Horizontal End Suction Fire Pumps

Centrifugal Fire Pump System

Installation, Operation & Maintenance Manual

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Overview

End-suction pumps are heavy duty, general purpose centrifugal pumps with heavy wall castings suitable for a variety of commercial and industrial applications demanding reliable and cost-efficient supply. The pumps are all non-self-priming single-stage, centrifugal volute pumps with axial suction port, radial discharge port and horizontal shaft. The pumps are of the back pull-out design enabling removal of the motor, coupling, bearing bracket and impeller without disturbing the pump housing or pipework. Even the largest pumps can thus be serviced by a single person with a crane. Close-coupled, space-saving economy plus rugged construction make an ideal selection for multiple applications. High efficiency, robust case construction of cast ironand impeller construction of bronze makes these pumps an ideal selection for applications that require easy-to-maintain, reliable, long lasting pumps.

Installation

1.1 STORAGE & PROTECTION

All pumps are shop serviced and ready for operation when delivered, but there is 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 equipment is to be stored for long periods of time (six months or more), the following precautions should be taken to insure that the equipment remains in good condition.

1. Be sure that the bearings are fully lubricated.
2. Unpainted-machined surfaces, which are subject to corrosion, should be protected by some corrosive resistant coating.
3. The shaft should be rotated 10 to 15 revolutions by hand periodically in order to spread the lubricant over all the bearing surfaces. Suitable intervals are from one to three months, depending on atmospheric conditions, etc. In order to insure that the pump shaft does not begin to sag, do not leave the shaft in the same position each time.
4. Space heaters on motors and controllers should be connected and fully operable if atmospheric conditions approach those experienced in operation. Consult instruction manuals for other precautions concerning storage of individual components of pumping unit.
5. Fresh lubricant must be applied to bearings upon removal of equipment form storage.

1.2 FOUNDATION FOR HORIZONTAL END SUCTION PUMPS

Foundation should be sufficiently substantial to absorb any vibration and to form a permanent, rigid support for the base plate.

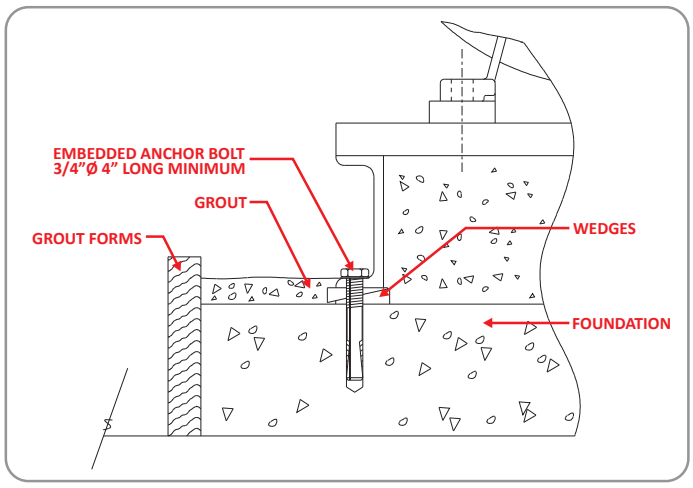
Foundation bolts of suitable size should be embedded in the concrete located by a drawing or template.

Place pumping unit on foundation with wedges under base plate leaving approximately 3/4” space for grouting.

Carefully level the unit by adjusting the wedges until shafts of pump and driver are leveled, recreating factory alignment.

Check coupling faces as well as suction and discharge flanges of pump with a level.

Slight misalignment at this point may be corrected by adjusting the wedges.



After unit has been in operation for about a week, check alignment. Any misalignment may be corrected by placing shims between base and driver or pump feet.

1.3 PUMP MOUNTING AND PIPING

Connect pipelines after the grout has thoroughly hardened. The suction and discharge piping should be installed with the shortest and most direct runs. Elbows should preferably be of the long radius type. Pipes must line up naturally. The piping must never be pulled into position by the flange bolts. Such action may draw the pump out of alignment. Pipes should be support independently of the pump so as not to put any strain on the pump casing. Suction piping, if not properly installed, is a potential source of faulty operation. Suction lines should be free of air leads, and arranged so there are no loops or high spots in which air can be trapped. Generally, the suction line is larger than the pump suction nozzle, and eccentric reducers should be used. Eccentric reducers are not necessary for bottom suction pumps. If the liquid supply is located below the pump centerline, the reducer should be installed with the straight side up.

Most often air enters the suction pipe entrained in the liquid. Installations with a static suction lift preferably should have the inlet of the vertical suction piping submerged in the liquid to four times the piping diameter. A large suction pipe will usually prevent the formation of vortexes or whirlpools, especially if the entrance is flared (Figure 1). A floating vortex breaker (raft) around the suction piping may be provided if a tendency appears for a vortex to form at the liquid surface. A stream of liquid falling into the sump near the intake pipe will churn air into the liquid (Figure 2). The supply line should extend down into the sump. Liquid supply entering a well perpendicular to the intake line tends to rotate the liquid, which interferes with the flow into the suction line (Figure 3).

