INSTALLATION - OPERATION - MAINTENANCE MANUAL
LANCASTER CENTRIFUGAL PUMPS - "E" SERIES
CLOSE COUPLED, END SUCTION DESIGN

The Lancaster "E" Series Centrifugal Pump is a general service pump designed to pump fluids in a wide range of applications.

Inspect your unit. Occasionally, products are damaged during shipment. If the unit is damaged, contact the transportation company or your dealer. Save the units packing materials until the claim is settled.

Carefully read the literature provided. Familiarize yourself with the specific details regarding installation and use. These materials should be retained for future reference.

ACCEPTABLE FLUIDS

- Hot and cold water
- Clean, thin, non-aggressive and non-explosive fluids. For fluids other than water, a special mechanical seal other than the standard mechanical seal may be required. Consult factory.

TEMPERATURE AND PRESSURE LIMITATIONS

- Pumps must be located where **ambient temperatures** are not so excessive as to be detrimental to the operation of the motor, which is rated for operation at 104°F (40°C) continuous duty.
- The mechanical seal is cooled and lubricated by the fluid being pumped. The mechanical seals are supplied for fluid temperatures between –30°F (-35°C) and 211°F (99.5°C). The **maximum fluid temperature** is 180°F (82°C) continuous duty, and 211°F (99.5°C) intermittent duty. Avoid thermal shock, which can crack the ceramic seat of the mechanical seal. This can occur by a sudden drastic change in temperature on the ceramic seat. For higher temperature applications, a special mechanical seal is required. Consult Factory.
- The maximum safe working pressure is the **maximum** pressure of the pumping **system** (fluid inlet pressure **plus** pressure developed by the pump). The maximum working pressure is determined by safe and reasonable life expectance limits of such items as the mechanical seal, gasket design, bolt strength, bursting strength of pump castings, etc. The **maximum working pressure** is 150 PSIG. Avoid water hammer conditions.

INSTALLATION

LOCATION: The pump should be located in an accessible area as close as possible to the source of liquid to be pumped. Location of the pump should allow for easy removal of drain/vent plugs as required for maintenance and priming of the pump. Pumps and motors should be protected against flooding. Provide enough clearance at the rear of the motor so that it and the bracket/impeller assembly can be removed from the pump casing for service.

FOUNDATION: The foundation should be able to absorb vibration and provide a permanent rigid support for the pump. A concrete foundation on a solid base is a good example. Foundation bolts of correct size should be embedded in the concrete.

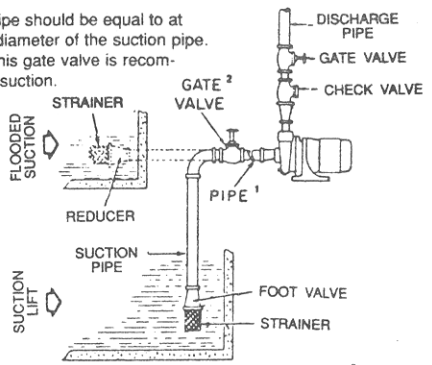
PIPING: Use pipe sealant compound or Teflon® tape on all male threads. Wherever possible, avoid use of unnecessary elbows, valves or accessory items, especially near the pump suction and discharge openings. Shim where necessary, under mounting feet of the pump, so that the unit is level. To avoid strain on the pump, all pipes should be aligned and supported independently at a point near the pump, before making any connections. When installing extra long pipe, provide a means to take care of elongation in pipes due to pressure and temperature.

The **suction pipe** should never be smaller than the suction tapping of the pump, and should be larger if the suction piping is long. The suction pipe should run as straight, short and with as few elbows as possible to keep friction losses to a minimum. If necessary, install a strainer at the open end of the suction line to prevent foreign matter from entering the pump. To maintain prime for pumps operating under suction lift, a foot valve must be installed at the opening of the suction line. The strainer should have 3 to 4 times the area of the suction pipe, and the foot valve should be 1-1/2 to 2 times the area of the suction pipe; otherwise excessive friction loss will be caused. Use extreme care in making up suction pipefittings, since air leaks will cause the pump to lose prime. Also, if the pump is operating under suction lift, horizontal suction piping must rise gradually from the source to the pump and contain no high spots, which allow air pockets to form. If the pump is operating under flooded or positive pressure conditions, a gate valve installed in the suction line as a means of isolating the pump is recommended.

