

## **SPECIFICATIONS FOR FIRE HYDRANT & SPRINKLET SYSTEM.**

### **1. General.**

1.1. Work under this subhead is time-bound and has to be completed within the time limit set in the tender. Work shall be executed in accordance with an agreed schedule which shall be submitted by the tenderers along with offer and agreed to by owners.

### **1.2 Scope of work.**

The scope of work in this subhead shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely do all work relating to the supply, installation, testing & commissioning of Fire Fighting System as described herein after and shown on the drawings. The scope of work in general shall include the following.

- i) Fire Fighting Pumps & Accessories and related electrical works.
- ii) External & Internal Fire Hydrant System.
- iii) Sprinkler system in entire building.
- iv) Hand Appliances.

Without restricting to the generality of the foregoing, the work shall include the following:

A Hydrant System covering the entire complex and consisting of the following :

- A. Three number of Pump – One number Main electric end suction pump of 2280 LPM at 60 M head, one number a Diesel Standby split casing Pump for Hydrant System of 2280 LPM at 60 M head and Jockey Pump for System pressurization of 180 LPM at 60 M. head.
- B. Other piping system ancillaries such as Suction and Delivery Headers, Air Vessel, Pressure Gauges, Pressure Switches, Pump Panel etc. as required.
- C. External Hydrant Ring Main of 150mm dia with single headed Yard Hydrants, RRL Hoses, Branch Pipes etc. all housed in a Hose Box.
- D. Internal Hydrant system where required with single headed landing valves on each floor accompanied by 1 number swinging type Hose Reel, 2 numbers RRL Hoses, 1 number of Branch Pipe etc. all housed in the niche. Bidder shall provide front frame with shutter for niche.
- E. Sprinkler system for entire building.
- F. Hand appliance as per Bill of Quantities.
- G. To obtain the approval of the relevant drawings before actual installation at site and to get the complete installation inspected and passed by the concerned authorities, as may be necessary as per local bye-laws. (any fee payable to the local bodies).

**1.3 Contractor's Experience.**

1.3.1 Contractors shall engaged specialist agency only for this work of Fire Fighting systems.

1.3.2 The selected specialist agency must have sufficient experience in the execution of turnkey projects as specified.

1.3.3 Contractor must submit with the tender a list of similar jobs carried out by him as required along with the name of works, name and address of clients, year of execution, capacity of plant and value of work.

**1.4 Technical Information.**

1.4.1 Contractor shall submit along with the tender copies of detailed specifications, cuts, leaflets and other technical literature of equipment and accessories offered by him.

1.4.2. Contractor's attention is specially invited to the special conditions and other clauses in the agreement which required the contractor to :-

- a. Submit detailed shop drawings.
- b. Use material of specific makes and brands
- c. Obtain all approvals from Fire Fighting authorities.
- d. Execute the entire work on a turn-key basis so as to provide a totally operating plant.

**1.5 Exclusions.**

1.5.1. Work under the contract does not include the following work.

1.5.2 Electrical cable up to incoming motor control centre.

**1.6. Site Accessibility.**

1.6.1 The equipments are to be located in pump house located within the Service block.

1.6.2 The equipment must be carried from the goods receiving station to the site in an extremely careful manner to prevent damage to the equipment building or existing services.

1.6.3 Contractor must visit the site and familiarize himself with above problems to ensure that the equipment offered by him are of dimensions that they can be carried and planed in position without any difficulty.

## 1.7 Approvals.

The contractor shall prepare all submission drawings and obtain all approvals of fire fighting works from fire fighting authorizes.

## 1.8 System Description.

- 1.8.1 The Hydrant System shall comprise of AC motor driven pump set, standby diesel pump set, jockey pump set for pressurization and fire booster pump with all required accessories including valves, special fittings, instrumentation, control panels and any other components required to complete the system in all respects.
- 1.8.2 The Hydrant System shall be semi automatic in action and shall be laid covering the entire area externally and all the floors internally with independent piping system for Sprinkler System, a separate piping system shall be installed.
- 1.8.3 The Hydrant System shall be kept pressurized at all times. The proposed Hockey Pump shall take care of the leakages the system, pipe lines and valve glands.
- 1.8.4 The pressure in the hydrant pipe work shall be kept constant at 6 Kg/cm<sup>2</sup>. In the event of fire when any of the hydrant valve in the network is opened, the resultant fall in header pressure shall start the AC motor driven fire pump through pressure switches automatically. There shall be one Diesel Engine Driven pump as standby for both hydrant system. In case of failure of electricity or failure of Electric Pump to start on demand, the standby Diesel Pump shall automatically take over.
- 1.8.5 However, shutting down of the pump set shall be manual except for the Jockey Pump which shall start and stop automatically through pressure switches. In addition to auto start arrangements, the main pump shall also have an over-riding manual starting facility by push bottom arrangement.
- 1.8.6 The ping for the hydrant system in the yard shall be laid in soil 1 Metre deep or in rectangular trench. The pipe laid in soil shall be protected as specified.
- 1.8.7 The yard hydrants shall be placed at a regular spacing of 45m centre to centre. The following accessories are proposed near each yard hydrant.
- i) One no. gunmetal single headed hydrant vales.
  - ii) Two nos. RRL Hoses of size 63mm dia x15m long.
  - iii) One nos. gunmetal Branch pipe.

Gun metal hydrant valve, RRL hose and gunmetal branch pipe will be accommodated in a aluminium hose box mounted on brick pedestals.