A baffle placed in front of the supply pipe will remedy this situation. A short elbow should never to bolted directly to the pumps suction nozzle. The disturbance in the flow caused by the sharp bend so near the pump inlet may result in noisy operation, loss inefficiency, and capacity, and heavy end thrust.

A long sweep or long radius elbow placed as far away from the pump as practicable should be used if a bend is necessary in the suction line. If separate suction lines cannot be used for each pump, then a tapering header with Y-branches should be used (Figure 4A). A straight branch header should never be used. Prior to installing the pump, suction piping and pump should be inspected internally, cleaned and flushed. If a strainer is installed in the suction line, the openings in the screen must be checked and cleaned periodically. The opening must be smaller than the sphere size allowed by the impeller.

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

Stuffing box seal connections are usually made form the top of the pump casing. If the liquid being pumped is unsuitable for sealing, then it is preferable to bring fresh, cool water to seal connections from an outside source. Centrifugal separators or other filters may be used to remove abrasive particles from the liquid being pumped if an outside source is not available. After all piping connections have been made, the alignmentshould be checked again.

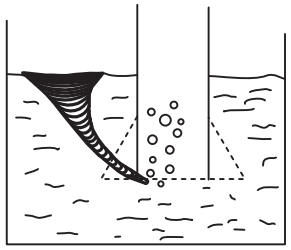


FIGURE 1
Enlarging the suction pipe usually prevents whirlpools and the resultant entrance of air into the pipes.

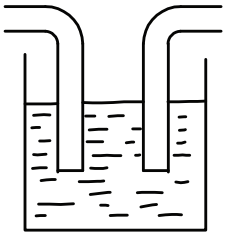


FIGURE 2(b)
Supply line should extend down into the sump to prevent the churning of air into the water.

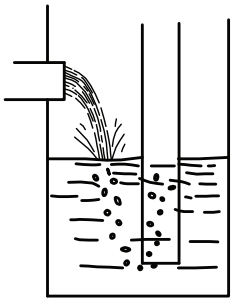


FIGURE 2(a)
Water falling into sump churns air into the sump liquid and causes trouble in the suction line.

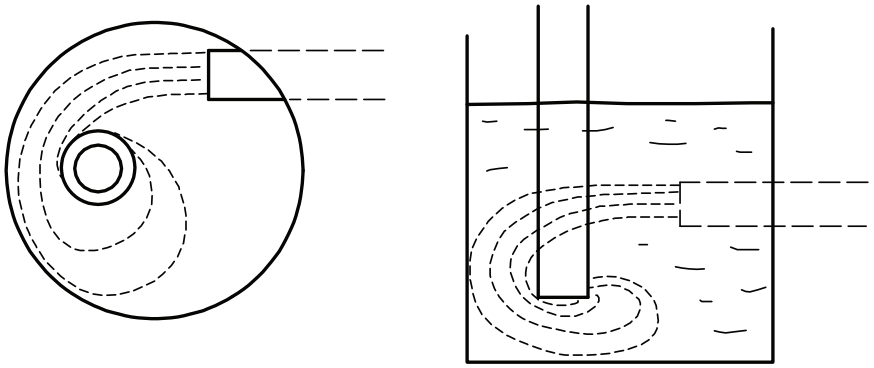


FIGURE 3
Rotation of water in the well, as illustrated, can be prevented with a baffle

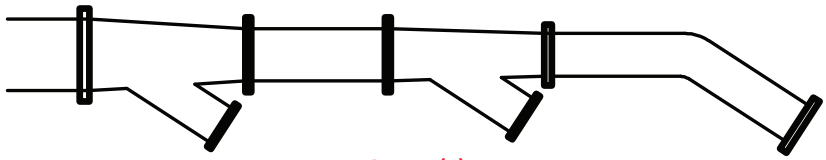


FIGURE 4(a)
Shows the tapering header which should be used
if two or more pumps are served with one intake line.