The **discharge pipe** should have a check valve installed to prevent back flow, which could damage the pump on shut down. A gate valve should also be installed as a means of isolating the pump for maintenance purposes; it will also be of assistance when priming the pump. Pipe, valves and fittings should be at least the same size as the discharge tapping of the pump, to keep friction losses to a minimum.

A **bypass** or pressure relief valve should be installed in the discharge line if there is any possibility that the pump may operate against a closed valve in the discharge line. Flow through the pump is required to keep the mechanical seal cooled and lubricated. Damage to the pump may result if the liquid becomes hot enough to vaporize.

1. The length of this pipe should be equal to at least five times the diameter of the suction pipe.
2. The installation of this gate valve is recommended for flooded suction.



WIRING THE MOTOR: Wire the electric motor in accordance with the latest edition of the National Electric Code and local codes and regulations. A qualified electrician is recommended. Wiring instructions are given on the motor nameplate. Note: Single phase fractional (56C Frame) motors are protected by an internal, automatic reset, thermal overload switch and no external protection is required. All three phase motors (56C and JM Frame) must be provided with a manual starter that incorporates overload protection. For overload protection as well as automatic operation (in conjunction with a float or pressure switch) a magnetic starter with proper overload relays ("heaters") installed in it must be used.

OPERATION

PRIMING THE PUMP: The pump and suction piping must be completely filled with the liquid being pumped before starting. If the liquid source is above the pump, prime the pump by removing the topmost vent plug from the front of the pump casing, allowing liquid to replace the air trapped in the pump. Replace the plug when a steady stream of airless liquid runs out the hole. If the liquid source is below the pump, prime the pump by pouring liquid through the pump casing discharge opening or an opening in the discharge piping at a level above the pump casing. The topmost vent plug from the front of the pump casing must be removed to allow trapped air to escape from the pump. Any high spots in the suction line must be purged while the system is being filled. Replace the vent plug and connect/seal the discharge piping. Remember, to maintain prime where the liquid source is below the pump, a foot valve must be installed in a vertical position at the open end of the suction line.

CHECK MOTOR ROTATION: After the pump and suction piping have been filled and vented, the motor rotation can be checked. Remember to never operate the pump dry. Rotate the pump shaft by hand to be certain it turns freely. Direction of rotation should be checked by observation of the pump shaft through the openings in the motor support casting. Briefly (for only an instant) switch the power on and observe the direction of rotation. Direction of rotation should be as shown by the arrow on the pump casting. In the event that the rotation is incorrect, refer to the motor nameplate instructions for single-phase motors and change the wiring as required. For three phase motors, interchange any two power leads on the load side of the starter.

STARTING THE PUMP: Now that the pump is primed and the motor rotation is correct, the pump is almost ready to be started. Before starting, make sure the gate valve in the suction line (if installed) is completely open. When starting the pump for the first time, and when there is no pressure in the discharge line, leave the gate valve in the discharge line closed or partially open. Start the pump. Gradually open the gate valve in the discharge line. Opening this valve too fast may cause water hammer in the discharge line. Unless the discharge valve is being used as a flow-throttling device, make sure the valve is completely open. A discharge pressure gauge is the best way to check whether or not liquid is being pumped. If pump fails to function after a few seconds of operation, stop it and allow it to sit idle for several minutes. Add more priming liquid if needed, open air vent plug briefly. Follow starting procedure again. If at any time, the gauge should drop to zero or register abnormal pressure, shut down the pump and determine the cause.

Troubleshooting Chart

A. No liquid delivered:

1. Pump not completely primed.
2. Speed too low — check for low voltage
3. Air or gas in liquid. Air leaks in suction line.
4. Impeller clogged
5. Pump body or discharge line clogged.
6. Foot valve strainer clogged.
7. Wrong direction of rotation.
8. Discharge valve closed; check valve installed backwards (or stuck).
9. Not enough NPSH available. For cool water, suction lift more than 20 feet (at sea level).
10. Discharge head too high (check system head).
11. Pump body air or vapor bound.

