



SERVICE INSTRUCTIONS FOR THE  
CHICAGO PUMP TYPE HBB  
AND VOS NON-CLOG PUMPS

FRAME: SP5

READ INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR OPERATING THIS UNIT. KEEP THIS BOOKLET IN THE INSTRUCTION ENVELOPE. DO NOT DESTROY.

If these instructions should be lost or soiled, a new copy may be procured from the Chicago Pump Company by writing for it and stating number of the unit as indicated on the pump nameplate. For part numbers and names of parts, see parts list and illustrations.

UPON RECEIPT OF PUMP EQUIPMENT: Check carefully to see that all equipment has been received and is in good condition. Immediately report any shortage or damage to the transportation company handling the shipment noting the extent of damage and/or shortage on the freight bill and bill of lading. Do not leave the unit exposed to construction or weather hazards where pump may be damaged mechanically or motor and ball bearings become wet. This pump is well designed, skillfully built and rugged, but must be given the same careful attention that is accorded to any precision machine.

NOTE: If the pump is to be stored for a prolonged period before installation, rotate the pump shaft manually every two weeks until the unit is placed in operation.

INSTALLATION

LOCATION: Both pump and motor should be located in a clean drained area where they are accessible for installation, inspection and maintenance. This location should be dry and well ventilated. Overhead room and facilities must allow for installing and removing the pump or motor for repairs.

PUMP FOUNDATIONS: For permanence and quiet operation, it is important that the pump be firmly bolted down. Figure 2 illustrates the generally accepted method of anchorage. This system traps the bolt for anchorage, at the same time permits the bolt to move within the sleeve for aligning with the holes in the pump base. The bolts are fastened to the template form, usually made of wood, and spaced to conform accurately with the pedestal anchor bolt holes. The form is carefully located so that the pump will stand exactly in its specified position as to elevation, shaft plumb, and suction-discharge pipe connections; then the concrete is poured. Before fixing foundation bolts into the form, plug top and bottom of the sleeves with oakum as illustrated, and be certain that sleeves are held rigid against square plates. This permits the bolts to be adjusted slightly after concrete has set allowing the bolts to conform accurately with pedestal bolt holes. This prevents strains or difficulties arising from slight dimensional discrepancies. Pipe sleeves should be about two and one half diameters larger than the bolts used, and the bolts must be long enough to permit the pump to be raised 1" before grouting.

If a raised foundation is desired, it should be at least 6" greater in length and width than the base of the pump pedestal and at least deep enough to "bury" the recommended anchorage. It should never be superficially poured over a smooth concrete floor but should be rooted by one of the following means: (a) when the concrete is newly poured, cast a shallow depression in the floor using a box form, (b) leave reinforcement bars protruding above the floor level, or (c) gouge holes in an existing concrete floor.

**SETTING THE PUMP:** Set pump on the foundation over the anchor bolts, but do not bolt down. Raise the pump unit 1" and level carefully for grouting by driving wedges under the pedestal. For leveling pump, place level on face of pump coupling half and face of pump discharge flange.

**GROUTING THE PUMP:** After pump is raised and leveled, pour a good quality grout under the pedestal and allow it to set; to prevent distortion, do not tighten down the nuts on the foundation bolts until the grout is properly hardened. When the pump is correctly installed, bring the suction and discharge piping to the pump connection; never force pump connections to install piping.

It is important that grouting underneath the base of a horizontal pump be carried out by pouring concrete into the large opening in the center of all pump bases, otherwise the procedure is similar to the description given above for the vertical units.

**PIPING:** To obtain a well designed pipe system, note the following piping recommendations:

1. Make pipe connections to the pump so that there is no pipe strain upon the unit. Support the weight of piping on suitable concrete piers or on supporting pipes with flanged feet.
2. When running a pipe through a concrete wall leave a generous, grooved, square hole and grout the pipe in only after the pipe unit is set and all final connections have been made.
3. Suction and discharge pipe lines should not be smaller in size than the connections on the pump; it is preferred that they be at least a pipe size or two larger.
4. In the suction pipe line include a gate valve near the pump, and employ Chicago Flexible Pipe Connections (see Fig. 4) for ease in making final connections and to prevent pipe strain due to settling of concrete.

NOTE: The weight of the gate valve may produce a strain on the suction piping; therefore, the suction piping should be supported on concrete piers, support pipes or hangers.

5. On the discharge line include a suitable swing check valve and a gate valve near the pump.

NOTE: It is common practice, where horizontal space does not permit, to mount swing check valve in a vertical position.

6. On vertical units install a drain pipe from the connection at the packing box drip pocket to the sump line. To be readily cleanable, include a union in the line near the pump; also, tees with plugs should be used rather than elbows.

## Type VOS Pumps:

**TO INSTALL UNIVERSAL JOINT SHAFTING:** When installing extended shafting with universal joints, always place the "A" section with the slip spline end (at the bottom) with spline next to the pump. When more than one section is provided, the order of connection is evident from the connection fittings provided and from the installation drawing; the opposite shafting ends are fixed to the pump and motor shafts by means of keyed couplings held with set screws. Connect the shaft sections and align them approximately, fixing the shafting temporarily but firmly to the bearing support beams by clamping the intermediate guide or steady bearings to the beams with a sufficient number of "C" clamps. **CAUTION!** One side of the intermediate bearing housing has a drilled drainage hole. Be sure when installing, that this bearing is installed properly to provide drainage of top side of bearing. When all sections are joined, align each section separately with a level as accurately as possible, starting from the bottom and using metal shims behind the steady bearings where necessary. Although universal joints will compensate for considerable misalignment, for maximum efficiency, it is desirable to obtain as exact an alignment as possible. (See Fig. 3 for proper method of installation.)

