Al Khoory Pumps

# FIRE PUMP INSTALLATION AND START UP MANUAL


## HORIZONTAL END SUCTION PUMPS

**GENERAL:**

Please carefully follow instructions contained herein as each of these instructions is of vital importance in assuring long life, efficient operation and reduced maintenance of fire pump unit.

**UNPACKING THE PUMP:**

The packaging should be opened immediately upon its arrival from the factory, and the contents of each carton inspected for damage and shortage of components. Many Fire Pump accessories are shipped loose for field installation, and these items should be checked using the packing.

The following standard accessories are shipped unassembled in separate packages

- Discharge pressure gauge
- Compound suction gauge
- Float-operated automatic air release valve
- Casing relief valve furnished on electric motor driven pumps only

Other optional accessories if ordered may also be shipped loose. Some common examples are:

- Eccentric tapered suction reducer
- Concentric tapered discharge increaser
- Flow meter
- Main relief valve (diesel driven pumps)
- Waste cone (diesel driven pumps)

Diesel driven Fire Pumps are furnished with additional standard accessories and they include:

- Batteries, 12-volt (two for 12-volt engines; four for 24- volt engines)
- Battery rack(s) (one for 12-volt engines; two for 24-volt engines)
- Battery cables (four for 12-volt engines; six for 24-volt engines)
- Muffler (commercial grade is standard; residential grade is optional)
- Flexible exhaust connector

If a diesel fuel tank is included, the following components are also included:

- Fuel tank
- Fuel level gauge
- Lockable fuel cap
- Vent
- Lockable fuel supply valve
- Two flexible flame resistant fuel hoses are attached to the diesel engine by the manufacturer

Fire Pump controllers, whether for diesel or electric units, are shipped as free units as obtained directly from the respective controller manufacturers.

**PUMP FOUNDATION:**

A substantial foundation is important in maintaining alignment. The foundation for the pump must be sufficiently rigid to absorb any vibration and stress encountered during operation. A raised foundation of reinforced concrete shall be preferable to assure a satisfactory base and protection against flooding while facilitating drainage and keeping the area clean.

The pump and driver base should be firmly bolted to the foundation using mounting bolts or studs accurately located per the applicable dimension sheet provided for the pump.

**PREPARING TO INSTALL THE PUMP:**

The pump and driver will be mounted on a common base plate as when shipped from the factory. The unit has been accurately aligned and securely mounted to the base at the factory. However, the entire unit must be re aligned once leveled on the foundation and again after the grout has set and foundation bolts have been tightened.

**LEVELING THE PUMP ON FOUNDATION:**

After the pump and driver unit has been placed on the foundation, the coupling halves should be disconnected. The couplings should not be reconnected until the alignment operation has been completed. Leveling the pump will require shims to support the unit base at the foundation bolts and at any other point of the base carrying a substantial weight load. The shims should be large enough to allow a gap of 3/4" to 1-1/2" between the base and the foundation for grouting. Using a spirit level, the unit base shall be leveled by inserting and adjusting the shims until the unit is leveled both horizontally and vertically. Now, tighten the bolts finger tight.

**ALIGNMENT OF FLEXIBLE COUPLING:**

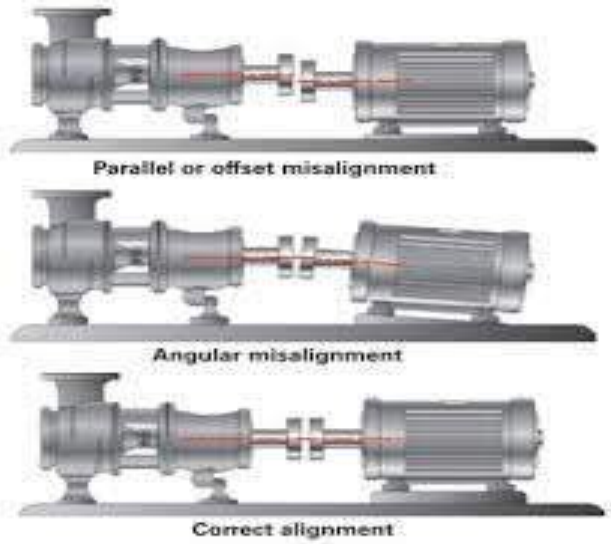
The pump and driver were accurately aligned from the factory, however it is necessary to realign after the unit base has been leveled on the foundation. Though, flexible couplings are used, however the purpose of the flexible coupling is to compensate for temperature changes and to permit end movement of the shafts without interference with each other while transmitting power from the driver to the pump. The faces

Couplings shall be properly aligned using a taper gauge or set of feeler gauges and a straight edge or using a dial indicator. Laser alignment could also be availed for better accuracy.

