CarVer®

**Instruction I-150LHB**

# INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS FOR LHB TOP PULLOUT VERTICAL PUMPS

**Preface:** The instructions in this manual apply to the Carver Pump Company LHB Top Pullout Vertical Pumps. LHB Pumps are designed for industrial service. All wetted surfaces are available in bronze fitted, all iron, stainless fitted, and stainless steel construction. The top pullout design provides fast, easy access to all working parts without disconnecting pipes.

## TABLE OF CONTENTS



### LIST OF TABLES



### LIST OF ILLUSTRATIONS



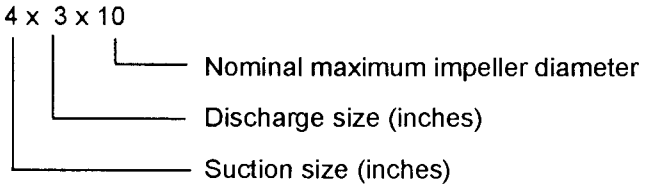
ISO 9001 CERTIFIED


**CARVER PUMP COMPANY**
2415 Park Avenue ● Muscatine, Iowa 52761-5691
Phone (563) 263-3410 ● Main Fax (563) 262-0509
Marketing Fax (563) 262-0510
E-Mail: carverpump@muscanet.com
WEB: www.carverpump.com

## I. GENERAL DESCRIPTION AND SAFETY PRECAUTIONS.

**A. GENERAL DESCRIPTION.** LHB Pumps are designed for industrial service. All wetted surfaces are available in bronze fitted, all iron, stainless fitted, and stainless steel construction. The top pullout design provides fast, easy access to all working parts without disconnecting pipes.

**B. PUMP IDENTIFICATION.** Use the following example for identifying information about your pump model number.




**C. NAMEPLATE.** A nameplate is attached to each pump. The data on the nameplate should be recorded and filed for easy reference. Nameplate data should be furnished to Carver Pump Company or its representative when ordering spare parts or requesting information. The serial number of the pump is also stamped on the circumference of the suction flange. Record pump serial number and model number below.

Pump Serial Number _____

Pump Model Number _____

**D. SAFETY PRECAUTIONS.** The manual contains descriptions and instructions which are the result of carefully conducted engineering and research efforts. The manual is designed to provide adequate instructions for the safe and efficient installation, operation, and maintenance of the pump. Failure or neglect to properly install, operate, or maintain the pump may result in personal injury, property damage, or unnecessary damage to the pump.

Variations exists in both the equipment used with these pumps and in particular installation of the pump and driver. Therefore, specific operating instructions are not within the scope of this manual. This manual contains general rules for installation, operation, and maintenance of the pump.

Observe all caution or danger tags attached to the equipment or included in this manual.

### CAUTION

**IMPORTANT SAFETY NOTICE**

Installation, use, and operation of pumping equipment is affected by various federal, state, and local laws and the regulations concerning OSHA. Compliance with such laws relating to the proper installation and safe operation of pumping equipment is the responsibility of the equipment owner and all necessary steps should be taken by the owner to assure compliance with such laws before operating the equipment.

## II. INSPECTION AND STORAGE.

**A. INSPECTION.** Upon receipt of the shipment, unpack and inspect the pump, driver assemblies, and individual parts to insure none are missing or damaged. Carefully inspect all boxes and packing material for loose parts before discarding them. Immediately report any missing parts or damage incurred during shipment to the factory and to the transportation company and file your "damaged and/or lost in shipment" claim with carrier.

**B. STORAGE OF PUMP.** If the equipment is not to be immediately installed and operated, store it in a clean, dry well-ventilated place, free from vibrations, moisture, and rapid or wide variations in temperature. Rotate the shaft for several revolutions at least once every two weeks to coat the bearings with lubricant, retard oxidation and corrosion, and prevent possible false brinelling.

Consider a unit to be in storage when:

1. It has been delivered to the job site and is waiting to be installed.
2. It has been installed but operation is delayed pending completion of construction.
3. There are long (30 days or more) periods between operation cycles.
4. The plant (or department) is shut down for periods of longer than 30 days.

### NOTE

Storage requirements vary depending on climatic environment, length of storage, and equipment. For storage periods of three months or longer, contact manufacturer for specific instructions. Improper storage could damage equipment and would result in non-warranty covered restoration or non-warranty covered product failures.

## III. INSTALLATION.

The pump should be installed by skilled personnel in accordance with engineering standards. Faulty installation will result in operating troubles and premature wear of parts.

The pump and driver should be located in an area that will permit periodic inspection and maintenance. Head room and access should be provided. The pump should always be submerged enough to prevent vortexes from forming which might allow air to enter the suction.

When pump is supplied with coupling, motor, and baseplate, the complete set is assembled at Carver Pump Company. After ascertaining the unit has suffered no damage in transit, the pumping unit can be installed. Proceed as follows:

1. Make sure the foundation is level. Capscrew base to foundation. Check that pump rotates freely.
2. Connect suction and discharge piping. Extreme care should be taken when connecting new piping lines to be sure that no foreign matter such as dirt, chips, tools, etc., is in the piping, tank, or return piping as this debris will be drawn into the pump and cause excessive damage. Any debris caught in the pump passageways will throw the pumping unit out of balance.
3. Connect any necessary auxiliary piping and gauge lines.
4. Since the pumping unit is shipped with bearings packed, initial greasing will not be necessary unless pumping unit has been in storage for an extended period of time.
5. On chair mount pumps, check alignment of pump and motor as outlined in section IV in this manual. If misaligned, follow instructions in section IV on aligning the pumping unit.
6. Turn pump and motor shafts by hand to be sure they rotate freely.
7. Connect wiring to motor. Due to high voltage required to operate the pumping unit, personnel working with the equipment should be familiar with electrical safety practices and modern methods of resuscitation.
8. Connect electrical power supply to motor.
9. Open system valves.