B. Not enough liquid delivered; Not enough pressure:

1. Liquid level in source too low (air vortexing into suction).
2. Speed too low — check for low voltage.
3. Air or gas in liquid. Air leaks in suction line, or high spots.
4. Impeller partially clogged or damaged.
5. Pump body or discharge line partially clogged.
6. Foot valve strainer partially clogged.
7. Wrong direction of rotation.
8. Discharge valve partially closed.
9. Not enough NPSH available. Suction lift excessive. On hot water, pump must have a positive head on the suction, according to the water temperature.
10. Discharge head too high.
11. Excessive impeller running clearance.
12. Impeller vanes worn.

C. Pump uses too much power; Fuses blow or circuit breakers or heaters trip:

1. Voltage low.
2. Head lower than pump rating (allows pump to handle too much liquid, pumping too much capacity.)
3. Liquid heavier and more viscous than water.
4. Rotor binding.
5. Seal binding.
6. Impeller dragging inside pump casting.
7. Bent shaft.
8. Wrong direction of rotation.
9. Motor defects, motor shorted or grounded, defective capacitor (single phase).
10. Wiring or connections faulty.

D. Excessive vibration:

1. Air or gas in liquid.
2. Badly worn bearings
3. Bent shaft.
4. Wrong direction of rotation.
5. Impeller plugged or damaged.
6. Pump foundation not rigid.
7. Liquid level in source too low (air vortexing into suction).
8. Not enough NPSH available.

E. Pump loses prime while running:

1. Suction line has air leaks
2. Air or gas in liquid.
3. Suction lift excessive.
4. If hot water, has pump adequate positive suction head?

F. Pump loses prime standing still:

1. Foot valve leaking.
2. Suction pipe or pump housing leaking.
3. Mechanical seal leaking.

G. Mechanical Seal Leaks:

1. Improper assembly.
2. Worn seal faces.
   a. Corrosion due to character of liquid pumped.
   b. Excessive amounts of abrasive material in liquid causing an accumulation around the rotating assembly which results in faces opening up and allowing grit between them.
   c. Seal running dry.

H. Pump cycles too much:

1. Pressure switch is not properly adjusted or is defective.
2. Liquid level control is not properly set or is defective.
3. Insufficient air charging or leaking tank or piping.
4. Tank is too small.
5. Pump is oversized.

MAINTENANCE

- **PUMP LUBRICATION:** The rotating parts of a pump are lubricated by the liquid being pumped. No additional lubrication is required. DO **NOT START OR RUN PUMP DRY!**
- **MOTOR LUBRICATION:** Motors are generally equipped with sealed ball bearings, requiring no additional lubrication.
- **MECHANICAL SEAL:** Seal adjustments are not required. Occasionally a new seal may leak slightly during its first hour of operation, but unless the seal is faulty or installed incorrectly, this leakage will stop. When leakage occurs after the pump has been installed for a long time, the seal must be replaced.
- **FREEZE PROTECTION:** If the pump is installed in an area where freezing could occur, the pump and system should be drained during freezing temperatures to avoid damage. To drain the pump, close the gate valves on the suction and discharge lines and remove the casing drain/vent plugs at both top and bottom of the pump. **DO NOT** replace the plugs until the pump is to be used again. In certain applications, adding a corrosion-inhibiting anti-freeze could be used.
- **MOTOR REPLACEMENT: Replacement motors must be of the same NEMA frame size and have the same speed, voltage, horsepower and service factor.**

DISASSEMBLING PUMPS WITH 56C FRAME MOTORS

To disassemble and reassemble pump, consult Fig. 1 for identification of components referred by item numbers in ( ). For actual part numbers, refer to separate parts list sheet for your model pump.

MAKE SURE POWER TO THE MOTOR IS DISCONNECTED TO PREVENT START-UP OR ELECTRICAL SHOCK.

Remove capscrews (11), which fasten bracket to casing. Back out motor and bracket assembly from casing. The gasket (10) will be reusable if not mutilated; however, recommended practice is to install a new gasket each time the pump is reassembled.

With the above assembly removed from the casing, the impeller (2) can be removed from the stub shaft (5) by holding the stub shaft (5) across its flats (through the window of the bracket) with an open-end wrench and unscrewing the impeller. While holding the stub shaft (5), insert a screwdriver between the vanes of the impeller (2) and gently loosen the impeller in a counter-clockwise direction. Use moderate torque so as not to damage the impeller vanes. (When reassembling the pump, tighten the impeller with slightly extra pressure, and be sure to check rotation as described in the operation section.)

