Vertical Turbine Fire Pumps

Centrifugal Fire Pump System

Assembly, Installation, Operation & Maintenance Manual

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Important Note

The descriptions and instructions included in this book cover the standard design of the equipment and any common deviations when possible. This book does not cover all design details and variations, nor does it provide for every possible contingency, which may be encountered. When information cannot be found in this book, contact LIFECO.

SAFETY PRECAUTIONS WARNING ! ! !

Never operate this equipment in excess of its rated speed or other than in accordance with the instructions contained in this manual.

The equipment has been found satisfactory for the conditions for which it was sold, but operation in excess of these conditions may subject it to stresses and strains for which it is not designed.

When working on or around equipment described in this instruction book, it is important to observe safety precautions to protect personnel from possible injury.

The following is an abbreviated list of safe practices to keep in mind:

- Avoid contact with rotating parts
- Avoid bypassing or rendering any safeguards, or protective devices inoperative
- Avoid extended exposure in close proximity to machinery with high noise levels
- Use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment
- Do not modify this equipment, consult factory if modification is deemed necessary
- Use only OEM repair parts
- Observe all caution and danger included in this manual Safe maintenance practices with qualified personnel are imperative. Failure to heed this warning may result in an accident causing personal injury.

NOTE

These instructions must be read prior to installing, operating, using and maintaining the equipment in any region worldwide. The unit is capable of many years of troublefree operation when properly applied, installed and maintained. The equipment must not be put into service until all the conditions relating to safety noted in the instructions, have been met. Failure to follow and apply the present user instructions is considered to be misuse. Personal injury, product damage, delay or failure caused by misuse are not covered by the LIFECO warranty.

General Information

The design, material, and workmanship incorporated in the construction of LIFECO Vertical Turbine Pumps makes them capable of giving long, trouble free service. The life and satisfactory service of any mechanical unit, however, is enhanced and extended by correct application, proper installation, periodic inspection and careful maintenance. This instruction manual is provided to assist operators in understanding the construction and the correct methods of installing, operating, and maintaining these pumps. Due to the many variations and custom designed units it is impossible to cover every design variation or contingency which may arise, however, the basic information contained herein will cover most applications. Refer to the section under "Special Features" for any additional information regarding your particular unit.

Identification

Should questions arise concerning the pump, the factory will require the complete serial number to be of assistance. The serial number is stamped on a metal nameplate affixed to the discharge head assembly. A photo of nameplate is preferable

General Description

The basic components of open coupled fire pump system are discharge head assembly, column assembly (when used), and bowl assembly. The pumps are normally shipped assembled and ready for installation.

Discharge Head Assembly

The discharge head supports the driver and bowl assembly as well as supplying a discharge connection. A shaft sealing arrangement is located in the discharge head to seal the shaft where it leaves the liquid chamber. The shaft seal will usually be a packing box seal assembly.

Column Assembly

The column assembly is flanged with an open lineshaft construction, which utilizes the liquid being pumped to lubricate the lineshaft bearings.

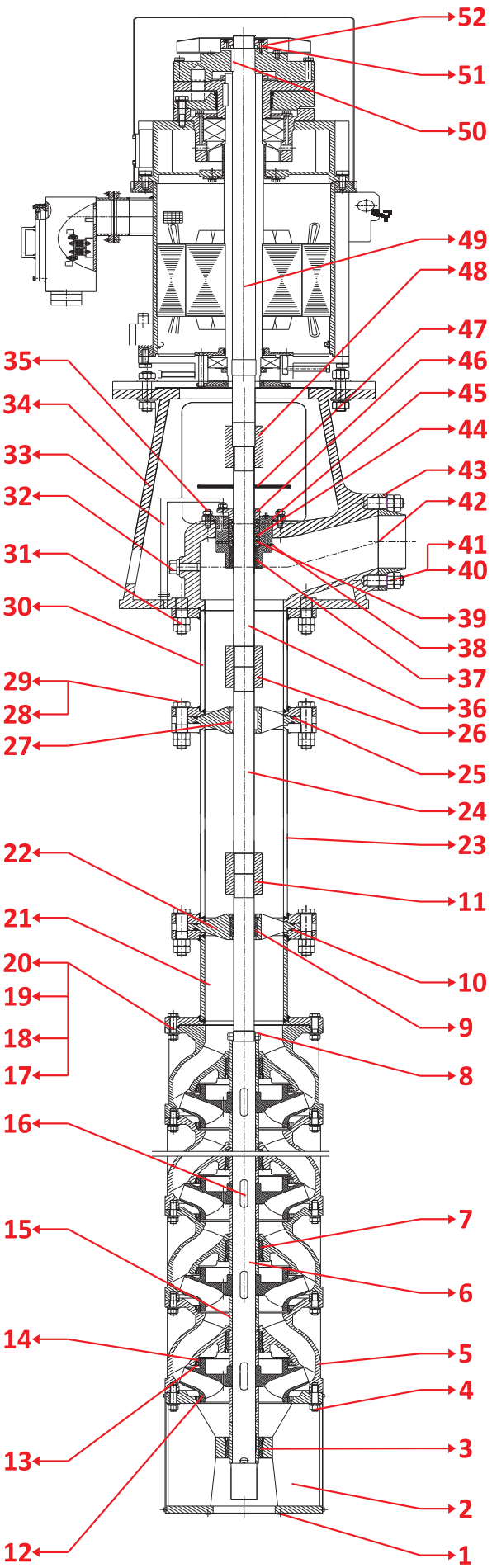
The column assembly will consist of column pipe, which connects the bowl assembly to the discharge head and carries the pumped liquid to the discharge head, the shaft, which connects the rotor part together and transfers the power and torque, the bearing bracket unit, which supports and centralize the lineshaft, the coupling, which connects the shafts together and transfers the power and torque.

NOTE:
Some units will not require a column assembly, having the bowl assembly connected directly to the discharge head.

Bowl Assembly

The bowl assembly consists of impellers rigidly mounted on the bowl shaft which rotate and impart energy to the fluid. The bowls contain the fluid at increased pressure and direct it vertically to the next stage and eventually to the column pipe. The suction directs the fluid into the first impeller. Bearings are located in the suction, discharge case, and between each impeller.