## IV. ALIGNMENT.

The pump and motor are connected by a flexible coupling.

On barrel mount pumps, the motor bracket aligns the pump and motor. No further alignment is necessary.

### NOTE

The remaining paragraphs in section IV, apply to chair mount pumps only.

On chairmount pumps, the motor and pump shafts must be accurately aligned as any misalignment will cause damage to the coupling, motor and pump. When the shafts are in correct alignment, the coupling hubs will be on a common axis, concentric with each other, and at the correct distance apart.

To check the coupling gap and angular alignment, use a spacer bar equal in thickness to the gap specified by the coupling manufacturer. Insert bar to the same depth at 90 degree intervals and measure clearance between bar and coupling hub with a feeler gauge. The gap should be the same at all points. Angular misalignment must not exceed 1 degree.

To check axial alignment, place a straight edge on coupling hubs. the straight edge should be parallel to the pump and motor shaft at all points around the periphery. For a more accurate alignment, mount a dial indicator on the driving shaft and a dial indicator on the pump shaft. Slowly rotate both shafts. Record total indicator readings at 90 degree intervals. The four measurements must be within +0.005 inch tolerance.

## V. OPERATION.

### A. PRESTART CAUTIONS.

1. Before starting or operating the pump, read this entire manual, especially the following instructions.
2. Before starting the pump, rotate shaft by hand to assure all moving parts are free.
3. Before starting the pump, install closed guards around all exposed rotating parts.
4. Observe all caution or danger tags attached to the equipment.
5. Never run pump dry. Dry running may result in pump seizure.
6. If excessive vibration or noise occurs during operation, shut the pump down and consult a Carver representative.
7. Use of a check valve in discharge piping is recommended if there is a high volume of reverse flow.
8. Check level in tank to see that the pump is submerged in fluid.

**B. STARTING THE PUMP.** The pumping unit will operate without operator intervention once system valves have been adjusted to specified pumping conditions. The casing of the pump will be submerged in the fluid being pumped, thus rendering it self-priming. Proceed with operation as follows:

1. Make sure no one is working on the pumping unit.

2. If the pumping unit has been idle for a period of time, make sure unit is firmly attached to its foundation.
3. Open valves to pressure gauges in system.

### CAUTION

Check level of liquid in tank to be sure casing is under liquid level.

4. Jog starter switch on motor to check direction of rotation. Direction of rotation is clockwise from fan end of motor.
5. Partially open discharge valve.
6. Start the pumping unit in accordance with the directions on the electrical power supply.
7. Slowly open discharge valve and adjust it to operating condition required.
8. Pumping unit is now in full operation.

**C. STOPPING THE PUMP.**

1. If pump is being stopped for overhaul, slowly close the discharge valve. Otherwise leave discharge valve set at condition.
2. Stop the pumping unit in accordance with the directions on the electrical power supply.
3. If the pump is being stopped for overhaul, close pressure gauge valves.
4. The pumping unit is now in the off position.

## VI. MAINTENANCE.

Generally the pump does not require continuous supervision. Occasional visual checks are recommended. Data should be recorded for each pump to keep track of maintenance which has been performed and to note operational problems. A pump service record sheet is provided for this purpose at the back of this manual.

**A. FIELD INSPECTION.** Shutdown is not required. Perform field inspection at regular intervals and cover the following procedures:

1. Check and record the suction and discharge pressures to establish differential head. It should conform to the pump nameplate.
2. Check and record the power input and speed of driver.
3. Check and record pumping temperatures.
4. Check pump for quiet running.

**B. STUFFING BOX.** The stuffing box is equipped with a throat bushing which requires no regular maintenance. The inside diameter of the throat bushing will increase with wear. The throat bushing should be inspected after pump disassembly. The throat bushing requires replacement if the inside diameter is more than 0.020 inch out of round.

**C. BEARING TEMPERATURE.** Bearing temperature should be monitored periodically. Normal operating temperatures are 120 degrees F to 160 degrees F, depending on the ambient temperature. Bearings may appear to run hot when pump is first started. This is caused by the shaft seal, not the bearing. When the seal is seated, temperature should drop to normal.

Check bearing temperature by placing a pyrometer against the bearing frame while pump is running. A temperature rise above 180 degrees F indicates possible damage that requires checking. The most common cause of high bearing temperatures is overgreased bearings.

**D. BEARING LUBRICATION.** Lubrication frequency depends on operating conditions. Normal duty calls for relubrication every 1000 hours of operation. Bearings are lubricated at Carver Pump Company with Amoco Rykon Premium Grease No. 2EP, non-soap, polyurea thickened grease with a drop point of 450 degrees F. This grease was selected because of its suitability to extreme pressures and its high temperature stability. Never mix greases with differing properties.

Polyurea base greases are NOT compatible with lithium or soda soap base greases. Therefore, the type of grease added should not vary. However, if it is necessary to change grease types, the bearings, bearing frame, and bearing holder should be thoroughly cleaned and flushed with suitable solvent to remove all traces of old grease. Disassemble pump, remove shaft and bearings from bearing frame and follow these procedures:

### NOTE

It is recommended that bearings removed from the shaft be replaced. If bearings that are in good condition must be reused, follow the procedures below.

1. Place bearings, bearing frame, and bearing holder in a wire or mesh basket and suspend the basket in a light mineral solvent. Allow it to soak, preferably overnight.
2. After soaking and cleaning, the bearings, bearing frame, and bearing holder should be rinsed in a clean, light mineral solvent and agitated vigorously to remove all loosened hard grease and dirt.
3. Dip bearings in clean, light oil and spin by hand to determine that all foreign matter has been removed.
4. After cleaning, repack bearings half full on both sides with a good quality ball bearing grease.