- 1.8.8. The Internal Hydrant System (Wet Risers) shall be provided at points as indicated on the drawing on each floor.

1.8.9. The hydrant point shall be directly tapped from the Riser pipes, and shall be furnished with required accessories such as –

- i) One no. gunmetal single headed hydrant valves.
- ii) Two nos. RRL Hoses of size 63mm dia x 15m long.
- iii) One no. first aid Dunlop hose reel full swinging type 20mm dia x 30m long.
- iv) One nos, gunmetal Branch pipe.

The hydrant risers shall be terminated with air release valve at the highest points to release the trapped air in the pipe work. At each tapping from the Riser a Orifice Plate shall be located in the lower floors to reduce the pressure.

An overhead tank 20000 litres capacity will be connected to the fire hydrant system.

1.8.10 Sprinkler system shall be distributed entire building so as to cover 12-12 sq.m area with one sprinkler

Sprinkler risers shall be provided with instantaneous control valve with alarm gang.

An overhead tank of 20000 litres capacity with makeup line will be connected to sprinkler riser at basement (overhead tank is excluded from scope of work)

A suitable drainage arrangement with bye-pass valve shall be provided to facilitate maintenance of sprinkler pipe work.

1.8.11 To compensate for slight losses of pressure in the system and to provide an air cushion for counteracting pressure surges/water hammer in the underground pipe work Air Vessels shall be furnished in the pump room near fire pumps. The air vessel shall be normally partly full of water and the remaining being filled with air which shall be under compression when the system is in normal operation.

1.8.12 The entire Wet Riser and external Hydrant Ring Main System shall be fed from the water supply (Static Water Tank) and pump room to be provided by the others.

## 1.9 GENERAL SPECIFICATIONS.

### 1.9.1 Pipes and Fittings.

Pipes for Wet Riser system shall be of GI pipe (Heavy Duty). Pipes upto 150mm dia shall be GI and conform to IS-1239. Pipes with dia 200mm and above (6mm thick) shall be MS and conform to IS-3589. All pipes shall be I.S.I. marked. Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

### 1.9.2 Jointing

Joint for black steel pipes and fittings shall be metal-to-metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between C.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with C.I. or M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

**Note :** Joints for pipes and fittings upto 50mm diameter shall be threaded joints using Teflon Tape or equivalent bonding tape on the threads. Joints for pipe and fittings above 50mm diameter shall be welded joints.

**1.9.3 Pipe Protection.**

- a) All pipes in underground masonry trenches/service tunnels, above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.
- b) Pipes in wall chases shall be protected from corrosion by 2 coats of bituminous paints.
- c) Protection of Underground pipes.

The underground steel pipes shall be protected by coating and wrapping. The coating and wrapping shall be done, in general as per IS:10221-1982.

It specified in Bill of Quantities, the proprietary pipe production system shall be provided as per the Manufacturers recommendation. The proprietary system shall be of approved make.

**1.9.4 Installation of Pipes.**

All pipes shall be adequately supported from ceiling or walls by structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time of slab casting or provide suitable anchor fasteners.

The pipe supports or hangers shall be designed to withstand combined weight of pipe, pipes fittings, fluid in pipe and insulation. Pipe supports shall be of steel and coated with rust preventing paint and finished with two coats enamel paint. The maximum spacing for pipes supports shall be as below :

<b>Pipe (MM)</b>	<b>Spacing (MTR)</b>	<b>Size of support</b>
Up to 25	2.0	6mm
32 to 65	2.4	8mm
75 to 125	2.7	10mm
150 & above	3.0	12mm

Pipes supports shall be spaced at maximum interval of 1.5 mtrs. on either side of heavy fittings and valves. Wherever piping passes through walls, pipes sleeves of diameter larger than that of piping shall be provided. Pipe sleeves shall be of steel or cast iron pipe.

The underground piping shall be supported with cement concrete blocks of suitable size and strength provided at an interval of 2.5 mtrs. The pipes shall be laid at 1 mtr. Depth (top of the pipe) and trench excavated for sufficient width. The rate of pipes shall include the scope of excavation / refilling the trench. 1:2:4 concrete thrust blocks are also to be provided at turning of pipe. The cost of installation includes concrete pedestals etc. as required and to be included in the item rate.

### **1.9.5 Orifice Flanges.**

Contractor shall provide orifice flanges fabricated from 6mm thick stainless steel plates on the branch lines feeding different zones/floors so as to allow required flow of water at a pressure of 3.5 kg/sq.cm. for each hydrants and 2 bar at 1800 LPM at installation valve for sprinkler system. The contractor shall design the orifices to ensure the required pressure.

### **1.9.6 Air Vessel and Air Release Valve.**

Air vessel on top of wet riser piping shall be fabricated of at least 8mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 250mm dia and 1m high. This shall be complete with necessary flange connection to the wet riser piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanized to be IS:4736 – 1968. This shall be tested for twice the working pressure.

### **1.9.7 Valves & Other Accessories.**

#### **1.9.7.1 General**

Each valve body shall be marked with cast or stamped lettering giving the following information's:

- a) The manufacturer's name or trade mark.
- b) The size of the valve
- c) The guaranteed working pressure.

Isolating valves on the water supply lines shall be full bore ball valve type for pipe diameters upto 50mm. For 65mm dia and above these shall be butterfly valves.

#### **1.9.8. Full Way Ball Valve.**

The valves shall be of full bore type and of quality approved by the Consultant / Owner. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

#### **1.9.9 Butterfly Valves.**

Butterfly valves shall be of centric disc construction with single piece body of Cast Iron with disc of aluminium bronze with nitrile seat. Shaft shall be stainless steel with Teflon bearing butterfly valve shall conform to PN 1.6 rating and shall be provided with suitable matching flanges compatible with PN 1.6 rating of valves.