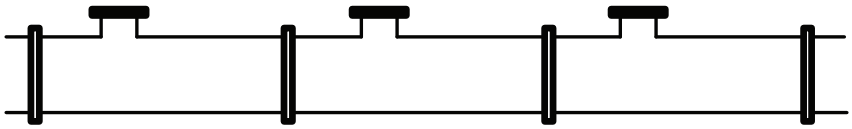
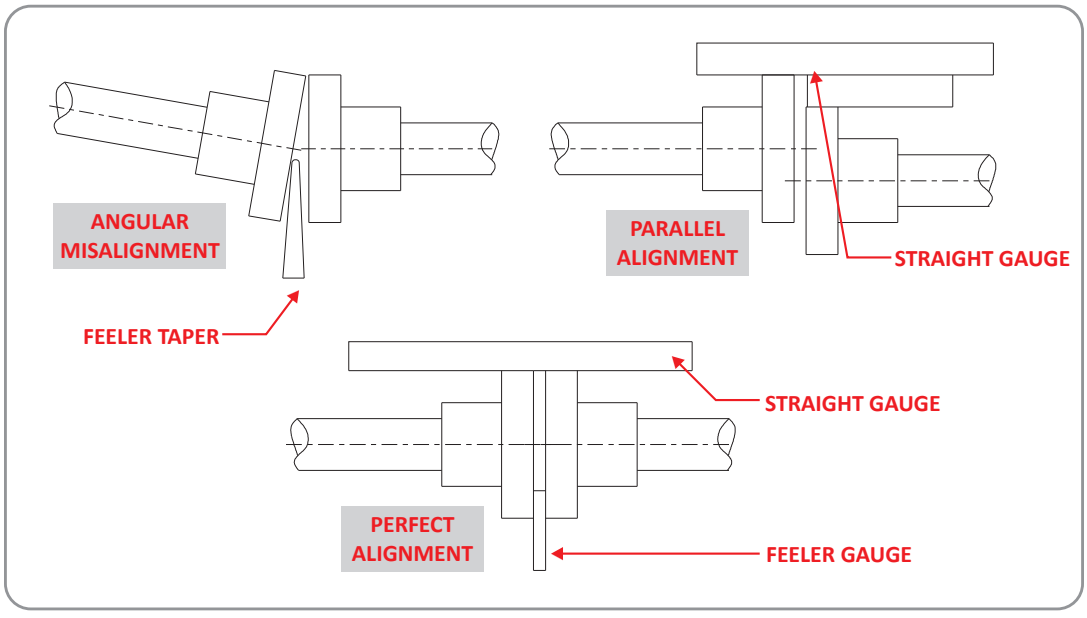


FIGURE 4(b)
The pipe shown in the above figure should never be used.

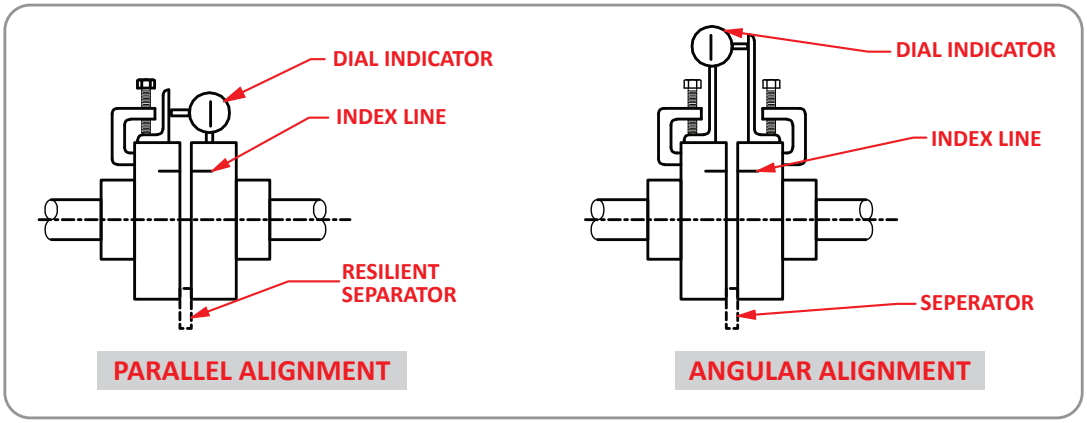
1.4 ALIGNMENT

The flexible coupling compensates for temperature changes and permits shafts end movement without interference; it will not compensate for misalignment. Faulty alignment will result in noisy pump operation, reduced bearing life, excessive coupling wear.

- Carefully verify the alignment after the foundation bolts have been properly tightened
- Alignment should be again verified after piping is installed and unit has operated under normal conditions at operating temperature
- To verify alignment, place a straight edge across the coupling as shown; this must rest evenly on both rims at top, bottom and both sides
- With a pair of inside calipers or thickness gauge, check distance between coupling halves at points where straight edge was used; distance must be equal at all points