The two forms of misalignment could occur between the two halves of the flexible couplings:

1 .Angular misalignment- where shafts are not parallel

2. Parallel misalignment- where shafts are parallel but not on the same axis



The faces of the coupling halves should be spaced far enough so that they do not strike each other when the driver coupling half is moved hard over toward the pump and due allowance shall be provided for wear of the thrust bearings.

Angular and parallel misalignment shall be corrected by means of shims under the motor mounting feet. After each change it is necessary to recheck the alignment of the coupling halves. Adjustment in one direction can disturb the alignment already made in another direction. It should not be necessary to adjust the shims under the pump.

When the alignment is correct, foundation bolts shall be tightened evenly but not too firmly.

The unit can be then grouted to the foundation. The base plate shall be completely filled with grout and it is recommended to grout the shims in place. Foundation bolts shall be fully tightened only after the grout is hardened, which is usually about 48 hours after pouring.

After the grout has set and the foundation bolts have been properly tightened, the unit should be checked once again for parallel and angular alignment, and if necessary shall be realigned.

**PIPING:**

Suction pipe and discharge pipe shall be installed in accordance with NFPA 20. Suction and discharge piping shall be properly connected to the pump flange. Piping shall be connected such that there shall be no strain on the pump casing. The layout and design of the suction pipe must be carefully considered in order to avoid generation of air bubbles in the suction pipe and to avoid unbalanced flow into the pump suction flange. Suction and discharge piping shall be provided proper supports and shall not be supported by the pump casing. Where a reduction in pipe diameter is required at suction side, an eccentric suction reducer shall be used and shall be installed with its top horizontal; tapered side shall be on the bottom. Where an increase is pipe diameter is required at discharge side, a concentric increaser shall be used. Placing a horizontal elbow or butterfly valve within 10 pipe diameter of the suction flange creates an unbalanced flow of water into the impeller which could damage the pump over time / causes severe cavitation if not corrected. After the piping of the unit has been connected the alignment should be checked again.

Note: Please refer to NFPA 20 for correct installation position of elbows and tees and to know about the permitted suction and discharge pipe fittings.

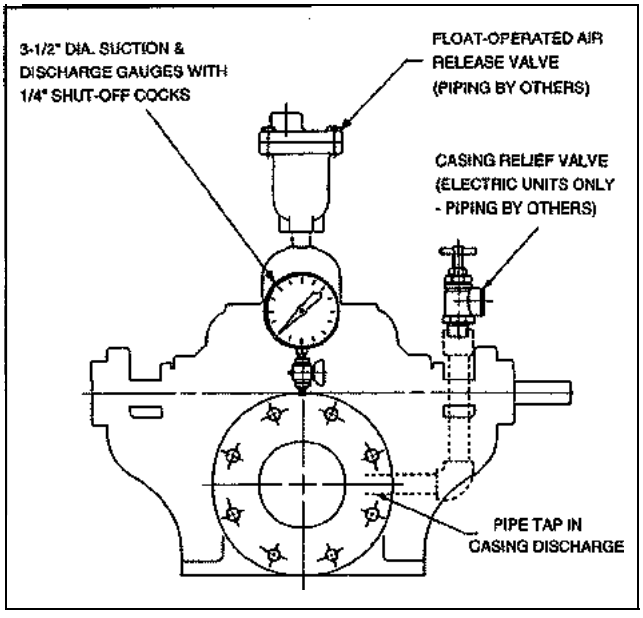
**FIRE PUMP ACCESSORIES:**

Standard fire pump accessories:

Standard Fire Pump fittings are to be properly installed.

All fire pumps are furnished with compound gauge which is to be installed at the suction side of the pump and a pressure gauge to be installed on the discharge side of the pump.

A float-operated automatic air release valve is furnished for all Fire Pumps, and is to be installed in the top (or highest point) of the casing. A 1/2" pipe nipple is needed to connect it to the casing



A casing pressure relief valve is provided for all electric motor driven Fire Pumps. It shall be installed in or piped to the tap in the side of the discharge neck on the pump casing. A separate outlet shall be piped to a drain to discharge the water from the relief valve.

**OPTIONAL ACCESSORIES:**

Main Relief Valve:

Where a main relief valve is supplied along with diesel engine fire pump, it shall be located between the pump and the pump discharge check valve and shall be so attached that it can be easily removed for repairs without disturbing the piping. The discharge of the relief valve shall be piped of adequate size and capacity to accept maximum flow from any discharge. If a closed loop piping arrangement is used a circulation relief valve shall be installed for cooling purpose.

**Note: Please refer to NFPA 20 for discharge piping options**

Waste cone:

A waste cone if supplied, shall be secured to the outlet of the main relief valve and shall be piped to a point where water can be freely discharged.

