

FIRE PUMP

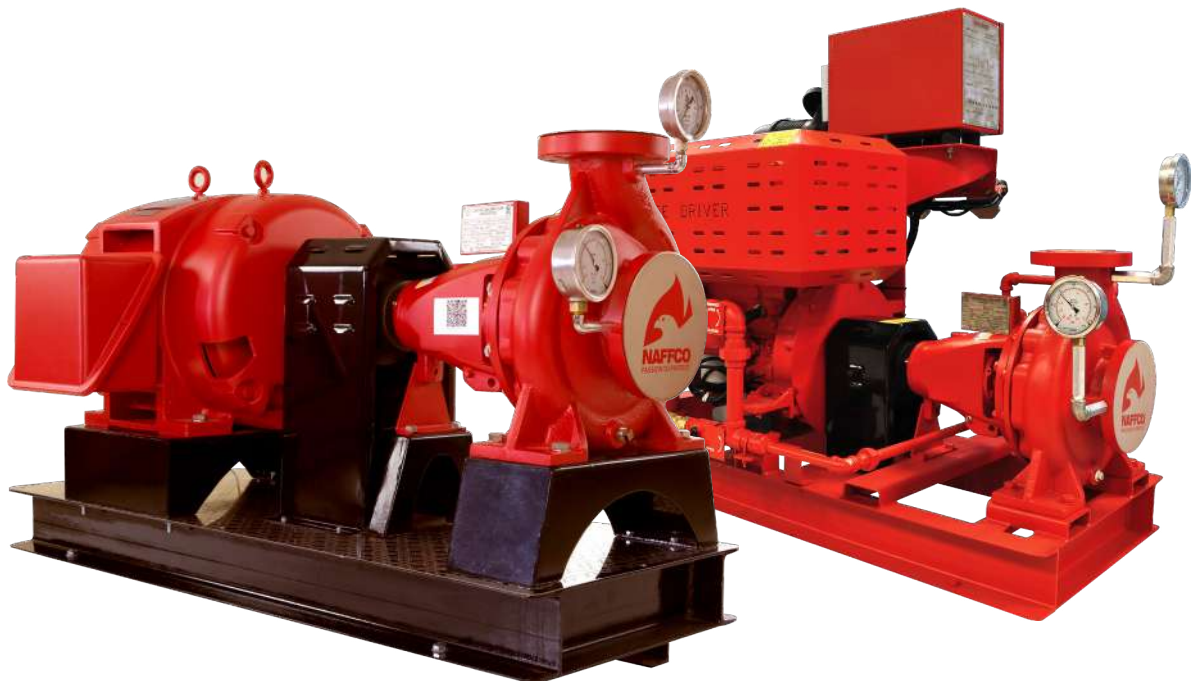


INSTALLATION,

OPERATION &

MAINTENANCE

I N S T R U C T I O N S



HORIZONTAL END SUCTION - NF-E / NF-ES SERIES





FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



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INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



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1. SAFETY

1.1. GENERAL SAFETY INSTRUCTIONS



DO NOT OPERATE THIS PUMP AT ANY PRESSURE, FLOW RATE, OR LIQUID TEMPERATURE OTHER THAN THOSE WHICH SHOWN ON THE NAME PLATE. DO NOT PUMP ANY LIQUID OTHER THAN WATER. IGNORING THIS WARNING CAN RESULT IN PUMP FAILURE AND SERIOUS PERSONAL INJURY OR DEATH.

If the safety labels are missed or damaged, contact NAFFCO and get label and replace.

While starting pump set make sure pump set coupling guard fixed in the pump set.

Only proper tools of correct size shall be used for maintenance and service.

Do not wear loose clothing that could catch on moving parts.

Pump room should be kept clean from oil, waste cloth, water and easily explosive materials.

Pump room should not be treated a like store room.

Fire pump should be monitored during running to ensure that it was started due to an actual demand and water tank should be monitored to avoid dry run condition.

1.2. ELECTRIC HAZARDS

Check proper earth connection of the electric, diesel, jockey controllers and electric motors.

Make sure safety labels and operation labels are stuck in the controllers if damaged please get from NAFFCO and replace.

Use only qualified personnel for installation and maintenance.

Electric motor cables terminals should be properly terminate and covered with terminal cover.

Inspect cable and connector if any damage replace immediately.

Do not keep tools on top of battery, this could result short circuit.

1.3. MECHANICAL HAZARDS

Wear eye protection during welding, grinding, drilling etc. Wear ear protection while operating diesel engine. Always wear safety shoes and safety gloves.

Monitor water leakage of pump gland packing. If excessive leak adjust the packing, do not place hands or finger into this area.

During maintenance disconnect battery negative terminal connector.

Do not refuel the engine when its running, fuel fumes are highly flammable.

Diesel engine exhaust pipe line should be insulated from temperature and it should be kept separate from discharge line.

2. INTRODUCTION

This manual provides general instruction for the installation, operation, maintenance, dismantling and assembling of horizontal end suction fire pump manufactured by NAFFCO, U.A.E. Each centrifugal fire pump is tested in our fac-

tory as per NFPA guidelines and hydrostatically tested in accordance with the Hydraulic Institute Standards to verify individual performance. Certified copies of all test reports shall be submitted to the engineer for approval, and our QC engineer shall check all the equipment against shipping paper.

The NAFFCO UL Listed and FM approved centrifugal pumps will give trouble-free and satisfactory service for a long time if they are properly installed and maintained periodically. Follow the instructions in this manual carefully. Do not run the pumps under operating instructions which differ from those specified by us.

3. IDENTIFICATION

Every pump unit is coming with separate name plate. This name plate is having serial number, model, flow rate and head.

It is important that the serial number should be quoted while claiming for spares or service. This will identify the unit exactly and ensure that correct advice and parts are selected. If it is known that any update or modification to the pump has been carried out since original supply then this information is also crucial (Refer fig. no. 1).

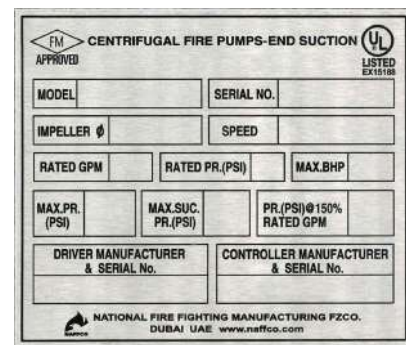


Fig. No. 01

4. HANDLING

Pump set shifting and lifting shall be done using forklift (refer fig no. 02). When lifting the pump set it should be very careful not to broke the fire pump set. The pump set mounting holes should match properly with the foundation bolts without any damage.

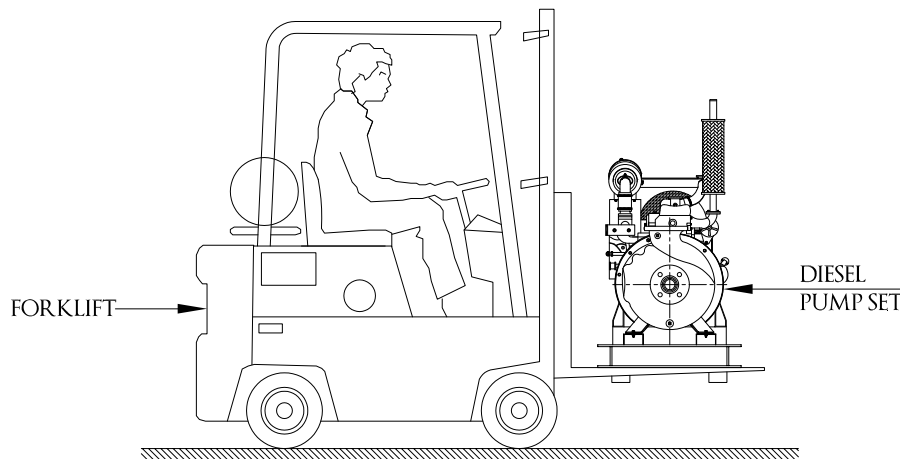


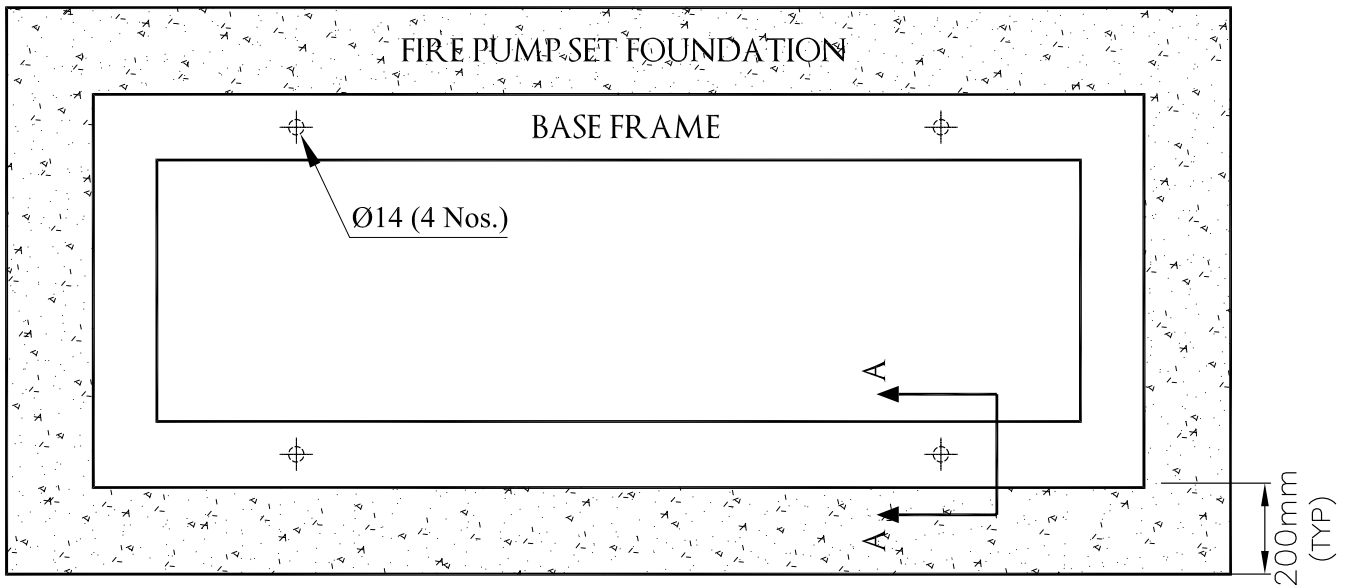
Fig. No. 02

5. INSTALLATION

Fire water pump sets and control systems should be installed, and accepted, in accordance with NFPA 20. Failure to install the supplied NAFFCO fire pump set fully in accordance with the NFPA 20 will void the equipment warranty. Proper ventilation and drainage system shall be provided for fire pump room.