Fire Pump Sketch



	BOWL ASSEMBLY
1	Column Head Screw With Groove M5x6
2	Suction
3	Bearing (suction)
4	Stud Bolt
5	Bowl
6	Pump Shaft
7	Bearing (casing)
8	Lock Nut
9	Bearing (bracket)
10	O-ship Ring
11	Coupling
12	Impeller
13	Fixing Screws M6xl0
14	Wear Ring
15	Shaft Sleeve
16	Key
17	Bolt
18	Level Washer
19	Spring Washer
20	Nut
21	Interconnection Pipe
22	Bearing Bracket

	COLUMN PIPE ASSEMBLY
23	Column Pipe
24	Line Shaft
25	O-ship Ring
26	Coupling
27	Bearing (Bracket)
28	Bolt
29	Nut

	DISCHARGE HEAD ASSEMBLY
30	Column Pipe (Discharge Head)
31	Stud Bolt
32	Bolt
33	Pipe Assembly
34	Discharge head
35	Stud Bolt
36	Line Shaft
37	Bearing (Discharge Head)
38	Bolt
39	Seal Cage
40	Pocking
41	Stuffing Box
42	Packing Cover
43	Water Fender

	COMPANION FLANGE OF DISCHARGE HEAD ASSEMBLY
44	Stud Bolt
45	Nut
46	Seal Gasket
47	Flange

	DRIVE ACCESSORIES
48	Coupling
49	Shaft
50	Key
51	Bolt
52	Lock Nut

Storage

Storage & Protection

All pumps are shop serviced and ready for operation when delivered, but there are occasions when considerable time elapses between the delivery date and the time the pump is put into operation. Equipment, which is not in service, should be kept in a clean, dry area. If the equipment is to be stored for a long period of time (six months or more), the following precautions should be taken to insure that the equipment remains in good condition.

- Unpainted machined surfaces, which are subject to corrosion should be protected by some corrosion resistant coating.
- The shaft should be rotated a 1/4 to 1/2 revolution by hand periodically to insure that the pump shaft does not begin to sag. Suitable intervals are from one to three months.

Pre-Installation

Receiving & Unloading

When the shipment is received extreme care should be exercised when unloading. Heavy parts should be skidded to the ground if lifting equipment is not available. Do not drop the unit, or any parts, as damage may cause trouble in assembly and operation of the unit.

Inspect the pump for signs of transit damage before beginning to uncrate or store. If damage is evident, the local transporting company agent should be notified before uncrating and a claim filed with the agent.

Uncrating & Cleaning

If the pump appears undamaged proceed with uncrating. The pump is shipped as a unit from the factory and it is advisable to lift it into the vertical position before uncrating. If this is not possible the longer units must be supported at more than one place when raised to the vertical position. At no time should any pump weight be placed on the suction.

Clean all parts of all dirt, packing materials and other foreign matter. Flush the pump inside and out with clean water. Clean all machined surfaces -these are coated with a rust preventative, which must be removed. Remove any rust spots found on the machined surfaces with fine emery cloth. Clean all threaded connections and any accessory equipment.

NOTE

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

Installation, Equipment & Tools

No installation should be attempted without equipment adequate for the job. The following list covers the principal items required for an installation.

- Mobile crane capable of hoisting and lowering the weight of the pump.
- Cable sling for attaching to the pump lifting eyes.
- Ordinary hand tools - end wrenches, socket set, screw drivers, Allen wrenches, etc.
- Wire brush, scraper and fine emery cloth.
- Thread compound.

Pre-Installation Check List

The following checks should be made before starting actual installation to assure proper installation and prevent delays:

1. Where more than one pump is received, check the pump serial numbers against the packing slip to be sure the correct unit is being installed.

2. Check the data indicated on the pump nameplate (located on the discharge head) and the performance curve, to be sure a matched drive.

3. Check the depth of the sump against the pump length to be sure there will be no interference.

4. Check the proposed liquid level in the sump against the pump length refer to table 1 for the minimum submergence of the suction bottom.

Table 1

Minimum Submerge for Different Models of Vertical Turbine Pump

Model	LFP-750-70-VT	LFP-1250-80-VT & LFP-1000-80-VT	LFP-2000-90-VT
Minimum Submerge	760 mm	860 mm	900 mm

5. Clean the sump and piping system before installing the pump.

6. Check the installation equipment to be sure it will safely handle the equipment.

7. Check all pump connections (bolts, nuts, etc.) for tightness. These have been properly tightened before leaving the factory; however, some connections may have worked loose in transit.

Location

Several factors should be considered when selecting a location for the pumping. The pump should be accessible for both inspection and maintenance. Headroom should be provided for the use of a crane, hoist or other necessary lifting devices. The location should require a minimum of elbows and fittings in the discharge line to minimize friction losses, and the pump should be protected against flooding.

Foundation

The foundation should be sufficiently substantial to absorb vibration and to form a permanent rigid support for the pump. Concrete is most widely used for foundations.

Before pouring a foundation, locate anchor bolts per the outline drawing. Anchor bolts should be installed in sleeves twice the anchor bolt diameter to allow for alignment with the holes in the discharge head, see Figure 4-A. Allow for 3/4 inch to 1-1/2 inches of grout between foundation and discharge head. The top surface of the foundation should be roughened to provide a good bond for the grout.

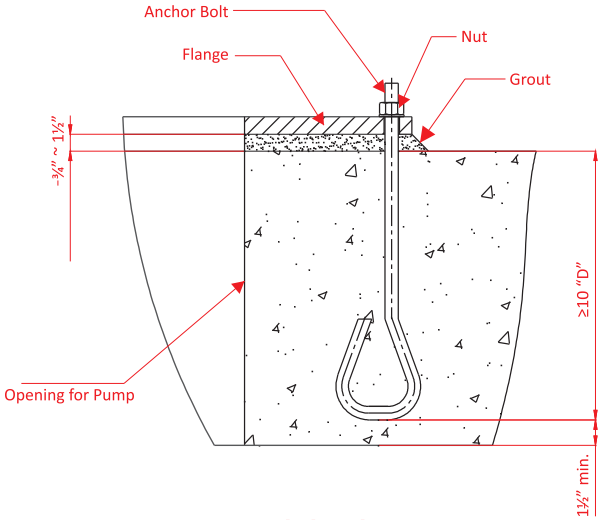


Figure 4-A Recommended Anchor Bolt Arrangement

Leveling the Pump

Position the pump so the anchor bolts are aligned in the middle of the mounting holes in the base. Place metal shims or metal wedges directly under the part of the base carrying the greatest weight, and space them close enough to give uniform support and stability. Adjust the metal shims or wedges until the top flange of the discharge head is level. Tighten the foundation bolts snugly, but not too firmly, and recheck the alignment before grouting.

