

# SERIES 'B' VERTICAL CPVC SUMP PUMPS

## MODELS

B1½ x 1

B1½ x 2

B1½ x 3

Refer to Product Bulletin P-303 and  
Parts List P-3125.

**CAUTION:** It is important that the entire contents of this booklet be studied before installation.

All parts of the pump below the mounting plate are constructed of corrosion resistant non-metallic materials except the pump shaft and bearing fasteners. The shaft is stainless steel, sleeved with CPVC, with titanium fasteners at each bearing. The major parts are made from CPVC. These parts have been carefully designed to safely handle all operating loads anticipated. They should still be treated with care, to avoid damage to the pump. All piping must be independently supported and all temporary external loads on the pump must be avoided. Be careful not to over-tighten the fasteners used on the pump. Please pay strict attention to the maximum torque values listed below for the various fasteners.

**Auxiliary connections: (Bearing lubricated lines)**

**Do not install metal pipe fittings directly onto pipe connections on non-metallic parts. These items are polypropylene and included with pump.**

**Pump bolting:**

All plastic bolting below mounting plate not to exceed 10 foot-pounds torque. All metal bolting at underside of mounting plate not to exceed 20 foot-pounds torque.

## SAFETY

**!** This manual contains instruction for installation, operation and maintenance of your Series 'B' centrifugal pump. It has been designed to provide safe and reliable service. However, it is both a pressure vessel and a piece of rotating machinery. Therefore, the operator(s) must exercise good judgment and proper safety practices to avoid damage to the equipment and surroundings and prevent personal injury. The instructions in this manual are intended for personnel with a general training in operation and maintenance of centrifugal pumps.

## INSTALLATION, OPERATION AND MAINTENANCE

In these instructions you will encounter the words **WARNING**, **CAUTION** and **NOTE**. These are intended to emphasize certain areas of personal safety and satisfactory pump operation and maintenance. The definitions of these words are as follows:

**!** **WARNING:** - An operating procedure, practice, etc. which, if not correctly followed, could result in personal injury, or loss of life.

**!** **CAUTION:** - An operating procedure, practice, etc. which, if not strictly observed, could result in damage to, or destruction of, equipment.

**NOTE:** - An operating procedure, condition, etc. which is essential to highlight.

## SAFETY PRECAUTIONS BEFORE STARTING PUMP

1. Read operating instruction and instructions supplied with chemicals to be used.
2. Refer to 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 of pump.
6. Always close valves slowly to avoid hydraulic shock.
7. Ensure that all fittings and connections are properly tightened.

## 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. Verify compatibility of materials as stated in Item 2, Page 1.
4. Shut off power to motor at disconnect switch.

## IMPORTANT:

1. Even though you have determined that CPVC is chemically compatible with the solution, care should be taken to protect the pump components against unnecessary wear and physical abuse.
2. For pumps operated with flow type or probe type level controls, refer to supplemental Operating Instructions O-380 before energizing motor.
3. Record all models and serial numbers for future reference. This information will be required when contacting the Application Engineering Department.
4. Pump should be handled with care when removing from shipping crate, or when placing pump in tank or sump.

## APPLICATION

The pump has been designed to operate safely and reliably under normal service conditions. It is extremely important that the pump be used within the limits specified in the following sections of this instruction book:

The corrosion-resistant non-metallic "wet-ends" of the pump were designed to handle a wide variety of liquids; however, do not use this pump on any other service than that for which it was intended without first checking a Chemical Resistance Data Chart and other appropriate sources to determine its applicability and suitability for any change in service.

**FLOW, PRESSURE, TEMPERATURE<sup>1</sup> CONNECTIONS**

MODEL	MAX FLOW GPM	MAX FT. TDH	MAX PSI	INLET NPT	OUTLET NPT	MAX OPER. TEMP <sup>2</sup>	BEARING COOLING WATER SUPPLY
B1½ x 1	150	47	20	3	2	160°F	¼" NPT
B1½ x 2	160	52	22	3	2	(71°C)	
B1½ x 3	180	54	23	3	2		

<sup>1</sup> Refer to Corrosion Resistance Guide for temperature limits of specific chemicals. Minimum temperature = 0°F or 5° above freezing temperature of the solution.