To relubricate bearings use the following procedure:

## CAUTION

Overgreasing creates heat and is the cause of many problems requiring repair. DO NOT OVERGREASE.

1. Never relubricate pump bearings while unit is running. If necessary, shut down pump according to section V, paragraph C.
2. Remove plugs opposite grease fittings on both ends of bearing frame.

## CAUTION

Do not lubricate bearings with a power grease gun.

3. Using a hand-operated grease gun on grease fittings, add approximately one ounce of fresh grease for each bearing. With most hand-operated grease guns, two or three pumps is enough. DO NOT OVERGREASE. When installing new bearings, pack new bearings only half full with grease.

Bearing temperature may rise above normal immediately after lubrication, but should stabilize within 4 to 8 hours.

## VII. TROUBLESHOOTING.

The pump should provide reliable service and long life if the installation and starting procedures outlined in this manual are followed. If operating problems do occur, refer to table 1 to eliminate some of the most common causes of those problems.

## VIII. SERVICE AND REPAIR.

**A. PREPARATIONS FOR DISASSEMBLY OF PUMP.** Read this entire section and study figure 1.

1. Stop pump according to section V, paragraph C. Disconnect, lock out, and tag electrical power supply to motor. Disconnect wiring from motor.
2. Shut off and tag all valves controlling the flow of liquid to the tank and from the pump. If necessary, flush pump to remove corrosive or toxic pumpage.

**B. PUMP DISASSEMBLY.** The LHB Pumps are of the same basic design, but some parts do vary between model to model. Parts that may vary from model to model are: semi-open or enclosed impeller, wear ring (enclosed impeller pumps only), shaft sleeve, and chair or barrel mount. The top pullout design of this pump allows the shaft and impeller to be removed without disconnecting the piping or casing.

During disassembly, mark parts so that they can be fit exactly as before during reassembly. When removing capscrews, use socket or box-ended wrenches instead of open-ended wrenches. After extended operation, it may be difficult to separate some components. Rust solvent may be used and suitable extricating tools where possible. Do not use metal-headed hammers; use only those with plastic or rubber heads.

Disassemble as follows:

1. Remove coupling guard, disconnect coupling.

## CAUTION

To lift motor, a hoist or suitable lifting device must be used.

2. Attach hoist to motor. Remove capscrews (607), freeing motor from motor bracket (71). Hoist motor and motor coupling half away from pump and rest on plywood or heavy cardboard.

## CAUTION

To lift rotating element, a hoist or suitable lifting device must be used.

3. Screw lifting eye into the tapped hole located at coupling end of pump shaft or place a strap through motor bracket (71). Attach hoisting equipment to lifting eye or strap.
4. Remove nuts (615) from studs (630) separating outer column (53) from column plate (102). Use forcing capscrews (612) to separate outer column (53) from column plate (102). Back off forcing capscrews (612).
5. Hoist rotating element and remove to a suitable work area.
6. Remove impeller capscrew (26) from end of shaft (6). Remove impeller washer (28). Pull or pry impeller (2) from shaft (6). Remove impeller key (32) from either impeller (2) or shaft (6).
7. Remove O-ring (89) from backcover (11).
8. Remove capscrews (601) separating backcover (11) from inner column (101). Remove backcover (11)/gland (17)/throat bushing (63) assembly.
9. If throat bushing (63) needs to be replaced, remove capscrews (602) separating gland (17) from backcover (11). Remove setscrews (190) separating throat bushing (63) from gland (17). Remove gland (17). Push or machine throat bushing (63) out through locking ring end of backcover (11).
10. Remove shaft sleeve (14) if equipped.
11. Remove nuts (616) and capscrews (609) separating motor bracket (71) from bearing frame (19). Remove motor bracket (71) from bearing frame (19).
12. Remove pump coupling (42) half. Remove coupling key (46) from either coupling (42) or shaft (6).

**Table 1. Troubleshooting**

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Motor will not start. | 1. No input power. | 1. Check connections to electrical power source. Check fuses or circuit breakers. Check terminals at source of power input. |
| | 2. Improper voltage. | 2. Check voltage at motor terminals. |
| | 3. Motor overload. | 3. Refer to "Overload on motor". |
| | 4. Mechanical obstruction that prevents rotor from turning. | 4. Examine and clean pumping unit thoroughly. Check for bearing failure or bent shaft. |
| Motor overheats. | 1. Motor overload. | 1. Refer to "Overload on motor". |
| | 2. Improper voltage. | 2. Check voltage at motor terminals. |
| | 3. Obstruction in ventilation. | 3. Check ventilation opening of motor. Keep clear of obstructions at all times. |
| | 4. Insufficient cooling medium. | 4. Check ambient temperature. Motor temperature should not exceed ambient temperature plus the rated temperature increase of the unit. |
| | 5. Overgreased motor bearings. | 5. Remove lubricant from bearing chamber until the proper amount of grease is in chamber. |
| | 6. Improper motor grease. | 6. Remove grease and replace with grease recommended by motor manufacturer. |
| Failure to deliver liquid. | 1. Discharge valve closed. | 1. Check discharge valve. |
| | 2. Discharge head above shutoff. | 2. Consult with nearest Carver Pump Company representative or factory. |
| | 3. Impeller or suction pipe clogged. | 3. Inspect and clean impeller and suction pipe. |
| | 4. Wrong rotation. | 4. Check power connection to motor. |
| | 5. Liquid level in tank too low. | 5. Add liquid to system. |
| Reduced capacity and/or pressure. | 1. Discharge valve closed. | 1. Check discharge valve. |
| | 2. Damaged impeller. | 2. Replace impeller. |
| | 3. Impeller or suction pipe partially clogged. | 3. Inspect and clean impeller and suction pipe. |
| | 4. Suction pipe too close to bottom of tank. | 4. Reduce length of pipe. |
| | 5. Liquid level in tank too low. | 5. Add liquid to system. |
| | 6. Total head too high. | 6. Consult with nearest Carver Pump Company representative or factory. |
| | 7. Wrong rotation. | 7. Check power connections to motor. |