NOTE

The elevation of the discharge head may have to be adjusted to obtain alignment.

NOTE

The pump discharge head will have to be adjusted to obtain level. Adjust the shims as necessary.

Grouting

Grout compensates for uneveness in the foundation and distributes the weight of the pump uniformly on the foundation. It also prevents lateral shifting of the baseplate and reduces vibration. Use a non-shrinking grout. Foundation bolts should be tightened evenly, but not too firmly. Grout the pump as follows:

1. Build a strong form around the baseplate to contain the grout.
2. Soak the foundation top thoroughly, then remove the surface water.
3. Pour grout. Tamp liberally while pouring to fill all vacancies and prevent air pockets. The space between the foundation and baseplate should be completely filled with grout. Wedges may be left in place. Adjust the metal shims or wedges until the top flange of the discharge head is level. Tighten the foundation bolts snugly, but not too firmly, and recheck the alignment before grouting. Utilize a level graduated in thousandths of an inch. The pump must be level to within 0.001 inch per foot of width.
4. After grout has hardened (usually about 48-hours), thoroughly tighten foundation bolts.
5. Approximately 14 days after the grout has been poured or when it is thoroughly cured and dry, apply an oil base paint to exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

Piping

Connect pipelines after the grout has thoroughly hardened. The piping should be installed with the shortest and most direct runs. Elbows should be of the long radius type and pipes should line up naturally. Exterior strain must not be transmitted to the pump. The most common cause of trouble in this respect is forcing the piping to mate with the pump. This is especially critical on pumps with an underground discharge where the discharge may be several feet below the supporting structure and a relatively small strain can cause misalignment.

Discharge piping should be installed with a check valve and gate valve, with the check valve being between pump and gate valve. The check valve prevents reverse flow and protects the pump from excessive back pressure. The gate valve is used for starting and to isolate the pump for maintenance.

Installing the Pump

If the pump is shipped assembled, proceed to the next step. If the pump is shipped unassembled, see Pump Assembly Section for assembly instruction.

1. Position lifting equipment so it will center over the foundation opening.

NOTE:

Sump and piping should be thoroughly cleaned of all loose debris before starting installation.

2. If a soleplate is used, level the mounting surface and grout and anchor in place (see grouting in previous section).

3. Clean pump discharge flange.

NOTE:

All machined surfaces are coated with rust preventative prior to shipment, this must be completely removed along with any paint overspray or rust, which might be on the machined faces. The faces should be scraped and wire brushed first and then fine emery cloth used to remove any stubborn spots. Use a fine file to remove any nicks or burrs.

NOTE:

All threads should be checked for damage and repaired if necessary. If filing is necessary, remove the part from the pump if possible, or arrange a rag to catch all filings so they do not fall into other parts of the pump. Clean all threads with wire brush and cleaning solvent.

Ends of shafts must be cleaned and any burrs removed since alignment depends on the shaft ends butting squarely. Lubricate all screwed connections with a thread lubricant - an anti-galling compound such as "Never-Seez" should be used on stainless and Monel mating threads.

Apply thread lubricant sparingly to male shaft threads only when making up shaft connections - excess lubricant should not be allowed to get between the ends of the shaft.

4. Lift the pump and lower slowly into the sump, using the window on the discharge head. Hand guide the pump as it is lowered and watch for any obstructions or binding of the pump, which can be felt through the hands.

   Stop lowering the unit when it is still a few inches off the foundation.

NOTE:

Be particularly careful not to damage any piping, which may extend down along the column and/or bowl assembly. This piping (when used) must remain open- should it be damaged it should be removed and replaced.

5. Rotate pump until discharge flange faces proper direction for alignment with piping and align anchor bolt holes.
6. Slowly lower pump onto the foundation.
7. Install anchor bolts or nuts, but do not tighten.
8. Pipe from discharge shifting the pump slightly on the foundation if required to facilitate alignment.

Exterior stresses should not be transferred to the pump - all piping must be carefully aligned and supported to prevent this.

9. Tighten discharge flange bolting - be sure the flanges mate without forcing.
10. Tighten anchor bolting.
11. See Impeller Adjustment- General Section for impeller adjustment.

Impeller Adjustment - General

Proper impeller adjustment positions the impeller inside the bowl assembly for maximum performance. The impeller must be raised slightly to prevent dragging on the bowl. Impellers should be raised 1 /8 to 5/32 Inch by lifting the (drive) shaft. Enclosed Prefer chart 1.

Packing Boxes

Packing boxes are pre-packed at the factory and will be factory installed. Do not tighten the packing gland. See Pre-Starting Check Section.

Pre-Starting Checks

Before starting the pump the following checks should be made:

1. Rotate the pump shaft by hand to make sure the pump is free and the impeller is correctly positioned.
2. Check that all piping connections are tight.
3. Check all anchor bolts for tightness.
4. Check all bolting and tubing connections for tightness (flanged coupling bolts, seal housing cover bolts, etc.).
5. On pumps equipped with packing box make sure the gland nuts are only finger tight- DO NOT tighten packing gland before starting.

Initial Startup

1. If the discharge line has a valve in it, it should be partially open for initial starting.
2. Start the pump and observe the operation. If there is any excess noise or vibration, or if the pump seems sluggish, or will not run, disconnect the pump immediately and refer to Section 6 for probable cause.
3. If the pump starts satisfactorily, open the discharge valve as desired.
4. Check complete pump for leaks, loose connections or improper operation.
5. If possible, the pump should be left running for approximately 1 /2 hour on the initial startup. This will allow the bearings, packing or seals, and other parts to "run-in" and reduce the possibility of trouble on future starts.

NOTE:
If abrasives or debris are present upon startup, the pump should be allowed to run until the pumpage is clean. Stopping the pump when handling large amounts of abrasives (as sometimes present on initial starting) may lock the pump and cause more damage than if the pump is allowed to continue operating.

Every effort should be made to keep abrasives out of lines, sump, etc. so that they will not enter the pump.

Packing Box Adjustment

On the initial starting it is very important that the packing not be tightened too much.

New packing must be "run-in" properly to prevent damage to the shaft and shortening of the packing life. See Startup with New Packing Section for further information.