In making final adjustments, the slip spline should be spaced as near as possible to the mid point of its slip or end play, there must be enough slip to separate the flexible shafting from the pump coupling. Steady bearings are of the self-aligning type, perfect leveling of the bearings is not necessary; and since steady bearings are not provided to stand end-thrust, the shafting weight should be taken up by the motor bearings. When alignment is completed, drill holes in the bearing supports and bolt bearings in place. Remove "C" clamps.

**NOTE:** When installing a double universal joint assembly ("A" Section), it is important that both of the universal joints operate at equal angles, as shown in Fig. 3. It is also important that the slip joint be assembled to the slip stub so that the slip yoke and the yoke welded to the tube are in the same plane.

**SETTING AND ALIGNING THE MOTOR ASSEMBLY:** (See Fig. 1) The motor is mounted on a tripod. Set the tripod over the floor hole; position the universal shafting to the motor coupling, set and shim the motor assembly so that it is level and the shaft alignment below is maintained.

**IMPORTANT:** The motor must support the weight of the line shafting. The motor coupling half should be installed in a fixed position to carry the weight of the line shaft. (See Fig. 1). You will note that the coupling half has been provided with two set screws located 180° apart. One set screw is directly over the keyway and locks the key in place. The other set screw **MUST** seat itself firmly into the motor shaft.

**WIRING:** Connect the electric service to the controls and make intercontrol electrical connections according to wiring instructions accompanying the switches and motor, using conduit and wire sizes as required by local power companies. Be certain current characteristics of voltage and frequency indicated on the motor nameplate are the same as service provided.

**ROTATION:** Check rotation of the motor, see that it turns in the direction indicated by the rotation arrow on pump casing; if incorrect refer to motor manufacturer's instructions for reversing.

**FUSE RECOMMENDATIONS:** Be certain fuses are installed and comply in size with the National Electrical Manufacturer's Association Code and local code recommendations.

## LUBRICATION

**MOTOR LUBRICATION:** Lubricate the motor according to motor manufacturer's instructions, avoiding over lubrication.

**PUMP LUBRICATION:** Prior to leaving the factory, bearings in the power frame are lubricated with a neutral mineral ball bearing grease. This lubrication should be sufficient for 3-6 months under normal operating conditions. To replenish the grease, remove the relief plug opposite the grease fitting and inject grease through the grease fitting. Use a high grade grease equal in consistency to any of the following: Shell Alvania Grease #2, American Oil Rykon Grease #3, Arco Opaline I Grease, Texaco 1994 or Regal Starflex Special. Continue injecting the new grease until it appears in the relief plug opening. Clean excess grease and operate pump 10 to 15 minutes before replacing plug. This operation is required for the bearings at both the pump and motor ends every 3 to 6 months. New grease should be added to the bearings during periods of inactivity. They should be manually turned at least twice a month. This will insure a protective coating of grease for rust prevention, and prevent superficial spalling of the bearings from vibration.

**STEADY OR INTERMEDIATE GUIDE BEARINGS:**(See Fig. 1) Steady bearings are provided with Alemite fittings for grease lubrication, and should be lubricated with grease having the same consistency as the lubricant recommended for the pump. Steady bearings ordinarily need greasing every 3 to 6 months.

**UNIVERSAL JOINT COUPLINGS:** (See Fig. 1) Universal joint bearings and slip splines are provided with Zerk Alemite fittings for grease lubrication, and may be lubricated with the same grease recommended for steady bearings. They need greasing rarely, once a year usually being sufficient. Pull motor disconnect before lubricating.

**CAUTION:** Use only grease that is specified for use with ball bearings. Acids contained in other lubricants will ruin the bearings.

### **PACKING BOXES, PACKING AND PACKING SEALS:**

1. **Packing Boxes:** Centrifugal pumps employ gland adjusted packing boxes for sealing around shafts. These require the use of soft, water pump packing made of long fiber yarn loosely woven with twisted core and braided jacket, thoroughly lubricated and graphite impregnated under vacuum. Packing boxes are packed before shipment.
2. **Grease Seals:** When water is not available, a grease seal must be used. For grease seals to be effective, a constant pressure of waterproof grease must be maintained on the packing, for which purpose a spring loaded grease cup (see Fig. 5) is usually employed. This spring loaded grease cup is designed for controlled lubrication. The cup has a knurled adjusting screw at the top that permits the operator to decrease or increase the tension on the spring and thus assures a precise regulation of a constant lubricant flow.

The reservoir of the cup is filled with lubricant through the Alemite fitting located at the cup base. As the lubricant is forced into the reservoir, the cup leather and the pressure spring are elevated until the spring stops at the safety shoulders where the top of the cup slopes inward. The pressure is then extended downward through the cup channel, flushing the packing and refilling it with a special type tapered valve stem which moves in a tapered delivery channel. As the spring expands by its own tension, the valve stem descends.

This combination of tapered stem and tapered channel automatically compensates for the decreasing tension of the spring and an exact uniform pressure of lubricant is effected.

When the spring loaded grease cup is used for this purpose, the cup must be kept loaded at all times with special grease, Arco Litholine Multipurpose Grease or equal. It is imperative that grease be forced through the packing at a rate of at least 1 oz. per day. For high head pumps (over 100 ft. head) more grease is required.