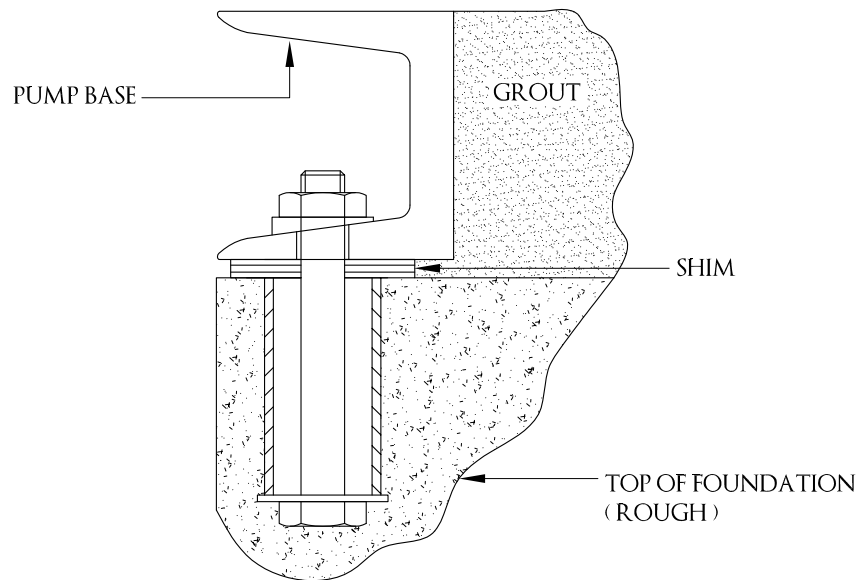
5.1. FOUNDATION

We recommend that you install the pump on a concrete foundation which is heavy enough to provide permanent and



BASE FRAME WITH FOUNDATION

Fig. No. 03

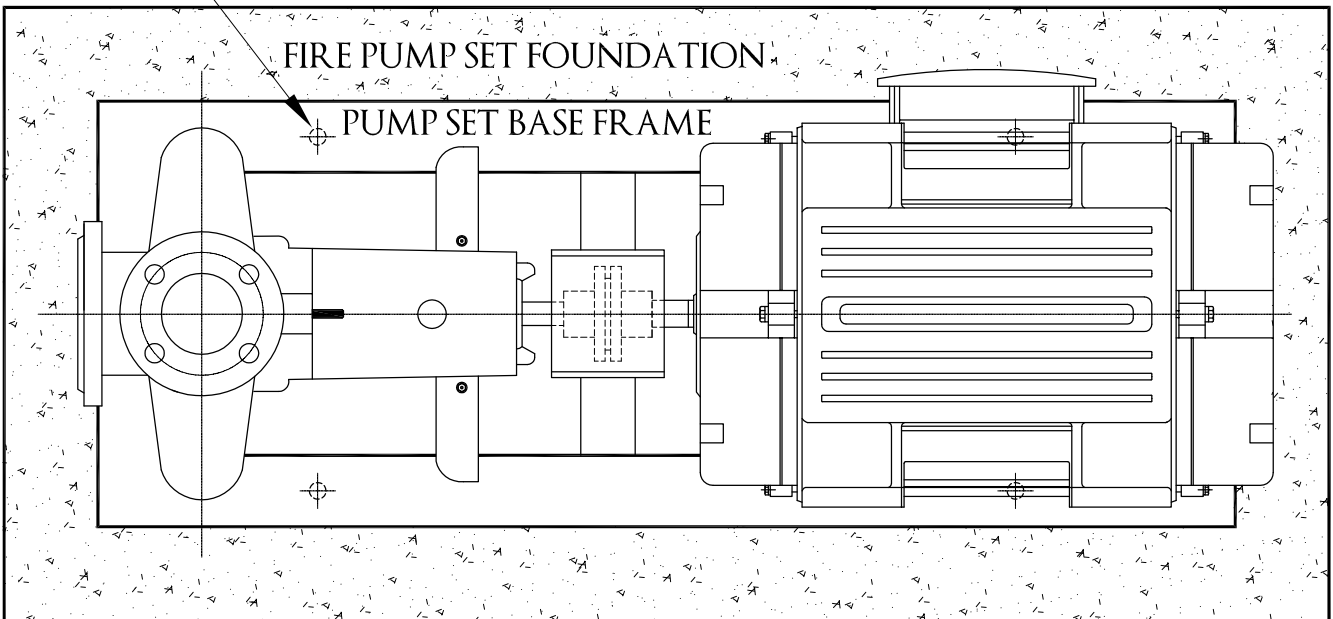


SECTION A-A

Fig. No. 04

rigid support to the entire pump. The foundation must be capable of absorbing any vibration, normal strain or shock. As a rule of thumb, the weight of the concrete foundation should be 2.5 times the total weight of the pump. The concrete foundation must have an absolutely level and even surface. Place the pump on the foundation and fasten it. The base frame must be supported on the whole area. Make sure the concrete foundation has set before mounting the pump set. The surface of the foundation must be completely horizontal and perfectly flat. The foundation should be 200 mm larger than the base frame on all four sides. (See fig. no. 03, 04 and 05).

Ø14 (4 Nos.)



PUMP SET WITH FOUNDATION

Fig. No. 05

5.2. MOUNTING

Position the pumps set on the foundation and align using a precision spirit level (on the base frame) Fig No 06. Always fit shims to left and right of the foundation bolts, between the base frame and the foundation. If the shims are more than 800 mm apart, position extra shims equal distant between them. All shims must be perfectly flush and uniformly tighten up securing means. Base plates have to be grouted with non-shrinking mortar up to the upper edge of the frame after having been fixed in position.

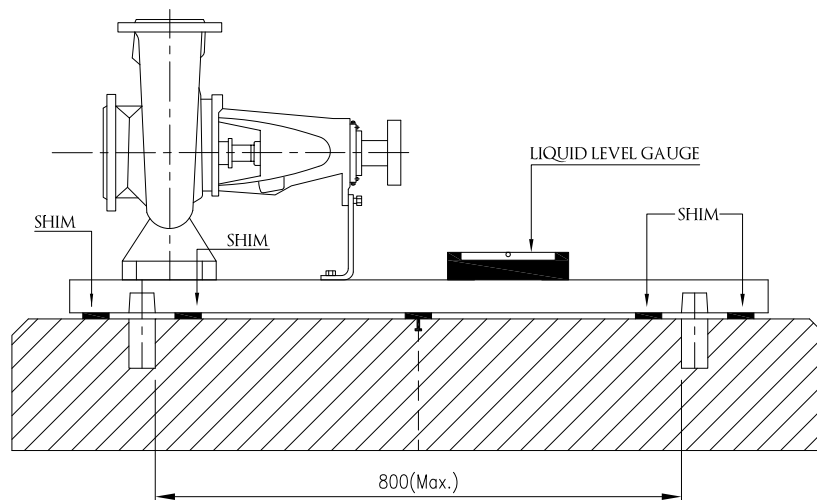


Fig. No. 06

5.3. ALIGNING PUMP AND DRIVER

The coupling must be checked and the pump set realigned even if the pump and driver are supplied ready mounted on a common base plate in order to rectify any misalignment that might have happened during transportation and installation.

a) Radial Alignment:

Mount a dial gauge on the driver shaft with the gauge running on the outer-machined diameter of the pump coupling (see figure -07 - 1A). If the driver shaft is not accessible then the dial gauge can be mounted on the driver coupling. Turn the driver shaft, note the total indicator reading, and adjust the driver position accordingly. The allowable misalignment is 0.4 mm or as per coupling manufacturer's recommendation. Another method for radial alignment is using a straight gauge as give below (fig no. 07 - 1B).

b) Axial alignment:

Measure coupling outer face with caliper in 4 side (360°) (see figure No. 07 - 2B). Adjust the driver in the direction required. Maximum allowable misalignment is 0.92 mm or as per coupling manufacturer's recommendation. Another method for axial alignment is with dial gauge as shown below (fig no. 07 - 2A)

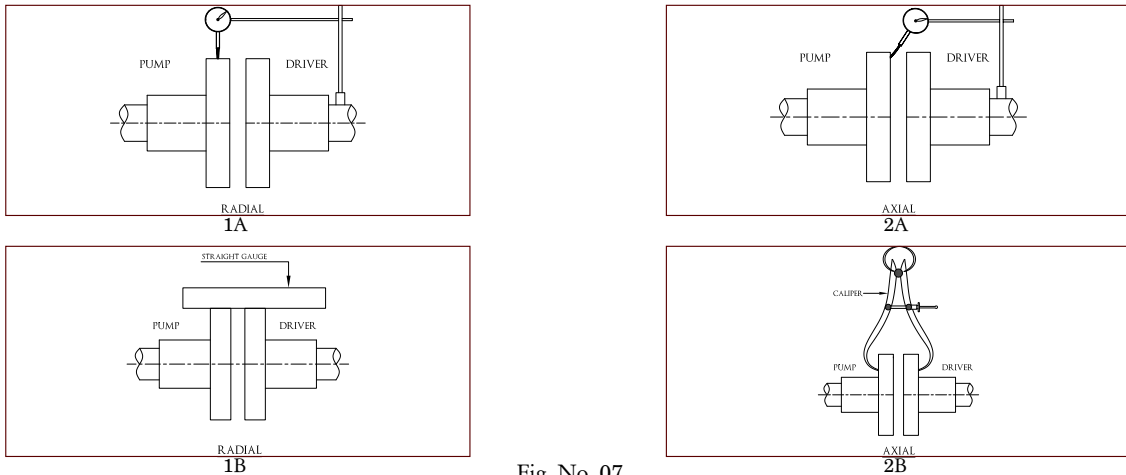


Fig. No. 07

5.4. SUCTION CONDITION

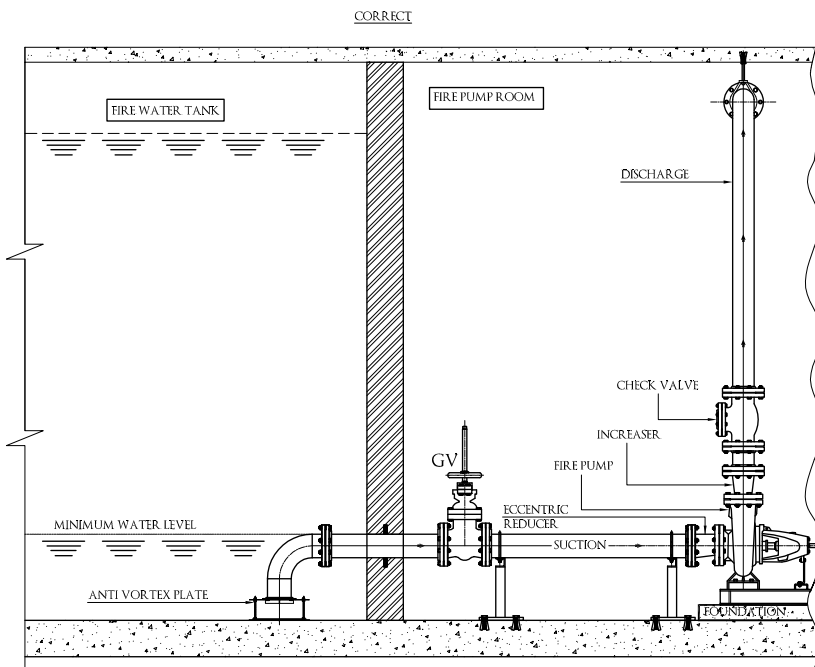


Fig. No. 08

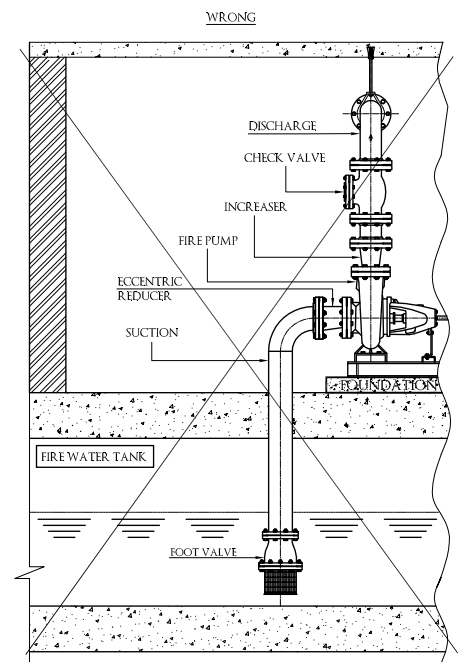


Fig. No. 09

- » NFPA 20 no longer permits fire pumps to operate under a suction lift condition – that is, a negative pressure is not permitted at the suction flange. (See fig. no. 08 and 09).
- » Pump performance with a minimum suction pressure of 0 psi (0 bar) at the gauge at 150 percent of rated capacity

5.5. SUCTION LINE ARRANGEMENT

The length of suction pipe should be arranged within 10 diameters which is located upstream of fire pump suction flange. The final arrangement shall provide effective pump performance with a minimum suction pressure of 0 psi (0 bar) at the gauge at 150 percent of rated capacity. (See fig. no. 10).

