TECHNICAL SPECIFICATIONS
FOR FIRE FIGHTING WORKS

FIRE FIGHTING SYSTEM

Contents

SECTION – I : FIRE FIGHTING SYSTEM

1.0 *GENERAL INSTRUCTIONS*

1.1 Fire suppression works specified in the tender have to be executed in accordance with:

i) The rules and regulations of Local Fire Authority as per the statutory regulations applicable for obtaining the occupation/No objection certificate from the Local Development / Fire Authority.

ii) Applicable norms laid down by the relevant sections of latest editions of National Building Code 2016 (NBC 2016) and all relevant codes of Bureau of Indian Standards (B.I.S.) and CPWD general specifications for electrical works Part – 5 (Wet riser and sprinkler system) shall be followed as applicable.

iii) The codes of the National Fire Protection Association of USA (N.F.P.A.) shall used as a general guide for good engineering practice, design and workmanship norms.

1.2 All materials used in the works shall have Bureau of Indian Standards valid certification stamped, marked or cast on the material in an acceptable and approved manner, as specified hereinafter.

1.3 It is the contractor's responsibility to ensure the competence of design to meet the above requirements.

1.4 Drawings issued with the tenders are schematic and indicate the concept. Contractor shall make his shop drawings on basis of Architectural and Interior design drawings issued by the Engineer-in- Charge. Work will be executed only as per approved shop drawings.

1.5 Contractors shall furnish detailed shop drawings, design calculations for submission and approval of the Local Fire Authority and for Insurance Companies as may be required by the Client.

2.0 SCOPE

2.1 Work under this sub-head consists of furnishing all Labour, Materials, equipment, and accessories necessary and required to completely install the Fire Fighting equipment etc.

2.2 Without restricting to the generality of the foregoing the work of Fire Fighting System shall include the followings:

a) Providing MS black steel pressure pipe line main including Valves, Fire Hydrants, Excavation for Pipes, Laying of pipes, Painting of pipe and Making Connection to supply system.

b) GI Pipe, Mains Laterals, Branches, Valves Hangers and Appurtenances.

c) Hose Reels, Rubberized fabric lined hose pipes, Hose cabinets & Landing Valves.

d) Portable Fire Extinguishers.

e) Fire Fighting Pumps.

3.0 APPLICABLE CODES

IS: 1239/3589 (Part 1 & 2)--		M.S. Pipe Heavy duty
IS: 14846	--	Sluice valves for water works purposes (50 to 300 mm.size) IS:
6392-1971	--	Steel Pipe Flanges
IS: 554	--	Pipe threads where pressure tight joints are Required
IS: 909	--	U/G fire hydrants, sluice valve type
IS: 5312 (P-1)	--	NRV
IS: 778	--	Gunmetal full way valves with wheel tested to 20kg/cm2 class II
Butterfly valves	--	They shall be of specified quality conforming to IS:13095
IS:529	--	Internal hydrant shall comprise “Single Headed Single Outlet GM Landing Valve” conforming to Type “A”.
IS:12585	--	Hose tubing (Thermoplastic)
IS:854	--	Hose tubing, Globe valve, Stop cock & Nozzle
IS:636	--	Hose pipes rubber lined woven jacketed (RRL) & 63mm dia, conforming to type “A”
IS:903	--	The couplings shall be of instantaneous [Branch pipe, nozzle, spring lock type Coupling etc]
IS:15683	--	Portable fire extinguishers
IS:5	--	Painting works

4.0 *APPROVAL BY LOCAL FIRE SERVICE*

It shall be the responsibility of the contractor to get the approval in stages including provisional Fire NOC from the Local fire Service as required. This shall be without any extra liability / cost to Client and the cost shall be considered in the tender offer.

On successful completion of work, the contractor shall prepare as built drawings which have been so approved by the Fire Service incorporating all changes that might have been effected during execution of the work.

The contractor shall also bring to the notice of the Engineer-in-charge any deviations from Local Fire Service/Building Bye Laws Norms and requirements in the systems that he shall install as well as architectural features that will affect approval from the Fire Service. No extra charges shall be paid on account of interaction with the Fire Service.

5.0 *COORDINATION*

The Contractor shall be required to co-ordinate his activities with all other services such as Air Conditioning, Electrical and Civil (Interiors) etc.

6.0 FIRE FIGHTING PUMPS (N.A)

6.1 This section covers the general requirement of water pumps for main fire pump (Sprinkle and Hydrant), Jockey (pressurization) pump and Terrace pump.

CAPACITY: The discharge and head of the pumps shall be as mentioned in Bill of Quantities.

6.2 Type

The pump shall be centrifugal type direct driven with a 3 phase, 415 V ±10%, 50 Hz, A.C. Motor. The standby fire pump shall be driven by diesel engine. The pumps may be either of horizontal split casing (HSC) type with operating speed not exceeding 1500 rpm, or solid casing with operating speed not exceeding 3000 rpm, as specified in the tender documents.

6.3 Rating

The main fire pump and terrace pump shall be suitable for continuous operation in the system. The jockey pump shall be suitable for intermittent operation to built up pressure in the system on account of leakage. The head and discharge requirements shall be as specified in the Tender documents. The head shall be suitable for the system and shall take into consideration the pressure drops across the various components in the water circuit as well as the frictional losses.

- Pump shall be capable of discharging not less than 150 percent of the rated discharge at a head of not less than 65 percent with the rated head. The shut off head shall not exceed 120 percent of the rated head.