#### **1.9.10 Non-Return Valves.**

Non-return valves are to be IS:778-1984 manufactured from gun-metal or dezincification resistant brass.

#### 1.9.11 Drain Valve.

Drain Valves are to be provided at all low points in the system for draining the water. These shall be 40mm dia full way ball valve fixed on 40mm dia black steel pipe.

#### 1.9.12 Pressure Switches.

Pressure switches shall be differential type for operation of all pumps and for the various duties and settings required. Pressure switches shall be for heavy duty operation and of approved make. All pressure switches shall be factory calibrated.

#### 1.10 External Fire Hydrants.

Yard Hydrant valves shall be single headed as per IS:5290. The valve shall be complete with hand wheel, quick coupling connection spring loaded type and gun metal blank cap. The Yard Hydrant shall be laid on 150mm dia Hydrant Ring Main, branched off to 80mm dia and Stand Post of 80mm dia.

#### 1.11 Internal Landing Valves.

The internal landing valves shall be double-headed made of gun metal and conforming to IS:5290. It shall be complete with hand-wheel, quick coupling connection spring loaded type and blank cap.

#### 1.12 Hose pipes, Branch Pipes and Nozzles.

**Hose Pipe** : Hose pipe shall be rubber lines woven jacketed and 63mm in diameter. They shall conform to type-2 (Reinforced rubber lined) of IS:639-1979. The hose shall be sufficiently flexible and capable of being rolled.

Each run of hose pipe shall be complete with necessary coupling at the ends to match with the landing valve or with another run hose pipe or with Branch pipe. The couplings shall be of instantaneous spring lock type.

**Branch Pipe** : Branch pipe shall be of gunmetal 63mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

**Nozzle** : The nozzle shall be of copper or gunmetal, 20mm in internal diameter. The screw threads at the inlet connection shall match with the threading on the branch pipe, the inlet end shall have a hexagonal head to facilitate screwing of the nozzle on to the branch pipe with nozzle spanner.

End couplings, branch pipes, and nozzles shall conform to IS:903-1985, two hoses of 15 mtr. Lengths with couplings shall be provided with each external (yard) hydrant. One nozzle and one branch pipe with coupling shall be provided with each yard hydrant.

#### 1.13 External Fire Hose Cabinet.

The external fire hose cabinet to accommodate the hose pipes, branch pipe nozzle and the hydrant outlets shall be fabricated from 1.5m sheet steel. This shall be lockable and provided with center opening glazed doors.

The support for hose cabinet shall be of brick work up to a height of 0.5m above ground level. The depth of footing for this support shall be minimum 50cm below ground level, resting on leveling course of minimum 10cm of PCC (1:5:6). The brick work shall be plastered in cement mortar (1:6). The hose cabinet shall be painted red and stove enameled.

#### 1.14 **Internal Fire Hose Cabinet.**

Each internal fire hydrant valve shall be housed in a niche of size indicated on drawings. Each internal fire hose Cabinet shall hold double headed hydrant, 4 Hoses and 2 Branch pipes and 1 no. Dunlop hose reel mounted on a drum.

- A) The cabinet shutters & frames shall be fabricated from boxed steel sections and MS plate 2mm thick.
- B) The front glass of shutters shall be 5.0mm thick clear glass and shall be held by means of rubber. Locking arrangement shall also be made with one number of mortice lock of approved make. A separate Key Box of 16mm thick MS sheet with glass facing shall be provided.
- C) The Shutter shall be given a powder coat finish in post office red colour.

#### 1.15 **Hose Reel.**

The hose reel shall be directly tapped from the riser through a 25mm dia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The Hose Reel shall be swinging type (180 degrees) and the entire Drum, Reel etc. shall be as per IS:884. The rubber tubing shall be of approved quality and the nozzle shall be 6mm dia shut off type.

#### 1.16 **Brigade inlet Connections.**

One set of 4 ways collecting head Fire Brigade connection shall be provided at the location indicated in the drawing.

The inlet to the riser shall be with 150mm dia sluice valve and non-return valve. The scope shall include providing necessary reducers, tees bends and special fittings as required. Necessary enclosure made of 2mm thick sheet metal with support shall be provided, as in the case of hose cabinets.

#### 1.17 **AUXILIARY PUMPING EQUIPMENT.**

##### 1.17.1 **Scope.**

This section covers the details or requirements of the auxiliary equipment necessary for the operation of the fire pumps and the wet-riser system.

##### 1.17.2 **Drive**

The pump shall be directly driven from the electric motor. Flexible coupling and coupling guard shall be provided.



### 1.17.3 **Capacity.**

The discharge and head of the jockey pump shall be as mentioned in Bill of Quantities.

Jockey pump shall be Horizontal /Vertical mono-block / coupled type. The pump casing shall be of cast iron and parts like impeller, sleeve, wearing ring etc. shall be of non-corrosive metal like bronze, brass or gunmetal. The shaft shall be of stainless steel.

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of the dust or water. The pump casing shall be designed to withstand 1.5 time the working pressure.

### 1.17.4 **Motor.**

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz, system. The motor shall be totally enclosed fan cooled type conforming to protection clause IP 21 of IS 4691. The class of insulation shall be B, synchronous speed shall be 3000 RPM/1500 RPM. The motor shall conform IS 325-1978 and rated for continuous duty.