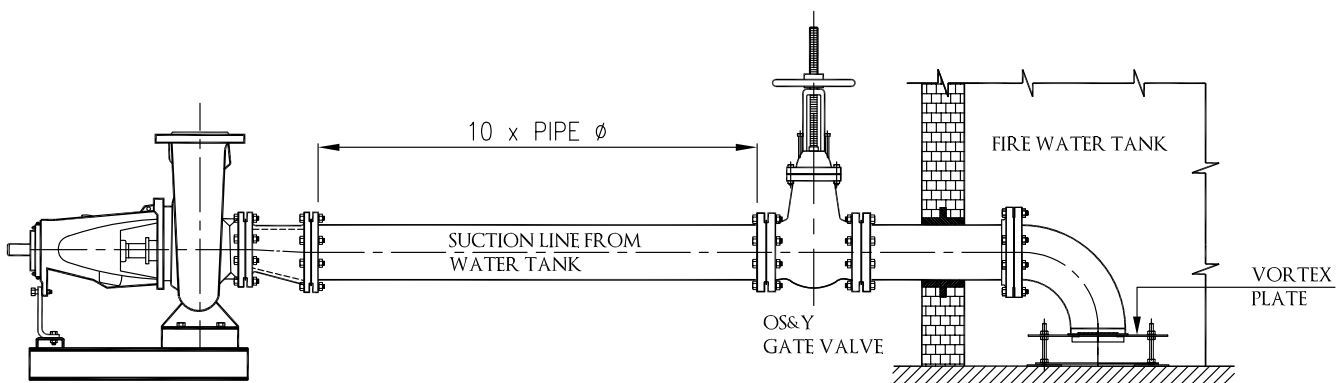


Fig. No. 10

5.6. SUCTION AND DELIVERY PIPING

Ensure that bolt grouting or chemical anchors are allowed to dry thoroughly before connecting any pipe work.

Note that fire pump sets have regulatory requirements for piping and these must be strictly observed. Refer to the appropriate standard for details. (See fig. no. 11).

Both suction and discharge piping should be supported independently and close to the pump so that no strain is transmitted to the pump when the flange bolts are tightened. Use pipe hangers or other supports at intervals necessary to provide supports closest to the pump.

Install piping as straight as possible, avoiding unnecessary bends. Where necessary use 45° or long sweep 90° bends to decrease friction losses.

Make sure that all piping joints are airtight. Where reducers are used, eccentric reducers with flat side in up position are to be fitted in suction line and concentric increasers are to be fitted in discharge line. Failure to comply with this may adversely affect the performance of the pump by causing the formation of air pockets in the pipe work.

The suction pipe from fire water tank should be as short and direct as possible, and should be flushed clean before connecting to the pump. Horizontal suction lines must have a gradual rise to the pump. If the pumped fluid is likely to contain foreign particles then a filter or coarse strainer should be fitted to prevent ingress to the pump from the adequate distance from the Suction flange.

TYPICAL END SUCTION PUMP PIPING INSTALLATION

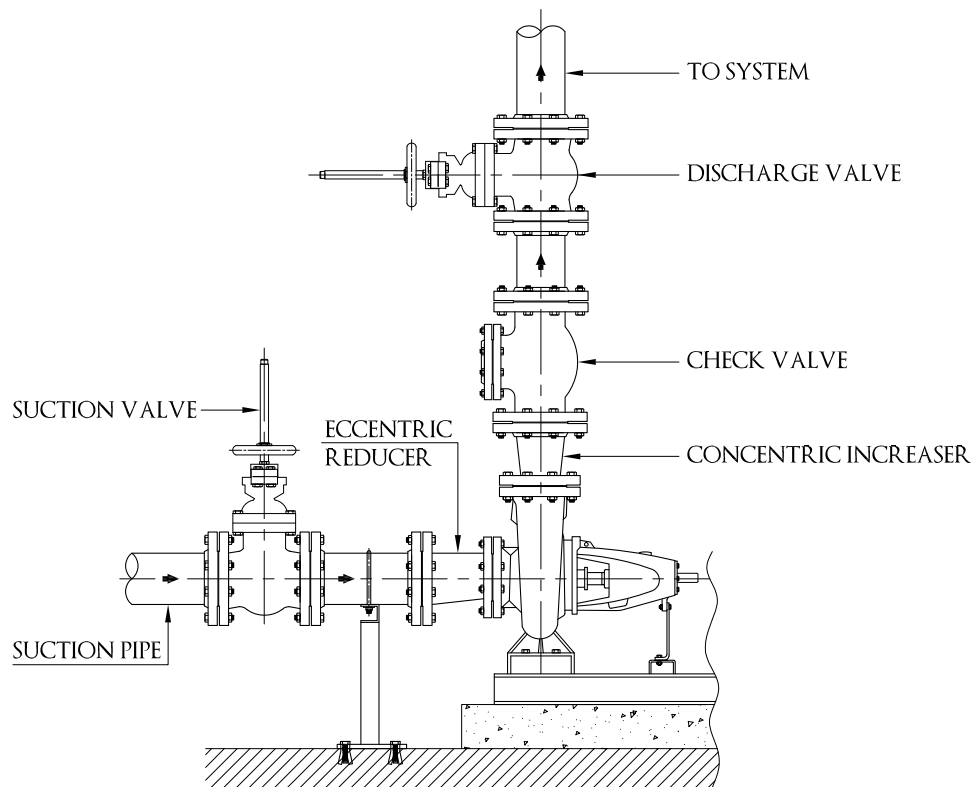


Fig. No. 11

5.7. PRESSURE RELIEF VALVE

Pressure relief valve is required only for diesel engine driven fire pump sets. Pressure relief valve should be evaluated and operated at 121% of the net rated shutoff pressure considering the pressure rating of the fire fighting system components.

5.8. OPERATING INSTRUCTIONS OF FLOW METER

The flow meter arrangement of NAFFCO pump set is built as per flow meter manufacturer's instructions. The operating guidelines are following (See fig. no. 12 also):

1. Close the system OS&Y valve.
2. Open OS&Y test line valves (shown in the fig. no. 12) or butterfly throttle valve (according to- system requirement).
3. Purge meter located on venture as follows:
 - Open shut off valves and air vent valves.
 - When a steady stream of water is passing through each plastic hose, the meter is purged of air.
 - Close air vent valve after purging.
4. Open the air release valve provided upstream of the flow meter.
5. Start fire pump, read meter in gpm.
6. Refer to pump flow requirement and adjust throttle valve.
7. After test, open system valve and close system test line and throttle valves.

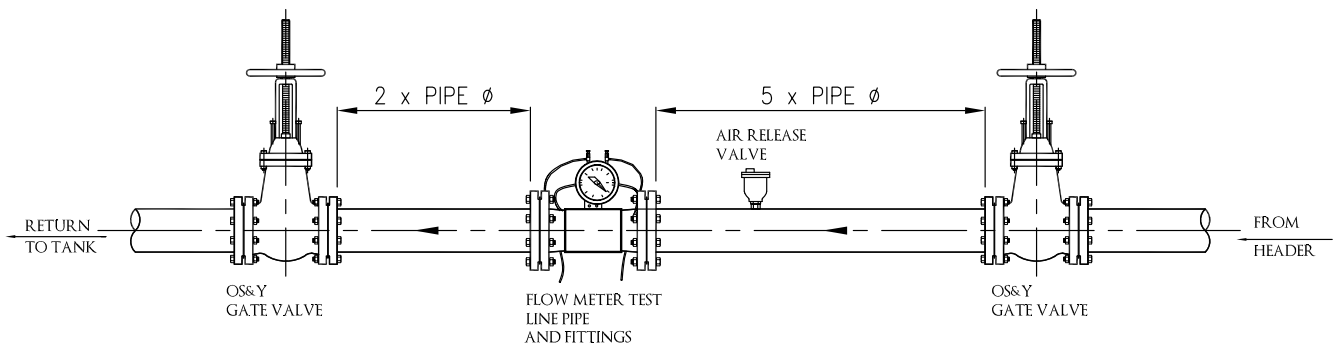


Fig. No. 12

Subject to flow meter manufacturer's recommendations.