6.4 Material And Construction

i. The Centrifugal pumps shall conform to IS 1520.

ii. The Pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.

iii. The impeller shall be of Bronze of Gunmetal. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.

iv. The shaft shall be of stainless steel and shall be accurately machined. The shaft shall be balanced to avoid vibrations at any speed within the operating range of the pump.

v. The shaft sleeve shall be of Gunmetal.

vi. The bearings shall be ball or roller type suitable for the duty involved. These shall be grease lubricated and shall be provided with grease nipples/cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.

vii. The shaft seal shall be mechanical type, so as to allow minimum leakage. A drip well shall be provided beneath the seal.

viii. The pumps shall be directly coupled with motor /diesel engine shaft through a flexible coupling protected by a coupling guard.

ix. The pump and motor / diesel engine shall be mounted on a common base plate fabricated from mild steel section. The base plate shall have rigid, flat and true surfaces to receive the pump and motor/diesel engine mounting feet. The Pump will be perfectly aligned with motor/engine so as to avoid any vibration during operation.

6.5 Accessories (N.A)

Each pump shall be provided with the following accessories: -

(a) Butterfly / Sluice valves on suction and discharge (if positive suction is not provided butterfly valve at suction is not to be provided).

(b) Reducers, as may be required to match the sizes of the connected pipe work.

(c) Non-return valve at the discharge.

(d) Pressure gauge at discharge side between pump and non-return valve.

6.6 Installation (N.A)

(i) The pump and motor/engine assembly shall be mounted and arranged for ease of maintenance and to prevent transmission of vibration and noise to the building structure or to the pipe work.

(ii) The pump and motor / engine assembly shall be installed on suitable RCC foundation. The Length and Width of the foundation shall be such that 100 mm. space is left all around the base frame. The height of foundation shall be so decided that the total weight of foundation block is 1.5 times the operating weight of the pump assembly. The foundation shall be isolated from the floor by vibration isolating pads. Angle iron frame of size 35 mm x 35 mm x 3 mm shall be provided on the top edges of the foundation.

(iii) More than one pump and motor assembly shall not be installed on a single base or cement concrete block.

(iv) The suction / discharge pipes shall be independently supported and their weight shall not be transferred to the pump. It should be possible to disconnect any pump for repairs without disturbing the connecting pipe line.

(v) A minimum clearance of 1 m. around the main pumps shall be provided. For jockey pump- clearance of 75 cm. shall be adequate.

(vi) Sufficient space is to be left in front for the radiator of diesel engine for free discharge of hot air. Arrangement of discharging hot air to outside the pump house shall be provided so that hot air does not stagnate in the pump house.

6.7 Air Vessel For Fire Pumps (N.A)

Air vessel shall be fabricated out of 8 mm thick MS sheet & the end shall be dished and suitable supporting legs, air vessel shall be provided with a 100mm dia flanged connection from pump, one 40mm dia drain with valve, one gunmetal water level gauge and 25mm sockets for pressure switches. The vessel shall be 250mmx1200mm dia high and tested at 25 Kg/cm2 pressure before installation.

The fire pumps shall operate on drop pressure in the mains automatically or manually.

(The ratings will be adjusted finally at the time of commissioning as per site requirement and final setting shall be kept as per approval of Engineer-in-Charge).

6.8 Operating Conditions For The Fire Pumps (N.A)

Fire Service Pump	Nos.	Cut in Pressure	Cut Out Pressure	Remarks
Jockey pump (N.A)	Two	Automatic	Automatic	To auto start and auto stop on pressure switch on air vessel to stop.
Main pump (Hydrant) (N.A)	One	Automatic	Push button manual	To auto start on pressure switch on air vessel and manual off.
Diesel Fire Pump (N.A)	One	Automatic	Push button manual	To auto start on pressure switch on air vessel and manual off.
Sprinkler Pump (N.A)	One	Automatic	Push button manual	To auto start on pressure switch on air vessel and manual off.

7.0 DIESEL FIRE PUMP (N.A)

7.1 Scope

This section covers the details of requirements of the standby fire pump, operated by a diesel engine.

7.2 General

The diesel pump set shall be suitable for automatic and manual 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 from mild steel channel.

7.3 Drive

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

The speed shall be 1500 RPM.

7.4 Diesel Engine

7.4.1 Environmental conditions: -

The engine shall be suitable to operate under the conditions of environment at site.

7.4.2 Engine Rating:

The engine shall be multi cylinder/vertical 4 stroke cycle, water cooled, developing suitable HP at the opening 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 of altitude, ambient temperature and humidity for specified environment conditions. The engine rating shall be suitable to drive the pump at 150 percent of its rated discharge with at least 65 percent of rated head. The engine shall have 10% overload capacity for one hour in any period of 12 Hours continuous run.

The engine shall be suitable for cold starting for which suitable headers shall be provided in lubricating oil.

The engine shall develop full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, amended up to date.

7.4.3 Engine Accessories

The engine shall be complete with the following accessories:-

i) Fly wheel dynamically balanced.

ii) Direct a coupling for pump and coupling guard.

iii) Radiator with hoses, fan, water pump, drive arrangement and guard.

iv) Air cleaner dry type.

v) Fuel service tank with necessary pipe work.

vi) Pump for lubricating oil and lub. oil filter.

vii) Elect. starting battery (12 V / 24V with 2 Nos. Battery).

viii) Exhaust silencer with necessary pipe work.

ix) Governor.

x) Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual staring).

xi) Necessary safety controls.

xii) Winterization arrangement.

xiii) Hand operated semi rotary pump for filing the service tank

7.4.4 Cooling System-

The Engine shall be radiator water cooled. The radiator assembly shall be mounted on the engine. The radiator fan shall be driven by the engine as its auxiliary with multiple fan belts. When half the belts are broken, the remaining belts shall 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.

7.4.5 Fuel System:

The fuel shall be gravity fed from the engine fuel storage tank to the engine driven fuel pump. The engine fuel storage tank shall be mounted either adjacent to the engine itself suitably wall mounted on bracket. The fuel filter shall be suitable located to permit easy services.