An alternate method of providing grease to the packing is by a Z&F lubricator (Fig. 5). The Z&F lubricator is partially factory assembled on the pump and ready to be placed into operation.

To put the unit into operation, first open shut-off cock and adjusting thumb screw and fill the cylinder with water. Close the adjusting thumb screw and fill the cylinder with grease using an ordinary grease gun applied to the Alemite fitting on the grease seal unit. When the cylinder has been filled with grease, open the adjusting screw. It is recommended that the unit be observed during the first few days of operation to determine the proper rate of flow of grease and that necessary adjustments be made using the adjusting screw on the unit. Proper greasing requirements should consume approximately 1/4" of grease in cylinder per day. Slightly more may be required on large high speed units or to prevent gland leakage.

If the high pressure tubing should become clogged, close the shut-off cock, and disconnect the end of the high pressure tubing from the shut-off cock. Close adjusting thumb screw and fill the cylinder with grease, forcing water and any clogged solids out through the open end of the disconnect tubing. With the tubing thus clear, reconnect tubing to shut-off cock and put the unit back into operation.

**CAUTION:** It is highly important that the correct specifications of lubricants are followed for satisfactory performance. Shell Avania EPRO 71030 grease or equal is recommended.

3. **Gland Adjustment:** Packing boxes should be watched for leakage of sealing water. A "weep" from the packing boxes while pump is running is necessary to keep packing cool and in good condition. If serious leakage or no leakage is noted, the packing gland should be tightened or loosened as required by turning the packing gland nuts evenly a few turns only. Do not draw packing glands too tight. After adjusting packing glands, turn the shaft by hand to be certain it rotates freely. If serious leakage will not stop, packing is probably burnt, worn, dried out or hard and should be replaced. (Remember that when replacing packing, replace all of the packing both above and below the lantern ring.) All packing should be renewed periodically to prevent scoring of shaft or shaft sleeve: see paragraph on "Packing Boxes, Packing, and Packing Seals".

**NOTE:** If upon removing the old packing, the shaft or shaft sleeve is found to be scored, then it will become necessary to replace the shaft or shaft sleeve before installing new packing.

## OPERATION

Check the following items before starting unit:

1. Be certain all equipment has been lubricated as per lubrication instructions.
2. Turn the shaft by hand to see that it rotates freely. If it sticks or turns with difficulty, refer to "Repair" section of these instructions.
3. See that current characteristics of voltage and frequency on motor nameplate coincide with service provided.
4. See that all thermal units are "set" and the selector switch (when used) is in the "off" position.
5. See that gate valves on the suction and discharge lines are open.
6. Vent air from the pump volute.

STARTING: To start the pump, engage the motor disconnect switch and set the selector switch (if used) to the automatic position. The pump will not operate unless the float switch is closed. If a selector switch is used, the pump may be run independently of the float control by turning it to the "Hand" or "ON" position.

After starting the unit:

1. See that shaft rotates in the direction indicated by the rotation arrow on the pump casing and that pump is delivering water.
2. See that all pipe connections are tight and the check valves are functioning.
3. Note operation of automatic control mechanism, observing a complete start-stop cycle: see that the float switch throws in and out properly as wet basin fills and is emptied by the pump. Check high-low water level adjustment.
4. Observe the extended line shafting, see that incorrect installation has not resulted in its vibrating or "whipping".
5. See that there is the desired water leakage from stuffing box (refer to paragraph under "Maintenance" for details.)
6. See that bearings (20 and 21) do not overheat due either to over or under lubrication.
7. Observe operation of pump closely for the first day and at regular intervals for two weeks. A new machine is frequently stiff or initial float control regulation may be incorrect; therefore, the unit should be watched to note performance. (See Periodic Inspection.)

## MAINTENANCE

1. Lubrication - At regular intervals, lubricate motor, pump steady bearings and universal shaft joints as per lubrication instructions.

2. Grease Seal - To be effective, grease seals must maintain constant and sufficient grease pressure upon the packing.
3. General Cleanliness - Keep the interior and exterior of motor and controls free from moisture, oil and dirt. When necessary, blow out their interiors using a bellows. When switch contacts show signs of wear or pitting, they should be replaced.
4. Stuffing Box - Occasionally observe the packing glands (1) for leakage. A slight leakage of seal water, say 60 drops per minute (large pumps may require more), from the stuffing box when pump is running, acts as a lubricant and also keeps packing (9) cool and in good condition. If serious leakage is noted, tighten the two gland nuts (34) evenly a few turns only; do not draw glands too tight. After adjusting packing glands turn the shaft by hand to be certain it rotates freely. If serious leakage will not stop, refer to "Repairs" instructions for packing renewal.

### LOCATING TROUBLE

If pump fails to operate:

1. Check fuses and thermal overload units, see if fuse is blown, thermal overload tripped or loose. Before replacing a burnt fuse, be certain cause for blowing is determined and corrected. Before resetting a tripped thermal unit, allow it to cool.
2. Be certain the shaft rotates, try turning by hand. If it will not turn, or is unusually stiff, see that the pump is not clogged; that motor, pump or steady bearings are not worn, dry or jammed by corrosion; that the shaft is properly aligned; and that packing glands (1) are not too tightly or unevenly adjusted.
3. See that switch contacts are not corroded, shorted or terminal connections broken anywhere in the circuit.
4. See if the automatic float control mechanism is functioning.
5. See if motor is shorted or burnt, or if brushes (when present) are stuck or worn.
6. See that wiring hook-up and service provided are correct and that all switches are set for operation.