5.9. PRESSURE SENSING LINE

- » For all pump installations, including jockey pumps, each controller shall have its own individual pressure sensing line.
- » This line has 1/2" non return valve with 2.4 mm hole in the clapper and will be connect in opposite direction.
- » The end of pressure sensing line is connected with ball valve to drain the water.
- » The pressure sensing line is intended to control automatic starting of the pump motor and the running cycle of the fire pump.
- » The pressure sensing line shall be brass, rigid copper pipe or stainless steel pipe or tube, and the fittings shall be

- ① 1/2" CV WITH 24MM HOLE IN CLAPPER AND WILL BE CONNECTED IN OPPOSITE DIRECTION
- ② BALL VALVE DRAIN

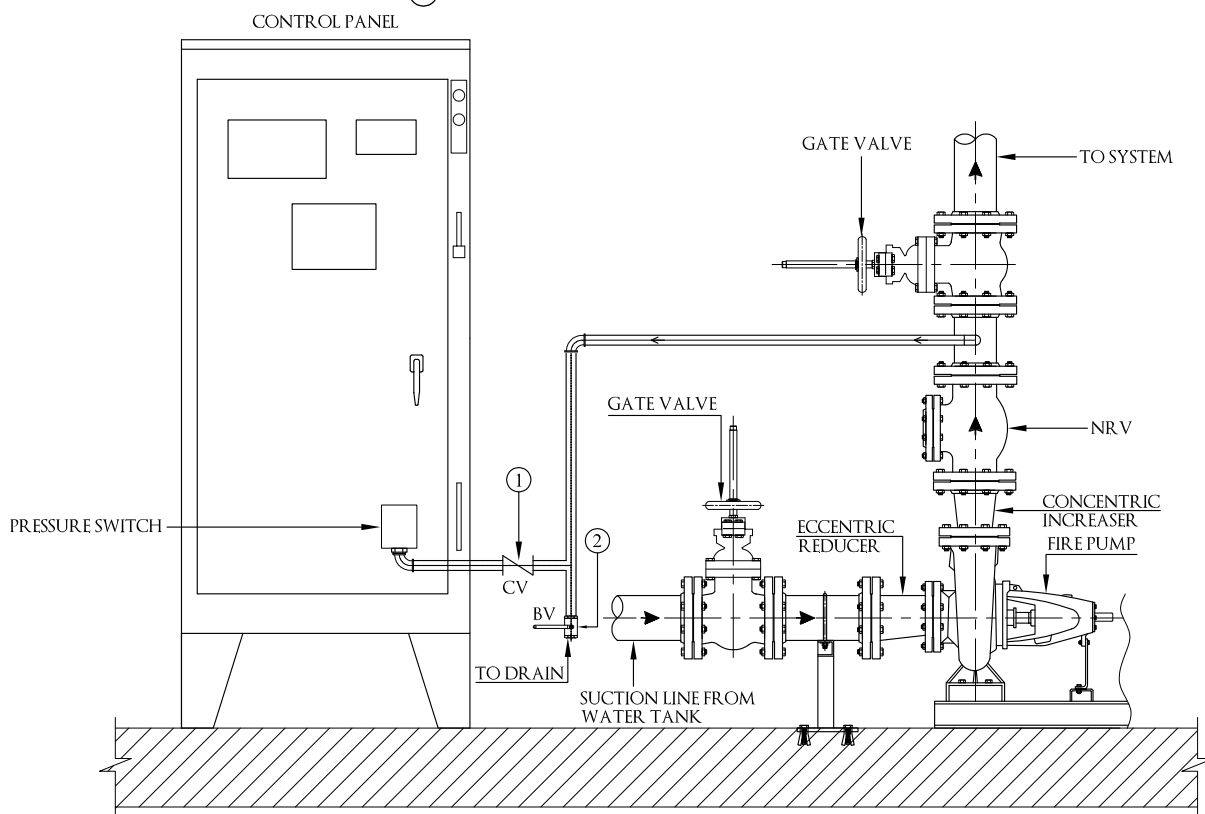


Fig. No. 13

of ½ in. (15 mm) nominal size.

- » The use of soft copper tubing is not permitted for pressure sensing line because it is easily damaged.
- » Where the water is clean (i.e. water that is free from obstructing material), ground-face unions with non-corrosive diaphragms drilled a nominal dia. of 0.09375 in. (2.4 mm) orifice shall be permitted in place of the check valves. In most cases, potable water is considered to be acceptable for this application.
- » Where the above requirements are not met, there shall be two check valves installed in the pressure sensing line at-least 5 ft. (1.52 m) apart with the nominal dia. of 0.09375 in. (2.4 mm) dia. hole drilled in the clapper to serve as dampening.
- » There shall be a no shut-off valve in the pressure sensing line.
- » Pressure switch actuation at the low adjustment setting shall initiate the pump starting sequence (If the pump is not already in operation)

Refer fig. no. 13 for details.

5.10. ENGINE COOLING LINE

Most fire water pump diesel engine installations use water cooling systems. These fall into two categories - radiator and heat exchanger.

Radiator cooled engines employ a fan to draw air through the radiator thus directly cooling the closed engine circuit. The pump house must have inlet and outlet vents of suitable size to provide adequate air without re-circulation.

Heat exchanger, closed engine circuits, are cooled by a supply of coolant from the pump outlet. This supply is passed through the heat exchanger and is then pipe to waste. (See fig. no. 14). A flow control system is fitted to prevent continuous flow of water to waste under standstill conditions.

Engine cooling line – bypass line:

Ensure that the following components are installed in the engine cooling line.

1. Drain plug
2. Ball valves
3. Strainer
4. Pressure reducing valves
5. Solenoid valve
6. Pressure gauge
7. Bypass line

In emergency conditions, when cooling water is not flowing or engine temperature is too high, open both manual bypass valves in the cooling line to enable the flow of water to the engine.

The raw water strainers (one on the normal line and another one on the bypass line) should be cleaned weekly, to remove sediment.

Engine cooling line - outlet discharge location:

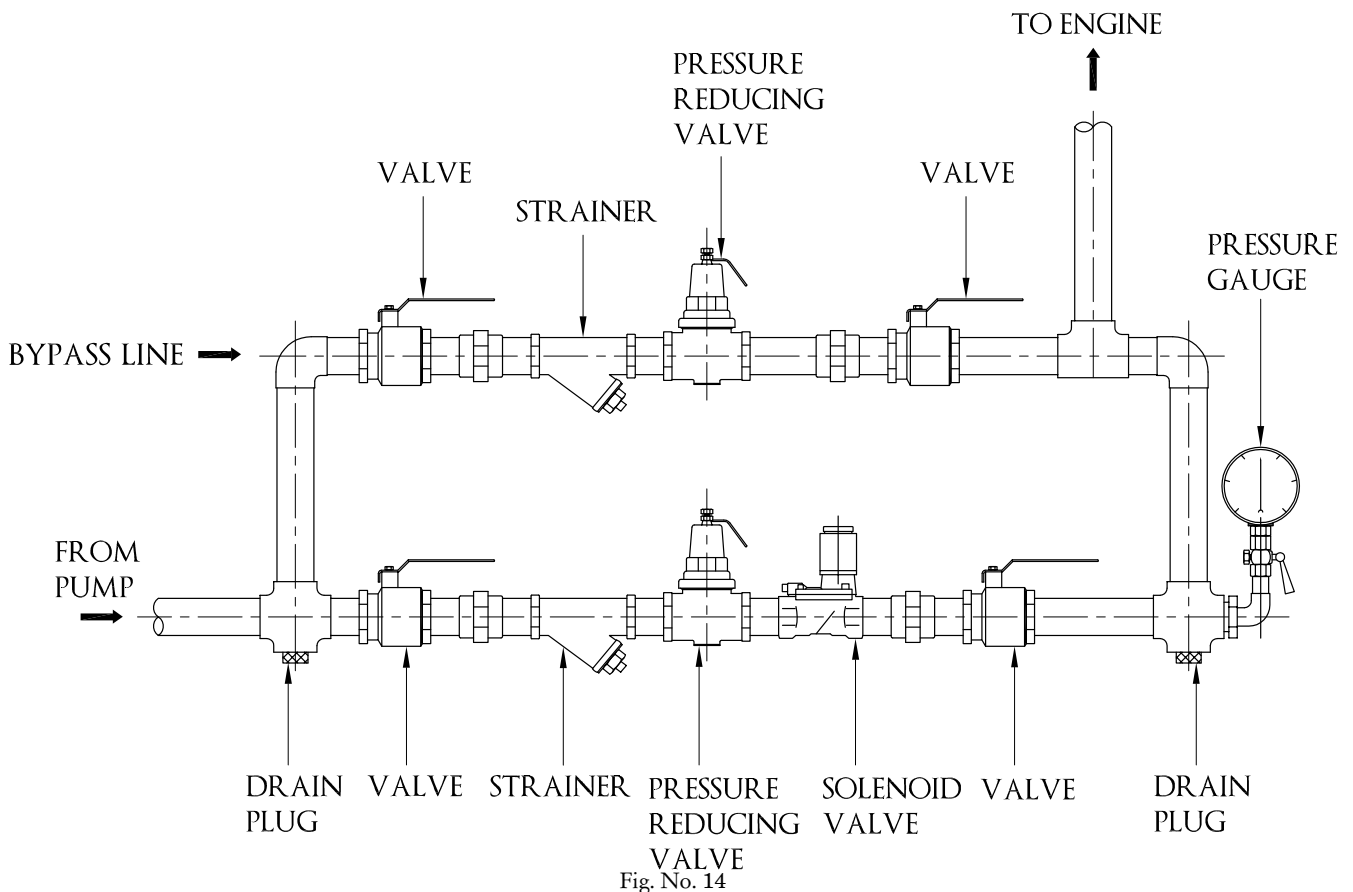
An outlet shall be provided for the waste water line from the heat exchanger, and the discharge line shall not be less than one size larger than the Inlet Line.

The wastewater line piping must be sized to handle the flow of cooling water leaving the discharge outlet. The size of the diesel engine drive will determine the size of the piping and drain. Hence the engine data sheet should be referred to determine the required flow rate of the cooling water to keep the engine temperature at the correct level; and the wastewater line piping must be sized accordingly.

The outlet line shall be as short as practical, shall provide discharge into a visible open waste cone, and shall have no valves in it.

When the waste outlet piping is longer than 15 ft. (4.6 m) and/or its outlet discharge are more than 4 ft. (1.2 m) higher than the heat exchanger, the pipe size shall be increased by at least one size.

COOLING LINE COMPONENTS



5.11. FUEL TANK ARRANGEMENT

If the fuel tank is supplied separately, it is intended to be positioned in a safe location with convenient filling access and giving short and direct fuel line runs.

When a fuel tank stand is supplied it is normally designed to be fixed on a floor having the same level as the pump house. If the stand is not supplied or when special conditions apply, reference should be made to the diesel engine

manufacturer's instructions for guidance on the correct level to mount the fuel tank. It is important to the company with requirement for gravity fuel feed to fire pump engines and to provide access for refilling and topping up the fuel.

The fuel gauge is normally supplied loose and must be fitted to the fuel tank as per the manufacturer instructions or installed and calibrated thus:

1. Fit the float through the 1.5" boss on the top of the tank; set the float to the bottom of the tank, i.e., in the empty position.
2. Screw the gauge into the boss and confirm that it reads 'empty'.
3. If the gauge needs to be calibrated, remove the face of the gauge and extract the pointer, replace the pointer in the empty position and refit the face of the gauge.

Fill the tank with sufficient fuel for one hour running for commissioning tests. (See fig. no. 15).

FUEL TANK ARRANGEMENT

NOTE

1. FUEL AND VENT PIPES MUST BE ADEQUATELY SUPPORTED
2. FUEL TANK OUTLET MUST BE SAME LEVEL OR ABOVE THE FUEL PUMP ON THE DIESEL ENGINE

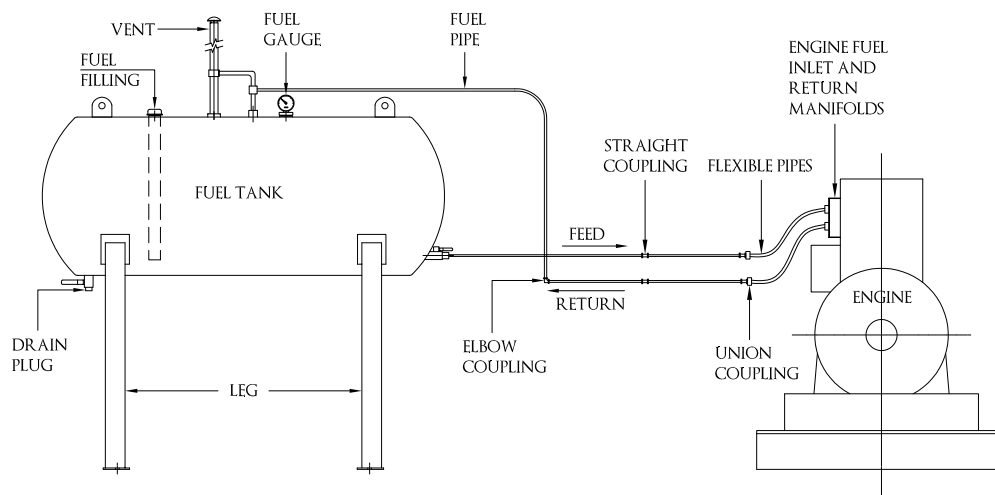


Fig. No. 15

5.12. BATTERY UNITS

1. Battery must be always kept in fully charged condition.
2. Automatic charging of battery from control panel should be monitored.
3. Ensure that the battery terminals are tight.
4. Each engine shall be provided with two battery units.
5. Current-carrying parts shall not be less than 12 in. (305 mm) above floor level.
6. Storage batteries shall be readily accessible for servicing.
7. Battery cables shall be sized in accordance with the engine manufacturer's recommendations considering the cable length required for the specific battery location.