The rotating assembly of the mechanical seal (4) can then be pulled off the stub shaft. If the Buna driving ring of the seal is firmly gripping the stub shaft (5) remove the bracket capscrews (12) and use the bracket (3) as a puller to remove the seal assembly (4). Press the cup seat holding the ceramic seat of the seal out of the bracket.

Lubricate the outside diameter of the new rubber cup seat with light oil; press the cup seat with seat face into the bracket cavity, making certain that it is seated squarely in cavity. If the seat and ring cannot be pressed into place with the fingers, cover the lapped seat face with the cardboard ring, which is packed with each new seal assembly, and tap seat and ring into place by using a light mallet with a piece of wood placed squarely against the seat face.

Inspect pump shaft to see that it is clean and smooth. Use emery cloth to polish the shaft if it is scored, or replace the stub shaft (5) if there is excessive wear. The stub shaft (5) is locked in place on motor shaft with setscrews (16). If stub shaft has been disconnected from motor shaft, it will be necessary to reposition pump shaft so that the impeller rotates freely inside pump case. With setscrews (16) loosened, determine the full travel of the shaft; then place shaft at mid-point of its full travel with the setscrews. Be sure that setscrews seat properly in motor shaft keyway. Once setscrews are properly positioned, remove them one at a time and apply Loctite 242 or similar medium strength removable thread locking compound and reseat. This will prevent the setscrews from vibrating loose and damaging the pump. Then wipe the shaft clean, and give it a thin coating of light oil. Slide the rotating portion of the seal assembly onto the shaft, with the carbon washer facing the ceramic seal in the bracket. Be extremely careful when sliding the rubber portion of the seal onto the shaft. Concentration of force on the rubber surface can be facilitated by using a sleeve which fits over the shaft, and butts up squarely against the back of the seal assembly.

Once the assembly is on the shaft, the force required to push it along the shaft is greatly reduced. Be sure to anticipate this reduction so that the carbon washer will not be fractured by being slammed against the seat face. Before sliding the carbon washer up against the seat face, make certain that the lapped faces are absolutely clean.

Place the seal spring in position. Apply Loctite 242 to the stub shaft threads (5) and thread the impeller (2) clockwise on the shaft. Use moderate force in tightening the impeller. The remaining components are then reassembled.

PUMP CROSS SECTION WITH 56C FRAME MOTORS

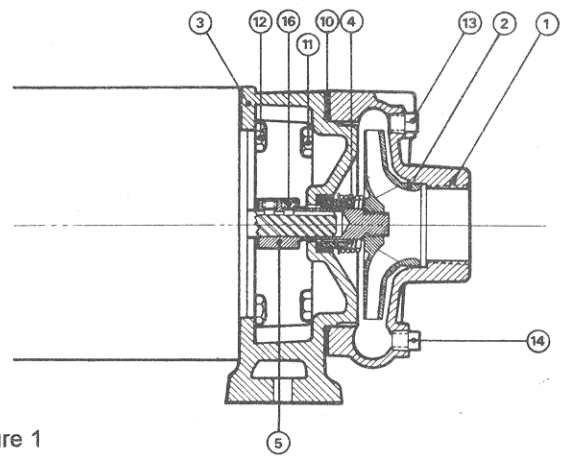


Figure 1

Item	Component	Item	Component
1	Casing	11	Casing Capscrew
2	Impeller	12	Bracket Capscrew
3	Bracket	13	Vent Plug
4	Mechanical Seal	14	Drain Plug
5	Stub Shaft	16	Shaft Setscrews
10	Casing Gasket		

DISASSEMBLING PUMPS WITH JM FRAME MOTORS

To disassemble and reassemble pump, consult Fig. 2 for identification of components referred by numbers in ( ). For actual part numbers, refer to separate parts list sheet for your model pump.

MAKE SURE THAT POWER TO THE MOTOR IS DISCONNECTED TO PREVENT START-UP OR ELECTRICAL SHOCK.

Remove capscrews (11), which fasten bracket to casing. Back out motor and bracket assembly from casing. The gasket (10) will be reusable if not mutilated; however, recommended practice is to install a new gasket each time the pump is reassembled.

With the above assembly removed from the casing, remove the impeller capscrew (7) and impeller washer (8). The impeller (2) can then be pried from the shaft. Remove the impeller key (9).