### 1.17.5 **Motor Starter.**

The motor starter shall be automatic star delta type with overload trip, but without under voltage / no volt trip. Starter shall conform to IS 1822-1967.

## 1.18 **MAIN ELECTRIC FIRE PUMP.**

### 1.18.1 **Scope**

This section covers the details of requirements of the motor, starter and pump for the electrically operated fire pump.

### 1.18.2 **General.**

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz A/C system,. Both the motor and the pump shall be assembled on a common base plate of fabricated MS channel type or cast iron type.

### 1.18.3 **Drive**

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided.

### 1.18.4 **Fire Pump (Electrical)**

The fire pump shall be horizontal end suction centrifugal type. It shall have a capacity to deliver 2280 LPM as specified, developing adequate head so as to ensure a minimum pressure of 3 kg. per sq.cm at the highest and the farthest outlet. The delivery pressure at pump outlet shall be not less than 6 kg. per sq.cm. in any case.

The pump shall be capable of giving a discharge of not less than 150 percent of the rated discharge, at a head of not less than 65 percent of the rated head. The shut off head shall be within 120 percent of rated head.

The pump casing shall be of cast iron to grade FG 200 to IS:210 and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze / brass / gunmetal. This shaft shall be of stainless steel.

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plate indicating the suction lift delivery head, discharge speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

#### **1.18.5 Motor**

The motor shall be squirrel cage A/C induction type suitable for operation on 415 volts 3 phase 50 Hz system. The motor shall be totally enclosed fan cooled type conforming to protection class IP 21 vide IS-4691. The class of insulation shall be B. The motor shall be rated to continuous duty as per relevant IS and shall have a horsepower rating necessary to drive the pump at 150 percent of its rated discharge.

#### **1.18.6 Motor Starter.**

The motor starter shall be automatic star Delta type conforming to IS:1822-1967. The starter shall not incorporate under voltage or overload trip or single-phase preventor. The starter assembly shall be suitably integrated in the power control panel for the wet riser system.

Each pump shall be provided with vibration isolating pads of appropriate size.

### **1.19 DIESEL FIRE PUMP.**

#### **1.19.1 Scope**

This section covers the details or requirements of the stand by fire pump operated by a diesel engine.

#### **1.19.2 General**

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bed plate, fabricated with mild steel channel.

#### **1.19.3 Drive**

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500/1800 RPM.

#### 1.19.4 Fire Pump (Diesel)

The fire pump shall be horizontal split casing centrifugal type. It shall have the capacity to deliver 2280 LPM as specified. Developing adequate head so as to ensure a minimum pressure of 3 kg. per sq.cm. at the highest and the farthest outlet. The delivery pressure at the pump outlet shall be not less than 7 kg per sq.cm. in any case. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head. The shaft shall be of stainless steel. The pump shall be provided with mechanical seal. The pump casing shall be designed to withstand 1.5 times the working pressure.

Bearing of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

#### 1.19.5 Diesel Engine

##### **Engine Rating :-**

The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater plugs etc.) The engine shall be multi cylinder /vertical, 4-stroke cycle, water-cooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump, Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient, temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum UP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of the rated head. The engine shall be capable for continuous non-stop operation for 8 hours. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run.

The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to B.S. 649/IS 160/IS 10002, all amended up to date.

#### 1.19.6 Cooling System.

The engine cooling system shall be radiator water cooled system. The radiator assembly shall be mounted on the common base plate. The radiator fan shall be driven by the engine as its auxiliary with a multiple fan belt. When half the belt brake remaining belts must be capable of driving the fan. Cooling water shall be circulated by means of an auxiliary pump of suitable capacity driven by the engine in a closed circuit.

#### 1.19.7 Fuel System.

The fuel shall be gravity fed from the engine fuel tank to the engine driven pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself suitably wall mounted on brackets. The fuel filter shall be suitably located to permit easy servicing.

The engine fuel tank shall be welded steel construction (3mm thick) and of capacity sufficient to make the engine to run on full load for at least 8 hours. The tank shall be complete with necessary supports, level indicator (protected against mechanical injury), inlet, outlet, over flow connections drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediment into the fuel line of the engine. A semi rotary hand pump filling the engine fuel tank together with hose pipe 5 mtr. Long with a foot-valve etc. shall also form part of the scope of work.

#### 1.19.8 **Lubricating Oil System.**

Forced feed Lubricating Oil system shall be employed for positive lubrication. Necessary Lubricating Oil filters shall be provided and located suitably for convenient servicing.

#### 1.19.9 **Starting System.**

The starting system shall comprise of necessary battery / batteries, starter motor of adequate capacity and axle type gear to match with the toothed ring fly wheel. Suitable metallic relay to protect starting motor from excessively long cranking runs shall be included within the scope of the work. The metallic relay protection shall be integrated with engine protection system.

The capacity of the battery shall be suitable for meeting the needs of the starting system but not less than 180 AH.

The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

The scope shall cover all cabling, terminals, initial charging etc.

#### 1.19.10 **Exhaust System.**

The exhaust system shall be complete with silencer suitable for indoor installation, and silencer piping including bends and accessories needed. The exhaust pipe shall protrude outside the pump room. The total backpressure shall not exceed the engine manufacturer's recommendations. The exhaust piping shall be suitably supported and the pipe used shall be of medium class MS pipe.

#### 1.19.11 **Engine Shut Down Mechanism.**

This shall be manually operated and shall return automatically to the starting position after use.