DIESEL ENGINE

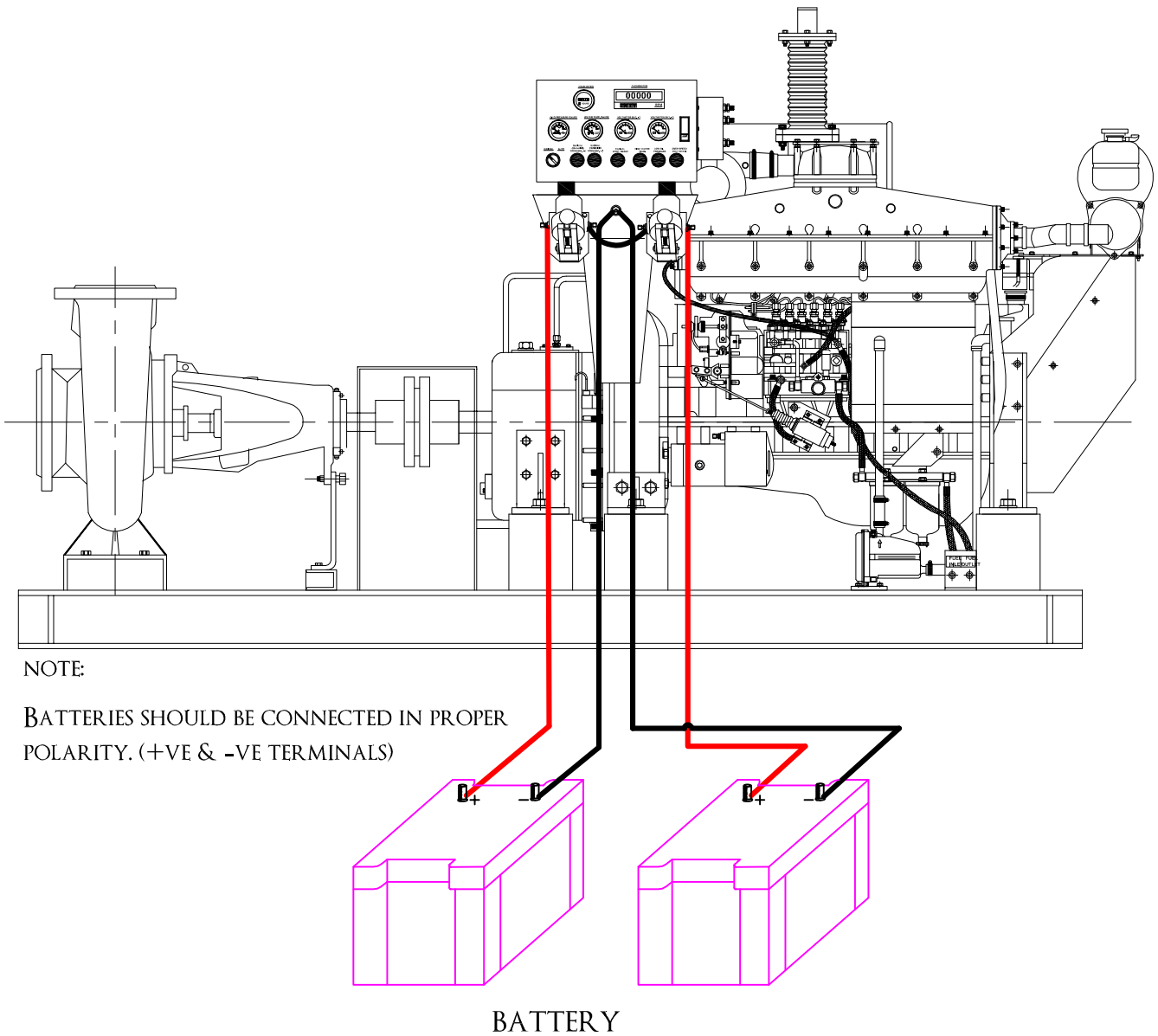


Fig. No. 16

5.13. PRESSURE SETTING

Pressure setting shall be done as described below.

- The jockey pump shall be stopped automatically at a point equal to the pump churn pressure plus the minimum static supply pressure.
- The jockey pump start point should be at least 10 psi (0.68 bar) less than the jockey pump stop point.
- The primary fire pump start point should be 10 psi (0.68 bar) less than the jockey pump start point.
- The secondary fire pump start point should be 10 psi (0.68 bar) less than the primary fire pump start point.
- Fire pumps shall be stopped manually.



FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



5.14. PIPES & FITTINGS MATERIAL OF CONSTRUCTION

SL. NO.	DESCRIPTION	SIZE	MATERIAL
1	Suction line	As per NFPA 20 (refer table 4.26(a), 2010 edition).	Mild steel
2	Discharge line	As per NFPA 20 (refer table 4.26(a), 2010 edition).	Mild steel
3	Sensing line	½" (15 mm)	Brass, rigid copper, stainless steel
4	Diesel fuel inlet	½" (15 mm)	Black steel or stainless steel piping
5	Engine exhaust line	As per diesel engine manufacture recommendation	Mild steel
6	Engine cooling line outlet	Outlet size higher than inlet	Mild steel
7	Pressure relief valve outlet	As per NFPA 20 (refer table 4.26(a), 2010 edition).	Mild steel
8	Concentric reducer	As per pump discharge flange and above mentioned discharge line size.	Mild steel
9	Eccentric reducer	As per pump suction flange and above mentioned suction line size.	Mild steel
10	Test line header	As per NFPA (refer para 20 4.20.3.4., 2010 edition)	Mild steel

5.15. G. A. DIAGRAM OF FIRE PUMP ROOM ARRANGEMENT

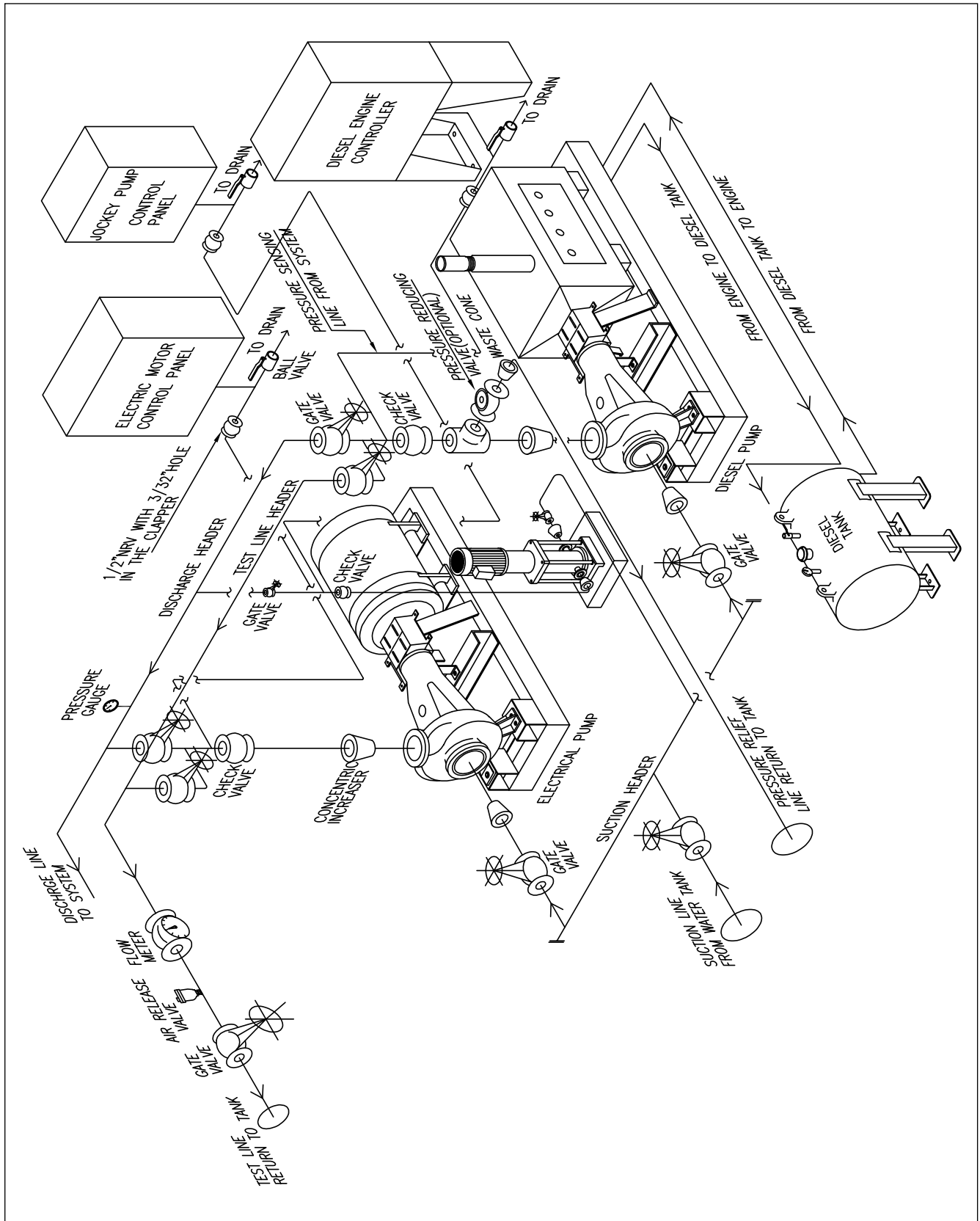
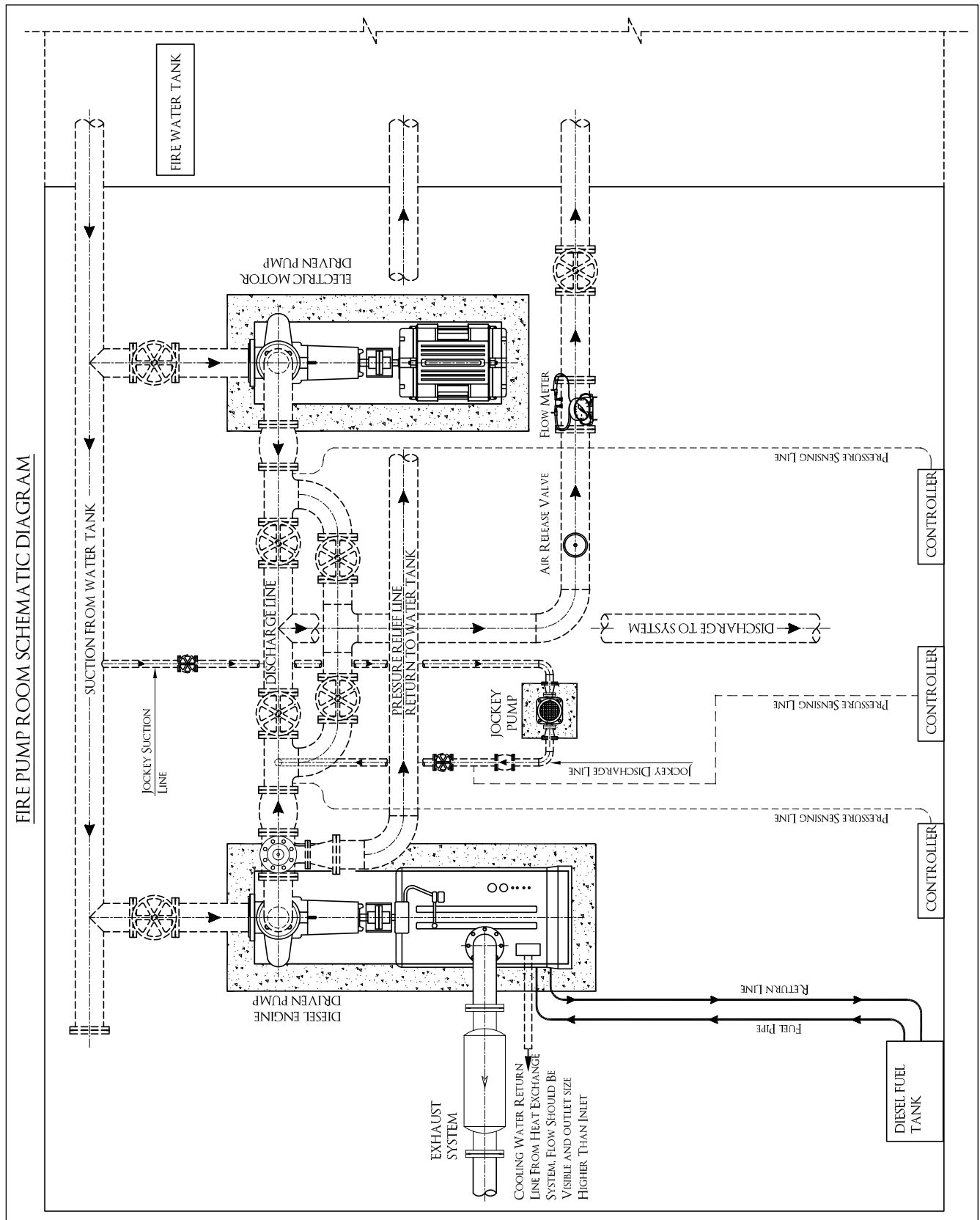