All fuel tubing in the engine shall be with copper and fuel piping from day oil tank to engine shall be MS C Class pipe with Reinforced flexible hose connection. Plastic tubing shall not be permitted.

The fuel tank shall be welded Steel Construction (3mm Thick) and of 200 Ltrs. capacity or of capacity sufficient to allow 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, overflow connection and drain plug and piping to the engine fuel tank. The outlet shall be so located as to avoid entry of any sediment into the fuel line to the engine.

Tank shall be provided with epoxy coat from inside and outside with one coat of Red oxide primer and two or more Coats of Synthetic enamel paint of approved shade.

7.4.6 Lubricating Oil System-

Forced feed Lub. Oil system shall be employed for positive lubrication. Necessary Lub. oil filters shall be provided, located suitably for convenient servicing.

7.4.7 Starting system

The starting system shall comprise necessary batteries 12V / 24V volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the flywheel. By metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work.

The battery capacity shall be suitable for meeting the needs of the starting system but shall not be less than 180AH. The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

Three attempt starting facility shall be provided if engine fails to start after third attempt, the engine shall be locked out and suitable audio visual alarm shall be given to indicate engine failure.

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

7.4.8 Exhaust system

The exhaust system shall be complete with residential type silencer suitable for outdoor installation, and silencer piping including bends and accessories needed to be taken out of the building as per statutory requirement. The Contractors are advised to see the drawing and site to assess the length and size of exhaust pipe required. The total backpressure shall not exceed the engine manufacturer's recommendation. The exhaust piping shall be suitably insulated with 50 mm thick glass wool & 1 mm thick Al. sheet cladding.

7.4.9 Engine shut down mechanism –

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

7.4.10 Governing System –

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

An over speed shutdown device to shutdown the engine at a speed approximately 20% above rated engine speed with manual reset, so that the automatic engine controller will indicate an over speed signal until the device is manually reset to normal operating position.

7.4.11 Engine Instrumentation

Engine instrumentation shall include the following:-

i) Lub. oil pressure gauge.

ii) Lub. oil temperature gauge

iii) Water temperature gauge

iv) Tachometer

v) Hour meter

The instrumentation panel shall be suitably mounted on the engine.

7.4.12 Engine Protection Devices –

The following engine protection and automatic shut down facilities shall be provided:-

i) Low lub. oil pressure

ii) High cooling water temp

iii) High lub. Oil temperature

iv) Over speed shut down

7.4.13 Pipe work

All pipe lines with fittings and accessories required shall be provided for fuel oil, lub. oil and exhaust systems. The fuel tubing to the engine shall be MS C – class pipe with flexible hose connections wherever required.

7.4.14 Anti Vibration Mounting –

Suitable anti-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.

7.4.15 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 trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

8.0 PIPING WORK

8.1 Pipes shall be of the following materials.

a) Pipes upto 150 mm dia shall be GI (C class) conforming to IS: 1239 for sizes up to 150 mm.

b) Pipes above 150 mm shall be Electric Resistance Welded black steel pipe (GI), Class 2 conforming to IS: 3589 for sizes greater then 150 mm. These pipes shall be factory rolled and fabricated from MS Sheet of thickness mentioned in the IS code. Cadmium plated steel nuts / bolts / washers shall be used.

8.2 Pipe Joints

i) Electric welding joints shall be provided in the GI pipe works. Flanged joints shall be provided for connection to valves, pumps, air vessels etc. and also on straight lengths at suitable points to facilitate erection and subsequent maintenance.

ii) MS Flange shall be in accordance with Table 17 of IS: 6392 i.e. Plate flanges for welding and Flange

Thickness shall be as under. Gasket thickness shall not be less then 3 m.

Pipe Dia	Flanged Thickness
250 & 200 mm	24 mm
150 mm	22 mm
100 mm	20 mm
180 mm	20 mm
65 mm and 50 mm	18 mm
40 mm and below	16 mm

All hardware items such as Nuts, Bolts, and Washers shall be of appropriate size. Washers shall be used on both side of the Bolt.

8.3 Installation Of Pipes

1) The installation work shall be carried out in accordance with the detailed drawings prepared by the contractor and approved by the Engineer-In-Charge.

2) In Pipe above Ground level expansion loops or joints shall be provided to take care of expansion / contraction of pipes.

3) Tee of connections shall be through equal and reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and Tapping of the walls of the main pipe shall not be resort to.

4) Open end of piping shall be blocked as soon as the pipe is installed to avoid the entrance of foreign matter.

5) Piping installation shall be supported on or suspended from structure adequately. The contractor shall provide clamps, hangers etc. as per detailed given below: -

- Split pipe support clamps with rubber lining for vertical, horizontal and roof hanging.
- Clevis hangers for horizontal support to adjust wiring height.
- Sprinkler hangers for horizontal supports for pipes from 15-150 mm dia.

- Fasteners and fully threaded rods shall be used for installing the pipe supports. The size of the pipe support and installation shall be in accordance with manufacturers recommendations.

- For pipes of size 100 mm and above with the prior approval of the Engineer-in- charge, U clamps with dash fasteners may be used for supporting horizontal pipe from ceiling.
- All the pipe support material shall be GI of approved branded make.

6) Pipe supports in Pump house shall be floor mounted and of G.I. Spacing of pipe support shall not be more than that specified below: -

Pipe Size (mm)	Spacing (M)
20 to 25	2.00
32 to 125	2.50
150 and above	3.00

Extra support shall be provided at the bends and heavy fittings like valves to avoid undue stress on the pipes.

7) Anti-vibration pads, Springs and Liners of resilient and non-deteriorating material shall be provided at each support so as to prevent transmission of vibration through the supports.

