

Please read and save this Repair Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

Electric Motor-Driven Pumps

Refer to Specifications Information and Repair Parts Manual for product specific information

Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

▲ 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 that, if not followed, may cause damage to equipment.

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts. (See pump exploded view and Repair Parts List.) Do not attempt to assemble or operate pump if any parts are missing or damaged. Determine that all parts are properly installed.

General Safety Information

1. Know the pump application, limitations, and potential hazards.

▲ CAUTION Pump should only be used with liquids compatible with pump component materials.

▲ Do not use to pump flammable or explosive fluids 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. Make certain that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing. If the power disconnect is out of sight, lock in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pressure within the system before servicing any component.
6. Drain liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use. Make certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (See Maintenance section).

10. Provide a means of pressure relief for pumps whose discharge line can be shut off or obstructed.

11. Personal Safety:

- a. Wear safety glasses at all times when working with pumps.
 - b. Wear a face shield and proper apparel when pumping hazardous chemicals.
 - c. Keep work area clean, uncluttered, and properly lighted; replace all unused tools and equipment.
 - d. Keep visitors at a safe distance from the work area.
 - e. Make workshop childproof - with padlocks, master switches, and by removing starter keys.
12. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. 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 weatherproof nor is it able to be submersed in water.
13. When wiring an electrically driven pump, follow all electrical and safety codes, 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!

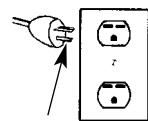
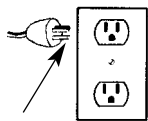
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General Safety Information (Continued)

14. **THREE-PHASE MOTORS:** 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. **ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN.**

▲ WARNING *Risk of electric shock! Never connect the green (or green and yellow) wire to a live terminal!*

15. **SINGLE PHASE MOTORS:** 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 1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding type receptacle (as shown in Figure A for 110-120 volt, or Figure B for 220-240 volt); 2) permanently wiring the unit with a grounded, metal raceway system; 3) Using a separate ground wire connected to the bare metal of the motor frame; 4) Other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.



Grounding blade Figure A Grounding blade Figure B

Figure 1 - Grounding Methods

Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle installed in accordance with the National Electrical Code, local codes and ordinances. To ensure a proper ground, the grounding means must be tested 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. All wiring should be performed by a qualified electrician.
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. Use wire of adequate size to minimize voltage drop at the motor.
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.
22. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

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



▲ WARNING *All single phase pump motors are equipped with an automatic resetting thermal protector and may restart unexpectedly. 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, or a defective motor or pump.

Installation

▲ WARNING *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.

Failure to follow any warning can result in personal injury and/or property damage.

1. Locate pump as close to the fluid source as possible, thus making the suction line short and direct as possible.

▲ CAUTION *The unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.*

2. Attach piping suction line to suction inlet and piping discharge line to discharge outlet. Avoid using looped section of pipe or fittings which might permit air to insure airtight pipe connections.

IMPORTANT: If plastic or fabric hose is used for the suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be one size larger than the discharge piping.

3. Support 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.

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Installation (Continued)

4. Install both a union and a gate valve (not furnished) on the discharge side of the pump for service convenience.

▲ CAUTION *Do not use a globe or other restricting 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:** It is recommended that a foot-valve be used on the suction line to assure quick priming and that a suitable suction strainer be attached to the suction line so that large pieces of foreign material are not drawn into the pump.

6. **WIRING:** For proper electrical connections, refer to the diagram located on the nameplate or inside the terminal of the motor. Make sure the connections are correct for the voltage being supplied to 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 the Wire Selection Guide.

Select the voltage to be used, either

- a. Single phase - 115V or 230V
- b. Three-phase - 230V or 460V

Check motor wiring to verify which voltage the motor is currently wired for. 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 *A wrong connection can burn out the pump motor, cause an electrical short, or produce an electrical shock. 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. Also, ensure that a good electrical ground is provided at the supply end of the line. Connections should be made with flexible conduit to minimize vibration transmission.*

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

Operation

SELF-PRIMING PUMPS

It is necessary to prime the pump before initial start up. 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.)

NON-PRIMING PUMPS

1. The casing and suction piping must be filled with liquid before the unit can begin pumping. In order to completely fill casing with liquid, 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. Activate 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. Other models, consult driver information that came with driver.

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

▲ 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.

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Maintenance

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

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

ROUTINE

1. Pump should be drained when subjected to freezing temperatures.
2. Clean the suction line strainer at regular intervals.
3. 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).
4. Periodically check to see if electrical connections are tight.
5. 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.

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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 	<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 unit to cool. Restart after reason for overload has been determined
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) 	<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
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 air has nowhere to go 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
Little or no discharge	<ol style="list-style-type: none"> 1. Casing not filled with water 2. Total head too high 3. Suction head too high 4. Impeller plugged 5. Rotation incorrect 6. Hole or air leak in suction line 7. Foot valve was too small 8. Impeller damaged 9. Foot valve or suction line not submerged deep enough in water 10. Suction piping too small 	<ol style="list-style-type: none"> 1. Fill pump casing with liquid 2. Shorten suction lift and/or discharge head 3. Lower suction head, install foot valve and prime 4. Disassemble pump and clean impeller 5. Correct (See wiring diagram on motor) 6. Repair or replace suction line 7. Match foot valve to piping or install one size larger foot valve 8. Replace 9. Submerge lower in water 10. Increase to pump inlet size or one size larger

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Troubleshooting Chart (Continued)

Symptom	Possible Cause(s)	Corrective Action
Little or no discharge (continued)	<ol style="list-style-type: none"> 11. Discharge piping too small 12. Motor wired incorrectly 13. Casing gasket leaking 14. Suction or discharge line valve closed 15. Single-phase, new installation. Motor wired for 230V, etc. but supply is 115V, etc. 16. Mechanical seal is leaking 	<ol style="list-style-type: none"> 11. Match to discharge outlet size on pump 12. Check wiring diagram 13. Replace 14. Open 15. Check voltage of incoming power supply. Rewire as necessary 16. Replace (See Maintenance)
Loss of suction	<ol style="list-style-type: none"> 1. Air leak in suction line 2. Suction lift too high 3. Clogged foot valve or strainer 	<ol style="list-style-type: none"> 1. Use thread sealant on piping, tighten, repair or replace 2. Lower suction lift, install foot valve and prime 3. Clean
Pump vibrates and/or makes excessive noise	<ol style="list-style-type: none"> 1. Mounting plate or foundation not rigid enough 2. Foreign material in pump 3. Impeller damaged 4. Worn motor bearings 5. Suction lift too high 6. Cavitation present 	<ol style="list-style-type: none"> 1. Reinforce 2. Disassemble pump and clean 3. Replace 4. Replace 5. Decrease suction lift 6. Check suction line for proper size and be sure valve is open. Remove excessive loops in suction line
Pump leaks at shaft	<ol style="list-style-type: none"> 1. Damaged or worn mechanical seal 2. Corrosion due to character of liquid pumped 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	Cavitation caused by insufficient inlet pressure or suction head (NPSH)	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