The packing box must be allowed to leak for proper operation. The proper amount of leakage can be determined by checking the temperature of the leakage, this should be cool or just lukewarm - NOT HOT - usually 40 to 60 drops per minute will be adequate.

When adjusting the packing gland, bring both nuts down evenly and in small steps until the leakage is reduced as required. The nuts should only be tightened about 1 /2 tum at a time at 20 to 30 minute intervals to allow the packing to "run-in".

When adjusted properly, a set of packing will provide good service. Occasionally a new ring of packing may need to be added to keep the box full. After adding two or three rings of packing, or when proper adjustment cannot be achieved, the packing box should be cleaned completely of all old packing and re-packed.

Line Shaft Lubrication

Open line shaft bearings are lubricated by the pumped fluid.

Shut Down

The pump may be stopped with the discharge valve open without causing damage.

However, in order to prevent water hammer effects, the discharge valve should be closed first.

1. Close discharge valve.
2. Stop driver.

Minimum Flow Limitation

All centrifugal pumps have limitations on the minimum flow at which they should be operated. The most common limitation is to avoid excessive temperature buildup in the pump because of absorption of the input power into the pumped fluid. Other less understood reasons for restrictions are:

1. Increased NPSHRat low flows.
2. Noisy, rough operation and possible physical damage due to internal re-circulation. (The noise may be under water and not audible).
3. Increased pulsation levels.

The size of the pump, the energy absorbed, and the liquid pumped are among the considerations in determining these minimum flow limitations. For example, some small pumps have no limitations, except for temperature build up considerations while many large, high horsepower pumps have limitations as high as 40-50% of the best efficiency point capacity. Safe flow for this pump is given under Pump Specifications.

General

A daily inspection is recommended as the best means of preventing breakdown and keeping maintenance costs to a minimum. Maintenance personnel should look over the whole installation with a critical eye each time the pump is inspected -a change in noise level, amplitude of vibration, or performance can be an indication of impending trouble.

Any deviation in performance or operation from what is expected can be traced to some specific cause. Determination of the cause of any misperformance or improper operation is essential to the correction of the trouble -whether the correction is done by the user, the dealer or the factory. Variances from initial performance will indicate changing system conditions, wear, or impending breakdown on the unit.

Periodic Inspection

A periodic (once a month) detailed inspection is suggested for the pump. During this inspection, the pump should be checked for performance and change in noise or vibration level, loose bolts or piping, dirt and corrosion. Clean and repaint all areas that are rusted or corroded.

Packing Box Maintenance

Maintenance of the packing box will consist of tightening the packing gland occasionally as the leakage becomes excessive, and installing new packing rings or sets as required.

Replacing Packing

Remove gland and all old packing. If the box contains a lantern ring remove this and all packing below it. Inspect shaft or sleeve for score marks or rough spots. Be sure bypass holes (if required) are not plugged. Repair or replace badly worn shaft or sleeve. If wear is minor, dress down until smooth and concentric. Be sure to replace lantern ring in proper position when used.

NOTE:
Formed replacement packing rings are recommended and are available from the factory. Replace gland and tighten nuts, making sure gland enters box squarely. Keep the packing under moderate pressure for one minute to allow it to cold flow and adjust itself. Back off on the gland until loose before starting the pump.

Startup with New Packing

Check that the bypass line (if used) is connected and packing gland is loose. Start pump and allow it to run for 20 to 30 minutes, do not tighten the gland during this "run-in" period even if leakage is excessive. If the leakage continues to be more than normal, adjust as outlined in Packing Box Adjustment Section. Should the new packing cause excess heating during "run-in" flush the shaft and packing box area with cold water or shut the pump down and allow it to cool if necessary.

Impeller Adjustment

Ordinarily the impeller will not require frequent readjustment if properly set at initial installation. Almost no change in performance can be obtained by minor adjustment of enclosed impellers.

Pump Lubrication

Other than the packing box lubrication and lines haft lubrication, the pump will not require further periodic lubrication. The suction bearing on the bowl assembly should be repacked when repairs is made, however, no attempt should be made to repack until repairs to the bowl assembly are necessary.

Trouble Shooting

Condition	Probably Cause	Remedy
Pump will not Run	1. Motor overload contacts open: - Incorrect control box - Incorrect connections - faulty overloads - low voltage - ambient temperature of control box or starter too high 2. Blown fuse, broken or loose electric connection. 3. Defective motor. 4. Foully control equipment. 5. Faulty switch. 6. Pump binding.	1. Check the following: - Check nameplate for HP and voltage. - Check the wiring diagram furnished with starter. - Replace - Check voltage at pump side of the control box. - Use ambient compensated relays 2. Check fuses, relays or heater elements for correct size and all electrical connections. 3. Repair or replace. 4. Check all circuits and repair. 5. Repair or replace. 6. Pull master switch, rotate pump by hand to check. Check impeller adjustment or disassemble unit to determine cause.
Pump Runs, but No Water Delivered	1. Line check valve backward. 2. Line check valve stuck. 3. Unit running backwards. 4. Lift too high for pump. 5. Pump not submerged. 6. Excessive amounts of air or gas. 7. Impeller plugged, or pump in mud or sand. 8. Impeller loose on shaft.	1. Reverse check valve. 2. Free the valve. 3. See Sections Installing Hollow Shaft Driver and Installing Solid Shaft Driver. 4. Check with performance curve. 5. Lower pump if possible or odd fluid to system. 6. Correct conditions. 7. Start and stop pump several times or use line pressure if available to bock flush. Pull pump and clean. 8. Pull unit and repair.
Reduced Capacity	1. Bypass open 2. Lift too high for pump 3. Motor not coming up to speed 4. Impeller portly plugged 5. Scaled or corroded discharge pipe or leaks anywhere in system. 6. Excessive amounts of air or gas. 7. Excess wear due to abrasives. 8. Impeller not properly adjusted. 9. Impeller loose on shaft. 10. Wrong rotation.	1. Check bypass valve 2. Check performance curve. 3. Check voltage while unit is running. 4. Start and stop pump several times or use line pressure if available to bock flush. Pull pump and clean. 5. Replace pipe or repair leaks. 6. Correct conditions. 7. Replace worn ports. 8. See Section Installing Solid Shaft Driver. 9. Pull unit and repair 10. Correct. See Sections Installing Hollow Shaft and Installing Solid Shaft Driver.
Pump Vibration Excessive & Noisy	1. Unit running backwards 2. Pump breaking suction and pumping air. 3. Loose fasteners. 4. Badly worn motor or pump bearings. 5. Impeller loose on shaft. 6. Pump and motor shafts misaligned. 7. Stress due to piping misalignment.	1. See Sections Initial Starting of Unit, Installing Hollow Shaft Driver, and Installing Solid Shaft Driver. 2. Lower pump or reduce co pacify. 3. Check all bolts, nuts, etc. 4. Pull unit and repair. 5. Pull unit and repair. 6. Pull unit and repair. 7. Pull unit and repair.
Excess Wear	1. Abrasives. 2. Pump in bind. 3. Vibration.	1. Change to harder materials. 2. Pull master switch, rotate pump by hand to check. 3. Disassemble unit to determine cause.
Corrosion	1. Impurities. 2. Corrosive liquid.	1. Analyse Fluid 2. Change to corrosion resistant materials
Pumped Liquid in Enclosing Tube	1. Insufficient pressure and flow lubricating system. 2. Worn bowl bearings. 3. Defective enclosing tube or connector bearing thread.	1. Adjust pressure/flow. Check for blockage. 2. Replace bearings. 3. Check and replace if necessary.
Excessive Packing Box Leakage	1. Gland not properly tightened. 2. Ends of pocking not staggered. 3. Worn packing or sleeve.	1. Adjusts necessary. 2. Replace per Section Replacing pocking. 3. Replace worn parts.
Overheating	1. Bearings - shaft bent - rotating element binds - pipe strain - insufficient bearing lubrication - flushing water not circulating through enclosing tube 2. Packing Box - Packing gland too tight. - Water flush line plugged.	1. Bearings - Check for shaft bent - remove and straighten or replace - Correct - Correct - Check for blockage or insufficient pressure 2. Packing Box - loosen gland until temp drop, adjust per Section Packing Box Adjustment - Correct