8) Pipe sleeves of diameters larger than the pipes by least 50 mm shall be provided wherever pipes pass through walls and annular spaces shall be filled with felt and finished with retaining rings.

9) a) Vertical riser shall be parallel to walls in column lines and shall be straight and in Plumb. Riser passing from floor to floor shall be supported at each floor by clamps etc. as per the para 5.

b) The space in the floor cutouts around the pipe works shall be closed using cement concrete 1:2:4 or steel sheet from the fire safety considerations, taking care to see that a small annular space is left around the pipes to prevent transmission of vibration to the strcuture.

c) Riser shall have suitable support at the lowest point.

10) Where mild steel/GI pipes are to be buried under ground the same shall be treated with anticorrosive protection before laying. The top of the pipes shall be not less than 100 cms. Below the ground level. Where this is not practicable, permission of the Engineer-In- Charge shall be obtained for buying the pipes at lesser depth. Masonry or C.C. blocks shall be provided for supporting the pipes at interval as per detail given above. After the pipes have been laid, the trench shall be refilled with excavated soil in layers of 20 cm and rammed and any extra soil shall be removed from the site of work by the contractor.

11) Underground pipe shall be laid at least 2 m away from the face of the building preferably along with roads and foot paths. As far as possible laying of pipes under road, pavement and large open spaces shall be avoided. Pipes shall not be laid under building and where unavoidable, these shall be laid in masonry trenches with removable covers.

12) For laying of external pipes, excavation up to a depth of 1.25 m or more is to be carried out. This may cause hindrance in execution of other building works. External pipes shall therefore be laid in a phased manner in coordination with other agencies. The pipes shall be tested, and earth filled back before excavation for next phase is taken up.' Equipment for testing etc should be available in advance before start of underground pipe laying work.

13) To facilitate detection of leak and isolation of defective portion of pipe, valves shall be provided in underground pipe at suitable locations. As far as possible such valves shall be provided over ground. If the valves shall are to be provided below ground, suitable masonry chamber with cover plate shall be provided. Locations where vehicles can pass shall be avoided for provision of valves below ground.

14) Pipe over ground shall be painted in red colour shade no. 536 of IS: 5. Suitable identification shall be provided to indicate the run of underground wherever the route of underground pipe cannot be ascertained from the location of yard hydrant / isolating valves.

15) It shall be made sure that proper noiseless circulation is achieved in the system if proper circulation is not achieved due to air bound connections, the contractor shall rectify the defective connections. He shall bear all the expenses for carrying out the above rectification including the tarring - up and re - finishing of floors, walls etc. as required.

16) Wherever pipes pass through the brick or masonry/slab openings, the gaps shall be sealed with fire sealant such as fire barrier caulks.

8.4 Pressure Testing

a) All piping shall be tested to hydrostatic test pressure of at least one and half times of maximum operating pressure, but not less than 10 kg/cm² for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-charge.

b) Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

c) System may be tested in sections and such sections shall be securely capped.

d) Pressure gauges may be capped off during pressure testing of the installation.

Complete Flushing out Test of Sprinklers installation shall be carried out to clean the sprinkler pipes for foreign materials before fixing the sprinkler heads to avoid obstruction in the sprinklers

The Contractor shall provide all materials, tools, equipment, instruments, services and labour required to perform the test, and shall ensure that the plant room and other areas are cleaned up and spill over water is removed.

The Engineer-in-charge shall be notified well in advance by the contractor of his intention to test a section of piping and all testing shall be witnessed by the Engineer-in-charge or his authorized representative.

8.5 Anti-Corrosive Protection On Under Ground Pipe

Corrosion protection tape shall be wrapped on M.S./GI Pipes to be buried in ground. This corrosion protection tape shall comprise of coal tar/asphalt component supported on fabric of organic or inorganic fibre and minimum 4 mm. thick and conform to requirement of IS:10221 - code of practice for coating and wrapping of underground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the
pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15 mm and 250 mm shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated insitu after the pipe line is installed. The tape shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

8.6 Pipe Measurement

Measurements of plumbing work shall be on following basis:-

a) Piping shall be measured along the centre line of installed pipes including all pipe fittings and accessories but excluding valves and other items for which quantities are specifically indicated in the schedule of work. No separate payment shall be made for fittings and accessories.

b) The rate for piping work shall include all wastage allowances, flanges pipe supports, hangers, excavation, refilling, testing, nuts, vibration isolators, and suspension where specified or required, and any other item required to complete the piping installation. None of these items will be separately measured and paid.

9.0 VALVES & ACCESSORIES

9.1 Sluice Valves

Sluice valve conforming to IS: 14846 shall be provided. Valves shall be suitable to with-stand the pressure in the system and rating shall be PN 20. Valves shall be right-handed (i.e. handle or key shall be rotated clock wise to close the valve), the direction of opening and closing shall be marked and an open/shunt indicator fitted.

The material of valves shall be as under:

Body : Cast iron

Disc: Stainless steel

Seat: Nitrile rubber

O-ring: Nitrile

9.2 Butterfly Valves with and without Tamper Proof Switch

Butterfly valve conforming to IS: 13095 shall be provided. Butterfly valve shall be suitable to with- stand the pressure in the system and rating shall be PN 20. Valves shall be right-handed (i.e. handle or key shall be rotated clock wise to close the valve), the direction of opening and closing shall be marked and an open/shunt indicator fitted.

The material of valves shall be as under:

Body: Cast iron

Disc: Stainless steel

Seat: Nitrile rubber

O-ring: Nitrile

Tamper Proof Switch has 100 percent synchronization which activates the alarm panel even when the valve is closed upto 50% and in bidirectional way. In addition, the switch is designed to operate in temperatures ranging from –40°C to 49°C (–40°F to 120°F). The Switch is equipped with tamper resistant cover screws to prevent unauthorized entry. Inside, two sets of SPDT (Form C) synchronized switches are enclosed in a durable terminal block to assure reliable performance.