Fig. No. 17

5.16. SCHEMATIC DIAGRAM OF FIRE PUMP INSTALLATION





FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



5.17. CHECK LIST FOR FIRE PUMP SET AFTER INSTALLATION

SL. NO	DESCRIPTION	RESULT	
1	Suction piping should be proper size.(as per NFPA). not less than pump suction nozzle size.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2	Suction piping should be galvanized or painted inside for corrosion protection.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
3	Isolation valve (OS&Y) in suction piping should be proper location	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4	In suction piping, elbows are in the proper orientation or more than straight 10 pipe diameters away from the suction flange of Pump.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
5	In suction piping eccentric reducer (if needed) installed correctly. (Flat side up)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
6	Suction and discharge pressure gauge	Yes <input type="checkbox"/>	No <input type="checkbox"/>
7	Circulation relief valve (electric pump)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
8	Discharge piping should be proper size (As per NFPA)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
9	Check valve in discharge piping.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
10	Isolation valve in discharge piping.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
11	Separate and dedicated sensing line for electrical, diesel and jockey pump	Yes <input type="checkbox"/>	No <input type="checkbox"/>
12	The pressure-sensing line connection for each pump is made between that pump's discharge non- return valve and discharge control valve	Yes <input type="checkbox"/>	No <input type="checkbox"/>



FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



SL. NO	DESCRIPTION	RESULT	
13	The pressure sensing line has ½” non return valve with 2.4 mm hole in the clapper and will be connect in opposite direction.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
14	All isolation valves supervised in the open position	Yes <input type="checkbox"/>	No <input type="checkbox"/>
15	Test header and flow meter valves supervised in the closed position	Yes <input type="checkbox"/>	No <input type="checkbox"/>
16	Diesel pump pressure relief valve (if provided) without isolation valve	Yes <input type="checkbox"/>	No <input type="checkbox"/>
17	In diesel engine, two storage batteries provided with charger	Yes <input type="checkbox"/>	No <input type="checkbox"/>
18	Cooling system from heat exchanger or cooling water supply pipe line from pump discharge is installed (engine).	Yes <input type="checkbox"/>	No <input type="checkbox"/>
19	Cooling line return line one size higher than inlet and this return water should be visible to monitor.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
20	Diesel tank located above ground (Outlet of diesel tank should be above or same level of diesel engine inlet).	Yes <input type="checkbox"/>	No <input type="checkbox"/>
21	Water supply to the fire pump adequate to meet fire pump requirements and Local Civil Defense.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
22	Alignment of coupling must be checked.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
23	The surface of the foundation must be completely horizontal and perfectly flat.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
24	The foundation should be 200 mm larger than the base frame on all four sides.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
25	Flow meter upstream and down stream consider as per manufacturer’s recommendation.	Yes <input type="checkbox"/>	No <input type="checkbox"/>



FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



6. OPERATION

6.1. CHECK LIST FOR FIRE PUMP SET PRIOR TO OPERATION / COMMISSIONING

SL. NO	DESCRIPTION	RESULT	
1	Check the foundation.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2	Check the suction & discharge pipeline stain.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
3	Check the lubrication of pumps and drivers if stored long time.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4	Remove the air whole system.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
5	Ensure there is sufficient water in the tank to complete the test.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
6	Commissioning test shall use water at ambient temperature as the test liquid.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
7	Ensure pressure gauges, suction and discharge, automatic air release valve and flow meter are available.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
8	Ensure the voltage, frequency and no. of phases power supply are matching with the name plate of the equipment.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
9	Check the circuit wiring connections, terminals and proper earthing of equipment prior to final energization.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
10	Check the diesel level to complete the testing. Batteries are full energized condition ensure battery terminals are tight (diesel pump set).	Yes <input type="checkbox"/>	No <input type="checkbox"/>
11	Check alignment and make sure that the alignment is within tolerance between the driver and pump.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
12	Rotate pump shaft manually to confirm free rotation of shaft (electric pump set).	Yes <input type="checkbox"/>	No <input type="checkbox"/>
13	Make sure to proper connections of suction and discharge lines. Ensure all fasteners are tightened.	Yes <input type="checkbox"/>	No <input type="checkbox"/>



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SL. NO	DESCRIPTION	RESULT	
14	Ensure suction lines are opened.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
15	If heat exchanger engine, cooling line should be connected from discharge line and also that flow of lines is visible.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
16	Make sure exhaust muffler should connect and insulated properly.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
17	Make sure fuel tank having sufficient fuel.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
18	Make sure pressure sensing line connected with in between control valve and non-return valve.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
19	Stick reflective tape on the pump shaft for checking speed by the tachometer.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
20	Start the electrical motor and check the direction of rotation.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
21	Check the performance of the driver (engine or motor).	Yes <input type="checkbox"/>	No <input type="checkbox"/>
22	Observe the noise during running for further investigation and rectification if any.	Yes <input type="checkbox"/>	No <input type="checkbox"/>

6.2. VENTING THE PUMP AND ASSOCIATED CHECKS

Vent the pump and suction line before start up. The shut off valve in the suction line must be completely open. Fully open all auxiliary lines and check they are functioning properly.

6.3. START UP

Start the pump against a closed discharge valve only. Once the pump has reached full speed slowly open the valve and set to the duty point. Start up of the engine and controllers shall be as given in their respective IOM manuals. Automatic starting of the pumps shall be based on the pressure setting given under section '5.13. - Pressure Setting'.

6.4. METHODS OF STOPPING

Manual:

Manual shut down shall be accomplished by operation of push-button on the outside of the controller enclosure.

Automatic shutdown after automatic start:

Automatic shutdown shall not be permitted if starting and running causes are present.



FIRE PUMPS - NF-E SERIES

INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



6.5. FIELD ACCEPTANCE TEST FORM FOR FIRE PUMP SET

Electric motor driven fire pump set

Pump Model: _____ Sl. No.: _____

Rated Capacity		Speed (RPM)	Capacity (GPM)	Volts	Amps	Head (PSI)	Suction Pressure (PSI)
Shut off	1						
Rated Flow	2						
150% of rated flow	3						

Diesel engine driven fire pump set

Pump Model: _____ Sl. No.: _____

Rated capacity		Speed (RPM)	Capacity (GPM)	Oil pressure (PSI)	Water temperature (Deg. Celsius)	Cooling raw water Pressure (PSI)	Head (PSI)	Suction Pressure (PSI)
Shut off	1							
Rated Flow	2							
150% of rated flow	3							

7. MAINTENANCE

7.1. WEEKLY INSPECTION AND TESTING

The purpose of the weekly fire pump inspection and test is to ensure the fire pump is in an operation condition free of physical damage and is capable of providing continuous delivery for required fire protection demands. An additional purpose of the weekly test is to detect deficiencies that may not be obvious by visual inspection.

7.2. VISUAL INSPECTION

- » Check the power indicating light on the controller to verify that there is power to the pump
- » Make sure that the temperature in the pump room is not less than 40°F (70°F for diesel engines without heaters) during colder months.
- » Check to make sure ventilating louvers are free to operate.
- » Check to make ensure the pump suction, discharge valves is open.
- » Examine piping, fitting, and connections for any physical damage or leakage.
- » Check to make sure the suction and discharge gauge pressure reading is normal.
- » Check the system pressure gauge to ensure the system pressure reading is normal.
- » Make sure the test header valves are closed in properly.
- » Check pressure sensing line leakage and block (open drain valve and check block).
- » Check free rotation of electric pump.





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INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



- » Check to make sure the reverse phase alarm pilot light is off or normal phase pilot light is on.
- » Make sure fuel tank is $\frac{3}{4}$ full.
- » Check the controller and verify the selector switch is in the automatic position.
- » Check to ensure voltage readings on both sets of batteries is normal.
- » Check and verify charging current readings are normal on both sets of batteries.
- » Check oil filter, fuel filter and air filter conditions.
- » Ensure proper clean exhaust vent.
- » Check to ensure battery terminals are free of corrosion and connections are tight.
- » Check and make sure cooling water level is normal in diesel engine if radiator type.
- » If provided, check to ensure the water jacket heater is operating (Heat exchanger diesel engine).
- » Check to ensure that antifreeze in cooling system heat exchanger is adequate.
- » Check all hoses, fuel lines, and cooling line connections for any leakage and to ensure they are in a good condition.
- » Also refer no. 11. Fire pump Inspection, Testing and Maintenance Schedule.