TESTING ALIGNMENT - STRAIGHT EDGE



TESTING ALIGNMENT - DIAL INDICATOR

1.5 MINIMUM FITTINGS

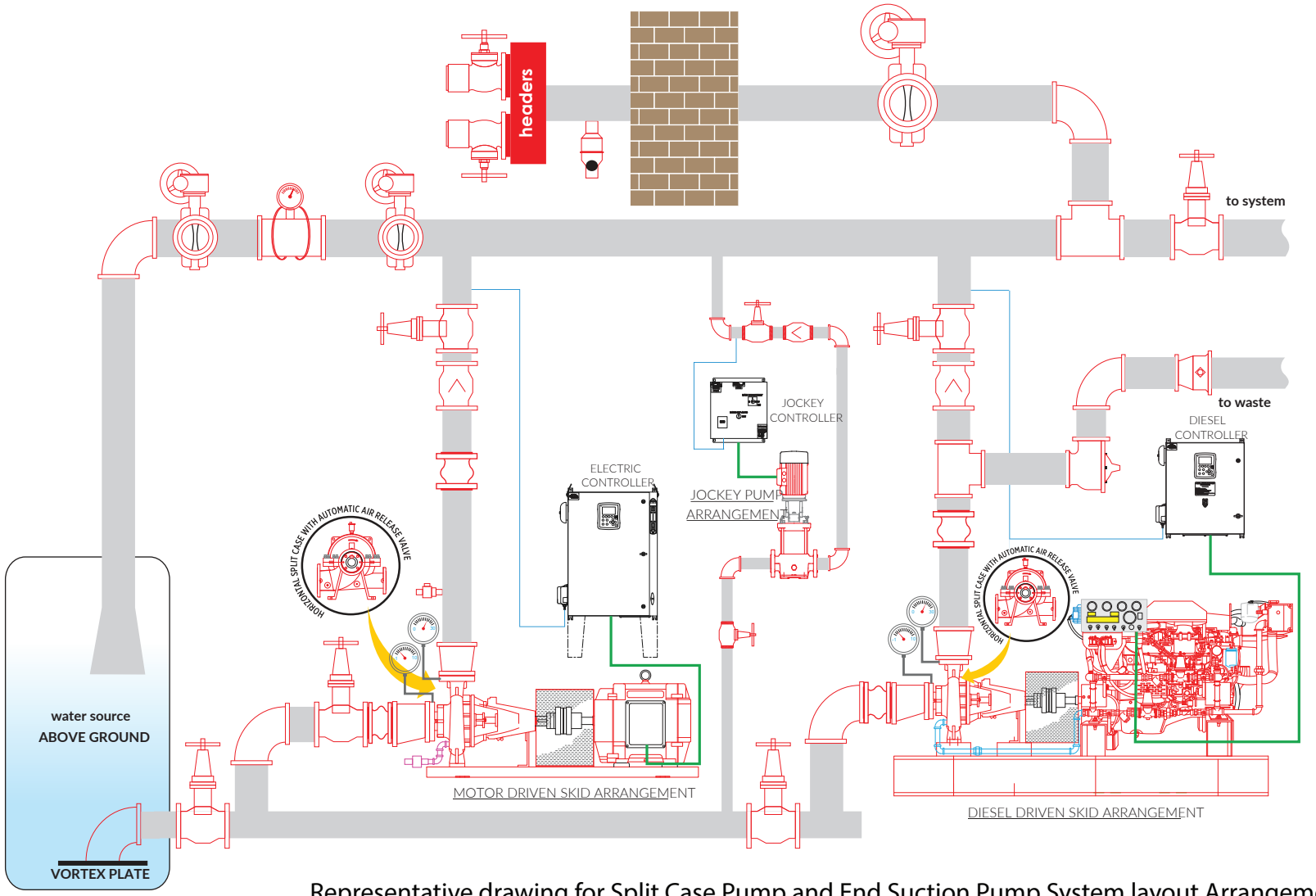
If minimum fittings recommended by N.F.P.A. 20 are supplied loose, they should be installed as follows:

SUCTION AND DISCHARGE GAUGES

- The following gauges are required to measure both suction and discharge pressures, and must be supplied with all fire pumps to ensure close check on pump performance:

  - 4 " dial combination pressure and vacuum suction gauge
  - 4 " dial discharge pressure gauge

Sample Arrangement



Representative drawing for Split Case Pump and End Suction Pump System layout 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
- CIRCULATION RELIEF VALVE
- CIRCULATION RELIEF LINE

Operation

WARNING

PRIOR TO START-UP, CHECK THE COUPLING ALIGNMENT AS COVERED IN THE INSTALLATION SECTION. OPERATION OF THE PUMP WITH THE UNIT MISALIGNED WILL CAUSE DAMAGE TO THE SHAFT, BEARINGS, AND THE COUPLING.

2.1 STARTING

- When possible, turn the pump shaft by hand to insure that the parts do not bind
- Check the bearing lubricant
- Open the valve in the pump suction line, if fitted
- Close discharge valve
- Prime the pump in one of the following ways:

- If the pump operates under positive pressure, open vent valve on top of the pump casing. After all entrained air has escaped, close the vent valves. Rotate the shaft, if possible, to allow any air trapped in the impeller passages to escape.