**Table 1. Troubleshooting - (Contd)**

| SYMPTOM | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Reduced capacity and/or pressure. - (Contd) | 8. Speed too low. | 8. Consult with nearest Carver Pump Company representative or factory. |
| | 9. Semi-open impeller running clearance too large. | 9. Check semi-open impeller clearance according to section VIII, paragraph E. |
| | 10. Enclosed impeller clearance between suction cover or wear ring, if equipped is too large. | 10. Check enclosed impeller clearance according to section VIII, paragraph C, step 7. |
| Pump surges. | 1. Liquid level in tank too low. | 1. Add liquid to system. |
| Pump loses prime after starting. | 1. Suction lift over six feet. | 1. Check with vacuum gauge. |
| | 2. Liquid level in tank too low. | 2. Add liquid to system. |
| Overload on motor. | 1. Head lower than that for which pump is designed. | 1. Consult with nearest Carver Pump Company representative or factory. |
| | 2. Mechanical defects of pump or motor such as bent shaft, binding or rubbing rotating element. | 2. Replace defective parts or replace pump or motor. |
| | 3. Liquid handled of higher specific gravity or lower viscosity than intended application. | 3. Consult with nearest Carver Pump Company representative or factory. |
| Insulation failure. | 1. Oil or water soaked windings. | 1. Disassemble motor; clean and dry windings. |
| | 2. Excessive vibration. | 2. Refer to "Vibrates or is noisy". |
| | 3. Wrong voltage. | 3. Check voltage at motor terminals. |
| Vibrates or is noisy. | 1. Insufficient or insecure foundation. | 1. Enlarge foundation or relocate pumping unit so it can be firmly bolted to foundation. |
| | 2. Mechanical defects of pump or motor such as bent shaft, binding rotating element, or warped impeller. | 2. Replace defective parts or replace pump or motor. |
| | 3. Foreign matter in pump. | 3. Disassemble pump; clean and replace damaged parts. |
| | 4. Strain due to piping or improper piping supports. | 4. Check piping alignment and remove piping weight from pump with proper supports. |
| | 5. Misalignment. | 5. Align pump and motor as outlined in section IV of this manual. |
| | 6. Damaged bearings. | 6. Replace bearings. |
| Rapid wear of coupling spider. | 1. Misalignment on chair mount pumps. | 1. Align pump and motor as outlined in section IV of this manual. |
| | 2. Bent shaft. | 2. Replace shaft. |

13. Remove capscrews (608) separating bearing holder (37) from bearing frame (19). Use forcing capscrews (610) to loosen rabbet fit of bearing holder (37) and bearing frame (19).
14. Force shaft (6) out through coupling end of the bearing frame (19). The bearings (16 and 18) and bearing holder (37) will remain on shaft (6).
15. Remove snap ring (176) from bearing holder (37). Let snap ring (176) rest on shaft. Pull bearing holder (37) from shaft (6).
16. Uncrimp bearing lockwasher (69) and remove bearing locknut (22) and lockwasher (69).
17. Using a puller, remove thrust bearing (18) from coupling end of shaft (6). Remove radial bearing (16) from shaft (6). Remove snap ring (176) from shaft (6).
18. Loosen capscrews (605) separating bearing frame (19) from column plate (102). Remove bearing frame (19).
19. Remove grease seal (47) from bearing frame (19) and discard. Remove grease seal (47) from column plate (102) and discard.

**NOTE**

Proceed to step 20 only if replacement of gasket (73) is necessary.

20. Remove capscrews (611) separating casing (1) from suction cover (9). Remove gasket (73).

## C. PARTS INSPECTION.

1. All parts should be thoroughly cleaned or replaced with new ones if necessary. All sealing faces should be perfectly clean. It is recommended that grease seals (47) gasket (73), O-ring (89), and locking devices with a nylock feature be replaced with new if disturbed from position.
2. Inspect bearings (16 and 18) for damage. Damaged bearings must be replaced. If bearings are removed from shaft, it is recommended that bearings be replaced. If bearing replacement is not possible and bearings are in good condition bearings should be cleaned according to section VI, paragraph D. Protect until ready for use.
3. Inspect for bent shaft (6) and replace shaft (6) if necessary. Shaft threads should be in good condition. Bearing seat must be in perfect condition.
4. If the impeller (2) shows excessive wear due to abrasion or corrosion and performance cannot be restored, it must be replaced.
5. Inspect the inside diameter of throat bushing (63). The inside diameter of the throat bushing (63) will increase with wear. The throat bushing requires replacement if the inside diameter is more than 0.020 inch out of round.
6. Inspect and replace any defective grease fittings.
7. On an enclosed impeller pump, check the clearance as follows:
   a. Measure outside diameter of front impeller (2) hub in three places.
   b. Measure inside diameter of suction cover (9) or wear ring (7), if equipped in three places.
   c. If difference between high reading of inside diameter of the suction cover (9) or wear ring (7), if equipped and low reading of outside diameter of impeller (2) hub exceeds double