7.3. JOCKEY PUMP – TESTING

- » Verify start and stop settings on the pressure maintenance pump (jockey pump) by dropping the pressure in the jockey pump sensing line.

7.4. ELECTRIC FIRE PUMP – TEST PROCEDURE

- » Ensure that the discharge line is closed in the system
- » After completion of all inspection procedures, start the pump automatically by slowly dropping the pressure in the controller sensing line. After starting, the pump should be run at least 10 minutes.
- » Record the pressure at which the pump automatically started.
- » Record the pump suction and discharge pressures.
- » Check the pump packing glands to ensure proper tightness and adequate lubrication (should be slow drips – approximately 1 drop per second – adjust glands if necessary with pump off).
- » Check and verify proper operation of the circulation relief valve (this will usually be located on a $\frac{3}{4}$ inch line off the discharge side of the pump – should be discharging a steady stream of water).
- » Check the pump shaft bearings, packing gland stuffing box, and casing for any signs of overheating (bearings and stuffing box should be warm to the touch – casing should be cool to the touch).
- » Check for any unusual noise or vibration.
- » Verify operation of all supervisory signals (i.e., pump running, loss of power, phase reversal, etc.).
- » Verify all the valves are back to the normal position.
- » Verify that pump is left in the automatic start mode upon completion of each test.

7.5. DIESEL FIRE PUMP – TEST PROCEDURE

- » Ensure that the discharge line is closed in the system
- » After completing all inspection procedures, start the pump by slowly dropping the pressure in the controller

sensing line. The pump should be run a minimum of 30 minutes.

- » Record the pressure at which the pump automatically started.
- » Observe how long it takes the engine to crank and once started how long it takes to reach running speed.
- » Record the pump suction and discharge pressures.
- » Check the pump packing glands to ensure proper tightness and adequate lubrication (should be slow drips – approximately 1 drop per second – adjust glands if necessary with pump off).
- » Check for any unusual noise or vibration.
- » Check the pump shaft bearings, packing gland stuffing box, and casing for any signs of overheating (bearings and stuffing box should be warm to the touch – casing should be cool to the touch).
- » Verify proper operation of pressure relief valve.
- » Check the heat exchanger for cooling water flow.
- » Record cooling system temperature.
- » Check engine speed and record rpm's.
- » Check oil pressure (should confirm to manufacturer's recommendation) and record
- » Record amp reading (should be +2 to +5 amps after 5 minutes of running time).
- » Verify that engine will start off of both sets of batteries.
- » Verify operation of all supervisory signals (i.e., pump running, pump off, etc.).
- » Verify all valves are back to normal position.
- » Verify that pump is left in the automatic start mode upon completion of each test.

8. DISMANTLING AND REASSEMBLY

8.1. GENERAL

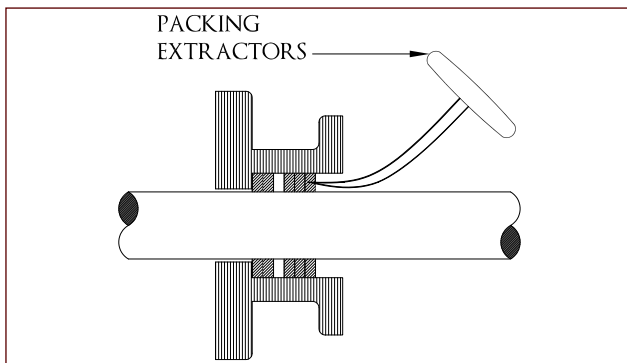
Before dismantling, make sure the pump set is disconnected from the power supply and cannot be switched on accidentally. The suction and discharge shutoff valves must be closed. The pump casing must be empty and not under pressure.

8.2. GLAND PACKING REPLACEMENT

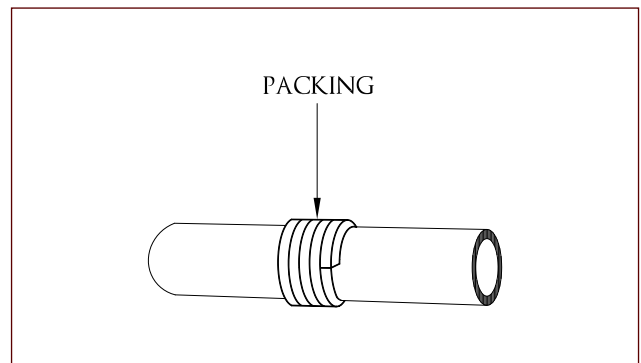
When the gland leaks excessively and adjustment has no effect then it is time to replace the gland packing.

1. Drain the pump and pipe work and ensure that there is no pressure remaining in the stuffing box. Remove any guarding surrounding the stuffing box. Remove the gland retaining nuts and washers and withdraw the gland clear of the stuffing box.
2. Carefully withdraw the old packing using paired extractor tools of the correct size placed on opposite sides of the shaft. Remove all traces of the old packing material and clean the stuffing box thoroughly (see fig. 19-a).
3. Gland packing is normally supplied as graphite impregnated. The requisite number of rings of the required Length must be cut from this coil.
4. Place the packing around the shaft or a mandrel of the same diameter. To assist in cutting draw two lines parallel to the shaft axis separated by a distance equal to the packing section (see fig. 19-b).
5. Cut a ring from the spiral, cutting at an angle of 45 degree diagonally across the guide lines (see fig. 19-c).
6. Check the first ring to ensure a correct fit in the stuffing box before cutting further

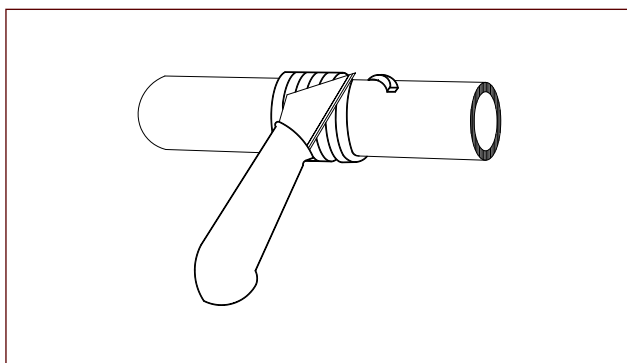
7. Fit the first ring ensuring it is against the end of the packing recess. Turn the shaft to ensure it is not binding; fit the second ring with the joint 120 degree apart to ensure that there is no direct leak path. Turn the shaft again.
8. Fit the lantern ring. This should be slightly above its final position to allow for the slight compression of the packing when secured. Fit the remaining rings, again with their joints 120 degree apart and turning the shaft between each fitting each ring to ensure free movement.
9. Bring the gland up squarely against the last packing and tighten the nuts evenly to finger pressure (see fig. 19-d).



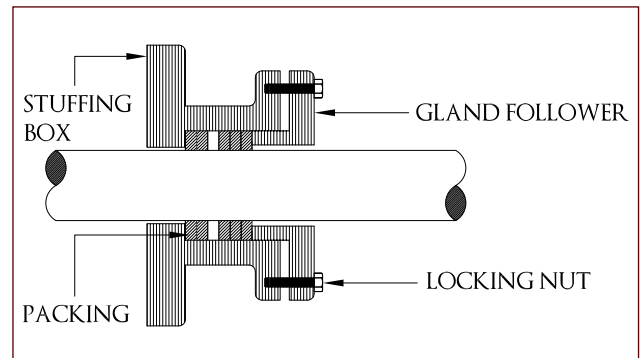
a. Remove old packing with extractors.



b. Wrap packing around the shaft before cutting.



c. Cut the rings from the spiral wrap at a 45° angle.



d. Typical stuffing box assembly.

Fig. No. 19

8.3. DISMANTLING

- » Detach all auxiliary supply lines.
- » Remove coupling guard.
- » Disconnect electric connection from electric motor.
- » Loosen electric motor from base plate.
- » Dismantling of complete pump.
- » During dismantling the volute casing can remain on the base plate and in the pipeline.
- » Pull out bearing bracket with discharge cover and complete rotor (assembled unit).

8.4. REASSEMBLY

Reassemble in accordance with standard engineering practice. Check o-rings for wear and replace if necessary. Make sure the new ones are the same thickness as the old ones.

8.5. EXPLODED VIEW OF END SUCTION FIRE PUMP

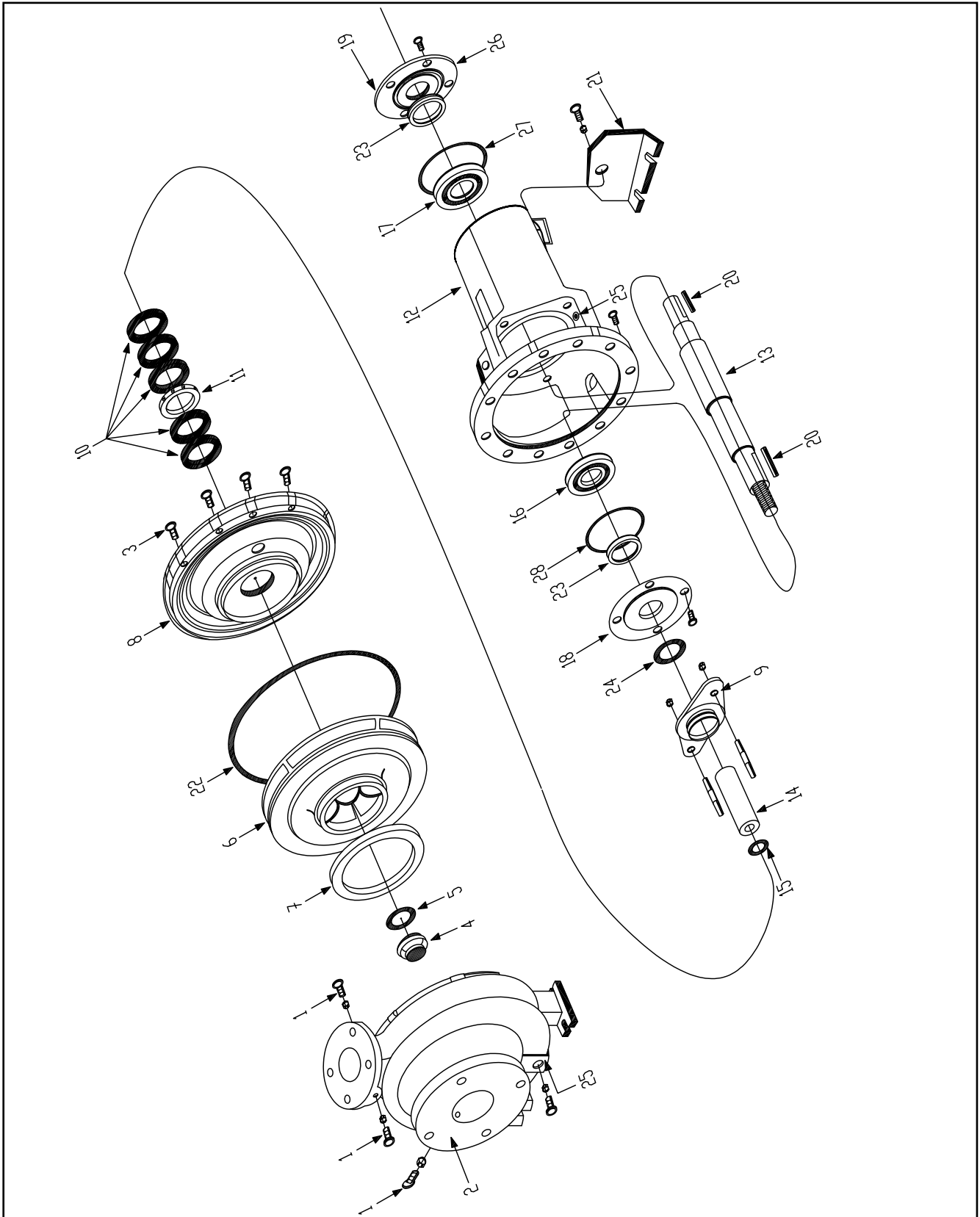


Fig. No. 20



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Ensure the condition of shaft protection sleeve. If worn –out, replace to new one. Check the shaft surface for pits, score marks, grooves, ridges or scratching. Any of these occurs, replace the shaft. Check the shaft for concentricity with the stuffing box bore and that the shaft run-out is within 0.05 mm (0.002”).