<sup>2</sup> Refer to bearing material in Table below.

**MATERIALS IN SOLUTION CONTACT**

ITEM	MATERIAL	ITEM	MATERIAL
Pump column	CPVC	Bearing	Graphite 160°F or Rulon 140°F
Shaft sleeve		Fasteners for bearing	Titanium or Hastelloy C 257
Casing, impeller		Suction strainer	Polyethylene
Discharge pipe (if ordered) & casing bolts		Bearing cooling lines	Polypropylene
"O"-rings	EPDM or Viton		
Liner	Silica-free ceramic		

**CHECK UPON ARRIVAL**

The unit should be inspected immediately upon arrival, and any irregularities arising due to shipment should be reported to the carrier.

Care should be taken when unpacking pumps (see "Uncrating" and "Handling"). A copy of this instruction book as well as instruction sheets for other various components (such as driver) will be included in the shipment. Put these papers in a safe, accessible place for ready reference when required. It is important that the entire contents of this booklet be studied before installation.

Pump parts and accessories may be packed inside shipping containers, or attached to skids in individual packages. Inspect all containers, crates and skids before discarding.

**STORAGE**

The pump is protected against contamination for the period of shipment and installation only.

If the pump is not to be installed at once, find a clean, dry location for storage. Unit should be stored in an approximately level position with no strains applied. Protective coverings should be left in place. The pump should be left in its shipping container or skid for storage.

Pumps are furnished with a corrosion-resistant shaft material and CPVC sleeved so no special preservation measures are required.

**UNCRATING**

Raise shipping skid/crate into vertical position (driver end up) before uncrating and removing pump. Do not sling on the pump column or motor support to raise into the

vertical position. Sling on either the shipping skid itself or the pump mounting plate.

Remove only enough of the skid/crate to allow access to all the foundation holes on the pump mounting plate. Install eyebolts in 3 or 4 of the foundation holes in the pump mounting plate. Use large flat washers on both sides of the mounting plate when installing eyebolts. Carefully sling pump using these eyebolts. Use a spreader between slings to prevent damage to the motor support when lifting.

Remove rest of shipping crate.

**HANDLING**

Pump should be handled only in the vertical position.

Use care when moving pumps. Rough handling of the pump can cause breakage or permanent misalignment. Take care that bearing lubrication lines will not be bent or damaged when handling.

Do not handle the pump by using the motor support. Use the pump mounting plate, whether lifting the pump alone or the pump/motor combination. The motor eyebolts should be used only to lift the motor by itself.

Make sure that any equipment used to lift the pump or any of its components is capable of supporting the weights encountered. Make sure that all parts are properly rigged before attempting to lift.

**CLEANING THE PUMP**

Before putting the pump into operation, the liquid end of the pump should be flushed out with water to

## LOCATION

In the initial consideration of sump pump location, attention should be paid to room and facilities to lift and install the pump, plus access to auxiliary sources such as electrical power, air and water, if required.

Also important, especially in the larger-flow units, is proper sump design. Liquid velocity approaching the pump should be one foot per second or less. When more than one pump is installed and used at the same time in the same sump, the location and spacing of the pumps is important.

The guidelines for sump design and pump placement as outlined in "Hydraulic Institute Standards" are recommended.

Proper pump submergence will prevent pumping troubles due to air or gas being drawn into the pump or vortexing of the liquid as it enters the pump. Minimum liquid level should not be confused with NPSH, since in some cases the NPSHR of the pump could be greater than the pump submergence.

Pumps furnished with suction extensions should be used only on draw-down and stop service with optional level control.

**⚠ CAUTION:** Liquid level in sump must be above pump casing whenever pump is started.

## FACTORY ASSEMBLY AND TEST

All Series 'B' Pumps are factory checked and tested for alignment, free rotation, flow, TDH and current draw, to assure the assembly meets performance specifications.

Handling during shipment, storage, or preparation for installation could have caused distortions resulting in pump shaft binding or disabling damage. If either situation occurs, DO NOT install or operate until corrected.

When installing auxiliary equipment on the pump (such as float controls and Dri-Stop protector) or while lowering the pump into the pit, check all bolts and nuts for tightness. Check to see that the discharge pipe is not causing any distortions to the pump or column which could cause shaft binding.