If no water is delivered:

Check:

1. If the water level is so low that pump is not primed.
2. Pump to see if it is air bound by venting casing at plug on back of backplate.
3. Whether the gate valve in discharge line is shut or check valve is jammed.
4. Whether the suction pipe or inlet is clogged or gate valve is closed.
5. TDH, see if beyond pump rating.

6. If pump rotation is reversed.
7. If the impeller is badly worn.
8. If the motor speed is too slow.

If not enough water is delivered:

Check:

1. If there are air leaks in the suction line or stuffing box.
2. If motor speed is too slow.
3. If the TDH is higher than anticipated.

If fuses blow out:

1. Check fuse rating used.
2. Turn shaft by hand to see that it rotates freely. If it sticks or turns with difficulty, see paragraph 2 under "LOCATING TROUBLE".
3. Check wiring and controls. Test for loose connections.
4. See that controls are not worn or arcing.
5. See that motor is not grounded or partially burnt out.
6. Check brushes (when present) for sparking while running or starting, or for sticking.
7. Observe if motor is overheating from overload or lack of proper ventilation.
8. See if fuse location is too hot.

## REPAIRS

IF PUMP REQUIRES CLEANING: Removable hand hole covers are provided on the pump volute (2). To clean pump, disengage disconnect switch, lock out, close all valves, drain the pump, remove the cleanout cover (15), and remove any solids.

TO DISMANTLE THE PUMP:

1. Open the electric circuit, close all gate valves on suction, discharge and water seal lines. Drain the pump of water by removing the casing vent (47) and drain plugs.
2. Disconnect piping at suction and discharge flanges, and break water seal and drip pocket drain lines at nearest unions.
3. Remove cap screws holding pump to sub-base.



4. Set pump on table or floor in vertical position with suction end down.
5. Remove gland adjusting nuts (34); slip off washers (45) and take out split packing gland (1). Remove cap screws (43) from the bearing cap (39) and drop the bearing cap down.
6. Remove pump half coupling set screw and slip coupling off shaft. Retain the coupling key (31).
7. Remove bearing cap screws (55) and slip cap (10) and oil seal (54) off shaft.
8. Remove shaft locknuts (11) then pull off thrust bearings (21). Retain spacer (12) and shims (17).
9. CAUTION - Before dismantling unit further, carefully mark relative positions of all castings with a file or center punch.
10. Remove bearing housing cap screws (42), and separate bearing housing (4) from rest of the pump.
11. Before removing inner ball bearing (20) from shaft, carefully mark or measure its exact position on the shaft. Loosen casing nuts (33) and shim at equal distances between volute (2) and casing cover (10). The inner ball bearing (20) is pressed fit on the shaft. To loosen this bearing carefully tap on the top of the shaft with a rubber mallet. CAUTION: Do not let the impeller drop on the lower side of the volute (2) without some protection inside of the casing. The inner ball bearing (20), grease seal (53), bearing cap (39) and the deflector ring (13) can now be removed.
12. Pick out rings of packing (9) and slip up the water seal ring (18).
13. To remove the impeller (8) take off the hex nuts (32) and remove the suction cover (27). Take out impeller screws (37). The impeller can then be removed.
14. To remove the shaft (6) pull the shaft thru the casing cover.
15. The pump is disassembled further, if desired, by removing casing nuts (33). The casing cover can now be separated from the discharge casing.
16. If shear bars (70) were supplied with the pump they can be taken off by removing the cap screws (71) and washers (72).
17. Any optional accessories are easily removed if desired. Clean all parts in kerosene and remove all burrs made on machined surfaces before reassembling pump.

**TO ASSEMBLE PUMP:** To assemble the pump, reverse the dismantling procedure but take the following precautions:

1. File off all burrs made on machined surfaces.
- 2.A. Radial bearing must have sealed side toward the inside of the power frame.
- 2.B. The first two thrust bearings (starting at the coupling end of the shaft) must have the stamped outer race facing the impeller (the side with the smallest gap between the inner and outer races). The third thrust bearing must have the stamped outer race facing away from the impeller.

3. Check all gaskets, replace if necessary and grease before using. Use only .012 inch manila paper for paper gaskets.
4. If grease seals (53, 54) show signs of wear, replace them.
5. Before placing sleeve on shaft, clean the shaft with a solvent, and coat the shaft with Loctite 271 or equivalent.
6. Be sure to set on the deflector ring (13), lower bearing cap (39), grease seal (53) and inner ball bearing (20) before mounting the bearing housing (4).
7. Replace spacer (12) and shims (17) under the thrust bearings (21). The proper clearance between impeller and casing suction face (below it) should be .020 to .025 on the open type impeller. The spacer shims (17) used under the thrust bearing regulate this spacing; increasing the thickness reduces clearance. The method used to measure this clearance (or to determine the thickness of spacer required) is as follows: this is done after the bearing housing impeller assembly has been set in and mounted on casing assembly and with unit in a vertical position, suction down.

Before setting on thrust bearings (21) place a straight edge across machined edge of bearing housing. With thickness gauge measure distance between bearing shoulder on shaft and the straight edge. Spacer thickness needed equals this distance minus .015 inch.

8. Replace the packing (9). Use only the proper size soft, square, woven graphite impregnated packing cut into individual rings; dip them in oil before inserting. Be sure the water seal and packing rings are replaced in the order they were originally found so that the water seal ring (18) is aligned with the water or grease seal inlet (49). The spliced ends of the packing rings should be staggered to insure a perfect seal. Lubricate bearings with grease as per lubrication instructions.