**Table 2. Enclosed Impeller Clearance**

| MODEL (Suction x Discharge x Maximum Impeller Diameter) | FACTORY STANDARD DIAMETRIC CLEARANCE | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| 1.25 X 1 X 5L | 0.009 | 0.014 |
| 2 X 1.5 X 5L through 1.25 X 1 X 7L | 0.012 | 0.016 |
| 1.5 X 1.25 X 7L | 0.014 | 0.018 |
| 2 X 1.5 X 7L | 0.012 | 0.016 |
| 2.5 X 2 X 7L | 0.012 | 0.016 |
| 3 X 2.5 X 7L | 0.014 | 0.018 |
| 4 X 3 X 7L | 0.014 | 0.018 |
| 5 X 4 X 7L | 0.015 | 0.020 |
| 1.5 X 1.25 X 10H | 0.011 | 0.014 |
| 2 X 1.5 X 10H | 0.012 | 0.016 |
| 2.5 X 2 X 10H | 0.012 | 0.016 |
| 3 X 2.5 X 10H | 0.012 | 0.017 |
| 4 X 3 X 10H | 0.012 | 0.016 |
| 5 X 4 X 10H | 0.016 | 0.021 |
| 6 X 5 X 10H | 0.021 | 0.026 |

the maximum clearances given in table 2, replace suction cover (9) and impeller (2) or wear ring (7), if equipped. To replace wear ring (7) refer to section VIII, paragraph F.

**D. PUMP REASSEMBLY.** To reassemble the pump, use the following procedures:

## NOTE

It is recommended that grease seals (47) gasket (73), O-ring (89), and locking devices with a nylock feature be replaced with new if disturbed from position.

It is recommended that bearings (16 and 18) be replaced if removed from shaft.

Proceed to step 2, if casing was not removed.

1. If casing (1) was removed, install gasket (73) on suction cover (9). Install casing (1) on suction cover (9) and secure with capscrews (611). Reconnect piping. Ensure column (53) and casing (1) are secured with capscrews (600).
2. Install grease seal (47) in bearing frame (19). Place snap ring (176) on shaft (6) between two bearing seats.
3. Install radial bearing (16) and thrust bearing (18) on shaft (6). Bearings (16 and 18) may be pressed onto shaft (6) or heated so they will slide onto shaft (6). Pack bearings half full with grease. Refer to section VI, paragraph D for proper grease type. Install bearing lockwasher (69) and bearing locknut (22). Recrimp lockwasher (69).
4. Install bearing holder (37) over thrust bearing (18). Install snap ring (176) on bearing holder (37).
5. Set wet end of shaft (6) in through bearing frame end of bearing frame (19). Install shaft (6), bearings (16 and 18), and bearing holder (37) through bearing frame (19) by applying force to bearing frame end of shaft (6).
6. Secure bearing holder (37) to bearing frame (19) with capscrews (608). Tighten capscrews (608) by hand only, leaving a 0.25 inch gap between bearing holder (37) and bearing frame (19) so impeller vanes won't be damaged when rotating element is installed in casing (1).
7. Install coupling key (46) in keyway of shaft (6). Install pump coupling (42) half.
8. Install motor bracket (71) and secure to bearing frame (19) with nuts (616) on capscrews (609).
9. Install slinger (40). Secure with setscrews (191).
10. Install grease seal (47) in column plate (102).
11. Install shaft sleeve (14) if equipped.
12. If throat bushing (63) was removed, press new throat bushing (63) into backcover (11) using gland as a guide, until the throat bushing (63) and backcover (11) are flush. Install gland (17), securing it to backcover (11) with capscrews (602). Drill and tap new holes for setscrews (190) in gland (17). Install setscrews (190).
13. Install backcover (11) and secure to inner column (101) with capscrews (601).
14. Install new O-ring (89) on backcover (11).

## CAUTION

Use a new impeller capscrew (26) during reassembly. Impeller capscrew (26) has a nylock feature. Once used, impeller capscrew (26) may not provide adequate security.

15. Install impeller key (32) in shaft (6). Install impeller (2) and impeller washer (28). Secure to end of shaft (6) with new capscrew (26). Do not use old capscrew as impeller damage could result.

## CAUTION

To lift rotating element, a hoist or suitable lifting device must be used.

16. Install lifting eye into end tap or place a strap through motor bracket (71). Attach hoisting equipment to lifting eye or strap and return rotating element to pump.
17. Slowly lower rotating element into casing (1). Do not force rotating element. If installed correctly, it will slide in easily. Secure inner column (101) to column plate (102) with nuts (615) on studs (630).
18. Detach hoisting equipment and remove lifting eye from end tap.

## CAUTION

To lift motor, a hoist or suitable lifting device must be used.

19. Attach hoist and move motor, and motor coupling half into place on motor bracket (71). Secure motor to motor bracket (71) with capscrews (607).
20. If pump is equipped with an open impeller, adjust impeller clearance according to paragraph E in this section. If pump is equipped with an enclosed impeller, no impeller clearance is needed if impeller (2) does not contact casing (1) when rotating element is lowered into casing (1). Evenly tighten capscrews (608).
21. If pump is equipped with an enclosed impeller and impeller (2) bumps casing (1) when rotating element is installed, follow this procedure to adjust impeller clearance:
    a. Measure the gap between the bearing holder (37) and bearing frame (19).

b. Tighten forcing capscrews (610) evenly until gap measures 0.125 inch over original reading.
c. Evenly tighten capscrews (608).

22. Connect coupling. Attach coupling guard.
23. Reconnect wiring to motor. Remove tags from electrical power supply. Unlock and connect electrical power supply to motor.
24. Remove tags from system valves. Open all system valves.
25. Start pump according to section V, paragraphs A and B.

**E. ADJUSTING IMPELLER CLEARANCE ON PUMP EQUIPPED WITH SEMI-OPEN IMPELLER.** To adjust impeller clearance on a pump equipped with an semi-open impeller, follow this procedure:

1. Stop pump according to section V, paragraph C. Lock out and tag the power to the driver. Remove coupling guard.
2. Disconnect coupling (42) by removing snap-wrap spider to prevent binding or loading on coupling.
3. Loosen capscrews (608) from bearing holder (37). Loosen forcing capscrews (610) from bearing holder (37).
4. Rotate shaft (6) by hand until impeller (2) just rubs casing (1).
5. Measure the gap between the bearing holder (37) and bearing frame (19). Tighten forcing capscrews (610) evenly until gap measures between 0.010 inch and 0.015 inch over original reading.
6. Evenly tighten capscrews (608).