- If the pump operates on a suction lift and a foot valve is included in the system, fill the pump and the suction line with liquid from an outside source. Trapped air should be allowed to escape through the vent valve while filling.

- If the pump operates on a suction lift and no foot valve is provided, use a vacuum pump or ejector operated by air, steam, water, etc. to evacuate air from the pump case and suction line by connecting the ejector to the priming connection on top of the pump case.

Open valves in stuffing box seal lines, if fitted. Start driver. Open dischargevalve slowly when the pump is up to speed.

CAUTION

Overheating and/or loss of prime will result if the pump is operated against a closed valve for more than a few minutes

WARNING

The coupling guard should be in place when the unit is started. Stay clear of any exposed rotating parts while the pump is operating. Contact with rotating parts may result in injury to personnel.

Adjust the packing gland until there is a slight leakage from the stuffing box.

NOTE:
Should the pump fail to build up pressure or discharge water when the discharge valve is opened, stop the pump and read ***TROUBLESHOOTING.***

2.2 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.

- Close discharge valve.
- Stop driver.
- Close water seal valves.
- Close valve in the pump suction line, if fitted. If danger of freezing exists, drain the pump

Maintenance

3.1 LUBRICATION

COUPLINGS
Couplings with rubber drive elements do not require lubrication. Most other couplings require some form of lubrication. Consult manufacturer's instructions for recommendations.

BEARINGS
Frequency of lubrication depends upon operating conditions andenvironment, therefore, lubrication intervals must be determined by experience. Table I may be used as a general guide for grease relubrication. Lubricants need replacing only because of contamination by dirt or dust, metal particles, moisture or high temperature breakdown. A small amount of grease may be added about every 400 hours of operation. The bearing housing should be about 1/3 full of grease. Oil lubricated units are provided with constant level oilers. Bottles should be kept filled at all times so that there is a visible supply of oil. All lubricants have a tendency to deteriorate in the course of time, therefore, sooner or later it will be necessary to replace the old lubricant with new. Bearings, which are dismantled, are, of course, much more easily cleaned than bearings, which stay in assembled equipment. Solvents may be used more freely and effectively. For cleaning bearings without dismounting, hot light oil at 180° - 200° F may be flushed through the housing while the shaft is slowly rotated. Light transformer oils, spindle oils, or automotive flushing oils are suitable for cleaning bearings, but anything heavier than light motor oil (SAE 10) is not recommended. The use of chlorinated solvents of any kind is not recommended in bearing cleaning.

GREASE RE-LUBRICATION
(pumps are shipped with grease in bearing housings)
- Thoroughly clean grease fitting and outside of bearing housing.
- Remove drain plug.
- Inject clean, new grease forcing out the old.
- Start and run the pump for a short time to eject any excess grease.
- Wipe off all excess grease and replace drain plug.

WARNING

Proper lubrication is essential to the pump operation. Do not operate the pump if sufficient lubricant is not present in the bearing housing of if lubricant is contaminated with excessive dirt or moisture. Operation of the unit under these conditions will lead to impaired pump performance, and possible bearing failure. Do not operate the pump with excessive amount of lubricant. Such action will cause bearings to overheat.

3.2 STUFFING BOX

The purpose of a stuffing box is to limit or eliminate leakage of the pump fluid and to prevent air from entering the suction spaces along the pump shaft. Pumps are equipped with packing (limited leakage) or mechanical seals (no leakage). Normally, the pumped liquid is used to lubricate the stuffing box seal. If the liquid is dirty, gritty, or contains material that would gum or jam the seal, use a sealing liquid from an external source. If suction pressure is above atmospheric pressure, seal piping may not be required. For pumps equipped with packing, there must always be a slight leakage from the glands. The amount of leakage is hard to define, but we recommend a steady dripping of liquid through the gland. Stuffing box glands should be adjusted after the pump is started. When leakage is excessive, tighten gland bolts evenly a little at a time. Allow an interval for packing to adjust to new position. Never tighten gland to be leakproof, as this will cause overheating and undue wear on shaft sleeves.

Replace stuffing box packing as follows:
- Shutdown the pump.
- Take precautions to prevent driver from being inadvertently started.
- Remove the gland bolt nuts and gland.
- Remove and discard old packing rings – note location of lantern ring. When repacking stuffing box, lantern ring must be positioned such that the water seal connection is opposite lantern ring.
- Clean out the stuffing box.
- Inspect shaft sleeve for wear – if it is scored or grooved, it should be replaced.
- Make sure the stuffing box bushing (if furnished) is set at the bottom of the box.
- Insert rings of packing and tap lightly to seat against bushing. Be sure rings are of the proper size & length & installed with cuts staggered. Lantern ring must be installed opposite sealing water connection.
- Install gland and tighten, finger tight. With the pump running, adjust gland as described previously. Care should be taken during the first hour of operation to take up on the packing gradually just enough to maintain the required amount of leakage.

