



# SERIES 'ECI' & 'ESS' METAL VERTICAL PUMPS

Refer to Bulletin P-307 and Parts List P-2230 for Series 'ESS' and P-2235 for 'ECI'.

## **SAFETY PRECAUTIONS BEFORE STARTING**

1. Read operating instructions and instructions supplied with chemicals to be used.
2. **Refer to a chemical resistance data chart for compatibility of materials in pump with solution to be used.**
3. Note temperature and pressure limitations.
4. **Personnel operating pump should always wear suitable protective clothing: face mask or goggles, apron and gloves.**
5. All piping must be supported and aligned independently.
6. Always close valves slowly to avoid hydraulic shock.
7. Ensure that all fittings and connections are properly tightened.
8. **Ground motor before connecting to electrical power supply. Failure to ground motor can cause severe or fatal electrical shock hazard. Do not ground to gas supply line.**

## **BEFORE CHANGING APPLICATION OR PERFORMING MAINTENANCE**

1. **Wear protective clothing as described in Item 4 above.**
2. Flush pump thoroughly with a neutralizing solution to prevent possible harm to personnel.
3. Shut off power to motor at disconnect switch.

## **IMPORTANT**

1. Pump is constructed of stainless steel. Refer to a chemical resistance chart to confirm compatibility before start-up.
2. Record all model and serial numbers for future reference. Always specify model number and serial number when ordering parts.
3. Pump flow curves are based upon pumping water. Increased motor horsepower may be necessary for pumping other liquids or reduced motor horsepower may be permissible when pumping at higher discharge head/low flow rates. Refer to pump curve on bulletin.
4. Impellers are designed to offer maximum pump output and the motors are sized for non-overloading at maximum flow conditions. Impellers may be trimmed to reduce flow and discharge head, if desired. See Parts List P-2230 for series 'ESS' and parts List P-2235 for series 'ECI' impellers of various diameters.
5. Vertical discharge piping from the pump should be supported so that the pump does not take the forces generated by the weight of the pipe and the liquid being pumped.

6. If position of discharge is not suitable, it can be rotated. See Pump Service section.
7. The suction line or suction extension should be equal to or one size larger than the suction entrance. Elbows or valves should be located a minimum distance from the pump entrance equal to 5 times the pipe diameter.

## **PRE START-UP**

1. These pumps require no special care in mounting, although it is suggested that they be firmly bolted to a level surface. Adequate air movement over motor will help prevent overloads.
2. Connect electrical supply to the motor starter. Match voltage to nameplate voltage on motor. Incorrect voltage can cause fire or seriously damage motor, voiding warranty. If starter is furnished, verify that the starter is wired for the correct operating voltage and with the correct overload heaters. It is recommended that a motor starter be installed for overload protection if one was not provided with the pump assembly.
3. Pump rotation is counterclockwise when looking at the pump suction, or clockwise when looking down on the motor fan. (Check rotation arrow.) For 3-phase motors, it is necessary to verify correct direction of rotation by momentarily "jogging" the motor. An instantaneous "ON-OFF" of the starter is ample to check rotation. To change direction of rotation, interchange any two of lines L<sub>1</sub>, L<sub>2</sub>, or L<sub>3</sub>.

**WARNING: Incorrect rotation will cause pump damage, reduced performance or failure, voiding warranty.**

4. All units are factory tested to confirm that the pump and motor functioned properly at time of shipment.
5. Suction casing must be flooded to the level indicated on Bulletin P-307 prior to starting.
6. Check correct operation of level control. Make necessary adjustments for establishing high level and low level.

## **OPERATION**

**Priming.** All centrifugal pumps must be filled with liquid prior to start up. For the 'ESS' and 'ECI' series pumps illustrated in this guide, completely fill the volute and suction lines prior to operation. It is suggested that during initial start up the discharge valve be closed and then opened as the motor develops full rpm's. If pump does not build up pressure as motor speed increases, shut down and reprime pump, plus make sure that liquid flow into pump is not restricted (see "Troubleshooting").

**Note:** A centrifugal pump's flow and head (pressure) will vary with the amount of resistance (friction and flow restrictions) in the discharge line. As a valve on the discharge line opens, the flow and motor amperage will increase and head will drop. As a valve on the discharge line is closed, the flow and amp draw will decrease and the head will increase. If resistance in the discharge line is not sufficient, the pump will operate at a condition of maximum flow, also sometimes called "end of performance curve."

Maximum horsepower is required to operate at this point and motor overload may result. If excessive amperage draw and motor overload is recurring, reduce the system flow by installing a valve on the discharge line and restricting flow. Alternatively, reduce pump head by trimming impeller to a smaller diameter. Consult Application Engineering Department for assistance.