ALIGNMENT AND COUPLING ADJUSTMENT FOR SP5 HORIZONTAL PUMPS: Handling in shipment usually disturbs the pump/motor shaft alignment. This adjustment is always made at the factory before a unit is shipped. Although the pump is equipped with a flexible coupling connection which compensates for very slight variations, it is desirable to obtain as exact an alignment as possible. Alignment is checked by placing a straight edge across the coupling flanges or by measuring the distance between faces of the coupling halves with a thickness gauge or outside calipers at two or more points 90° apart. To attain perfect alignment, pump or motor may be shimmed or motor shifted. Check alignment both before and after pump is set and after pipe connections are made. There must be at least 1/16 to 1/8 inch metal-to-metal clearance between coupling faces. The buffers should not be pressed tightly between coupling faces.

ORDERS FOR REPLACEMENT AND SPARE PARTS: Always furnish the following information when ordering parts:

1. Unit serial number from nameplate.
2. Description from parts list.
3. Item number from cross sections

Send order to authorized sales representative or: CHICAGO PUMP PRODUCTS,  
1999 N. Ruby Street, Melrose Park, IL 60160

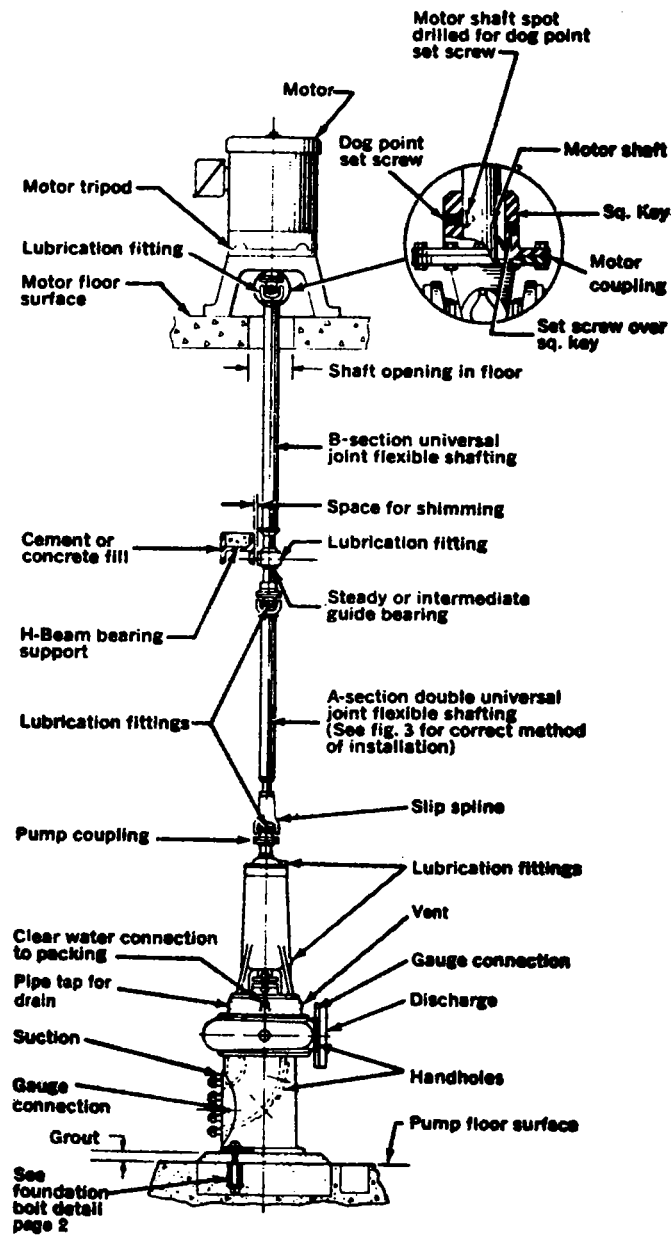


FIGURE 1 - TYPICAL VERTICAL OPEN-SHAFT PUMP INSTALLATION

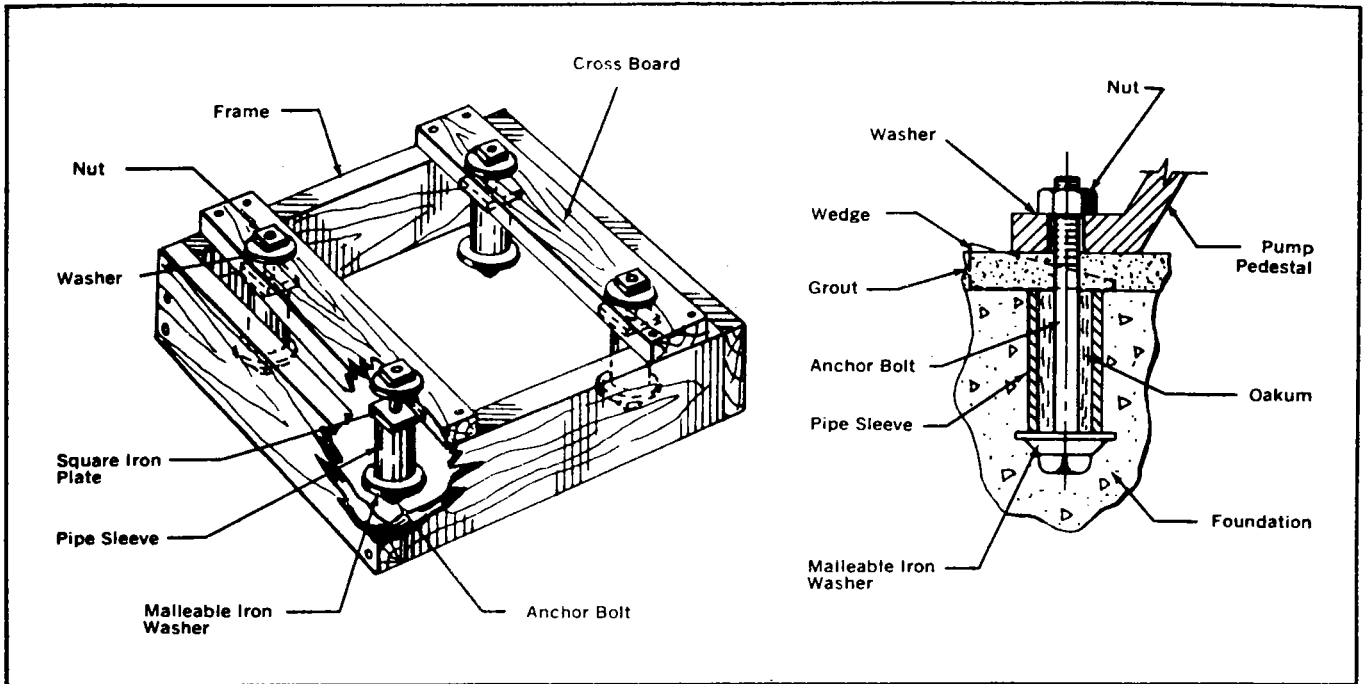


Figure 2—A Recommended System of Foundation Construction

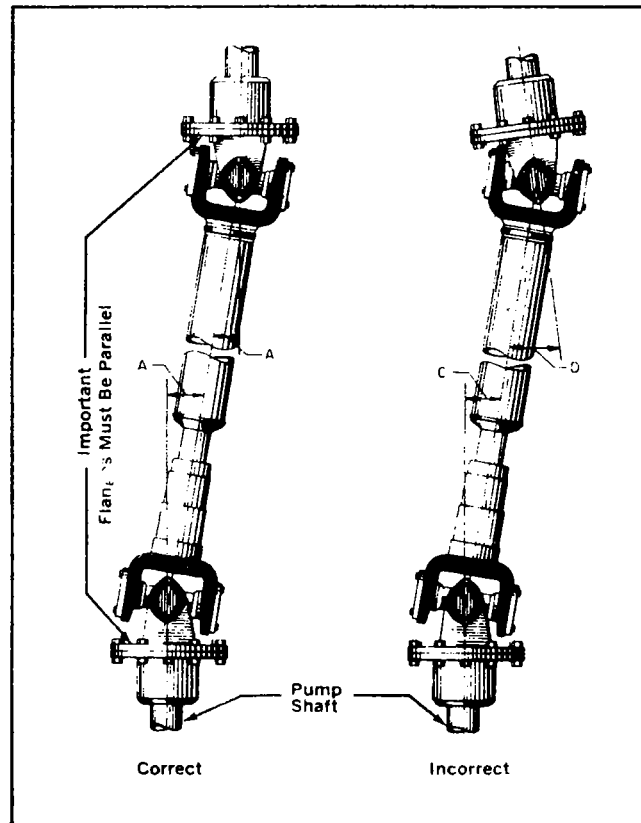


Figure 3

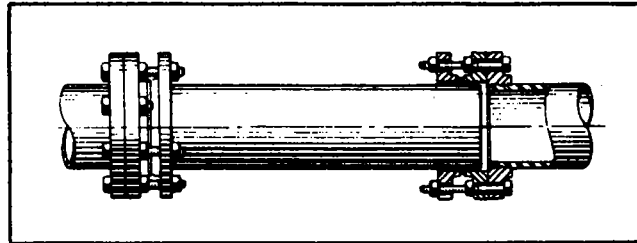


FIGURE 4 - FLEXIBLE PIPE CONNECTION

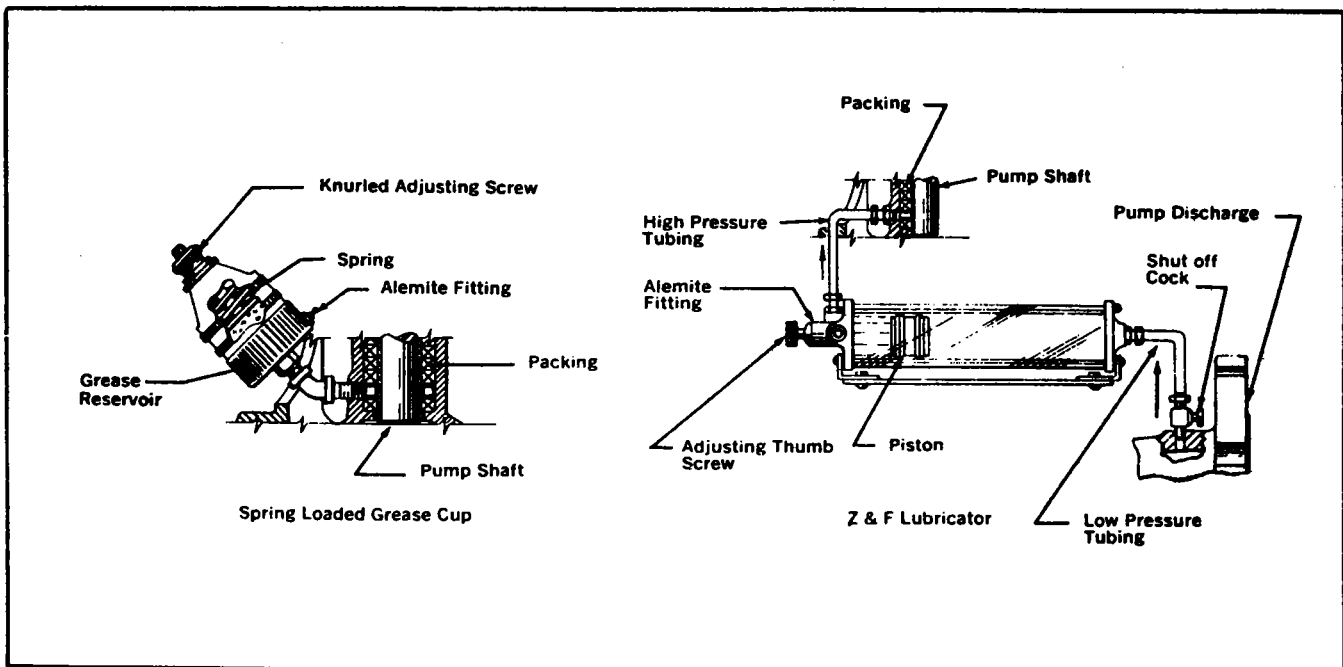


FIGURE 5 - GREASE SEALS

PARTS LIST

VOS and HBB

FRAME: SP5

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VOS and HBB

FRAME: SP5

<u>Item</u>	<u>Description</u>	<u>Item</u>	<u>Description</u>
1	Split Packing Gland	47	Casing Vent
2	Volute	48	Pipe Plug
3	Liner Plate	49	Pipe Plug
4	Bearing Housing	50	Oil Drain Plug
5	Bracket	51	Vent Plug