## FIELD ASSEMBLY

Pumps are shipped completely assembled. Depending on model ordered, float controls may or may not be pump mounted. Some optional equipment, when specified, would be shipped loose.

Assemble float control equipment (if furnished) following the instructions packed with equipment. The stops should be set in accordance with maximum and minimum liquid levels desired and required. Float rods are furnished in specified length to match pump.

## PUMP MOUNTING

The pump may be mounted directly on the pit using the pump mounting plate or in conjunction with a pit cover.

Carefully lower the assembled pump into the pit, taking care not to damage lube lines or float control equipment.

Make sure that any equipment used to lift the pump or any of its components is capable of supporting the weights encountered. Make sure that all parts are properly rigged before attempting to lift.

Pump mounting plate and/or pit cover must be level, and supported evenly at all points before being bolted down.

The foundation for the mounting plate or pit cover must be sufficiently rigid to prevent vibration. Supporting members must be sufficiently strong to prevent spring action and /or lateral movement.

## ELECTRICAL

With power off and solution in sump and water in bearing cooling lines:

Rotate the motor shaft by hand to make sure it is free to rotate when energized.

Connect the motor terminals to the leads from the starter panel.

Start the motor, immediately hit the stop button, check for proper rotation which should be clockwise when looking down on top of the motor. If rotation is wrong, interchange any two motor connections on three-phase motors. On single-phase motors, follow the motor manufacturer's instructions. After changing the connections, again check the rotation.

Failure to follow this instruction can result in serious damage to pump and driver if rotation is wrong.

## PIPING

**⚠ NOTE:**  
The design of piping systems, foundations and other areas of system design is the responsibility of customer. This data and comments are offered as an aid, but we cannot assume responsibility for the installation design and operation.  
We recommend that the customer consult a specialist skilled in the design of piping, sumps and related systems so as to supplement and interpret the information and ensure a successful installation .

Use discharge piping one size larger than the pump discharge or terminal end of discharge pipe assembly.

Discharge piping should be connected to the pump such that no strain or weight of the piping is carried by the pump. Check pump shaft for freedom of rotation by hand to make sure discharge piping strain is not causing binding.

A check valve is required to prevent back-flow through the pump on shut-down. Manufacturer will not be responsible for damages resulting from failure to install a check valve.

**NOTE:** If quick-closing valves are installed in the discharge piping system, protection MUST be provided to ensure that no surge or waterhammer is transmitted to the pump.

## PRE-STARTING CHECKS

Motor preparation

Prepare the driver for operation as instructed by the driver manufacturer. Re-check all connections to the motor and control with the wiring diagram. Make sure voltage and frequency on the motor and control nameplates correspond with the line voltage. Bearings are sealed. Lubrication is not required.

If the driver has not been checked for rotation, it must be done now.

### PRE-START-UP

1. Verify that materials of construction are compatible with solution being pumped. Refer to Page 2.
2. Verify that operating temperature is not in excess of maximum recommended. Refer to Page 2.
3. Carefully place pump into sump or tank and secure in position using bolts, clamps, etc. Check alignment and position of level controls as instructed above.
4. Connect electrical supply to motor starter. If starter is furnished, verify that starter and motor are wired for the correct operating voltage, and the starter contains the correct overload heaters. It is recommended that a motor starter be installed if one was not provided with the pump assembly.
5. If mounting plate bolts or pump-motor lock nuts are loosened, PUMP ALIGNMENT must be checked. Refer to PUMP SERVICE.
6. DO NOT ENERGIZE MOTOR UNTIL PUMP IS IMMERSSED IN LIQUID AND THEN FOLLOW START-UP NO.1.
7. Standard pump is shipped with bleed line for external water flush to bearings. Bearing cooling water must be provided, or convert pump to solution flush. Refer to PUMP BEARING LUBRICATION.
8. Secure the assembly, complete all piping and firmly support.
9. Check for correct high-low operation of level control by manually positioning float rod or a current check of conductivity level controls.
10. Check for correct operation of motor starter and Dri-Stop when included.

### WATER-LUBRICATED PUMP BEARINGS

Clean water from an external source must be used when pumps are furnished with bearings for which water lubrication is required.