#### 1.19.12 **Governing System.**

The engine shall be provided with an adjustable governor to control the engine speed with 5% of its rated under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

#### 1.19.13 **Engine Instrumentation.**

Engine instrumentation shall include the following :

- a) Lubricating Oil Pressure Gauge.
- b) Lubricating Oil temperature gauge
- c) Water temperature gauge.
- d) Water pressure gauge
- e) Tachometer
- f) Hour meter
- g) Starting key

The instrument panel shall be suitably mounted on the engine.

1.19.14 **Pipe Work :**

The piping for exhaust outlet as well as fuel piping between fuel tank and the engine shall be with Medium class M.S.

1.19.15 **Anti Vibration Mounting.**

Suitable vibration mounting duly approved by engineer-in-charge shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated in the report, which will be submitted to engineer-in-charge before installation.

1.19.16 **Battery Charger.**

Necessary float and boost charger shall be incorporated in the control section of the power and control panel to keep the battery under trickle condition. Ammeter to indicate the state of charge of the batteries shall be provided.

1.20 **POWER AND CONTROL PANEL AND OTHER CONTROL COMPENENTS.**

1.20.1 **Scope**

This section covers the detailed requirements of the power and the control panel for the wet riser system, and also for the various control components in the system.

1.20.2 **Power and Control Panel.**

1.20.2.1 **Constructional Requirements**

**General Features.**

The power and control panel shall be totally enclosed, free standing floor mounted cubic type, fabricated out of sheet steel not less than 2mm thick. Where necessary, additional stiffening shall be provided by angle iron frame work. General construction shall be of compartmentalization and sectionalisation such as mains incomes, electric fire pump, diesel fire pump, pressurization pump, and control, so that there is no mix up of power and control wiring and connections in the same sections as far as possible. The panel shall also have the space for cable allays. The space for cable alleys shall be at least 200mm wide to the entire depth of panel. The panel shall be front operated type with all connections accessible from the front. Front doors shall be hinged type. Back doors shall be hinged type or removable type for inspection. The door hinges shall be of concealed type. The doors for bus bar chamber shall be of removable type with the help of bolts. The doors shall be provided with quick fixing doors knobs with indication. The general arrangement of the panel shall be got approved before fabrication the cubicle construction shall be to IP 21 as per IS:2147.

#### 1.20.2.2 **Cable entries and gland plates.**

All cable entries shall be through gland plates which are removable and sectionalized. Where heavy cable are brought in and terminated, suitable clamps shall be incorporated to relieve the stress on the glands due to the weight of the cable. Cable entries may be from top or bottom depending on the equipment layout and cable scheme as approved.

#### 1.20.2.3 **Bus bar and Connections.**

The Bus bar shall be air insulated, and of aluminium of high conductivity electrolytic quality (grade E 91 E to IS:5082) and a adequate cross section. Current density shall not exceed 1.3 amps. Per sq.cm. All connections to individual circuits from the bus bars shall preferably be with solid connections. The bus bars and the connections shall be suitable covered with PVC sleeves or in an approved manner. Bus bar shall be suitably supported using non-hygroscopic insulated supports. High tensile bolts and spring washers shall be provided at bus bar joints.

#### 1.20.2.4 **Earthing Arrangement.**

GI strip 24mm x 5mm shall be run at the rate of the board 2 nos., earth terminals shall be provided at the ends of the GI strip for connection to earth system.

#### 1.20.2.5 **Terminal Blocks and Small Wiring.**

Terminal blocks shall be heavy duty type and generally not less than 15 amps 250V grade up to 100V, and 600V grade for the rest of the functions. They shall be easily accessible for maintenance. All control wiring inside the panel shall be with PVC insulated copper conductor of 2.5 sq.mm size and 600V grade conforming to IS:694-1977. Suitable colour-coding may be adopted. Wiring harness shall be nearly formed and run preferably function wise, and as far as possible segregated voltage wise, Identification ferrules shall be used at both ends of the wires.

#### 1.20.2.6 **Instruments and Lamps.**

All indication lamps and instruments shall be flush mounted type in front of the panel. The voltmeter and ammeter shall of size 100mm nominal (dial size) conforming to clause 1.5 of IS 1248 for accuracy.

Current transformers shall be provided with ammeters.

Indicating lamps to indicate the availability of electric supply shall be provided at the incoming section. Necessary indicating lamps for alarm indication and battery charging shall be provided in the respective sections.

All indicating lamps and meter shall be protected with HRC cartridge type fuses.

#### 1.20.2.7 **Labels**

All internal components shall be provided with suitable identification labels. Suitably engraved labels shall be fixed at the panel for all switches, instrument push buttons, indicating lamps etc.

#### 1.20.2.8 **Painting.**

The entire panel shall be given a primer coat of red lead after degreasing and phosphating treatment and two coat of final paint or approved shade before assembly of various items.

#### 1.20.3 **Equipment Requirements.**

##### 1.20.3.1 **General**

The power and control panel shall comprises individual section for the various equipment's of the system and controls, in a combined cubicle type design. All switches MCCB. MCBS and fuse/fuses switch unit shall be conforming to relevant IS.

##### 1.20.3.2 **Incomer Section & Outgoing Section.**

###### (A) **Incomer section :**

1 no. 300 amps TPMCCB unit complete. One set of 96 mm square Ammeter (0-400 Amps) complete with selector switch and CTS. One set of 96mm square Voltmer (0-500 V) complete with control fuses and selector switch. One set of phase indicating lights with control fuses. One set of 4 strips of 300 Amps aluminium busbars.

