference, the motor faces for the above frame sizes are:

Standard NEMA-C Faced Close-Coupled Motor Dimensions

Motor	Shaft Dia.	Pilot Dia.	Bolt Circle Dia.	Bolt Tap	Shaft Key
56C	5/8"	4 1/2"	5 29/32"	3/8"	3/16"
143/145TC	7/8"	4 1/2"	5 29/32"	3/8"	3/16"
182/184TC	1 1/8"	8 1/2"	7 1/4"	1/2"	1/4"

- Standard frame motors in pulley drive applications (non-C faced).

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).

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Operation

⚠ CAUTION *Do not run pump dry as permanent damage to seals, bearings, shafts and other components will quickly occur.*

NON-PRIMING PUMPS

1. The suction 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.
2. Start the unit.

IMPORTANT: Proper Rotation - Power supply should be applied momentarily to the pump at first and the direction of rotation checked.

Positive displacement pumps are usually horizontally ported. That is the flow of the inlet port is in line with the flow from the discharge port. Many pumps are reversible, but the direction of rotation determines the direction of flow. When viewing the pump end of a close-coupled pump/motor combination, the flow is from right to left for counter-clockwise rotation (in most situations). It is opposite for reverse rotation. Flexible impeller pumps flow is from right to left for clockwise rotation as viewed from the pump end of the pump motor combination (in most situations).

Pump heads may be rotated on motor faces in ninety-degree increments. In the vertical position (suction port on the bottom), the pump becomes self draining and eliminates the need for a pipe elbow. When handling high viscosity fluids, the suction port should be facing up and the pump directly under the source. This will reduce the possibility of cavitation.

To change rotation on three-phase models, interchange any two incoming

line (power) leads. A switch may also be installed to allow the reversing of the unit. 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.

If the pump system can experience momentary periods of overpressure, a relief valve should be used (standard on some models). The pressure relief valve should be set with the pump in the system. Internal pressure relief valves on some pumps are only good for short periods of time (less than 30 seconds). For situations where partial or full relief is expected to occur for extended periods of time, the pressure relief valve should be externally ported back to tank or well downstream of the suction of the pump. Externally-ported pressure relief valves are standard on some models or an optional external pressure relief valve may be used.

3. On initial start-up (after 15 minutes running time), check power consumption to be sure motor is not overloaded.

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. If the pump is to be stored, place a small quantity of light oil or some other storage preservative compatible with your application in the pump and rotate the shaft very slowly to work the oil throughout the seal, gears, rotor or impeller and the body.

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.
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.
6. Carbonator and 48 frame motors will often come with sleeve bearings. Periodically oil the bearings with the motor manufacturer's recommended oil.

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How to Select Rotary Gear Pumps

(NOTE: Can be used as a guide for flexible impeller roller pumps.)

STEP 1

Determine total pump discharge pressure required. Add suction lift (in feet) to the discharge elevation (in feet); divide total by 2.31. To this figure, add the discharge pressure required, in psi. This sum is the total pump pressure needed.

STEP 2

Select pump and motor HP combination that delivers the flow (in GPM) required at, or above, the total pump pressure calculated in step 1.

STEP 3

Consider fluid viscosity. The viscosity/temperature of the liquid pumped will affect the pump speed (RPM). Where the viscosity/temperature SSU (Saybolt Seconds Universal) is greater than 500 SSU:

A) Pump speed (RPM) must be reduced to prevent cavitation. Use Table No. 1 as a guide.

B) Suction/discharge lines must be increased by at least 1 (or better 2) pipe size over the size of the pump ports.

C) The motor's horsepower must be increased over the power required to pump water under the same pressure and flow. Use Table No. 2 to find the percentage increase in horsepower required for various pressures and viscosities.

Note: An oil viscosity vs. temperature chart is included for reference (See Figure 4).

STEP 4

Consider the specific gravity of the fluid to be pumped and how it will affect horsepower requirements. If the specific gravity of the fluid is below 1.0 (specific gravity of water), consult the pump's performance table for recommended motor horsepower. If the specific gravity of the fluid is greater than 1.0, multiply the recommended horsepower in the pump's performance table by this figure. The result is the required motor horsepower.

STEP 5

Consider liquid compatibility with pump material. Liquids being pumped must be compatible with pump construction. See individual listings of pumps for specific materials used in the wet-end construction of the pump and refer to appropriate Chemical Compatibility Charts. The number one failure of pumps is misapplications, which includes chemical compatibility. The lack of testing for chemical compatibility is not covered under warranty.

PUMP ACCESSORIES

The line of positive displacement pumps may be used with many accessories to protect, maintain and control speed (flow). These include vacuum switches, strainers, adjustable pressure relief valves, gauges, gear reducers, adjustable frequency drives for electric motors, high viscosity gear kits, pulleys, motor couplers, drive motors, and replacement seals.