If the pump is operated daily, the stuffing box packing should be renewed about every two to three months before it gets hard and scores the shaft sleeves.

Mechanical seals should be removed, assembled, and/or adjusted according to the seal manufacturer's instructions. There should be no leakage from the gland if mechanical seals are used, except for a brief run in period.

3.3 WEAR RING CLEARANCE

Running fits between wear rings is given under the pump specifications. When these clearances are doubled, or the capacity of the pump is reduced by 5 to 10%, the rings should be renewed. The purpose of these rings is to keep internal bypassing of the liquid being pumped to a minimum. Clearances should be checked periodically and whenever the pump casing is opened. Check with feeler gauge or by direct measurement. Measure ID of case ring and OD of impeller ring, then compute clearance (ID minus OD).

Troubleshooting

4.1 PUMP WILL NOT START

FAULTY ELECTRICAL CIRCUIT
- Make sure both circuit breaker and disconnect switch are in the “ON” position
- If the circuit breaker trips when the pump tries to start check horsepower and voltage specified on the schematic and wiring diagram inside the starter door with the pump motor nameplate
- Ensure that the pressure switch is working properly and is responding to changes in pressure

STUFFING BOX TOO TIGHT OR PACKING IMPROPERLY INSTALLED
- Loosen gland swing bolts and remove stuffing box gland halves; replace packing

IMPELLER LOCKED
- Remove obstruction

EXCESS BEARING FRICTION DUE TO WEAR AND DIRT
- Remove bearings and clean, lubricate or replace as necessary

4.2 PUMP IS NOISY OR VIBRATES

STUFFING BOX TOO TIGHT OR PACKING IMPROPERLY INSTALLED
- Loosen gland swing bolts and remove stuffing box gland halves; replace packing

IMPELLER OBSTRUCTED
- Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller

EXCESS BEARING FRICTION DUE TO WEAR AND DIRT
- Remove bearings and clean, lubricate or replace as necessary

FOUNDATION NOT RIGID
- Tighten foundation bolts or replace foundation if necessary.

4.3 NO WATER DISCHARGE

AIR POCKET OR AIR LEAKAGE IN SUCTION LINE
- Uncover suction pipe and locate and re-arrange

SUCTION CONNECTION OBSTRUCTED
- Examine suction intake, screen, and suction pipe and remove obstruction

IMPELLER OBSTRUCTED
- Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller

PUMP NOT PRIMED
- First warning is a change in pitch of the sound of the driver; shutdown the pump

4.4 DISCHARGE PRESSURE TOO LOW

AIR LEAKAGE IN SUCTION LINE
- Uncover suction pipe and locate and re-arrange

SUCTION CONNECTION OBSTRUCTED
- Examine suction intake, screen, and suction pipe and remove obstruction

STUFFING BOX TOO TIGHT OR PACKING IMPROPERLY INSTALLED
- Loosen gland swing bolts and remove stuffing box gland halves; replace packing

WATER SEAL OR PIPE TO SEAL OBSTRUCTED OR AIR LEAK INTO PUMP THROUGH STUFFING BOXES
- Loosen gland swing bolt and remove stuffing box gland halves along with the water-seal ring and packing.
- Clean the water passage to and in the water seal-ring. Replace water seal ring, packing gland and packing in accordance with manufacturer's instructions

IMPELLER OBSTRUCTED
- Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller.

SPEED TOO LOW
- Check that rated motor speed corresponds to rated speed of pump, voltage is correct, and starting equipment is operating properly

WRONG DIRECTION OF ROTATION
- With polyphase electric motor drive two wires must be reversed; where two sources of electrical current are available, the direction of rotation produced by each should be checked

STUFFING BOX TOO TIGHT OR PACKING IMPROPERLY INSTALLED
- Loosen gland swing bolts and remove stuffing box gland halves; replace packing

RATED MOTOR VOLTAGE DIFFERENT FROM LINE VOLTAGE I.E., 220 OR 440 VOLT MOTOR ON 208 OR 416 VOLT LINE
- Obtain motor of correct rated voltage or larger size motor