###### (B) **Outgoing Feeder.**

- (i) One number of 250 A,ps TP MCCB unit complete, SP Preventer, ML 4 type contractor forstar delta starting, start an stop push buttons, auto-manual switch, Ammeter with CTS, A S S , phase indicating lights. Auxillary Contractors for interlocking / sequence of operation, control terminals complete in all respect with interconnections for Hydrant Pump and sprinkler pump.
  - (ii) Two numbers of 63 Amps rated TP MCCB unit complete, ML 1.5 type contractor D O L starting with overload relay, start and stop button. Ammeter, CTS and selector switch, hase indicating lights, AUxillary contacts for interlocking / sequence of operation, control terminals complete in all respect for Jockey Pump & fire booster pump.
- (C) Control wiring from pressure switches of different settings in Hydrant and Jockey Pumps, for sequence of operation shall be included to complete the system.
- (D) Colour code with ferrule marking shall also be make.
- (E) The wiring shall be PVC insulated and PVC armoured aluminium conductor cable of 650 /100 volts grade conforming to IS 1554 as required from Fire Pump Board to motor and cable of suitable size.

##### 1.20.3.3 **Electric Fire Pump Section.**

This section shall incorporate the following facilities.

- a) MCCB
- b) Control system components ad equipment such as relays, contractors, timers etc. for automatic operation.

- c) Starter Unit , Current Transformer and ammeter.
- d) Indication lamps, their fuses, terminal block, push buttons, control and selector switches etc. are as required.
- e) Pump lock out devices due to faults or abnormalities as specified in operating sequence.
- f) Visual/audio alarms, indications and communications facility as specified in operating sequence.
- g) Necessary inter-connection and control wiring etc.

#### 1.20.3.4 **Engine Section.**

The engine section shall incorporate the following facilities:-

- i) Control system components and equipment such as relays, contractors, timers etc. for automatic operation.
- ii) Instruments, indicator lamps, fuses terminal blocks, push buttons, control and selector switches etc. as are required.
- iii) Engine shut down and block out devices due to faults or abnormalities as specified.
- iv) Visual/audio alarms and indications as specified.
- v) Inter-connection and control wiring etc.

#### 1.20.3.5 **Auxiliary Pump Section.**

The auxiliary pump section for Jockey pump shall incorporate the following:

- a) TP&N MCBS
- b) Control system components such as relays, times, contractors etc. as are necessary for functional requirements.
- c) Starter unit, current transformer and ammeter.
- d) Indication lamps, fuses, terminal blocks, push buttons selector, switch etc. as required.
- e) Inter-connections and control wirings etc.

#### 1.20.3.6 **Control Section.**

This section shall incorporate the following –

- a) Control components integrating the various sections, so as to satisfy the functional requirements.
- b) Battery charger unit with boost / float charge facility with voltmeter, capable of independently charging 2 sets of batteries at a time.



- c) Visual / audio alarms, not covered in individual sections.
- d) Lamps healthy test facility.
- e) Instruments, indicating lamps, pushbuttons, fuse terminal blocks etc. as are required.
- f) Test facility to simulate operation of hydrants.

#### 1.20.4 **Other Control Components**

##### 1.20.4.1 **Pressure Switches.**

Pressure switches shall be provided for switching on and off the pressurization pump at present pressures and also for switching off the fire pump at present pressure. Being the main component for initiating the signal for the operation of the pumps, the pressure settings shall be totally reliable, sturdy in construction and of long life. The pressure settings shall be adjustable.

##### 1.20.4.2 **Power Supply for Controls.**

In order to ensure that the control systems remains co-operational at all times the control system shall be designed for 24 VDC operation fed from the battery. This shall be independent of the starting battery for the engine i.e. battery shall remain trickle charged at all times from the separate battery charger at the control system.

#### 1.21 **Electrical Work and Earthing.**

##### **Scope.**

This section covers the detailed requirements of electrical works including earthing, for the materials installation.

Electric power supply shall be terminated in the incoming switch gear of the power and control panel by the Department. All further connections to the various components of the system shall be the responsibility of the contractor, for a complete and working system, satisfying all the functional requirements.

The scope shall particularly include the following :

Power and Control Panel(s) as given in relevant section.

All inter-connections with multi-core armoured copper cables of size suitable between various control units and control panel(s)

All power cable connections with multi-core armoured aluminium cables of size as specified in BOQ, between panels, motors etc.

Necessary earthing with 2 Nos. G.I. plate electrodes and loop earthing.

The work shall be carried out conforming to CPWD General Specifications for Electrical works Part-I (Internal) amended up to date and Part-II (External) amended upto date.

## 1.22 **Sprinkler System.**

### 1.22.1 **Sprinkler Heads.**

Sprinkler heads shall be of quartzoid bulb type with bulb, valve assembly yoke and the deflector. The sprinklers shall be approved make and type.

### 1.22.2 **Types**

#### 1.22.2.1 **Conventional Pattern.**

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown upwards to the ceiling side of wall extra. The sprinklers shall suitable for erection in upright position or pendant position.

##### A. **Side Wall Sprinklers.**

These shall be designed for installation along with the walls of room close to the ceiling. The discharge pattern shall be similar to one quarter of sphere with a small proportion discharging on the wall behind the sprinklers.