9.3 Non-Return Valve

Non-return valves shall be swing check type in horizontal run and lift check type in vertical run of pipes. They shall conform to IS 5312. They shall be suitable to with-stand the pressure in the system and rating shall be PN 20.

The material of valves shall be as under:

Body: Cast iron

Disc: Stainless steel

Seat: Nitrile rubber

O-ring: Nitrile

AIR RELEASE VALVE

Air release valves shall be provided at all high points in the piping system for venting. Valves shall be of the double float type, with G.M. body, vulcanite balls, rubber sealing, etc. Air valves shall be of the sizes specified and shall be associated with an equal size forged ball valve.

9.4 Full Way Ball Valve

9.4.1 The Ball Valve shall be made from forged brass. The valve shall be internally threaded to receive pipe connections.

9.4.2 The Ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body bonnet gasket and gland packing shall be of Teflon.

9.4.3 The handle shall be of chrome plated steel with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the teflon packing shall be sealed to prevent water seeping.

9.4.4 The handle shall also be provided with a lug to keep the movement of the ball valve within 90 degree.

9.5 Strainer

Strainers shall be preferably of the approved type with fabricated steel bodies. Strainers shall be fabricated by minimum 1 mm thick stainless-steel sheet with 3 mm dia. perforation holes. Strainers shall be provided with
flanges or threaded sockets as required. They shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of screen without disconnection of the main pipe.

9.6 Pressure Gauges

Pressure gauges shall be of 150mm dia. dial and of appropriate range and be complete with shut off gauge valve etc.

duly calibrated before installation. Care shall be taken to protect pressure gauges during pressure testing.

9.7 Flexible Connection For Pumps

All suction and delivery lines shall be provided with double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump. Length of the connector shall be as per manufacturer's details.

10.0 EXTERNAL YARD HYDRANTS (N.A)

10.1 For fighting fire from outside the building, yard hydrants are provided around the building. For connecting yard hydrants, a ring of pipe shall be laid under ground around the building at a minimum distance of 2 m. from the face of the building.

Yard hydrants shall be located at a minimum distance of 2 m but not more than 15 m from the building face. The yard hydrants shall be accessible and should normally be provided near boundary wall/along road. While locating yard hydrants it should be ensured that same don't become hindrance in vehicular movement or entrance to the building. Yard hydrants should be located around the building in such a way that it should be possible to fight fire on any face of the building from the nearest hydrant. A distance of 45 m from hydrant to hydrant will be adequate.

Yard hydrant will include the following accessories.

(i) connection from ring main with 80 mm dia MS Pipe

(ii) 63 mm dia single head landing valve -- 1 No.

(iii) Butterfly / Sluice valve 80 mm dia. -- --

(iv) Hose pipe 63 mm dia 15 m long with male and female

coupling at both ends. -- 2 Nos.

(v) Branch pipe 63 mm dia with 20 mm (nominal internal diameter) nozzle and suitable

for instantaneous connection. -- 1 No.

All above components shall be housed in a 750x600x250 mm size MS Cabinet made from 2 mm thick MS sheet with glass door of thickness 6 mm. The cabinet shall be painted with red color shade no. 536 as per IS: 5.

A brick pedestal with brick wall with plaster shall also be constructed for supporting the FHC box. All surfaces shall be plastered with 1:4 ratio (1 cement: 4 fine sand) mortar.

Sample of one installation to be approved before proceeding the execution.

11.0 INTERNAL HYDRANTS (LANDING VALVE)

Landing valves are provided in the system for connection of hose pipes for discharging water for firefighting by fire brigade or trained personnel.

11.1 The Landing valve shall be as per IS: 5290

11.2 The Landing valve are of Double head outlet types

11.3 Material of construction

i) Body, outlet and cap etc.	-	SS 304
ii) Spindle	-	SS 304
iii) Hand wheel	-	C.I.

11.4 The water discharge shall be not less than 900 LPM for single head valves at 3.5 Kg/cm2 pressure.

11.5 Installation

The landing valve shall be fitted to a T connection of the riser at the landing in such a way that the valve is in the centre of the internal hydrant opening and at a height of 1 m. from floor level.

The valve base shall be vertical and the valve facing outside. There should be no hindrance in the operation of the handle.

All above components shall be housed in a 2100x900x700 mm size 14 Gauge MS Cabinet made from 2 mm thick sheet with glass door of thickness 6 mm.

12.0 FIRST-AID HOSE REEL EQUIPMENT

12.1 First Aid hose reel is meant for delivering small quantity of water in early stage of fire and cane be operated even by untrained personnel, and thus provides a most effective firefighting facility. It consists of length of 20 mm (nominal internal) diameter hose tubing warped around a reel with water inlet pipe, stop valve and shut off nozzle. The

entire assembly is mounted on a wall bracket and can swing 180 degrees. The water inlet is connected to the riser pipe by means of 40 mm socket and valve. The hose tube can be pulled out easily for the purpose of discharge of water on fire.

First aid hose reel shall be as per IS-884. The coupling, branch pipe and nozzle shall be as per IS: 8090

12.2 Material of construction: -

i) Hub and sides - GI
ii) Wall Bracket - GI
iii) Hose tube (20 mm) - Termoplstic (Textile reinforced) type - 2 as per IS : 12585
(Nominal internal dia)
iv) Nozzle with branch pipe - Brass
v) Stop valve (Ball valve) - Brass

Normally MS construction is used. Other material may be used in areas having corrosive atmosphere.