4.5 PUMP WILL NOT STOP

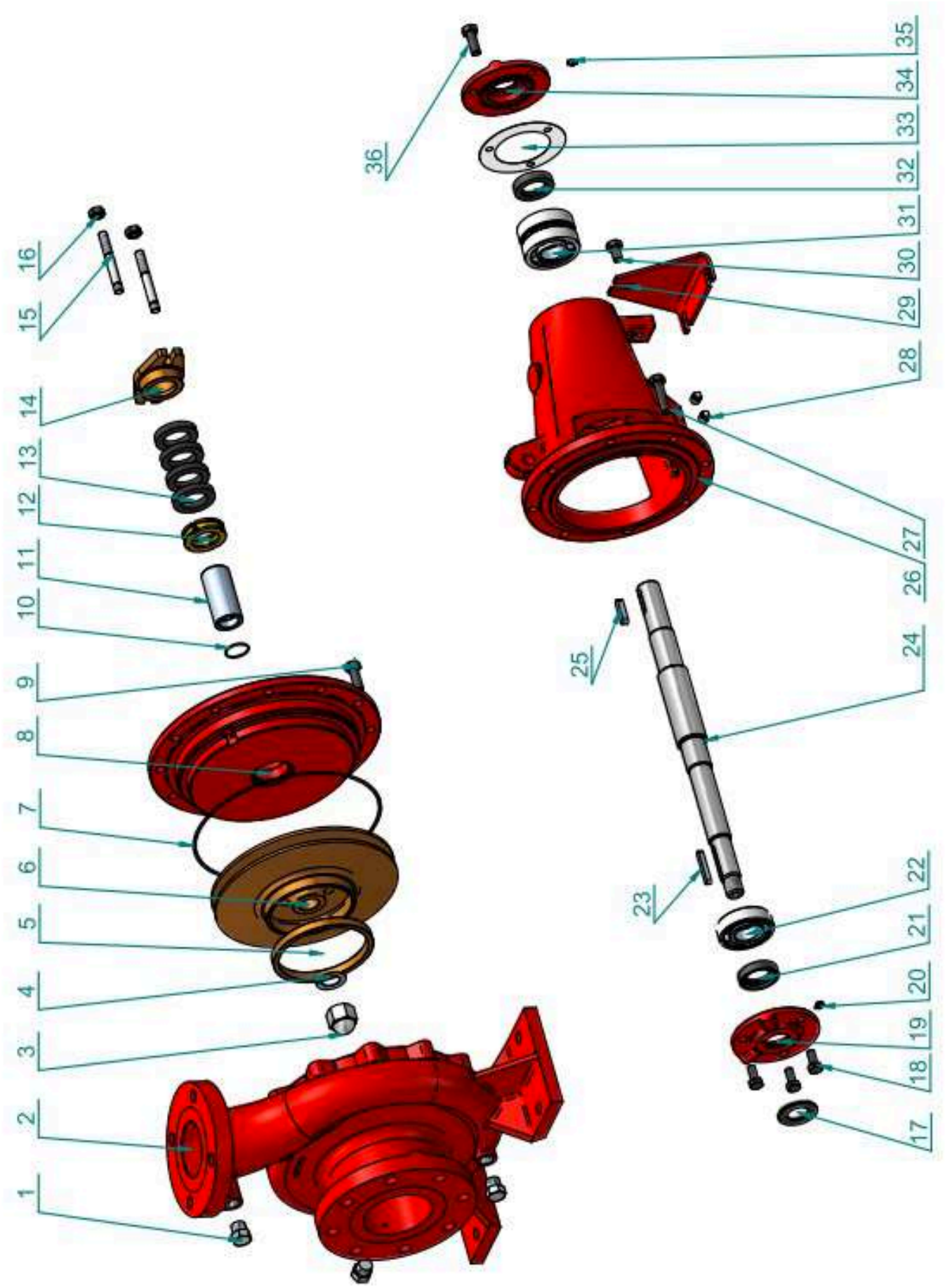
*FAULTY ELECTRICAL CIRCIUT
- Is the pressure switch inside the starter properly piped up to the water system? (system side)
- Is the stop valve in the piping to the pressure switch open?
- Check that pressure switch is working properly by disconnecting one of the pressure switch leads to simulate open contact position
- Ensure that pressure switch connection lines have been flushed to clear dirt in piping
- Make sure that pressure switch set point is correct according to suction and working pressure
- Change manual start handle to automatic

RUN PERIOD TIMER DEFECTIVE
- Remove jumper if applicable.

PRESSURE TOO LOW
- Verify pressure switch setting compared to system pressure.