General

It must be borne in mind that eventually repairs will have to be made. When regular maintenance checks indicate unusual vibration levels or a drop in performance, an overhaul is probably imminent.

Repairs will consist of removal of the unit and disassembly to the point necessary for replacement of worn parts.

Disassembly should be performed in a clean area with sufficient space to lay out the parts in order of disassembly. Cleanliness throughout repairs is important - remember this is a close tolerance, high-speed machine and should be handled as such.

CAUTION

Protect machined surfaces from burrs and scrapes, which will cause misalignment

Equipment & Tools

Required equipment and tools will be as listed in Section 3 and Section 4 of this manual.

CAUTION

Always pull and lock the driver master switch before doing any work on the pump or driver.

Packing Box Repairs

Packing box repairs can be done without removing the complete unit. Packing replacement is outlined in Section 4 can be accomplished without disturbing the pump or driver. The packing box bearing can be replaced if necessary by removing the driver and sliding the packing box off over the shaft.

Disassembly

NOTE:.
Refer to Section 8 for parts drawings and identification.

1. Disconnect pump shaft from driver. Remove shaft nut lock screw, adjusting nut gib key, and driver clutch. Unscrew headshaft from the shaft coupling inside discharge head and remove.
2. Remove bolts which attach driver to discharge head.
3. Lift driver off pump and set on wooden supports.
4. Disconnect discharge piping from pump.
5. Remove anchor bolts (or nuts).
6. Lift pump vertically until the pump suction clears the foundation.
7. Cover opening in foundation.
8. Lower pump and position horizontally on suitable support and in suitable area for disassembly. Be sure & support the bowl assembly when lowering, so that weight is not carried by the suction.

NOTE:
If more than minor repairs are anticipated it is recommended that the unit be taken to a shop or other clear area with a smooth floor and overhead lifting equipment.

9. Remove gland
10. Remove capscrews, which attach the packing box or seal housing to discharge 13. Remove packing box tensioner or seal housing head.

NOTE:
Before proceeding further make sure the discharge head and bowl assembly are supported independently of each other.

11. Disconnect bowl assembly or top column from discharge head. This connection is be flanged.
12. Remove discharge head being careful not to damage shaft.
13. Disconnect top column pipe, if present, at first joint below top and remove from shaft.
14. Open lineshaft construction - each time a lineshaft coupling is exposed by removing a length of column pipe the lineshaft and coupling should be removed by holding the coupling and turning the upper lineshaft in right-hand direction (lineshaft threads are left-handed).

CAUTION

When using wrenches on shafting always place the wrenches on the same side of the shaft as illustrated in Figure 7-A to avoid excess side strain on the shafting.

Figure 7-A Correct Positioning of wrenches on shafting

15. Disconnect each section of column pipe one at a time and remove along with shaft as applicable until all are removed.

16. Remove bowl assembly to clear area and continue disassembly as outlined in the Bowl Disassembly, Inspection, Repair, and Reassembly Section.

Inspection & Cleaning

After disassembly, all components should be thoroughly cleaned and examined for physical defects, wear, corrosion and damage. Check all bearings for total clearance over the shaft diameter. It is recommended that all bearings indicating wear be replaced.

All bearings are pressed into their respective bores and can be either pressed out or machined on the inside diameter until the wall is thin enough to collapse. Bearings are removed by collapsing the bearing and removing, or by trimming off one end and sliding the bearing out.

Replacement Parts

Parts showing signs of damage, cracks or excessive wear should be replaced. Use only genuine LIFECO Pump parts for replacements. Order replacement parts as indicated in Section 8.

When repairing a pump that has been in seNice for several years, the physical condition or strength of all parts such as capscrews, bowls, threads, etc., must be carefully checked to be sure these parts can continue to perform their function without failure.

Repack suction bearing as outlined in the Bowl Disassembly, Inspection, Repair, and Reassembly Section. Thoroughly clean all threaded connections and flanges and paint with pipe joint compound.

Assembly

Assembly of the pump is basically the reverse of disassembly. Before proceeding with assembly, clean thoroughly and check all threads, registers and mating faces for burr. Clean up with file where required. Lubricate as outlined above.

Proceed with assembly in reverse order of disassembly as outlined in the Disassembly Section above.

Figure 7-B indicates recommended torque values for standard fasteners.

Torque Values for Standard Fastener								
Fastener Size	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4
Torque (ft-lb)	5.4	10	17	27	40	60	84	135

Cleanliness and proper lubrication are very important since one small chip, burr or one dry bearing can be cause for redoing the whole job.