The water flow rate shall be not less than 24 lpm and the range of jet shall be not less the 6 m.

12.3 Installation

a) First aid hose reels are installed with internal hydrant. First aid hose reel shall be installed in MS cabinet made from 14 Gauge thick sheet with glass door of size 2100x900x715 mm. The size of the cabinet shall be such that there is no obstruction in swinging the hose reel. The location of cabinet shall be such that there is no obstruction in swinging the hose reel and does not form obstruction to passage / escape route.

b) The length of hose tube shall be such that the nozzle of the hose can be taken in to every room and within a range of 6 m from any part of the room.

c) There shall be no obstruction in swinging the hose reel and should be installed above landing valve where provided.

d) The inlet valve shall be at 900 mm above floor level.

e) Hose reel bracket should be firmly grouted on the wall with the help of rawl botls.

13.0 *FIRE HOSE DELIVERY COUPLING, BRANCH PIPE AND NOZZLES (N.A)*

13.1 These are important accessories used for fire fighting operations.

13.2 Material of construction: Stainless steel 304

13.3 Delivery hose coupling's

13.3.1 The 63 mm dia. delivery house couplings consist of male half coupling and female half coupling. Groves are provided on outer side on both coupling for binding hose pipes with wires. In female couplings spring loaded cam tooth is provided for holding male half coupling in position. Male half coupling and female half coupling are provided on both the sides (i.e. on one side male and on the other side female) of hose pipes. Two or more pipes can be joined together with the help of these couplings instantaneously.

13.4 Branch pipe and Nozzle

13.4.1 Branch pipes with nozzle are mounted and the end of hose pipe. Branch pipe is properly finished and free from sharp edges. During operation a fire man has to hold the branch pipe. One end of branch pipe is fixed with hose coupling and the other end is threaded to fit the nozzle.

13.4.2 Nozzle is tapered pipe with one and threaded internally which is fixed on branch pipe. The size of other end i.e. Nozzle shall be 20 mm (nominal internal diameter)

14.0 FIRE SERVICE INLET AND FIRE SERVICE CONNECTION

a) These are provided for connection of fire service hose pipes for either directly pressurizing the system with their pumps or filling water in the tank from a distance. In the first case non return valve with butterfly valve shall be provided for holding water pressure. Fire service inlet shall be provided with each wet riser / down comer and the ring main. The arrangement has been shown in Fig. 5. These are fixed to 150 mm dia pipe and located in MS Box made of 2 mm thick mild steel sheet with open able glass cover.

b) These shall be as per IS: 904.

c) Material of construction : Gunmetal / CI

15.0 HOSE PIPES

a) Hose pipes shall be rubber lined woven jacketed and 63 mm in diameter. They shall conform to Type A (Re-inforced rubber lined) of IS: 636. They shall be flexible and capable of being rolled. Length of hose pipe will be 15 m.

b) The hose pipe shall be complete with male and female coupling at the ends as per detailed given in 13.3.

c) Besides keeping hose pipe with internal hydrant and yard hydrant, spare hose pipes along with branch pipe shall be kept in fire control room / pump room.

16.0 ORIFICE PLATE (N.A)

16.1 The pressure in a Fire Fighting system varies from point to point. The pressure will be maximum in the pump house and minimum at the farthest hydrant at TOP level. To

reduce pressure to operating pressure at every internal /external hydrant, orifice plates are provided before connection of landing valve between the flanges of landing valve and pipe flange

Table for selection of orifice plate

Pressure loss (kg/cm2)	Diametre of orifice	
	Pipe Size	
	80 mm	100 mm
3.5	41.9	
3	43.0	
2.5	44.80	
2	46.40	
1.5	48.90	56.20
1	52.30	57.60
0.9	53.20	59
0.8	54.10	60.40
0.7	55.30	62
0.6	56.60	63.90
0.5	58.20	66.50
0.4	59.80	69.70
0.3	62.00	74.20
0.2	65.00	81.10
0.1	----	82.20

17.0 PORTABLE FIRE EXTINGUISHER

Portable fire extinguishers shall be provided as per Bill of Quantities and shall: -

17.1 ABC Type Dry Powder Extinguisher

17.1.1 The Extinguisher shall be filled with ABC Grade 40, Mono Ammonium Phosphate (MAP base) from approved manufacturer.

17.1.2 The Capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 15683, part II 8/ IS 2171, shall be 4.0 kg +/-2 % or 10 kg +/-3 %.

17.1.3 It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety city, fitted with a pin, to prevent accidental discharge. It shall be pressurized with Dry Nitrogen, as expelling. The Nitrogen to be charged at a pressure of 15 kg / cm^2.

17.1.4 Body shall be of mild steel conforming to relevant IS Standards. The neck ring shall be also mild steel and welded to the body. The discharge valve body shall be forged brass or leaded bronze, while the spindle, spring and siphon tube shall be of brass. The nozzle shall be of brass, while the hose shall be of braided nylon. The body shall be cylindrical in shape, with the dish and dome welded to it. Sufficient space for Nitrogen gas shall be provided inside the body, above the powder filling.

17.1.5 The Neck ring shall be externally threaded the threading portion being 1.6 cm. The filler opening in the neck ring shall not less then 50 mm. Discharge nozzle shall be screwed to the hose. The design of the nozzle shall meet the performance requirement, so as to discharge at least 85 % of contents upto a throw of 4 meters, continuously, at least for 15 seconds. The hose, forming part of discharge nozzle, shall be 500 mm long, with 10 mm dia internally for 5 kg capacity and 12 mm for 10 kg capacity. It shall have a pressure gauge fitted to the valve assembly or the cylinder to indicate pressure available inside. The extinguisher shall be treated with anti corrosive paint, and it shall be labeled with words ABC 2.5 cm long, within a triangle of 5 cm on each face. The extinguisher body and valve assembly shall withstand internal pressure of 30 kg / cm^2 for a minimum period of 2 minutes. The pressure Gauge shall be imported and suited for the purpose.