6	Shaft	52	Gland Bolt
7	Sleeve	53	Oil Seal
8	Impeller	54	Oil Seal
9	Packing Set	55	Bearing Cap Screw
10	Casing Cover	56	Washer
11	Shaft Locknut	57	Foot
12	Spacer	58	Street Elbow
13	Deflector Ring	59	Stud
14	Alemite Fitting	60	Oil Seal
15	Cleanout Cover	61	Hex Nut
16	Cap Screw	62	Stud
17	Set of Shims	63	Pedestal
18	Waterseal Ring	64	Gasket
19	Bearing Cap	65	Hand Hole Cover
20	Inner Ball Bearing	66	Packing Ring
21	Thrust Bearing	67	Yoke Screw
22	Gasket	68	Yoke
23	Gasket Paper	69	Elbow
24	Gasket Paper	70	Shear Bar (optional)
25	Washer	71	Socket Head Cap Screw (optional)
26	Liner Plate Ass'y with shear ring	72	Washer (optional)
27	Suction Casing		
28	Stud		
29	Stud		
30	Stud		
31	Coupling Key		
32	Hex Nut		
33	Casing Nut		
34	Gland Adjusting Nut		
35	Hex Nut		
36	Hex Nut		
37	Impeller Screw		
38	Hollow Head Cap Screw		
39	Bearing Cap		
40	Hollow Head Cap Screw		
41	Alemite Fitting		
42	Bearing Housing Cap Screw		
43	Cap Screw		
44	Gasket Paper		
45	Washer		
46	Lockwasher		