Stuffing Box/ Tensionier Assembly & Adjustment

1. Clean all o-rings sealing surfaces and oil lightly.
2. Slide stuffing box with bearing on the discharge head.
3. After assembling discharge head to column, connect the head lineshaft.
4. Put a seal cage into packing box by hand.
5. Install packing into packing box.
6. Tighten packing box I tensioner until the holes in the tensioner line up with the first tapped hole in the discharge head (1 /8 to 1/4 turn maximum past contact).
7. Proceed with remainder of installation.

Bowl Disassembly, Inspection, Repair, And Reassembly:

Bowl Disassembly

1. Match mark all flange butts. A punch mark on each flange will help. For formal structure:
2. With the bowl laying on a horizontal surface, unbolt and slide the bowl together with the wear ring and bushing as a unit from the shaft.
3. Slide the shaft sleeve.
4. Remove the impeller and the key from the shaft, match marked.
5. Repeat 2-4 till the last impeller is disassembly.
6. Slide the suction unit from the end of the shaft.

For Inversion Structure

1. With the bowl laying on a horizontal surface, unbolt and slide the suction unit from the end of the shaft.
2. Slide the shaft sleeve.
3. Remove the impeller and the key from the shaft, match marked.
4. Slide the bowl together with the wear ring and bushing as a unit from the shaft.
5. Repeat 3-5 till the last bowl is disassembly.

All the parts should be match marked.

Inspection

After disassembly, all the components of the bowl assembly should be thoroughly cleaned and examined for physical defects. The following components should be inspected for wear, corrosion and damage.

1. **Impeller**
   check water passageways for signs of damage from abrasion or corrosion, check impeller skirts against "as new" clearance.

2. **Shaft**
   check shaft for pitting and wear. Check for straightness shaft must be straight within .005 total indicator reading.

3. **Bowls**
   check water passageways for signs of damage from abrasion or corrosion, check bushing & bushing house against "as new" clearance.

4. **Bearings**
   check all bearings for total clearance over the shaft diameter. It is recommended that all bearings indicating wear be replaced. The chart below lists the most common observations, and corrective action required.

Bowl Disassembly

Parts showing signs of damage, cracks or excessive wear should be replaced. Use only genuine LIFECO Pump parts for replacements. Order replacement parts as indicated in Section 8.

When repairing a bowl assembly that has been in service for several years, the physical condition or strength of all parts such as bowls must be carefully checked.

When attempting to rework any part extreme care must be taken to maintain alignment of mating parts and "as new" tolerance.

1. **Replacing Bearings:**
   Replacement bearings are furnished "to size" for press fitting into their respective bores with a .001" to .003" interference fit. If the bearing bore is heavily scarred or corroded. The part should be replaced or reworked to provide a true bore for the bearing.

2. **Replacing Shah:**
   Shaft damage is usually best corrected by replacing the shaft. Due to the possibility of interim damage, replacement shafts should always be checked for straightness before installing.

3. **Repairing Enclosed Impeller and Bowl Seal Surface:**
   Enclosed impeller skirt and bowl seal surface wear can be corrected by installing wear rings if the damage is not excessive. This is usually accomplished by turning the impeller skirt to obtain a smooth surface and then boring the bowl and installing wear rings on either, or both, surfaces. If the original unit was furnished with either bowl or impeller (or both) wear rings, these should be removed completely and replaced.

   When wear rings are installed on the impeller it is recommended that a shrink fit be utilized -the interference should be heavy to prevent slippage, 0.01 0" on the smaller units and up to 0.015" to 0.020" on the larger sizes. Sufficient heat is then applied to the wear ring to expand it and allow the wear ring to drop over the impeller.

   When wear rings are installed in bowl a .003" to .005" press fit should be used. The wear ring can be installed by carefully tapping into place. A wooden block should be used to protect the wear ring.

Reassembly

Assembly of the unit is essentially the reverse of disassembly. Before proceeding with assembly, clean thoroughly and check all threads, registers and mating faces for burrs. Cleanup with file where required.

Cleanliness and proper lubrication are very important since one small chip, burr or one dry bearing can be cause for redoing the whole job.

1. Place the bowl shaft on a horizontal surface.
2. Check shaft closely for nicks or burrs- smooth with emery cloth as required.
3. Check shaft for straightness - shaft must be straight within .005" total indicator reading. If the shaft is not straight it must be straightened or replaced. If the deflection is gradual over a considerable length the shaft can usually be straightened by supporting on two blocks straddling the crooked section and applying pressure to the high side to deflect the shaft in the opposite direction. If the shaft has a sharp crook (dog-leg) it is recommended that the shaft be replaced since the shaft will not always remain straight even if satisfactorily straightened.

For Formal Structure

4. Slide the suction and shaft sleeve on the shaft.

All the parts should be match marked.

5. Slide the impeller on the shaft and set it at the bdc. Check the location dimension A by a depth indicator. Refer to the figure 7-D and 7-E for the recommended value.

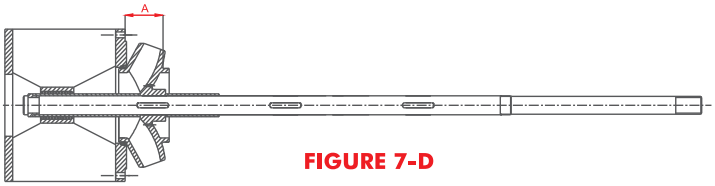


FIGURE 7-D

RECOMMENDED VALUE OF A/A' & C-B/B'-C'					
MODEL	RECOMMENDED VALUE				REMARKS
	A mm	C - B mm	A' mm	B' - C' mm	
LFP-750-70-VT	≤ 70.5	≥ 8			Formal Structure
LFP-1250-80-VT			≥ 9	≥ 8	Inversion Structure
LFP-2000-90-VT			≥ 21	≥ 10	Inversion Structure

FIGURE 7- E. RECOMMENDED VALUE OF A/N & C-B/B'-C'

6. Assemble the first bowl to the head face of the suction and bolt on by double nut (or single nut with flat washer & spring washer). Slide the Shaft sleeve and the key on the shaft.

If the shaft is too long (more than 3 stages), avoid by all means to put the bowl on the shaft and generate radical stress. The bowl should assembled without exert any force to the shaft. Check the shaft to make sure the shaft rotating flexible without stuck.