8.6. PARTS DETAILS OF END SUCTION FIRE PUMP

PART NO.	DESCRIPTION
1	½" VENT PLUG
2	CASING
3	STUD BOLTS & NUTS
4	IMPELLER NUT
5	IMPELLER WASHER
6	IMPELLER
7	WEAR RING
8	STUFFING BOX (CASING COVER)
9	GLAND
10	GLAND PACKING
11	LANTERN RING
12	BEARING HOUSE
13	SHAFT
14	SHAFT SLEEVE
15	SHAFT SLEEVE 'O' RING
16	INBOARD BEARING
17	OUTBOARD BEARING
18	INBOARD BEARING COVER
19	OUTBOARD BEARING COVER
20	IMPELLER KEY & COUPLING KEY
21	FOOT SUPPORT
22	'O' RING
23	BEARING COVER SEAL
24	WATER PROOF RING
25	DRAIN HOLE
26	BEARING COVER BOLT
27	BEARING COVER GASKET



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Note – if any abnormal operation or condition is noted during the weekly test, the pump should be shut down and left in the shut down position until repairs are made. Repair should be completed as soon as possible and the pump retested.

9. SPARE PARTS & TOOLS

9.1. SPARE PARTS POLICY

Spare parts are available for purchase from factory. All spare parts being supplied are certified by manufacturer for suitability and operation.

To ensure best operation and efficiency of the supplied equipment, always use genuine spare parts supplied by Original Equipment Manufacturer (OEM).

When ordering repair parts, provide the complete pump model number including suffix letters and the pump serial number (both are engraved on the nameplate) and part name and/or number.

9.2. RECOMMENDED SPARE PARTS

- » Shaft
- » Impeller
- » Ball bearing
- » Bearing bracket
- » Gland packing (set)
- » Shaft protecting sleeve
- » Gasket and 'o' rings
- » Wear ring

9.3. RECOMMENDED TOOLS AND INSTRUMENTS

- » Bearing puller
- » Calibrated vernier caliper
- » Calibrated micrometer
- » Spanner – 1 set
- » Multimeter
- » Hammer
- » Screw driver

9.3. RECOMMENDED CONSUMABLES

- » Lubrication oil
- » Grease
- » Vaseline



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10. FAULTS & REMEDIES

Pump delivered insufficient pressure	Abnormal noise	Motor overloaded	Bearing overheated	Excessive temperature rise inside the pump	Heavily leaking gland packing	Water flowing through pressure relief valve, casing relief valve.	Fault	Remedy
☞							Pump operation more than system head.	Operate system head
☞			☞	☞			The pump or piping are incompletely vented or primed	Release air from system
☞							Impeller clogged	Remove clogs.
☞							Reverse rotation	Operate as per pump direction of rotation marked.
☞							Rotational speed is too low	Adjust diesel engine governor to Increase the speed.
☞							Excessive wear of the pump wearing ring	Replace wearing ring
		☞					Pump working less system head.	Operate system head
		☞					Gland follower too tight or tightened	Loose gland
					☞		Shaft protection sleeve worn-out	Replace shaft protection sleeve, gland packing
☞						☞	Pressure relief valve and/or casing relief valve deposit scaling (or) foreign particle	Clean PRV and/or casing relief valve
	☞						Misalignment of pump & driver	Align pump & driver as per manufacturer recommendation
☞	☞						Cavitation noise	Check the Suction Size as per the Pump and Eccentric Reducer.



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INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



11. FIRE PUMP INSPECTION, TESTING AND MAINTENANCE SCHEDULE

	Description	Visual Inspection	Check	Change	Clean	Test	Frequency	Date					
A.	Pump system												
	1. Lubricate pump bearings			X			Annually						
	2. Check pump shaft end play		X				Annually						
	3. Check accuracy of pressure gauges and sensors		X	X			Annually (change or re-calibrate when 5% out of calibration)						
	4. Check pump coupling alignment		X				Annually						
B.	Mechanical transmission												
	1. Lubricate coupling			X			Annually						
	2. Lubricate right-angle gear drive			X			Annually						
C.	Electrical system												
	1. Exercise isolating switch and circuit breaker					X	Monthly						
	2. Trip circuit breaker (if mechanism provided)					X	Annually						
	3. Operate manual starting means (electrical)					X	Semiannually						
	4. Inspect and operate emergency manual starting means (without power)	X				X	Annually						
	5. Tighten electrical connections as necessary		X				Annually						
	6. Lubricate mechanical moving parts (excluding starters and relays)		X				Annually						
	7. Calibrate pressure switch settings		X				Annually						
	8. Grease motor bearings			X			Annually						
D.	Diesel engine system												
	1. Fuel												
	(a) Tank level	X	X				Weekly						
	(b) Tank float switch	X				X	Weekly						





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INSTALLATION OPERATION AND MAINTENANCE INSTRUCTIONS



11. FIRE PUMP INSPECTION, TESTING AND MAINTENANCE SCHEDULE

Description	Visual Inspection	Check	Change	Clean	Test	Frequency	Date						
(c) Solenoids valve operation	X				X	Weekly							
(d) Strainer, filter, or dirt leg, or combination thereof				X		Quarterly							
(e) Water and foreign material in tank				X		Annually							
(f) Water in system		X		X		Weekly							
(g) Flexible hoses and connectors	X					Weekly							
(h) Tank vents and overflow piping unobstructed		X			X	Annually							
(i) Piping	X					Annually							
2. Lubrication system													
(a) Oil level	X	X				Weekly							
(b) Oil change			X			50 hours or annually							
(c) Oil filter(s)			X			50 hours or annually							
(d) Lube oil heater		X				Weekly							
(e) Crankcase breather	X		X	X		Quarterly							
3. Cooling System													





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11. FIRE PUMP INSPECTION, TESTING AND MAINTENANCE SCHEDULE

Description	Visual Inspection	Check	Change	Clean	Test	Frequency	Date						
(a) Level	X	X				Weekly							
(b) Antifreeze protection level					X	Semiannually							
(c) Antifreeze			X			Annually							
(d) Adequate cooling water to heat exchanger		X				Weekly							
(e) Rod out heat exchanger				X		Annually							
(f) Water pump(s)	X					Weekly							
(g) Condition of flexible hoses and connections	X	X				Weekly							
(h) Jacket water heater		X				Weekly							
(i) Inspect duct work, clean louvers (combustion air)	X	X	X			Annually							
(j) Water strainer				X		Quarterly							
4. Exhaust system													
(a) Leakage	X	X				Weekly							





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11. FIRE PUMP INSPECTION, TESTING AND MAINTENANCE SCHEDULE

Description	Visual Inspection	Check	Change	Clean	Test	Frequency	Date			
(b) Drain condensate trap		X				Weekly				
(c) Insulation and fire hazards	X					Quarterly				
(d) Excessive back pressure					X	Annually				
(e) Exhaust system hangers and supports	X					Annually				
(f) Flexible exhaust section	X					Semiannually				
5. Battery system										
(a) Electrolyte level		X				Weekly				
(b) Terminals clean and tight	X	X				Quarterly				
(c) Remove corrosion, case exterior clean and dry	X		X			Monthly				
(d) Specific gravity or state of charge					X	Monthly				
(e) Charger and charge rate	X					Monthly				
(f) Equalize charge		X				Monthly				
6. Electrical system										
(a) General inspection	X					Weekly				
(b) Tighten control and power wiring connections		X				Annually				
(c) Wire chafing where subject to movement	X	X				Quarterly				
(d) Operation of safeties and alarms		X			X	Semiannually				
(e) Boxes, panels, and cabinets				X		Semiannually				
(f) Circuit breakers or fuses	X	X				Monthly				
(g) Circuit breakers or fuses			X			Biannually				





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12. POLICY ON WARRANTY OF NAFFCO PUMP SETS

NAFFCO’s obligation and liability under this warranty being limited to replacing or repairing any part proving defective under normal use and service, and reasonable cost of repair and replacement of said part or parts, within one (1) years from the date of Testing & Commissioning, at NAFFCO’s facilities.

This warranty certificate must be presented to obtain services pursuant to the warranties set forth herein.

This warranty does not cover sets repaired by workshops not authorized by NAFFCO.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose and the obligation and liability of NAFFCO under this warranty shall not include any transportation, any other charges, liability for direct, indirect or consequential damages and delay resulting from the defect or any other obligations or liability on the part of NAFFCO, and NAFFCO neither assumes nor authorizes any other person to assume for it any other liability in connection with such equipment.

This warranty will be considered void by the following:

- 1) Failure to provide regular maintenance in accordance with safety regulations.
- 2) Evidence of quantities of sand, mud and construction debris in the installation. Sand and mud are abrasives and will damage shafts and bearings. Construction debris may lock impeller and cause the motor to burn out.
- 3) Pumping industrial wastes, corrosive liquids, paints, plaster, sludge etc. Unless specifically designed for this service.
- 4) Use of this equipment for temporary de-watering purposes on construction jobs.
- 5) Careless handling, accidental damage, faulty or improper installation or wiring.
- 6) Pumping liquids in excess of 150° Fahrenheit unless specifically designed for this service.
- 7) Pumping equipment is not serviced as per our IOM manual.
- 8) Damaged decomposition from chemical action or wear caused by abrasive materials.
- 9) Damaged by misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment.
- 10) Parts repaired outside seller’s factory without prior written approval.

NAFFCO makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture, since the same are usually covered by warranties of the respective manufacturers.

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NOTES



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NOTES

Project Name	:
Location	:
Fire Pump Set Duty Point	:
Electric Fire Pump Sl. No(s).	:
Diesel Fire Pump Sl. No(s).	:
Commissioned By	:
Date of Commissioning	:
Signature of Commissioning Engineer	:



NAFFCO
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In line with NAFFCO policy for continuous product development, NAFFCO has the right to change specifications without prior notice.

NFE-IOM/ 2018/ V.01

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