## NOTE

Shaft setting should be checked again after pump is installed and before restarting pump. Clearance should be between 0.010 inch and 0.015 inch over original measurement of gap.

7. Recheck coupling gap and adjust if necessary. Reconnect coupling.
8. Replace the coupling guard.
9. Start pump according to section V, paragraphs A and B.

**F. REPLACEMENT OF OPTIONAL WEAR RING ON PUMP EQUIPPED WITH ENCLOSED IMPELLER.** If your pump is equipped with an enclosed impeller, it may have an optional, replaceable wear ring (7) in the suction cover (9). If your pump is equipped with the optional wear ring (7), follow these instructions for wear ring replacement.

The clearance between the wear ring (7) and impeller (2) hub will increase with wear. Internal leakage will result and pump performance will decrease. Refer to section VIII, paragraph C, step 7 and table 2.

Usually wear ring material is matched to impeller as listed in table 3.

**Table 3. Impeller and Wear Ring Matching Materials**

| IMPELLER MATERIAL | WEAR RING MATERIAL |
|---|---|
| Cast Iron | Steel |
| Bronze | Bronze |
| Stainless Steel | Alloy 20 or 17-4PH Stainless Steel |

To replace wear ring, use the following procedure:

1. Stop pump according to section V, paragraph C. Disconnect, lock out, and tag electrical power supply to motor. Disconnect wiring from motor.
2. Shut off and tag all valves controlling the flow of liquid to the tank and from the pump. If necessary, flush pump to remove corrosive or toxic pumpage.
3. Disconnect suction piping, discharge piping, and gauges as necessary.

## CAUTION

To lift motor, a hoist or suitable lifting device must be used.

4. Attach hoist to motor. Remove capscrews (607), freeing motor from motor bracket (71). Hoist motor and motor coupling half away from pump and rest on plywood or heavy cardboard.

## CAUTION

To lift pump, a hoist or suitable lifting device must be used.

5. Screw lifting eye into the tapped hole located at coupling end of pump shaft or place a strap through motor bracket (71). Attach hoisting equipment to lifting eye or strap.
6. Remove nuts (615) from studs (630) separating outer column (53) from column plate (102). Use forcing capscrews (612) to separate outer column (53) from column plate (102). Back off forcing capscrews (612).
7. Hoist pump and remove to a suitable work area.
8. Remove capscrews (611) which fasten suction cover (9) to casing (1). Carefully break joint at gasket (73). Move suction cover (9) straight out so as not to damage impeller (2) hub.
9. Remove impeller socket head capscrew (26) and impeller washer (28). The best tool to remove impeller socket head capscrew (26) is a hex wrench welded to a socket head. Impeller (2) may now be pulled from shaft. Remove impeller key (32).
10. Take suction cover (9) and impeller (2) to a work area with access to machine shop equipment.

11. Remove wear ring (7) from suction cover (9). This can be best accomplished on a lathe.
12. Inspect impeller (2) hub for damage.
13. Press new wear ring (7) into suction cover (9). Beveled edge of wear ring (7) is installed toward impeller (2).
14. Place impeller (2) on an arbor and mount between centers in a lathe or a grinder. Indicate back of impeller (2) hub to within 0.002 T.I.R. maximum to be sure arbor and impeller (2) are running square.
15. Turn wearing surface of impeller (2) until a 63 RMS or better finish is obtained.
16. Measure outside diameter of front impeller (2) hub and record the value.
17. Mount suction cover (9) with new wear ring (7) installed in a lathe. Indicate male rabbet to within 0.002 T.I.R. maximum.
18. Bore wear ring (7) to within specified tolerance listed in table 2 in section VIII, paragraph C, step 7, over recorded size of outside diameter of front impeller (2) hub.

## CAUTION

Use a new impeller socket head capscrew (26) to secure impeller (2). Impeller socket head capscrew (26) has a nylock feature and once used may not provide adequate security.

19. Install impeller (2) and impeller washer (28) on shaft and secure with a new impeller socket head capscrew (26).
20. Install gasket (73) on suction cover (9). Install suction cover (9) and secure to casing (1) with capscrews (611).

## CAUTION

To lift pump, a hoist or suitable lifting device must be used.

21. Install lifting eye into end tap or place a strap through motor bracket (71). Attach hoisting equipment to lifting eye or strap and return to pump.
22. Slowly lower pump into place. Do not force rotating element. If installed correctly it will slide in easily. Secure inner column (101) to column plate (102) with nuts (615) on studs (630).
23. Detach hoisting equipment and remove lifting eye from end tap.

## CAUTION

To lift motor, a hoist or suitable lifting device must be used.

24. Attach hoist and move motor, and motor coupling half into place on motor bracket (71) with capscrews (607).
25. If pump is equipped with an open impeller adjust impeller clearance according to paragraph E in this section. If pump is equipped with an enclosed impeller, no impeller clearance is needed if impeller (2) does not contact casing (1) when rotating element is lowered into casing (1). Evenly tighten capscrews (608).
26. If pump is equipped with an enclosed impeller and impeller (2) bumps casing (1) when rotating element is installed, follow this procedure to adjust impeller clearance:
    a. Measure the gap between the bearing holder (37) and bearing frame (19).
    b. Tighten forcing capscrews (610) evenly until gap measures 0.125 inch over original reading.
    c. Evenly tighten capscrews (608).
27. Reconnect suction piping, discharge piping, and gauges as necessary.
28. Reconnect wiring to motor. Remove tags from electrical power supply. Unlock and connect electrical power supply to motor.
29. Remove tags from system valves. Open all system valves.
30. Start pump according to section V, paragraphs A and B.