7. Slide the next impeller on the shaft and set it at the bdc. Check the location dimension A by a depth indicator. Refer to the figure 7-F and 7-E for the recommended value

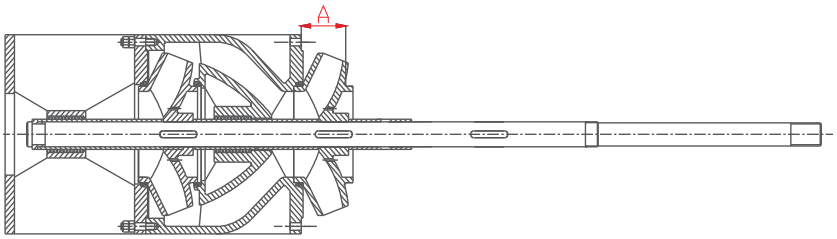


FIGURE 7-F

8. Refer to the description in 7, assemble the next bowl to the former one and bolt on by double nut (or single nut with flat washer & spring washer).

For pump more than 2 stages, repeat 5 to assemble the impeller and then 6 for the bowl, over and over again until the last bowl assembled. Finally, slide the shaft sleeve on the shaft and fasten the 2 lock nut.

The last sleeve should press the impeller (or the tangent sleeve), and the other end should cover the screws on the shaft at least 5 mm. When fastening the lock nut, make sure to fasten the second one after the first one is fully tighten.

9. Assemble the interconnection pipe to the last bowl (upper bowl), and bolt on by double nut (or single nut with flat washer & spring washer). Check the location dimension B by a depth indicator. Then adjust the rotor to BDC and Check the location dimension C by a depth indicator. Refer to the figure 7-E and 7-E for the recommended value.

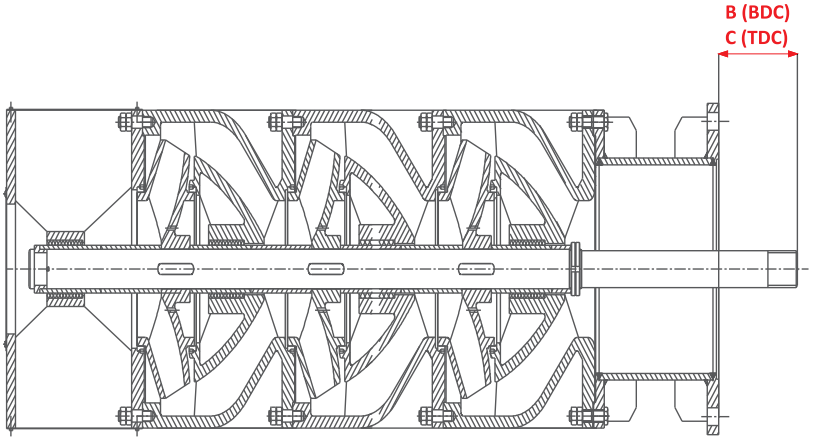


FIGURE 7-G

So Far the Bowl Assembly is Complete

For Inversion Structure

10. Assemble the last bowl on the shaft. Slide the Shaft sleeve and the key on the shaft.

CAUTION

If the shaft is too long (more than 3 stages), avoid by all means to put the bowl on the shaft and generate radical stress. The bowl should assembled without exert any force to the shaft. Check the shaft to make sure the shaft rotating flexible without stuck.

11. Slide the impeller on the shaft and set it at TDC.

CAUTION

Check the shaft to make sure the shaft rotating flexible without stuck. TDC and Check the location dimension A' by a depth indicator. Refer to the figure 7-H and 7-E for the recommended value.

12. Assemble the bowl to the end face of the upper bowl & bolt on by double nut (or single nut with flat washer & spring washer). Slide the Shaft sleeve and the key on the shaft.

CAUTION

Check the shaft to make sure the shaft rotating flexible without stuck.

13. Slide the next impeller on the shaft and set it at TDC.

CAUTION

Check the shaft to make sure the shaft rotating flexible without stuck. TDC and Check the location dimension A' by a depth indicator. For pump more than 2 stages, repeat 10 to assemble the bowl & then 11 for the impeller, over and over again until the last impeller assembled.

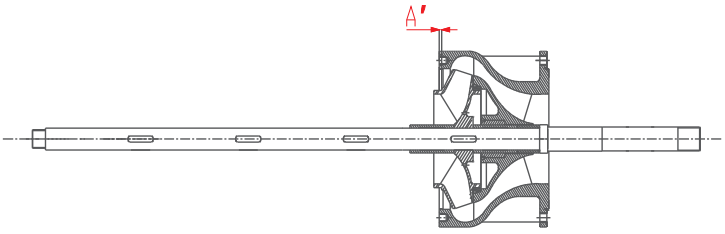


FIGURE 7-H

14. Slide the suction to the end face and bolt on by double nut (or single nut with flat washer&spring washer).

CAUTION

Check the shaft to make sure the shaft rotating flexible without stuck. Slide the shaft sleeve on the shaft and fasten the 2 lock nut.

CAUTION

The last sleeve should press the impeller (or the tangent sleeve), and the other end should cover the screws on the shaft at least 5 mm. When fastening the lock nut, make sure to fasten the second one after the first one is fully tighten.

15. Assemble the interconnection pipe to the last bowl (upper bowl), and bolt on by double nut (or single nut with flat washer & spring washer). Check the location dimension B' by a depth indicator. Then adjust the rotor to BDC and Check the location dimension C' by a depth indicator. Refer to the figure 7-1 and 7-E for the recommended value.

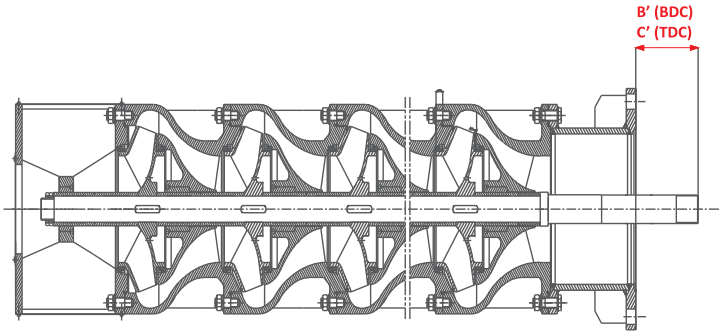


FIGURE 7-I

SO FAR THE BOWL ASSEMBLY IS COMPLETE

Ordering Parts

When ordering spare parts or replacement parts the pump serial number and size and type of pump must be given. This can be found on the nameplate furnished with the unit. Give the complete name and reference number of each part as indicated on the applicable sectional drawing (chart 1-fire pump sketch) and the quantity required.