17.3 Carbon Dioxide Extinguisher

17.3.1 The Carbon Dioxide Extinguisher shall be as per IS: 15683.

17.3.2 The Body shall be constructed of seamless tube conforming to IS: 7285, and having a convex dome and flat base.

Its dia shall be maximum 140 mm, and the overlay height shall not exceed 720 mm.

17.3.3 The discharge mechanism shall be through a control valve conforming to IS: 3224. The internal siphon tube shall be of copper or aluminum conforming to relevant specifications.

17.3.4 Hose pipe shall be high pressure braided Rubber hose with a minimum burst pressure of 140 kg/cm^2, and shall be approximately 1.0 meters in length having internal dia of 10 mm. The discharge horn shall be of high quality unbreakable plastic with gradually expanding shape, to convert liquid carbon dioxide into gas form. The handgrip of Discharge horn shall be insulated with Rubber of appropriate thickness.

17.3.5 The gas shall be conforming to IS: 307 and shall be stored at about 85 kg/cm^2. The expansion ratio between stored liquid carbon dioxide to expanded gas shall be 1:9 times and total discharge time shall be minimum 10 sec. and Maximum 25 sec.

17.3.6 The extinguisher shall fulfill the following test pressures:

a) Cylinder: 236 kg/cm^2

b) Control Valve: 125 kg/cm^2

c) Burst pressure of Hose: 140 kg/cm^2 minimum.

17.3.7 It shall be an upright type. The cylinder, including the control valve and high pressure Discharge Hose must comply with relevant Statutory Regulations, and be approved by chief Controller of Explosives, Nagpur and also bear IS marking.

17.3.8 The Extinguisher including components shall be ISI Mark.

18.0 SPRINKLER SYSTEM

18.1 System Design

18.1.1 Automatic sprinkler system shall be provided for all areas as per requirement with permitted exceptions e.g. electrical switch rooms, power transformers and D.G. rooms, Panel rooms, Electrical rooms, CNS Equipment rooms, UPS and Battery rooms as identified and as shown in drawings.

18.1.2 Sprinkler heads shall be provided at appropriate spacing to cover max 12 sqmtr. per Sprinkler head or as per specific requirements to meet the approval of the authority having jurisdiction. The spacing shall also be in conformity with the drawings and properly coordinated with Electrical Fixtures, Ventilation Ducts and Grills and other services along the ceiling.

18.1.3 Types of sprinklers to be used shall be as given in specifications, BOQ and approved by the Engineer-in-charge.

18.1.4 Spacing below Sprinkler Heads: - Clear minimum space of 0.5 m shall be maintained below the deflector of sprinkler head.

18.1.5 Location of Sprinkler in relation to Building Structure:-

i) Ceiling Sprinklers Deflector shall not be less than 150 mm and more than 300 mm below the ceiling.

ii) Side wall sprinkler defector shall not be less than 100 mm. and not more than 150 mm. below the ceiling.

iii) If depth of a beam in an area is less than 450 mm. distance at (i) and (ii) shall be maintained and provision of beam shall not be considered. If the depth of a beam in an area is more than 450 mm, then the beam shall be regarded as a boundary.

18.1.6 Concealed Spaces
Spaces between roofs and ceiling more than 0.8 m deep shall be sprinkler protected as follows:-

a) Sprinkler heads shall be provided considering the space as any other area in the building.

b) Sprinkler heads may be connected individually with the range/distributlon pipes below, which shall be sized by taking the room and concealed space sprinklers cumulatively.

c) Sprinkler heads may be connected with independent range/distribution pipes connected with common feed pipe. The common feed pipes shall be not less than 65 mm. dia.

18.1.7 Obstruction below Sprinklers:

Sprinklers shall be fitted under the following types of obstruction which are either More than 0.8 m. wide and less than 150 mm. from the adjacent walls or partitions, or more than 1 m. wide.

18.2 Sprinkler Heads

18.2.1 Sprinkler heads shall be quartz bulb with bulb, valve assembly yoke and the deflector.

18.3 Types

18.3.1 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 extras. The sprinklers shall suitable for erection in upright position or pendant position.

a) Spray Pattern
The spray type sprinkler shall produce a hemispherical discharge below the plane of the deflector.

b) Ceiling (flush) Pattern

These shall be designed for use with concealed pipe work, these shall be installed pendant with plate or
base flush to the ceiling with spray head below the ceiling.

c) Side Wall Sprinklers

These shall be designed for installation alongwith 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.

18.3.2 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 gun metal. 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) Deflection: 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.

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

Sprinkler Temperature Rating	Colour of the Bulb
68 deg.C	Red
79 deg C	Yellow

b) Size of sprinklker Orifices

The sprinklers shall be of 15mm nominal bore size.