The rotating assembly of the mechanical seal (4) can then be pulled off the shaft sleeve (5), or the rotating assembly of the mechanical seal (4) and the shaft sleeve (5) can be removed together off the motor shaft.

Pull ceramic seal seat and cup seat of the mechanical seal out of the bracket (3). If necessary, remove the bracket (3) from the motor and press the cup seat and the ceramic seat out of the bracket.

With the shaft sleeve (5) off the motor shaft, inspect the sleeve o-ring (6) and the o-ring spacer sleeve (6a). The sleeve o-ring (6) may be reusable if it is not damaged; however, recommended practice is to install a new o-ring each time the pump is reassembled.

Lubricate the outside diameter of the new rubber cup seat with light oil; press the cup seat with seat face into the bracket cavity, making certain that it is seated squarely in cavity. If the seat and ring cannot be pressed into place with the fingers, cover the lapped seat face with the cardboard ring, which is packed with each new seal assembly, and tap seat and ring into place by using a light mallet with a piece of wood placed squarely against the seat face.

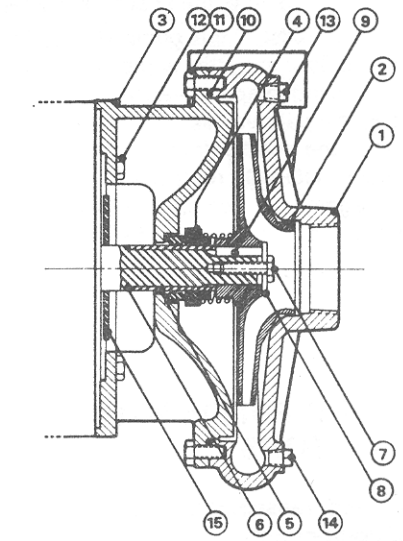
Inspect the shaft sleeve (5) to see that it is clean and smooth. Use emery cloth to polish the sleeve if it is scored, or replace the shaft sleeve (5) if there is excessive wear. Insert the o-ring spacer (6a) up to the shoulder of the shaft. Insert the o-ring (6) up to the spacer sleeve, and gently replace the shaft sleeve (5).

Then wipe the shaft sleeve clean, and give it a thin coating of light oil. Slide the rotating portion of the seal assembly onto the shaft sleeve, with the carbon washer facing the ceramic seal in the bracket. Be extremely careful when sliding the rubber portion of the seal onto the shaft. Concentration of force on the rubber surface can be facilitated by using a sleeve which fits over the shaft, and butts up squarely against the back of the seal assembly.

Once the assembly is on the shaft, the force required to push it along the shaft is greatly reduced. Be sure to anticipate this reduction so that the carbon washer will not be fractured by being slammed against the seat face. Before sliding the carbon washer up against the seat face, make certain that the lapped faces are absolutely clean.

Place the seal spring in position and replace the impeller key (9) and the impeller (2) on the shaft. Assemble the impeller washer (8) and capscrew (7). Tighten 3/8" capscrews to 35 ft. lbs. and ½" to 80 ft. lbs. The remaining components are then reassembled.

PUMP CROSS SECTION WITH JM MOTOR FRAME



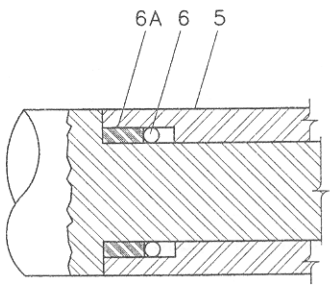


Figure 2

Item	Component	Item	Component
1	Casing	8	Impeller Washer
2	Impeller	9	Impeller Key
3	Bracket	10	Casing Gasket
4	Mechanical Seal	11	Casing Capscrew
5	Shaft Sleeve	12	Bracket Capscrew
6	Shaft O-Ring	13	Vent Plug
6a	Spacer Sleeve	14	Drain Plug
7	Impeller Capscrew	15	Slinger

TO ORDER PARTS, REFER TO SEPARATE "PARTS LIST" SHEET FOR YOUR MODEL PUMP.

LANCASTER PUMP A DIVISION OF C-B TOOL CO.
1340 Manheim Pike • Lancaster, PA 17601-3196 • Phone: 717-397-3521 • Fax: 717-392-0266 • www.lancpump.com