Stocking Spare Parts

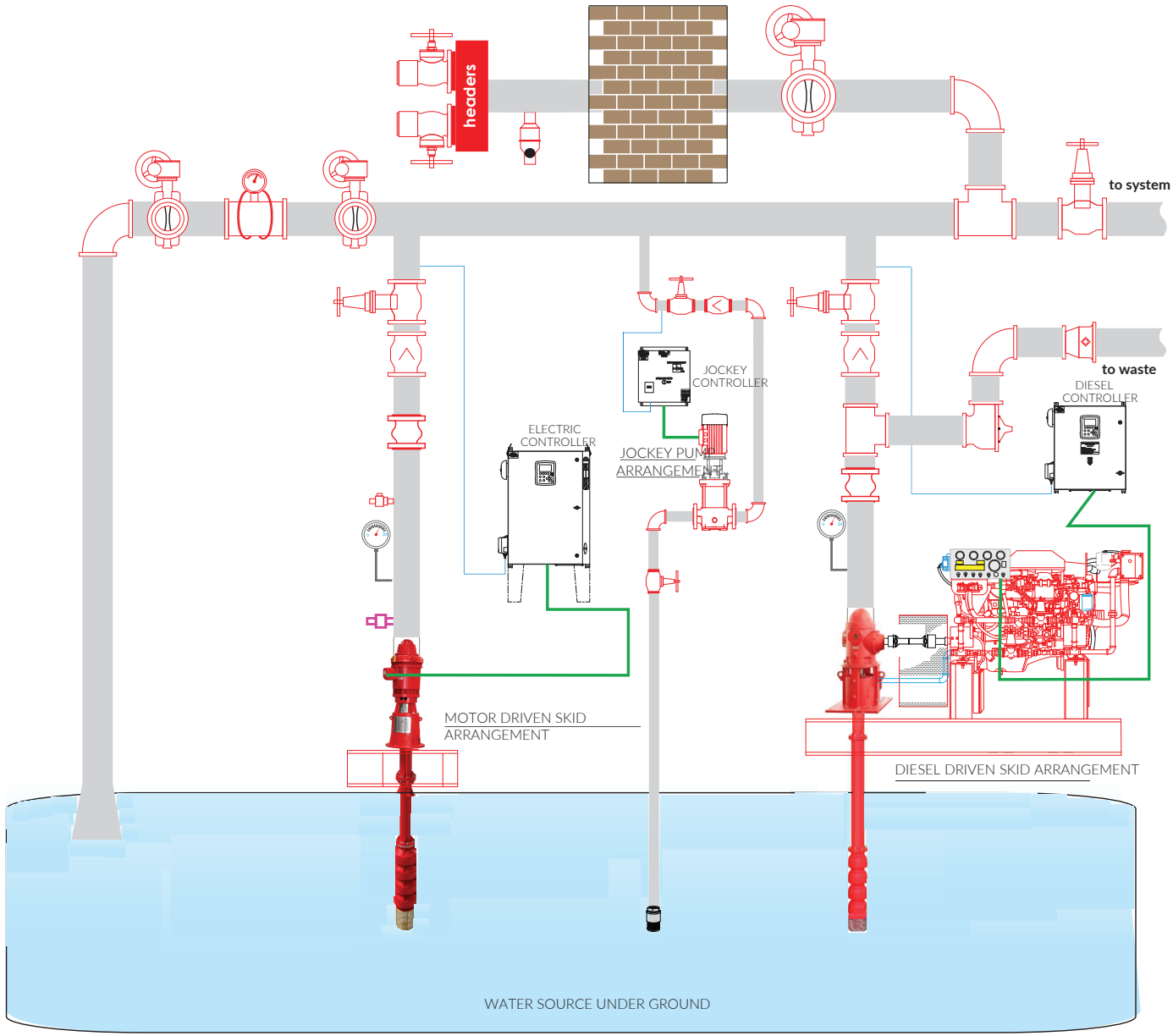
Spare parts to be kept in inventory will vary according to service, field maintenance anticipated, allowable down time and number of units. A minimum inventory of one complete set of bearings, gaskets, o-rings, and packing and one spare of each moving part is suggested.

Returning Parts

All materials returned to the factory must be accompanied by a Returned Goods Authorization (RGA) form. The RGA forms can be obtained directly from the factory or through your local LIFECO Pump representative. The RGA form must be filled in completely and forwarded as directed thereon. Parts being returned under warranty claim must have a complete written report submitted with the RGA form.

Returned material must be carefully packaged to prevent transit damage. The factory cannot assume any responsibility for parts damaged in transit.

Sample Arrangement



LEGEND OF ACCESSORIES

- ECCENTRIC REDUCER
- CONCENTRIC REDUCER
- GATE VALVE OS&Y
- CHECK VALVE
- FLEXIBLE JOINT
- ELBOW
- TEE
- COMPOUND PRESSURE GAUGE
- DISCHARGE PRESSURE GAUGE
- AIR RELEASE VALVE
- FLOW METER
- DRIP BALL VALVE
- BUTTERFLY VALVE
  GATE VALVE OS&Y CAN BE USED OPTIONAL
- GATE VALVE
- WASTE CONE
- PRESSURE RELIEF VALVE
- HOSE VALVE
- ELECTRIC CONNECTION
- RAW WATER COOLANT LINE
- PIPES
  PIPE SIZING PLEASE REFER TO NFPA 20
- SENSING LINE
- FOOT VALVE
- CIRCULATION RELIEF VALVE

DISCLAIMER

The information contained in this Manual is intended to be used for assisting operating personnel, by providing complete and accurate information to meet operating, maintenance or service requirements of the LIFECO Vertical Turbine Fire Pumps.

The contents of this manual, are not intended to supplement or replace any statutory or regulatory requirements, or does not relieve the user of their responsibility of handling the equipment. All working of the LIFECO Vertical Turbine Fire Pumps. must be in accordance with the applicable instructions and/or standards.

LIFECO reserves the right to make changes to its products and their specifications, and to this manual, without any prior notice.

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