** Note:*
Refer to control panel manufacturers installation instructions for other controller related problems.

Exploded View



No	Part	Material	Standard
1	Hex Plug	Stainless	AISI 304
2	Casing	Cast Iron	ASTM A-48
3	Impeller Nut	Stainless	AISI 304
4	Lock Washer	Stainless	AISI 304
5	Wearing Ring	Brass	ASTM B-176
6	Impeller	Bronze	ASTM B-145
7	O-Ring	Nitrile Butadiene Rubber	ASTM D3187-6
8	Stuffing Box	Cast Iron	ASTM A-48
9	Hex Bolt	Steel	ASTM F568M
10	O-Ring	Nitrile Butadiene Rubber	ASTM D3187-6
11	Shaft Sleeve	Stainless	AISI 420
12	Lantern Ring	Brass	ASTM B-176
13	Soft Gland *	Impregnated Graphite	---------
14	Gland Pusher	Brass	ASTM B-176
15	Stud Bolt	Stainless	AISI 304
16	Gland Nut	Stainless	AISI 304
17	Rubber Slinger	Nitrile Butadiene Rubber	ASTM D3187-6
18	Hex Bolt	Steel	ASTM F568M
19	Bearing Cover	Cast Iron	ASTM A-48
20	Grease Nipple	Brass	ASTM B-176
21	Oil Seal	Nitrile Butadiene Rubber	ASTM D3187-6
22	Inbound Bearing	SKF Explorer	ASTM A756
23	Shaft Key	Stainless	AISI 304
24	Shaft	Stainless	AISI 420
25	Shaft Key	Stainless	AISI 420
26	Bearing Housing	Cast Iron	ASTM A-48
27	Hex Bolt	Steel	ASTM F568M
28	Hex Plug	Steel	ASTM F568M
29	Support Foot	Steel	ASTM A794
30	Hex Bolt	Steel	ASTM F568M
31	Outbound Bearing	SKF Explorer	ASTM A756
32	Oil Seal	Nitrile Butadiene Rubber	ASTM D3187-6
33	Gasket *	Paper Gasket	----------
34	Bearing Cover	Cast Iron	ASTM A-48
35	Grease Nipple	Brass	ASTM B-176
36	Hex Bolt	Steel	ASTM F568M

Notes:
1. The Casing and Stuffing box below pump models are constructed using Ductile Iron
   a. GME 400-80 EH b. GME 450-80 EH
   c. GME 500-80 EH d. GME 500-12 EM
   f. GME 500-13 EM g. GME 750-26 EM
   h. GME 750-32 EM
2. Brass Impeller will be available upon request.
3. * - No Specific Standard.

PRE START-UP / POST START-UP CHECK LIST

START-UP DATE: ORDER NO.:		**START-UP DATE: ORDER NO.:**
SERIAL NO.: PUMP SIZE:		**SERIAL NO.: PUMP SIZE:**
MIN. SUCT. PRESS.	**FLOW:**	**HEAD:**
VOLT:	**PHASE:**	**Hz:**

PRE START-UP CHECKS	OK	REMARKS
1. STORAGE Verify equipment for improper storage or mishandling	☐	
2. INSTALLATION Compare electrical supply to one indicated on motor nameplate.	☐	
Compare current rating of overload relays and fuses in controller against full load current value on motor nameplate.	☐	
3. ALIGNMENT Verify the alignment of driver to pump. (Horizontal Pumps Only)	☐	
Verify suction and discharge for pipe	☐	
strain. Do the flanges meet squarely?	☐	
4. ROTATION Manually turn coupling to assure free rotation of pump and motor.	☐	
5. SYSTEM Ensure system is free of foreign matter which could damage the pump.	☐	
Responsible parties present when equipment is energized.	☐	
6. DIESEL DRIVEN FIRE PUMP ONLY Engine coolant filled to the proper	☐	
level? Engine oil filled to proper level?	☐	
Fuel line from the tank connected to engine (supply and return)?	☐	
Fuel tank filled with proper diesel fuel?	☐	
Silencer properly connected to engine and outside?	☐	
Engine controller wiring connected to engine junction box?	☐	
Is engine jacket water heater connected to AC power?	☐	
Batteries charged ***(min. 24 Hrs Prior To Start-up)*** and connected to engine?	☐	

POST START-UP CHECKS	OK	REMARKS
7. VIBRATION Upon occurrence of excessive vibration or noise, was equipment immediately shut down?	☐	
8. FLOW Has flow been established?	☐	
Take gauge and amperage readings (if motor driven)	☐	
Packing been adjusted to slight leakage?	☐	
If pumps are equipped with mechanical seals, has the establishment of a clear source of water to lubricate the seals been made?	☐	
Is the lubricating seal water pressure a constant 10 to 15 psi above the discharge of the pump?	☐	
9. READINGS Flow, pressure and amperage readings taken immediately after correction of all problems and restart.	☐	

Warranty

LFECO FIRE PUMPS are guaranteed against defective workmanship and material for a period of twelve months from date of shipment. Should the LIFECO FIRE PUMP fail within the warranty period, our responsibility islimited to the repair or replacement of defective parts provided such are returned to our Plant, transportation prepaid. We do not accept liability for damage or break-down from causes beyond our control, or the result of reasonable wear nor for repair made, or date attempted to be made without prior sanction, nor for any consequential damage resulting from the failure of a pump. The customer will assume all labor charges incurred in our making the replacement of adjustment of the part.

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