Check to see that connections are made to bearing lubrication fittings on pump mounting plate, and that ½ GPM of water per bearing at 10 PSIG is available. Do not install metal pipe fittings directly onto pipe connections on non-metallic parts.

Check to see that no damage has occurred to the lubrication lines during shipment or installation.

### OPERATION & START-UP

After all pre-starting checks have been performed, the pump is ready to start. Observe the following procedure to put the pump into operation:

1. Rotate the pump shaft by hand through at least one complete revolution to see that there is no rub

or bind.

2. Close, or leave open very slightly, the control valve in the discharge line.
3. If water-lubricated bearings are used, turn on water supply to the bearings.
4. Start the motor.
5. As soon as the pump is up to rated speed, slowly open the discharge valve to desired capacity or pressure.

### OPERATING CHECKS

Costly shut-downs will be avoided by making routine checks on pump operation.

1. Check to see if liquid is being discharged. A discharge pressure gauge is an easy way to check whether or not the liquid is being pumped. Compare discharge pressure to pump flow curve to determine flow rate. If, at any time, the gauge should drop to zero, or register an abnormally high pressure, shut down the pump immediately.
2. Observe pump for any abnormal noise or vibration. Any CHANGE in pump noise or vibration will require shut down and inspection
3. At maximum flow conditions, measure amperage on all lines. If in excess of motor nameplate ratings, stop and consult factory.
4. Pump bearing lubricating water flow should be checked frequently and before each start up.

### STOPPING THE PUMP

Normal operation of level controls will stop and start the pump when MANUAL-OFF-AUTO motor starter is at AUTO position. When performing maintenance, turn starter to OFF, disconnect electrical supply and follow standard safety procedures.

**CAUTION:** When operating for some time at reduced capacity, much of the pump horsepower will go to the liquid in the form of heat. A bypass must be provided under these conditions to prevent the liquid in the pump from becoming hot enough to vaporize. Damage to pump may result from prolonged operations at reduced capacities. See MINIMUM FLOW.

**WARNING:** In the interest of operator safety, the unit must not be operated above the nameplate conditions. Such operation could result in unit failure causing injury to operating personnel. Consult instruction book for proper operation and maintenance of the pump and its supporting components.

### MINIMUM FLOW

Always maintain sufficient flow through the pump to prevent flashing of the liquid passing through the pump. At low flows, a large proportion of the horsepower input is absorbed by the liquid as heat, so the flow must be maintained at a point sufficient to keep the temperature rise through the pump within a safe limit.

**CAUTION:** Damage to pump may result from prolonged operations at reduced capacities.

In addition to heat rise considerations for minimum flow, there is also a minimum flow requirement for mechanical protection of the pump. Damage to the pump may occur at reduced capacities due to increased hydraulic thrust loads. These higher loads cause increased vibration and shaft deflection, and decreased bearing life. Also encountered at low flows is the damage which could be done by erosive swirl. At low flows, much of the pumped liquid is recirculated through the pump. This can result in localized damage to the pump by erosive action particularly when pumping light slurries or "dirty" liquids.

Both heat rise and mechanical protection must be considered when determining correct minimum flow. The pump has been designed to operate at low flows without problems due to hydraulic thrust; however, the following table lists minimum flow required for satisfactory operation and pump life.

PUMP SIZE	MINIMUM FLOW
B1½ x 1	20 GPM
B1½ x 2	20 GPM
B1½ x 3	20 GPM

## TROUBLE CHART

If any of the following troubles are encountered, they may be due to the causes listed below.