Flow test devices:

Where a water flow test devices like a test header or a flowmeter is used, a special pipe shall be run from the discharge side of the pump back to the water supply or to some other acceptable discharge point. The piping shall be taken between the discharge check valve and gate valve of the fire pump discharge line. Where a flow meter is deployed, please refer to the factory or meter manufacturer for distance from the flowmeter to either isolation valve.

Note: Please refer to NFPA 20 for installation procedure if a closed loop system is followed.

**DIESEL ENGINES:**

ENGINE FLUIDS:

If diesel engines are shipped dry, lubricating oil and coolant must be added prior to start-up. The installer shall assure that all fluid levels are correct to avoid damage to the engine.

DIESEL ENGINE WIRING:

The Fire Pump controller shall be wired to the diesel engine's junction box. Installation contractor shall carry out the work responsibly in line with the panel manufacturer's line diagram. The electric solenoid valve in the diesel engine cooling loop piping must be wired to the engine junction box. Please refer to engine manufacture installation manual. Engines may have 12-volt or 24-volt systems, but all batteries furnished are 12-volt. Since dual battery sets are required by N.F.P.A. 20, two batteries are furnished for 12-volt systems and four batteries are furnished for 24- volt systems.

Battery racks provided along with the diesel pump unit is designed to keep the batteries elevated off the floor for housekeeping purposes.

They must be placed on a suitable level surface as close to the diesel engine as possible.

Electrolyte is not furnished along with the Pump; it must be procured locally

Electrolyte shall be added and the batteries charged at a low rate for at least 24 hours prior to start-up. For safety reasons, the batteries shall be filled with electrolyte only after being placed in their permanent positions in the pump room

When working on or near batteries, mixing or pouring acid solutions, always wear protective clothing and protect eyes with safety goggles. Keep sparks, flames and cigarettes away.

If acid contacts skin or eyes, flush affected parts with clean water immediately and repeat for 15 minutes. Then seek prompt medical attention.

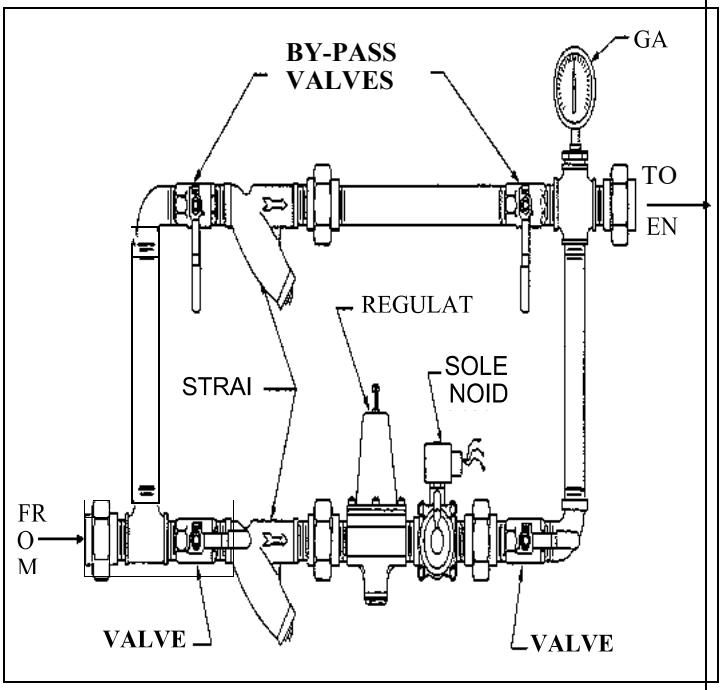
When charging batteries, keep area well ventilated and bar general access. Connect/disconnect batteries only when charge is switched off. Make sure tools cannot short circuit battery terminals. Keep vent caps on battery during charging.

Power wiring to the engine's jacket water heater must be completed only after it has been assured that there is sufficient coolant in the engine. Most heaters are continuously energized when wiring is connected and will burn out the heating element if no water is present. This failure is not covered by warranty. Refer to engine manufacturer's data sheet for correct voltage of the heater.

DIESEL ENGINE COOLING LOOP PIPING:

The cooling loop system utilizes a small amount of water from the pump discharge to the engine's heat exchanger to help control the operating temperature of the engine. Prior to start-up, it is recommended that this piping be checked for damage or displacement that might have occurred during shipment.

During normal operation, the top two valves of the cooling loop in the by-pass line are to be closed, and the lower two valves in the pressure regulated line are to be open. Failure to observe this may result in over-pressurization of the heat exchanger when the pump is started, causing damage to the engine.




Piping from the engine's heat exchanger to a drain is to be provided by the installer. It is important to use the recommended size piping to reduce back pressure and avoid over pressurizing the heat exchanger

DIESEL ENGINE FUEL SYSTEM:

The fuel tank should be installed so that the supply outlet is at the same elevation as the engine's fuel pump. It shall be the responsibility of the installer to elevate the tank.