**G. PARTS INVENTORY GUIDE.** Spare parts should be kept on hand to avoid maintenance delays.

For every one to three pumps keep in stock one spare parts set, as listed in table 4.

**Table 4. Recommended Spare Parts**

| Item No. | Qty. | Description |
|---|---|---|
| 2 | 1 | Impeller |
| 7 | 1 | Wear Ring (if equipped) |
| 14 | 1 | Shaft Sleeve (if equipped) |
| 16 | 1 | Radial Bearing |
| 18 | 1 | Thrust Bearing |
| 26 | 1 | Impeller Capscrew |
| 28 | 1 | Impeller Washer |
| 32 | 1 | Impeller Key |
| 46 | 1 | Coupling Key |
| 47 | 2 | Grease Seal |
| 63 | 1 | Throat Bushing |
| 66 | 1 | Bearing Locknut |
| 69 | 1 | Bearing Lockwasher |
| 73 | 1 | Gasket |
| 89 | 1 | O-ring |

**H. PARTS ORDERING.** When ordering parts from Carver Pump Company, prompt accurate service will be provided if you include the following information.

1. Serial number of pump on nameplate.
2. Part name from table 5.
3. Item number from table 5 and figure 1.
4. Quantity of parts needed.

Carver may ship an interchangeable part that is not identical in appearance or symbol. This is done only if the part has been improved. Examine the parts carefully on receipt before questioning the factory or representative. Never return parts to the factory without authorization from Carver Pump Company.

If an impeller is ordered, specify diameter across blade tips to be sure there was not further trim on diameter than shown on Carver Pump Company records. If a motor or motor parts are ordered, specify the name of the driver manufacturer and all data on the driver nameplate.

## IX. PARTS LIST AND FIGURE.

Refer to table 5 for the parts list of the LHB Pump. For location of all parts in the list, refer to the figure 1.

**Table 5. LHB Pump Parts List**

| Item No. | Part Name | Item No. | Part Name |
|---|---|---|---|
| 1 | Casing | 2 | Impeller |
| 6 | Shaft | 7 | Wear Ring (if equipped) |
| 9 | Suction Cover | 11 | Backcover |
| 14 | Shaft Sleeve (if equipped) | 16 | Radial Bearing |
| 17 | Gland | 18 | Thrust Bearing |
| 19 | Bearing Frame | 22 | Bearing Locknut |
| 23 | Base | 26 | Impeller Capscrew |
| 28 | Impeller Washer | 32 | Impeller Key |
| 37 | Bearing Holder | 40 | Slinger |
| 42 | Coupling | 46 | Coupling Key |
| 47 | Grease Seal | 53 | Column - Outer |
| 63 | Throat Bushing | 69 | Bearing Lockwasher |
| 71 | Motor Bracket | 73 | Casing Gasket |
| 76 | Grease Fitting | 89 | O-ring - Backcover |
| 101 | Column - Inner | 102 | Column Plate |
| 176 | Snap Ring | 190 | Setscrew - Bushing |
| 191 | Setscrew - Slinger | 422 | Plug |
| 600 | Capscrew | 601 | Capscrew |
| 602 | Capscrew | 603 | Capscrew |
| 604 | Capscrew | 605 | Capscrew |
| 606 | Capscrew | 607 | Capscrew |
| 608 | Capscrew | 609 | Capscrew |
| 610 | Forcing Bolt | 611 | Capscrew |
| 612 | Forcing Bolt | 615 | Nut |
| 616 | Nut | 617 | Nut |
| 618 | Nut | 630 | Stud |
| 635 | Washer | 655 | Washer |