Table 1 - Speed vs. Viscosity

Viscosity SSU	Speed (RPM)
50 to 500	1,725
1,200	1,500
2,000	1,300
7,000	1,000
20,000	600
50,000	400
100,000	200

Table 2 - HP vs. Viscosity

Pressure P.S.I.	%INCREASE IN HORSEPOWER						
	Viscosity in SSU						
	30	500	1000	5000	10,000	50,000	100,000
2	–	10	20	40	80	120	150
20	–	12	25	50	90	150	200
40	–	15	30	60	105	180	250
60	–	20	40	80	120	220	300
80	–	25	50	100	160	260	350
100	–	30	60	120	200	300	400

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TYPICAL GEAR PUMP INSTALLATION

(Note: Pump & motor turned vertical for illustration purpose only.)

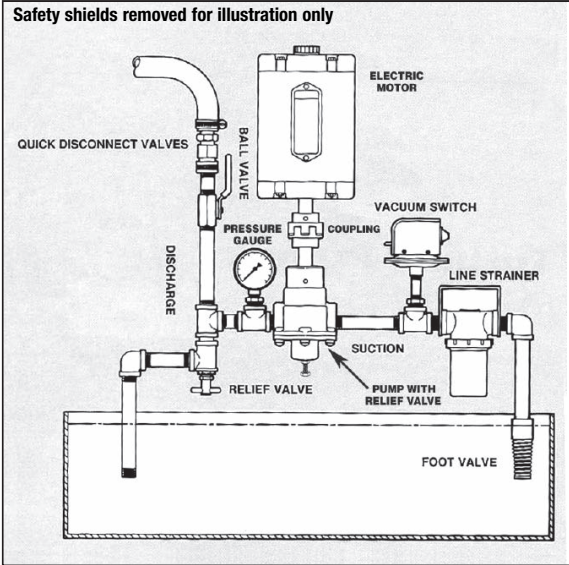


Figure 1

PEDESTAL GEAR PUMP DRIVE OPTIONS

Safety shields removed for illustration only

PEDESTAL GEAR PUMP LONG COUPLED WITH MOTOR

PEDESTAL GEAR PUMP DRIVEN BY PULLEY, BELT AND MOTOR

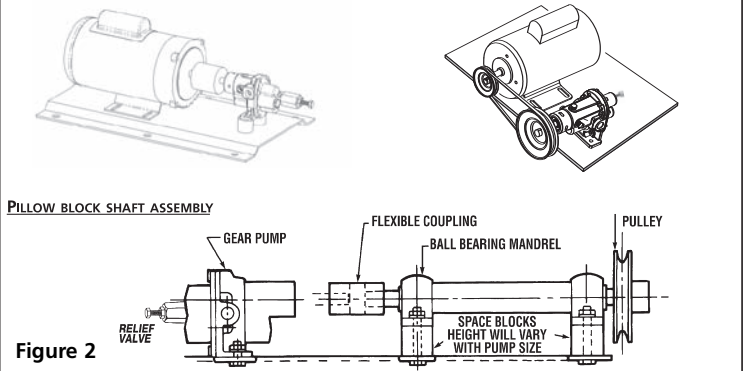


Figure 2

CLOSE-COUPLED GEAR PUMP WITH MOTOR AND RELIEF VALVE

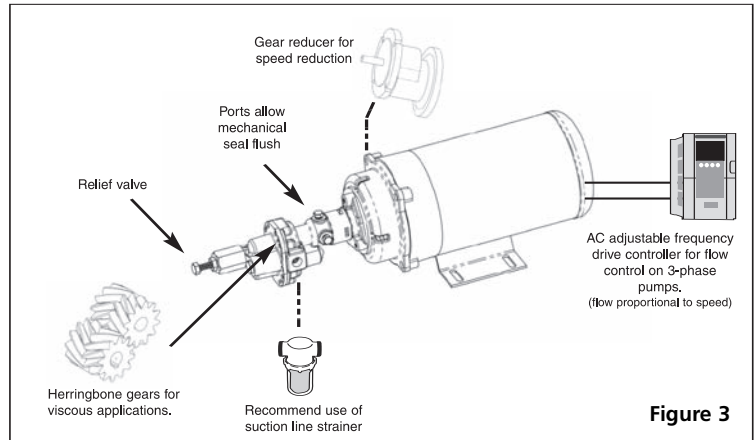
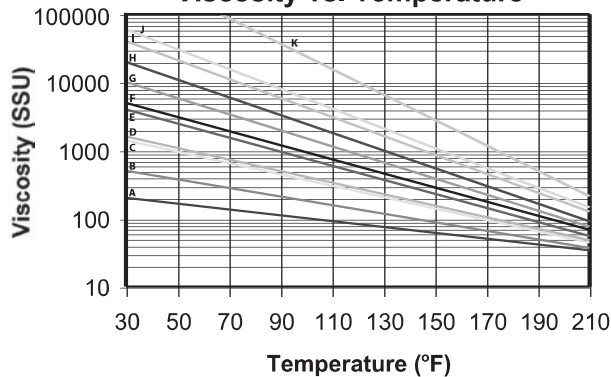