#### 1.22.2.2 **Construction**

- i) **Bulb** – Bulb shall be made of corrosion-free material strong enough to with stand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.
- ii) **Valve assembly** – Water passage of the sprinkler shall be controlling assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly be stable and shall withstand pressure surges or external vibration without displacement.
- iii) **Yoke** : The yoke shall be made of high quality gunmetal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti corrosive treatment if the same is to used in corrosive conditions.
- iv) **Deflector** : The deflector shall be suitable for either upright or pendent erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

##### B. **Colour Code.**

The following colour code shall be adopted for classification of sprinkler according to nomination temperature ratings.

C. **Sprinkler Temperature Rating.**

D. **Size of Sprinklers Orifices.**

The sprinklers shall be of 15mm nominal bore size.

1.22.2.3. **Pipes and Fittings**

Pipes for sprinkler system shall be of black steel conforming to I.S. 1239 (Heavy class).

Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

1.22.2.4 **Jointing.**

Joint for black steel pipes and fittings shall be metal to metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between G.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with G.I. or M.S. flanges with appropriate number of bolts. Flanged joint shall be made with 3mm thick insertion rubber gasket.

1.22.2.5 **Pipes Protection.**

All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

Pipes in chase or buried underground shall be painted with two coats of hot bitumen.

1.22.2.6 **Pipe Supports**

All pipes shall be adequately supported from ceiling or walls from structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time of slab casting or anchor fastener later.

1.22.2.7 **Valves**

Sluice valves of sizes 80mm and above shall be double flanged cast iron conforming to I.S.780. Check valve shall be of cast iron double flanged conforming to I.S.5312.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20 kg/sq.cm. Pressure. Valves shall conform to I.S. 778.

A. **Air Valves**

25mm dia screwed inlet cast iron single acting air valves on all high points in the system or as shown on drawings.

**B. Drain Valves**

50mm dia black steel pipe conforming to I.S.1239 medium class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

**1.22.2.8 Installation Control Valve.**

Installation control valves shall comprise of the following :

- a) One-man stop valve of full way pattern with gunmetal pointer to indicate where open/shut.
- b) One automatic alarm valve fitted with handle & cover.
- c) One hydraulic alarm motor and going for sounding a continuous alarm upon out-break of fire. One combined waste and testing valve including 5 mtr. Of tubing and fittings.
- d) Alarm stops valve.
- e) Strainer
- f) Drain plug.
- g) Padlock and strap
- h) Wall box for installation of valve.

**1.22.2.9 Pressure Gauges.**

Burden type pressure gauges conforming to IS/BS specifications shall be provided at the following locations.

- a) Just above alarm valve.
- b) Just below alarm valve, on the installation stop valve.
- c) One pressure gauge on delivery side of each pump.
- d) Required number of pressure gauges on pressure tank.

Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve. In case of basement and other areas where the pipe work is below the installation drain valve / auxiliary valves of the following sizes shall be provided.

- a) 20mm dia valve for pipes up to 50mm dia.
- b) 25mm dia valves for 65mm dia pipe.
- c) 32mm dia valves for pipes larger than 65mm dia.

Piping shall be be screwed type upto 50mm diameter, Welding of joints will be allowed for pipes of above 50mm dia.

- 1.22.2.10 The entire piping shall be pressure tested by hydrostatic method upto a pressure of 1.5 times the working pressure. The piping shall be slowly charged with water so that all the air is expelled from the piping by providing a 25mm inlet with a stop cock. The piping shall be allowed to stand full of water for a period of 2 hours and then the piping shall be put under pressure by means of manually operated test pump or by a power driven test pump. The pressure gauges used for testing shall be accurate and shall preferably be calibrated before the testing shall be rectified to the entire satisfaction of the Engineer-in-charge. The system may be tested in sections/parts as the work of erection of piping proceeds. The piping shall with stand 1.5 times the working pressure for at least 2 hours.

### 1.23 **Operating Sequence for the Fire Fighting System.**

- 1.23.1 The operating pressure in the mains is to be maintained at 6.0 kg/cm<sup>2</sup>.
- 1.23.2 The jockey pup shall start automatically the moment pressure drops to 5.5 kg/cm<sup>2</sup> because any leakage or minor draw-off from the system and stop when the pressure reaches 5.5 kg/cm<sup>2</sup> again.
- 1.23.3 In case, after the start of Jockey pump, the pressure still keeps on falling, the main fire pump shall start at 5.0 kg/cm<sup>2</sup> by triggering of the pressure switch. Jockey pump shall stop when main pump starts.
- 1.23.4 In the event of electrical or mechanical failure of main fire pump (hydrant) to start, the diesel engine driven pump shall cut in when the pressure in the mains fall down to 4.5 kg/cm<sup>2</sup>. The main electric pump shall then be locked out.
- 1.23.5 In the event of failure of wet rise system, there will be further drop in pressure and when the pressure reaches to 4.0 kg /cm<sup>2</sup> fire booster pump near overhead tank will start automatically .
- 1.23.6 If within a preset period the standby pump fails to start or fails to develop adequate pressure, the control system shall shut down the standby pump and lock it out and given an audiovisual indication to that effect at the control panel.
- 1.23.7 Jockey pump shall be shut down automatically when the fire pump electric or diesel, is operating. Necessary integration or pipe work and controls shall be provided for the purpose. A timer may be employed where necessary to distinguish between slow fall of pressure due to system leaks and sudden fall of pressure due to fire duty by opening of valves and thus prevent parallel start up of both pressurization and fire pumps.
- 1.23.8 The control panel shall status selection for each of the pumps for "automatic" as well as "manual" operation.
- 1.23.9 Pumps when under "manual" status shall be operated manually through relevant push buttons.
- 1.23.10 The fire pumps once started shall not be stopped automatically.