## TROUBLESHOOTING

### 1. Pump fails to build pressure:

Check for:

- a. Pump not primed.
- b. Incorrect rotation.
- c. Driver speed too low.
- d. Suction line restricted.
- e. Driver failure.
- f. Plugged or damaged impeller.
- g. Pump or impeller undersized.
- h. Pump cavitation.
- i. Impeller rubbing volute.

### 2. Pump fails to provide enough flow.

Check for:

- a. System resistance too high.
- b. Pump undersized.
- c. Pump not primed.
- d. Driver speed too low.
- e. Poor suction conditions.
- f. Impeller rubbing volute due to improper installation.
- g. Pump cavitation.
- h. Plugged or damaged impeller.

### 3. Excessive noise or vibration during operation.

Check for:

- a. Motor bearing failing.
- b. Pump cavitating.
- c. Impeller rubbing volute.
- d. Pump shaft bushing failing.

### 4. Pump gradually loses pressure and head.

Check for:

- a. Increasing temperature causing cavitation or liquid vaporization.
- b. Driver failure.
- c. Suction lift too high.
- d. Air entering suction line.

### 5. Motor/pump overheating.

Check for:

- a. Excessive flow and amp draw (Throttle discharge).
- b. Low voltage or frequency.
- c. Flow too low with resulting heat rise.
- d. Bearing failure.
- e. System temperature too high.

## PUMP SERVICE



### CAUTION

**Disconnect power to pump before servicing to avoid dangerous or fatal electrical shock hazards.**



**If pump has been used to pump hazardous materials, be certain that all materials have been removed prior to working on the pump. Inverting pump with liquid in it could cause liquid to get into motor bearings and cause damage. Before disassembling, be certain all liquid is removed from the pump.**

### IMPORTANT

Many causes of pump system failure are due to improper system design. Refer to the Troubleshooting List in this guide before carrying out pump inspection.

### DISASSEMBLY

1. Disconnect power source to motor.
2. Disconnect electrical connections, tagging wires carefully to preserve correct rotation. Loosen motor base.
3. Remove pump and motor assembly to repair area. Observe position of all parts prior to disassembly.
4. Unscrew volute bolts and remove volute from pump.
5. Remove impeller. Unscrew impeller lockdown. Slide impeller off shaft. Do Not throw shaft key away. A small pair of c-clamps or standard vise grips may be clamped to the pump shaft to prevent rotation while unscrewing impeller lockdown. Avoid damaging the setscrews of the shaft with the vise grips.
6. Remove four motor bolts and remove column from motor.
7. Loosen setscrews in pump shaft and remove shaft from motor (Note: New setscrews must be used when shaft is reinstalled).

### REASSEMBLY

1. Clean pump and motor shaft thoroughly.
2. Assure that the shaft is not grooved and that there is no evidence of pitting or fretting where the bushing rides. If the shaft is grooved, fretted or worn, replace it.
3. Install the pump shaft onto the motor shaft, aligning half dog setscrew of the pump shaft with the keyway of the motor shaft. Ensure all debris and burrs are removed from the motor shaft.
4. Install bushing and bushing plate into column. Tighten three allen cap screws securely.

5. Install column onto motor being careful not to damage bushing.
6. Install motor bolts and tighten.
7. Ensure shoulder of shaft is protruding above bushing before installing impeller. Slide impeller onto pump shaft, install shaft key and tighten impeller lockdown securely.
8. Install new volute gasket and mount volute. Secure with bolts and tighten evenly.
9. Set impeller clearance. Slide pump shaft towards volute until impeller touches volute. Back the impeller and shaft away from the volute approximately .010"-.015" and tighten one setscrew at this time.
10. Remove volute, impeller and column.
11. Tighten the half-dog setscrew in keyway securely.
12. Dial indicating "Total Indicated Run-Out". Using a magnetic base and dial indicator, align shaft with maximum TIR of .004" (Note: dial indicator should be set to run as close to end of shaft as possible). The three setscrews at the base of the pump shaft are used to align the shaft. Tighten the three setscrews evenly until TIR of .004" is accomplished. Note: when TIR is completed, all the setscrew must be tight.
13. Install column onto motor being careful not to damage bushing.
14. Install motor bolts and tighten.
15. Install impeller. Install key in pump shaft. Slide impeller onto shaft and install impeller washer and lockdown. Tighten evenly.
16. Install new volute gasket and mount volute. Secure with bolts and tighten evenly.
17. Rotate pump shaft by hand to ensure impeller does not rub against volute.
18. Return pump to installation, reconnect electric connections.
19. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow, pump may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors. Check wiring diagram of motor for single phase rotation.
20. Start pump, allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc. to see if pump performs properly.



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