Figure 3

Figure 4

Viscosity vs. Temperature



- A #2 Fuel Oil
- B #4 Fuel Oil
- C Light Hydraulic Oil
- D SAE #10 Oil
- E SAE #20 Oil
- F SAE #30 Oil
- G SAE #40 Oil
- H SAE #50 Oil
- I SAE #60 Oil
- J SAE #70 Oil
- K #6 Fuel Oil

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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 internally 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 on 3-phase motors 3. Faulty connection 4. High or low voltage 5. High viscosity or 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% of each other when under load. 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 and specific gravity; correct if necessary.

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Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Pump will not prime or retain prime	<ol style="list-style-type: none"> 1. Mechanical seal is leaking 2. Leak in suction line 3. Discharge line is closed and priming 4. Suction line (or valve) is closed 5. Pipe union was used on suction side instead of discharge 6. Pump is worn 7. Internal pump components are worn 8. Clogged foot valve, strainer or filter 9. Suction lift too far 	<ol style="list-style-type: none"> 1. Replace (See Maintenance) 2. Use thread sealant on piping, tighten, repair or replace. 3. Open 4. Open 5. Remove union from suction side. Replace with single section of pipe. 6. Replace worn parts 7. Replace 8. Clean or replace 9. Shorten lift and piping; install check or foot valve and prime.
Pump runs but no fluid	<ol style="list-style-type: none"> 1. Pump not primed 2. Faulty suction piping 3. Pump located too far from fluid source 4. Gate valve closed 5. Clogged strainer 6. Fouled foot valve 7. Suction height too great, or long piping 8. Gear, rotor or impeller loose on shaft 	<ol style="list-style-type: none"> 1. Prime, see Installation & Operation 2. Replace 3. Relocate 4. Open 5. Clean or replace 6. Clean or replace 7. Lower the height, shorten suction 8. Replace gear and shaft
Pump starts and stops pumping	<ol style="list-style-type: none"> 1. Fouled internal components 2. Leak in suction line 3. Leak in foot valve 	<ol style="list-style-type: none"> 1. Replace 2. Repair 3. Repair or replace
Pressure is low	<ol style="list-style-type: none"> 1. Incorrect motor size and speed 2. Line restrictions 3. Internal pump components are worn 4. Incorrect nozzle, no nozzle 5. Improperly adjusted pressure relief valve 	<ol style="list-style-type: none"> 1. Replace 2. Clean or replace 3. Replace 4. Resize 5. Adjust to correct relief valve pressure
Flow rate is low	<ol style="list-style-type: none"> 1. Incorrect speed 2. Piping is fouled or damaged 3. Internal pump components are worn 4. Discharge line restricted or undersized 	<ol style="list-style-type: none"> 1. Check drive 2. Clean or replace 3. Replace 4. Flush out piping or replace

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Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Excessive noise while pump in operation	1. Improper installation	1. Place rubber pad under pump base
	2. Worn gears, impeller or rotor	2. Replace
	3. Pump not secured to firm foundation	3. Secure properly
	4. Piping not supported to relieve any strain	4. Make necessary adjustments on pump assembly
	5. Restricted suction line	5. Clean or correct
	6. Excessive length of suction line and/or excessive elbows and bends in suction line will cause restriction and cavitation	6. Reduce pipe length, remove turns and elbows. If elbows are necessary, use large radius elbow. If necessary, relocate pump closer to source.
	7. Pump speed too high for viscosity of fluid being pumped, causing cavitation	7. Slow pump to speed appropriate with viscosity. Use high viscosity gear set.
	8. No discharge pressure	8. Increase discharge pressure
	9. Excessive discharge pressure	9. Decrease discharge pressure
	10. Worn or broken internal components	10. Repair or replace
	11. High viscosity fluid	11. Slow pump speed
	12. High vapor pressure in fluid	12. Lower fluid temperature
	13. Abrasives or particulates in fluid	13. Use strainer on suction
Mechanical seal leaks on new pump and/or mechanical seal runs hot	1. Pump was started without prefilling pump with fluid being pumped	1. Replace seal and prefill seal cavity before new start-up.
	2. Fluid being pumped is too viscous	2. Apply flush system appropriate for problem. Consult manual or mechanical seal specialist.

Limited Warranty on SHURflo Electric Motor-Driven Positive Displacement 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 six (6) months to one (1) year, depending on the product, 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.