<p><b>No liquid delivered:</b></p> <ol style="list-style-type: none"> <li>Liquid level in sump too low (pump casing not submerged).</li> <li>Speed too low - check motor voltage.</li> <li>Air or gas in liquid.</li> <li>Strainer clogged.</li> <li>Impeller clogged.</li> <li>Casing or discharge line clogged.</li> <li>Wrong direction of rotation.</li> <li>Discharge valve closed; check valve installed backwards (or stuck)</li> <li>Not enough NPSH available</li> </ol> <p><b>Not enough pressure:</b></p> <ol style="list-style-type: none"> <li>Liquid level in sump too low (pump casing not properly submerged)</li> <li>Speed too low - check motor voltage</li> <li>Air or gas in liquid</li> <li>Wrong direction of rotation</li> <li>Impeller partially clogged or damaged</li> <li>Excessive impeller running clearance</li> <li>Liquid vortexing in sump.</li> </ol>	<p><b>Not enough liquid delivered:</b></p> <ol style="list-style-type: none"> <li>Liquid level in sump too low (pump casing not properly submerged)</li> <li>Speed too low- check motor voltage</li> <li>Air or gas in liquid.</li> <li>Strainer partially clogged.</li> <li>Impeller partially clogged or damaged.</li> <li>Casing or discharge line partially clogged.</li> <li>Wrong direction of rotation.</li> <li>Discharge valve partially closed.</li> <li>Not enough NPSH available.</li> <li>Discharge head too high.</li> <li>Excessive impeller running clearance.</li> <li>Liquid vortexing in sump.</li> </ol>	<p><b>Pump uses too much power:</b></p> <ol style="list-style-type: none"> <li>Speed too high</li> <li>Head lower than rating (allows pump to handle too much liquid)</li> <li>Liquid heavier and more viscous than rating.</li> <li>Rotor binding.</li> <li>Impeller dragging.</li> <li>Wrong direction of rotation.</li> </ol> <p><b>Excessive vibration:</b></p> <ol style="list-style-type: none"> <li>Air or gas in liquid.</li> <li>Badly worn bearings.</li> <li>Bent shaft.</li> <li>Pump running backwards.</li> <li>Impeller plugged or damaged.</li> <li>Pump foundation not rigid.</li> <li>Liquid level in sump too low (pump casing not properly submerged).</li> <li>Not enough NPSH available.</li> <li>Pump and driver shafts misaligned.</li> <li>Liquid vortexing in sump.</li> </ol>
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## MAINTENANCE

**WARNING:** Do not attempt any maintenance, inspection, repair or cleaning in the vicinity of rotating equipment. Such action could result in personal injury to operating personnel.

Before attempting any inspection or repair on the pump, the driver controls must be in the "OFF" position, locked and tagged to prevent injury to personnel performing service on the pump.

## PREVENTIVE MAINTENANCE

Pumps are ruggedly constructed, and with proper care will give years of satisfactory service. It is recommended that operating personnel become familiar with "Operating Checks" described previously in this book, and that these checks be made as a matter of routine.

Periodically, depending upon your service schedule, the unit should be dismantled, and all internal parts and passages cleaned and inspected for wear. Any foreign matter found in the pump should be removed, and all excessively worn parts replaced.

Manufacturer assumes no responsibility or liability for improper start-up, unattended pump operation or routine inspection performance checks or maintenance.

The following is a list of normal maintenance procedures that might be performed between major overhauls:

### **PUMP BEARING LUBRICATION**

Each bearing has a lubrication line that terminates in a manifold above the mounting plate for external water supply to the ¼" NPT connections in the manifold. For product flush make connection from pump discharge to manifold block.

#### **PUMP BEARING LUBRICATION - WATER**

Check frequently to see that water is flowing to pump bearings. Water lubrication is needed to dissipate heat and abrasives. Some bearings may always or temporarily be above solution level. Flow of water lubrication must be checked.

To prevent motor from being energized without proper and adequate water lubrication to bearings, a DRI-STOP 2 flow switch can be installed in the water to manifold. If this pump protector device was included with pump assembly, then refer to Operating Instructions and Service Guide O-1685, which is included with the DRI-STOP.

#### **PUMP BEARING LUBRICATION - PRODUCT**

Pumps furnished with pumped-product bearing lubrication need no maintenance checks other than observing that product is flowing to bearings when motor is energized. If no flow to bearing then immediately deenergize motor, clean and flush bearing tubing and fitting. Refer to Page 8.

**⚠ WARNING:** Operation of the unit without proper lubrication can result in overheating of the bearings, bearing failures, pump seizures and actual breakup of the equipment exposing operating personnel to personal injury.

### **OVERHAUL INSTRUCTIONS**

Use extreme care in removing and dismantling pump. Refer to pump assembly drawing for part nomenclature.