- 1.23.11 The fire pumps shall be locked out for operation both for “manual” and “automatic” operations, once the low water controls operates and furnish an audio and visual alarm on the panel the audio alarm can be silenced by accepting the alarm. The visual alarm shall be individual for each equipment. It shall be flashing type and on acceptance remain steady. A reset button shall be provided for each pump for returning the pump for fire duty.
- 1.23.12 Over load or under voltage/mo volt trip device for electric fire pump shall not be provided in the starter. LED type indication lamps to indicate the availability of power shall be provided.
- 1.23.13 Once tripped the electric fire pump shall remain locked out for operation irrespective of the positive of its operational status selection switch. Lock out indication shall be available on the panel.
- 1.23.14 Rerun to normal operational availability shall be feasible only by manual re-set of locked out units by operation of appropriate push buttons.
- 1.23.15 When fire pumps are brought into operation an audible tone from turbine type alarm operated by water flow in the mains shall be provided in indicate the healthiness of the system. The healthy running alarm shall not be silenced till the fire pump is shut down, but the tone may be mellowed by the operation, if required.
- 1.23.16 Alarm for failure and lock out of any pump shall distinct from “healthy” alarm. Failure alarms shall be loud and can be silenced on acceptance.
- 1.23.17 Repeat indication of various audio and visual indications on a slave remote panel in fire control room in terminal building shall be available. The slave remote panel shall have indication lamps to show the status of :
- a) Power healthy in fire pump room
  - b) Jockey pump ‘ON’
  - c) Main pump “ON”
  - d) Fire booster pump “ON”

The slave Remote panel shall also have a hooter, which shall sound in case, any pump is “ON”. The slave Remote panel shall have a provision to reset the hooter with the help of a push button.

## 1.24 **Testing.**

### 1.24.1 **Testing on Completion of Installation.**

The entire system shall be tested after completion of installation as per the operating sequence specified.

#### **Standard and Codes.**

- |    |              |  |
|----|--------------|--|
| 1. | IS-1648-1961 | Code of Practice for fire safety of building (general) firefighting equipment and maintenance. |
| 2. | IS-3844-1966 | Code of practice for installation of internal fire hydrant in multi-storied building.          |

3. IS-2217-1963 Recommendation for providing first aid and fire fighting arrangement in public buildings.
4. IS-2190-971 Code of practice for selection, Installation and maintenance of portable first fire appliance.
- 5 IS-3589 Electrically Welded Steel pipes (Medium class)
6. IS-1239 Mild steel tubes, Tubular and other wrought steel fittings (Medium class)
7. IS-780 C.I. Double flanges sluice valve.
8. IS-778 Gun Metal Valve.
9. IS-909-1965 External fire hydrant (underground)
10. IS-5290-1969 Internal Landing Valve.
11. IS-884-1969 First and hose reel.
12. IS-934-1976 Specification for portable chemical fire Extinguisher soda acid type.
13. IS-2873-1969 Specification for fire extinguisher for carbon dioxide.
14. IS-2189 & 2109 Automatic fire alarm system or BSS-3116
15. National Building Code.

## LIST OF APPROVED MAKES FOR FIRE FIGHTING WORKS

Sl.No.	Materials	Brand Name
1.	M. S. Pipes	Jindal Hissar / Surya Prakash
2.	G.I. Pipes	Jindal Hissar / Surya Prakash
3.	Gun Metal Valves (Gate, Globe)	Kirloskar / Leader / Zoloto / AIP
4.	CI Double flanged sluice valves & check valves.	Kirloskar
5.	Butterfly Valves	Kirloskar / Audco/ Zoloto / AIP
6.	CI double flanged non-return valves	Kirloskar
7.	Suction Strainer	Leader / Sant.
8.	Sprinkler (UL Listed)	Spray Safe / HD / Viking / Tyco
9.	Fire Hydrant Landing Valves, Fire brigade connection (ISI marked)	Minimax / Newage / Guards
10.	Installation Valve (ISI Marked)	Spray Safe / HD
11.	Fire hose pipes, First Aid Hose Reel (ISI Marked)	Jaysree / Minimax / Newage / Chhatariya / Guards.
12.	Branch Pipe, Nozzle and coupling	Minimax / Newage / Guards
13.	Fire Extinguishers	Minimax / Guards
14.	Pumps	Kirloskar / Mather & Platt
15.	Motors	Kirloskar / Siemens / Crompton
16.	Starters	Siemens / L&T / Cutler Hammer
17.	Single phasing preventor / over load protection unit.	Siemens / Minilee
18.	Pressure Switch	Danfoss / Swizer
19.	Pressure Gauge	H. Gure / Fiebig
20.	Relays	L&T / Siemens
21.	Contractors	L&T / Siemens
22.	Control Cable	CCI / Gloster / Havells
23.	Diesel Engine for Fire Fighting	Cummins
24.	Moulded case circuit breakers.	L&T/ Siemens
25.	Fuse Disconnect switch / switch fuse units.	L&T / MDS / Siemens / GE power / ABB / Indo Asian Schneider / Control & Switch Gear.
26.	HRC Fuses	L&T / Siemens
27.	Ammeter, Voltmeter	Universal
28.	Selector switch, push button switch / emergency switch	L&T / Siemens
29.	1.1 KV LT Cables (ISI marked)	CCI / Gloster / Havells
30.	Fire Alarm Panel	Appolo / Edwards / System sensor.
31.	Fire electrical control panel	Diamond electrical / SPC eletroctech Pvt. Ltd.