All fuel fittings are shipped loose for field installation. They are to be assembled, to be consistent with Figure provided in N.F.P. A, Pamphlet 20. Installation may vary at the discretion of the installer with the approval of the local authority having jurisdiction. Note that some sections of common piping needed to complete this installation are not furnished along with the unit and shall be procured locally.

DIESEL MUFFLER AND EXHAUST SYSTEM:

A commercial grade muffles and flexible connector are furnished as standard on diesel Fire Pumps.

Piping, elbows and other components required to route the exhaust to the outside are not provided. It shall be the responsibility of the building contractor or on-site engineers to design and install the remainder of the exhaust system.

Mufflers are sized to allow the engine to operate at its rated speed with nominal back pressure. However, if more than 25 feet of additional piping and/or more than 4 90-degree elbow are required to complete the system, it is important to contact the factory for re- evaluation of the system with respect to back pressure. A larger muffler and piping may be required to allow the engine to operate properly.

The flexible connectors furnished are intended for use as a vibration control device. It is recommended that the flexible connector be placed as close to the engine's exhaust outlet as possible. The muffler and piping shall be supported to prevent strain on any diesel engine component.

**START-UP AND FIELD ACCEPTANCE TEST**

**GENERAL:**

The following is a general outline for starting and field testing for Fire Pump systems. It is recognized that requirements and methods may vary depending on local customs and practices. Those involved in Fire Pump sales shall fully understand all local requirements and N.F.P.A. Pamphlet 20. A general method to follow is outlined below.

Visit the jobsite after delivery of the equipment to verify that all components ordered have been received and are correct for the installation.

Visit the jobsite again after installation to assure that the components have been correctly assembled and installed.

After the installation is complete and the Fire Pump system is pressurized and checked by the contractor, the following items must be verified:

Coupling has been properly aligned.

Motor has been "bumped" to check for proper rotation.

Diesel engine (where applicable) has been properly serviced, necessary fluids added, batteries filled and charged, jacket water heater operating.

All electrical wiring to the fire pump motors, including control panel, jockey pumps, diesel engine panel shall be completed and checked by electrical contractor prior to initial startup.

**INITIAL TEST**:

The following steps are basic for an initial test of the Fire Pump system:

Close the valves on all discharge outlets.

Open the suction valve.

Having read the controller manual and gained an understanding of its operation, set the Fire Pump controller to "manual". The Jockey pump panel should be set to the "off" position.

See that the pumps are completely primed.

With the controller door closed, start the Fire Pump.

Adjust the packing to allow approximately 60 drops per minute to flow from each packing box. Further adjustment may be required later, so a recheck upon completion of the test is advised.

Close the relief valve completely for a brief period to verify that the shut-off pressure agrees with that on

the certified factory test curve. (Please refer to NFPA 20 Pamphlet for relief valve pressure setting)

Adjust the casing relief valve (electric-driven units only) to allow enough flow to keep the pump cool. (Please refer to NFPA 20 Pamphlet for relief valve pressure setting)

Stop the Fire Pump.

Set the Fire Pump controller to the "automatic" position.

Now adjust the start and stop pressure setting for all controllers (electric, diesel and jockey as applicable)

Slowly lower the system pressure with the control valve. The respective Pump should start on its set starting pressure .Further adjustments can be done in the pressure settings if necessary. (Adjustment procedure varies with controller manufacturer.) Now check the sequence of operation for each fire pump as applicable. Stop the Fire Pump.

**FIELD ACCEPTANCE TEST:**

Personnel on hand for the Fire Pump field acceptance test should include the controller representative, diesel engine service technician (if applicable), representatives of the insuring agency and local fire authority, as well as those responsible for building maintenance and supervision.

Equipment needed for the field acceptance test includes:

- Clamped on volt/ Ammeter
- Test suction and discharge Gauges
- Tachometer
- Pitot Tube & gauge (For use with hose and nozzle)

All equipment's shall be calibrated by an approved testing and calibration facility

**Test Procedure:**

1, Make a visual check. Ensure hose valves are closed. If a test meter is used, the valve on discharge side of the meter shall be closed

2. Start the pump

3. Partially open the one or two hose valves or slightly open the meter discharge valve

4. Check the general operation of the unit fir vibration or leaks .Adjust the packing gland if necessary.

Measuring Water discharge:

Where a test valve header is used, regulate the discharge by means if the hose valves and selection of nozzle tips.

Where a test meter is used, regulate the discharge valve to achieve the various flow readings

Note the readings at 150% of rated capacity, rated capacity and shut off.

Record the below parameters:

- Pump rpm
- Suction pressure
- Discharge pressure
- Number and size for hose nozzles, pitot pressure for each nozzle, and total gpm.
- For test meter, gpm can be recorded directly
- Amperes (each phase)
- Volts (each phase)