1. Close control valve in discharge line.
2. Lock out power supply to driver.
3. Disconnect all electrical connections.
4. Disconnect any external auxiliary piping connections.
5. Disconnect discharge piping from pump.
6. Unbolt pump support plate and lift pump from pit (let casing drain thoroughly before removing pump completely).
7. Remove liquid level controls (if any).
8. Lay pump horizontally on supports.

### **IMPORTANT**

These models have gravity lubricated bearings which means the cooling/lubrication solution enters pump column above the bearing assembly.

### **CLEANING AND INSPECTION**

All parts should be clean for inspection and reassembly. Wash all parts and spread them out in a clean area. Dry the parts with compressed air or lint-free cloths and carefully inspect them as described below. Discard "O"-rings and gaskets, as new ones should be used during reassembly.

1. Inspect impeller for excessive wear and etching due to corrosion. Large nicks and deep pits will unbalance the impeller and cause vibration and wear in other parts of the pump. Be sure "O"-ring sealing surface and polygon area are clean.
2. Check pump shaft for straightness. Inspect the surface of the shaft in the bearing areas to make sure it is smooth. It must be free of grooves, scratches, corrosion or wear. Check ends of shaft for burrs. Make sure that shaft threads are clean.
3. Inspect casing thoroughly, removing all burrs and foreign matter. Check hydraulic passages for cleanliness.
4. Check all other parts for burrs, wear, damage or corrosion.
5. Inspect inside diameter of bearings. Check for cracks, uneven or excessive wear, scoring or heat discoloration, and corrosion. Bearings should be replaced in accordance with the instructions given.

### **PUMP SERVICE**

The only parts considered for normal replacement are the ceramic casing liner and the rotating bearings (2) (Rulon or graphite) for each bearing assembly. Under abnormal conditions of service these components, the impeller, the impeller sleeve assembly and even the stainless steel drive shaft may fail prematurely. Major causes for premature failure are:

1. Clogged suction strainer.
2. Clogged cooling/lubricating lines to bearings when product flushed.
3. Failure of water supply to bearings when water lubricated
4. Motor energized before suction casing is immersed in solution.
5. Incorrect direction of rotation.

Recommended spare replacement parts are identified on the Parts List.

Before proceeding with pump service, be sure the assembly is disconnected from piping and electrical, drained and flushed.

### A. TO REPLACE IMPELLER

1. Loosen and remove casing bolts and lock nuts. Remove suction casing and "O"-ring. Note correct position of suction casing for reassembly.
2. Measure and record clearance between back of impeller and pump housing. Distance should be  $3/8" \pm 1/16"$ .
3. With vise grips or channel lock pliers, hold pump shaft just below motor (or hold motor armature at fan blade). With a monkey wrench across the impeller hub, turn the impeller-sleeve-bearing assembly in a counter-clockwise direction until the assembly is unscrewed from the pump shaft, and remove with care.
4. With vise grips or channel lock pliers, grip sleeve assembly (above button bearing). The impeller may be turned in a clockwise direction (left hand thread) with monkey wrench across impeller hub to unscrew and separate impeller from sleeve.
5. Thread new impeller to sleeve and tighten.
6. Replace impeller-sleeve-bearing assembly to drive shaft and tighten to same  $3/8"$  clearance dimension between back of impeller and pump housing.
7. Reassemble suction casing and if removed, replace fan blade and fan housing.

### B. TO REPLACE BEARING

1. Review Section A above and proceed with steps 1 - 4 to replace bottom bearing which consists of two bearing rings.
2. Note position angle of grooves and slide old bearings off sleeve. Replace with new bearings, noting location of keyway and correct angle of grooves. Refer to Figure 5.
3. If pump has only a single bearing, then proceed to reassemble according to Section A steps 5 -7. For replacement of multiple bearings, continue with Step 4 below.
4. Second and third pair of bearing rings are removed by loosening setscrew on collars and ring retainers, then sliding them off bottom (open end) of shaft sleeve.
5. Install new bearing ring, lock collars and retainers.
6. Reassemble per Section A steps 5-7.