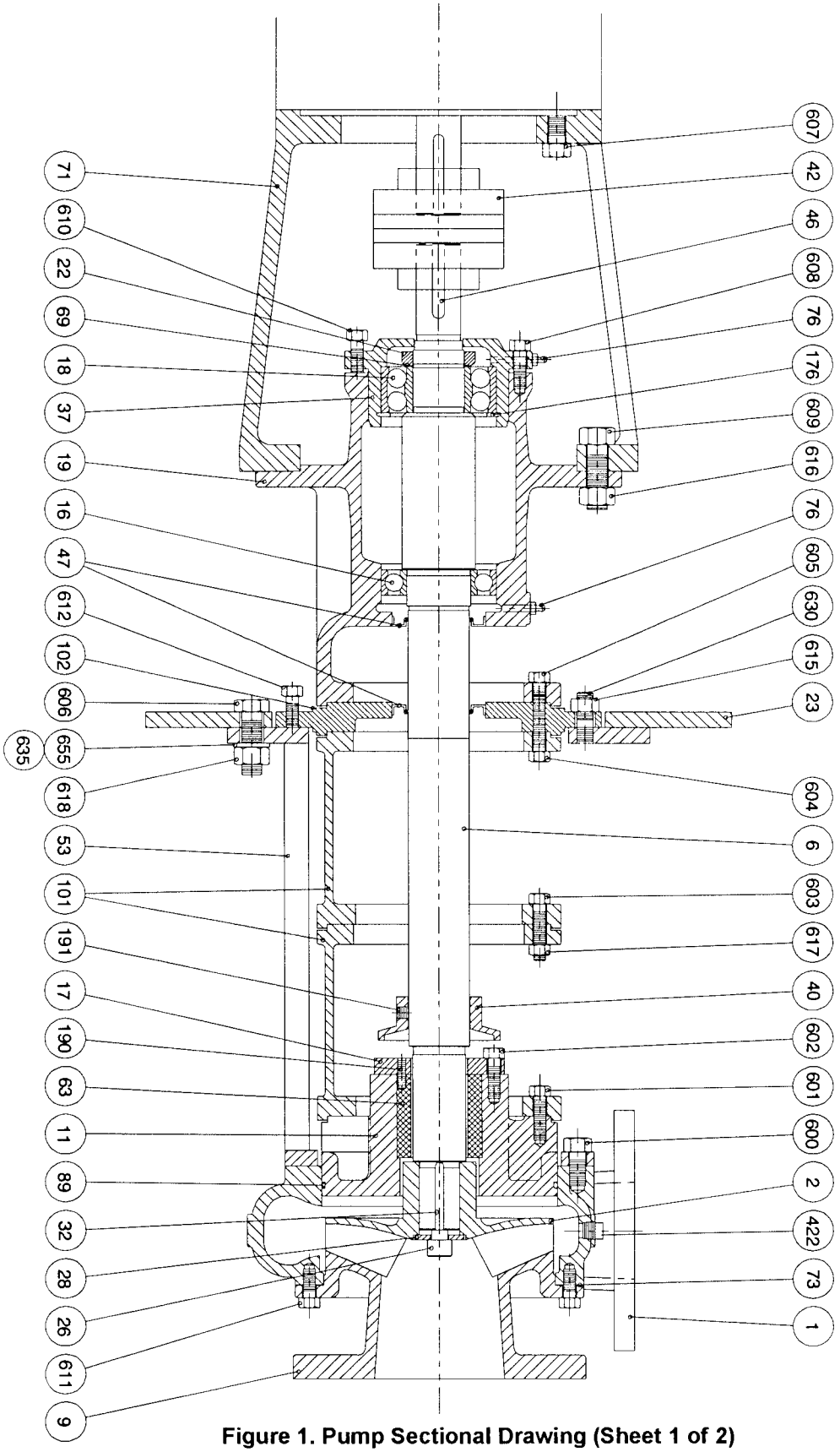
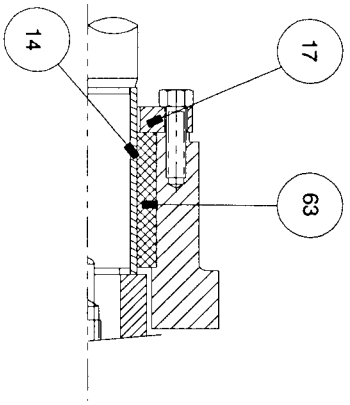
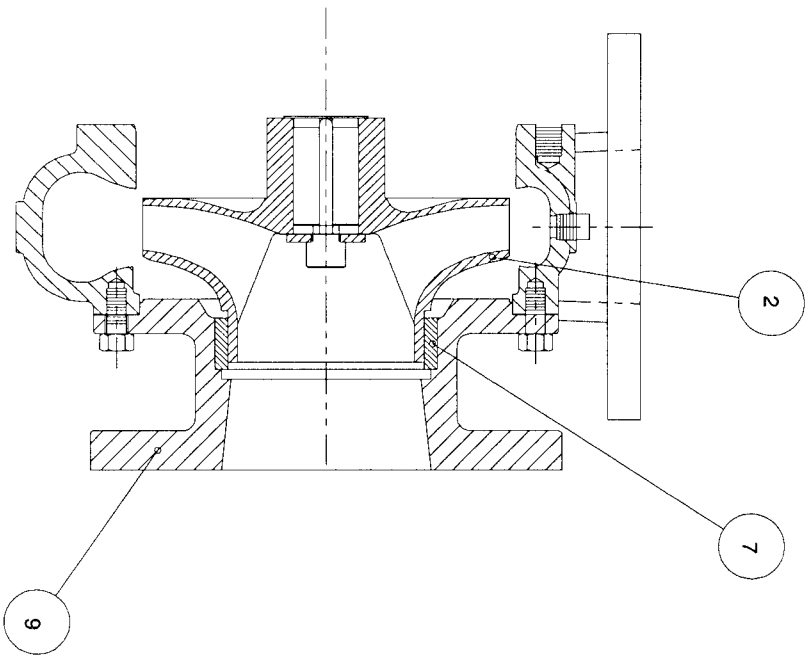



**Figure 1. Pump Sectional Drawing (Sheet 1 of 2)**




OPTIONAL SLEEVE




ENCLOSED IMPELLER WITH OPTIONAL WEAR RING

**Figure 1. Pump Sectional Drawing (Sheet 2 of 2)**

## X. Pump Service Record

Serial No. _____ Size and Type _____ Make _____

Cust.Order No. _____ Date Installed _____

| Install. Date | Location | Application |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

### PUMP RATING

Capacity (GPM) _____ Total Head (ft) _____

Suction Pressure _____ Speed (RPM) _____

Liquid _____ Temperature _____

Specific Gravity _____ Viscosity _____

Impeller Diameter (inches) _____

### PUMP MATERIALS

Casing _____ Backcover _____ Suction Cover _____

Impeller Capscrew _____ Shaft _____ Impeller _____

Bearing Frame _____ Bearing Holder _____

### MOTOR DATA

Motor _____ Make _____ Serial No. _____

Type _____ Frame _____ AC or DC _____

Volts _____ Phase _____ Cycles _____

HP _____ RPM _____

## Notes on Inspection and Repairs

| Inspect Date | Repair Time | Repairs | cost | Remarks |
|---|---|---|---|---|
| | | | | |

Notes: _____

**CARVER PUMP COMPANY**
2415 Park Avenue ● Muscatine, Iowa 52761-5691
Phone (563) 263-3410 ● Main Fax (563) 262-0509
Marketing Fax (563) 262-0510
E-Mail: carverpump@muscanet.com
WEB: www.carverpump.com

**January 2000**