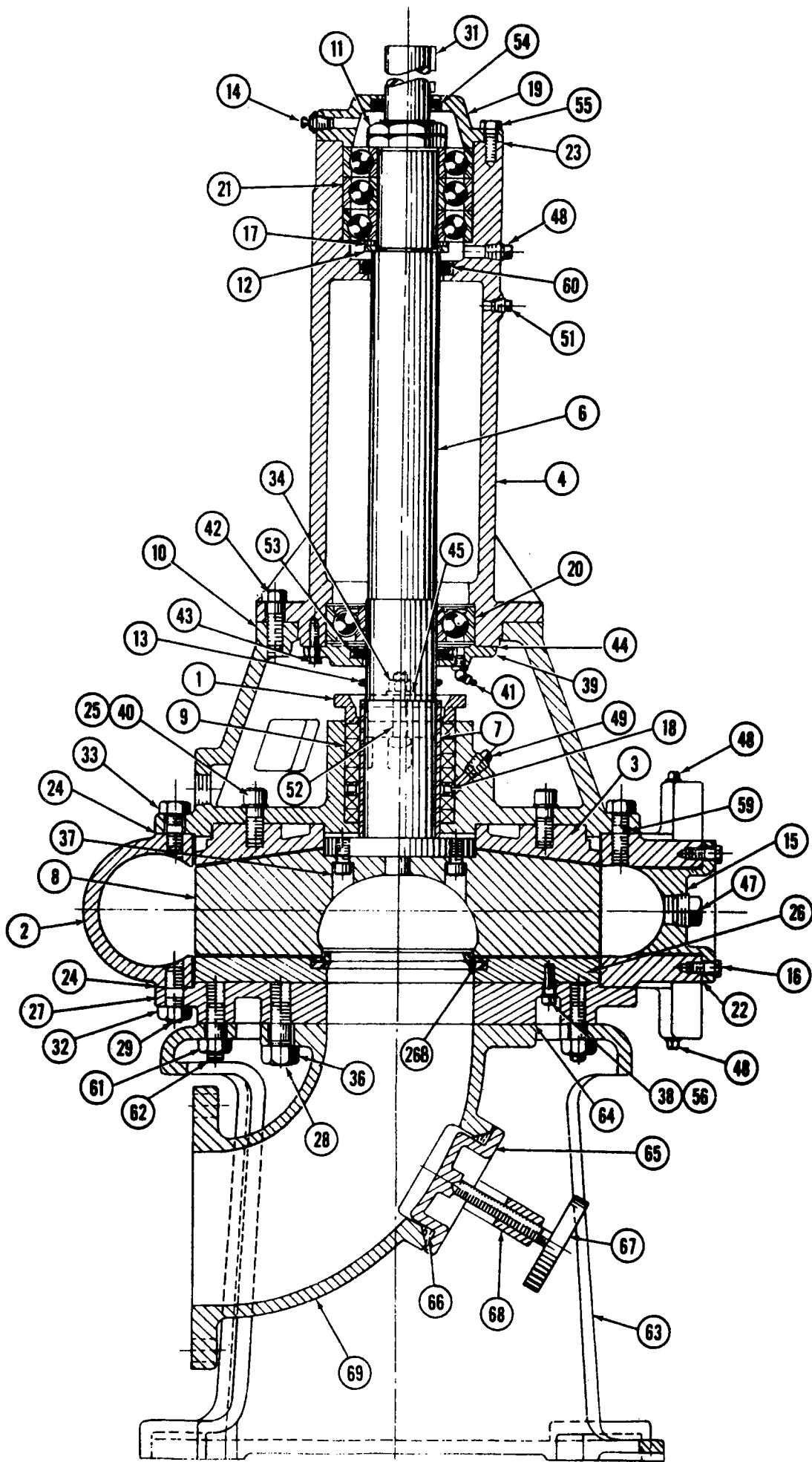


FIGURE 6 - VOS & VPM, FRAME SP5

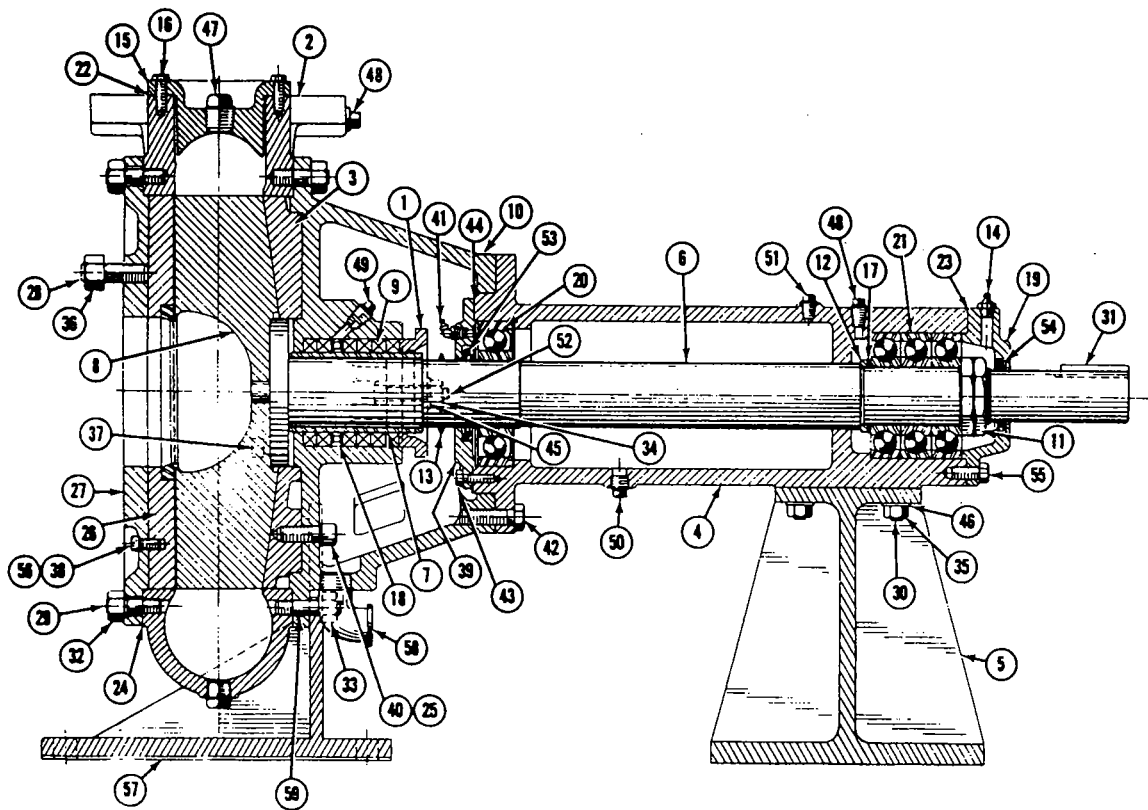


FIGURE 7 - HBB, FRAME SP5

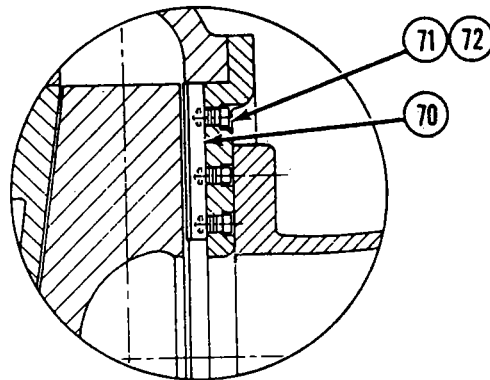


FIGURE 8 - SHEAR BAR DETAIL (OPTIONAL)



CHICAGO PUMP PRODUCTS  
 1999 North Ruby Street  
 Melrose Park, Illinois 60160  
 (708) 344-4960  
 FAX (708) 681-4432  
 Telex 72-8322