### C. TO REPLACE LOWER CERAMIC LINER

1. Refer to Section A, steps 1-3 to remove impeller-sleeve-bearing assembly.
2. Remove fan cover and fan blade. Place pump-motor in an upside down vertical position. A 4" long section of 6" diameter pipe will serve as a steady support and keep the motor shaft from resting on floor.
3. Loosen and remove four flange lock nuts (B). Refer to Figure 2.
4. Remove mounting plate, if provided, and remove column assembly by lifting over pump shaft.
5. Loosen and remove lock screws which are securing the ceramic liner. Remove liner by sliding down, pulling or breaking. 6. Replace liner, lock in position with setscrews.

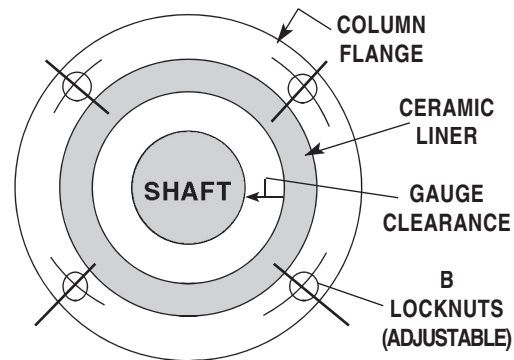


FIGURE 1

7. To reinstall original column assembly, refer to Section E.

### D. TO REPLACE MIDDLE AND UPPER CERAMIC LINERS

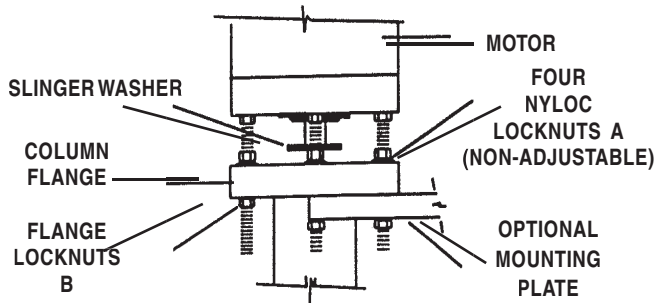
1. Follow preceding instructions Section C steps 1-7.
2. Remove setscrew at the column coupling. Disconnect lubrication bleed line by loosening hex nut on fittings. Remove lower column which is attached to discharge housing by using chain pipe wrenches on each section of column. Turn lower section only. Liner is in lower section and is removed by taking out the two setscrews holding the liner in place. If your pump has three or more liners, use the same procedure for removing the additional liners and replacing with new. Column assemblies can also be separated by positioning two 1/2" diameter x 18" long steel rods through the holes in columns and using a reverse lever.
3. Reassemble and tighten column sections.

### E. TO REINSTALL COLUMN ASSEMBLY

1. With all column sections tightened together, bring column assembly over shaft and down onto the four motor mounting studs. Note, motor and shaft are in the inverted vertical position.
2. Snug lock nuts B against column flange or mounting plate.
3. Using an inside dividers, gauge clearance between O.D. of shaft and I.D. of ceramic liner. Equalize clearance by adjusting opposite lock nuts B. Refer to Figure 1. DO NOT MAKE ANY ADJUSTMENT TO NYLON LOCK NUTS A.
4. Refer to Section A steps 6 & 7 to install impellersleeve-bearing to shaft and mount suction casing to column assembly.

**F. TO REPLACE SECTIONS OF PUMP COLUMN**

1. Follow disassembly instructions A to D except replace old sections of column with new sections.
2. Reassemble per Section E instructions.



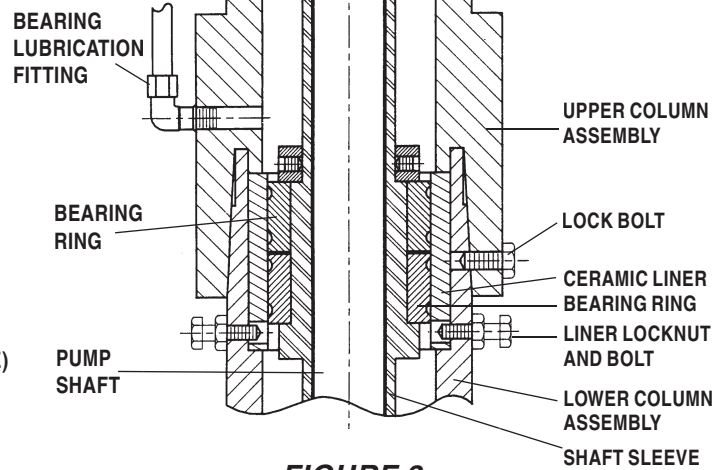
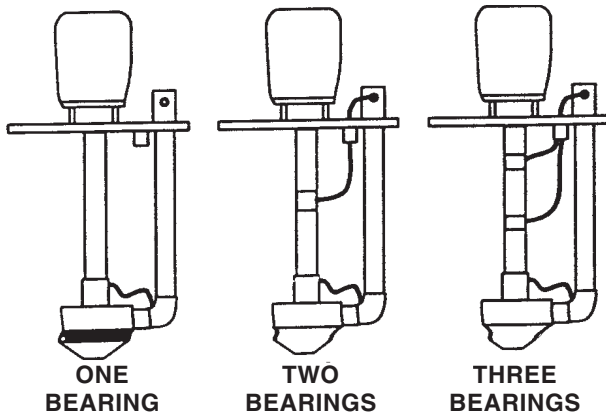
**FIGURE 2**

**COLUMN FLANGE ASSEMBLY BOLTED TO MOTOR  
(SHOWN WITH AND WITHOUT MOUNTING PLATE)**

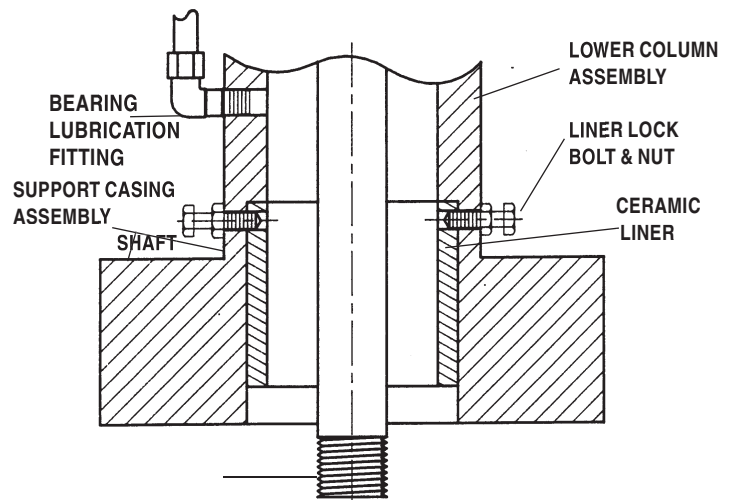
**G. TO REPLACE PUMP SHAFT**

1. Follow Pump Service sections A to D for disassembly instructions..
2. Remove old pump shaft by unthreading from motorshaft. Hold motor shaft at fan blade end with vise grips.
3. Check for shaft tip concentricity by hand rotating shaft and gauging tip for eccentric rotation. Use a dial indicator to check shaft tip run-out. If eccentricity is greater than .003 T.I.R., shaft should be straightened. Push down on the tip of the shaft at the point of maximum run-out. Repeat this operation until shaft is within .003 T.I.R.
4. Install pump column assembly and other components per Section E instruction.

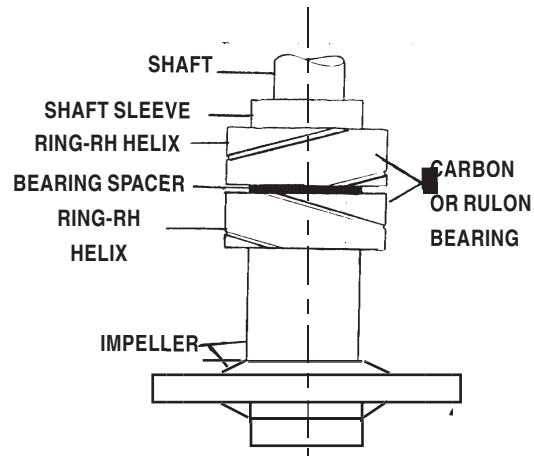
**PRODUCT FLUSH LUBRICATION OF BEARINGS**



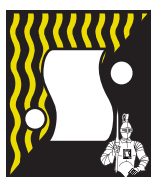
**FIGURE 3**



**FIGURE 4**



**FIGURE 5**



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