18.5 Alarm Valve & Automatic Water Motor Gong Valve

a) The alarm valve & water motor gong valve is to be provided on all the Sprinkler main delivery pipes or Installation Control Valves (ICV) as per approval of authority having jurisdiction.

b) The Installation Control valve (ICV) shall be double seated clapper type check valve. The Body and cover shall be made from Cast Iron to IS: 210 Grade FG 200. The seat and seat clamp shall be made from bronze to IS: 318, LTB II grade. The sealing to the seat shall be neoprene gasket. The hinges pin and ball shall be from stainless steel.

c) It shall be vertically mounted and the direction of water travel shall be indicated on the surface.

d) A By-pass check valve shall be fitted to adjust minor and slow variations in water pressure for balancing so as to avoid any false alarm.

e) The valve shall also be provided with a Test Control Box. The Box shall house a lever to test and operate the ICV. A brass strainer shall also be provided at the

point of water supply to the Alarm gong. A Retarding Chamber shall also be provided. The Chamber shall be able to balance the water pressure in case of water line surges.

f) Each Installation Control Valve (ICV) shall have two sets of pressure Gauges with brass ball valve type shut off.

g) A Water Motor Alarm shall also be provided. This shall be mechanically operated by discharge of water through an impeller. The drive bearing shall be weather resistant. A strainer shall be provided on line before the nozzle. The Gong piece shall be constructed from bronze to IS 318, 2 TB II Grade, and base of cast iron. The motor Housing, Rotor and Housing Cover shall be pressure die cast aluminum.

h) A brass automatic ball drop valve with the retard chamber shall also be provided.

18.6 Inspection Test Valves

Inspection and testing of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve.

18.7 Flow Switches with Retard (0-60 seconds)

The Flow Switches with Retartd (0-60 seconds) are to be provided on the Sprinkler System pipes for each zone, complete with all necessary wiring up to monitor modules as per instructions of the engineer in charge.

18.8 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.

18.9 Annunciation Panel

Electrically operated alarm shall be provided for indication of operation of sprinkler in an area. Water flow switches shall be installed in main distribution pipes which shall be wired to sprinkler annunciation panel. In the event of operation of a sprinkler, the flow switch will operate and give signal to the annunciation panel to

indicate operation of sprinkler in the area. This will initiate an electrically operated alarm. The system shall be independent of fire alarm system.

Construction details

The Panel shall be fabricated out of not less than 1.6 mm thick MS sheet and powder coated after 7 tank treatment process and shall be totally enclosed dust damp and vermin proof. Suitable knockout shall be provided for entry of cables. The panel shall be

designed such that the equipment for power supply battery charging are housed in independent compartments. Sealed maintenance free batteries shall also be accommodated inside the panel.

Indicating lamps control switches, buttons and fuses shall be suitably located in the front and properly labeled.

The indicating lamps shall be LED type of following colours. The flow switch operation conditions shall be indicated by twin lamps.

a) Red to indicate flow switch operation.

b) Amber to indicate fault condition.

c) Green to indicate healthy conditions.

The test buttons to test the indication lamps shall be provided.

The panel shall be solid state type or microprocessor type as indicated in the tender.

The primary function of the panel shall be to respond automatically to the operation of one or more flow switches to give alarm and to indicate area/areas where the device has activated. The operation of one or more flow switches shall result in simultaneous alarm given by the following: -

a) External alarm hooter (s)

b) A visible indication on panel.

c) Audible alarm on panel itself (common for all zones)

The panel shall indicate the fault within the system and immediate fault warning shall be given by an audible and visible signal on the panel in case of open circuit, short circuit and earth fault in cable between flow switch and annunciation panel.

The panel shall be complete with mimic diagram for the areas covered by different flow switches. The layout of mimic diagram shall be got approved by the Engineer-In-Charge.

Battery back up with trickle cum boost charger shall be provided for operation of the system. Indication of mains failure and low battery voltage shall be provided. The batteries shall be sealed maintenance free. The capacity of the battery shall be 12 Volt 2 Nos 24 AH each. All standard accessories shall be provided.

18.10 Installation Of Sprinkler System

a) The installation shall be carried out as per Chapter 8 and 18. Following additional points are to be taken care for sprinkler installations.

b) For fixing sprinkler heads, 15 mm dia M.S. Socket is to be welded to range pipes at the locations as per drawings. Dead plug shall be fixed in the socket.

c) If sprinkler head is to be provided away from range pipe, M.S. pipe nipple of suitable size be used to extend the sprinkler head and socket is welded at desired locations.

d) Joints for Sprinkler pipes: DI fittings up to 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.

e) After completion of work in sections, pressure rating of entire pipe work shall be carried out for 24 hours.

f) After completion of entire work, pressure rating of entire pipe work shall be carried out for 24 Hours at a pressure of 7.5 kg/cm2. The drop of pressure up to 0.5 kg/cm2 shall be accepted.

g) The lines shall be flushed before completion of building work so that any foreign matter which might have entered the system is taken out. The pressurization pump (Jockey pump) be operated and valve open at different locations.

h) During occupation of the building, sprinkler heads shall be provided in place of dead plugs. Taflon tape shall be used on threaded portion. The sprinkler heads shall be properly tightened in the socket.

i) When all sprinklers heads are installed, pressure is built up in the system by pressurization pump slowly and in case no leak is found, desired pressure is developed and maintained. In case any leak is detected, the same shall be attended before pressurizing the system further.

19.0 TESTING

19.1 Initial Testing

19.1.1 During laying of pipes, the same shall be subjected to 10 kg/cm2 hydraulic pressure for a period of 24 hours, in sections.

19.1.2 After completion of the work all valves/ fittings shall be installed in position and entire system shall be tested for

24 hours at a pressure of 10 kg/ cm2. The drop of pressure up to 0.5 kg/cm2 shall be accepted.

19.1.2 Final Testing

19.1.2.1 After completion, all operation checks as per Para 2.4.1.14 shall be carried out for automatic operation of the systems. For this purpose, landing valves may be opened at different locations. The exercise shall be repeated couple of times to ensure trouble free operation of the system

19.1.2.2 Flow Test: - The design flow of pumps shall be checked. The pump shall be operated after opening a number of landing valves at different locations. Design pressure is to be maintained in the pump house. Water discharge is to be measured by drop in level in UG tank for a certain period. All pumps shall be tested one by one. The flow rate shall be not less than as specified while maintaining the design pressure in pump house.

19.2 Inspection By Local Fire Officer

After completion of the work and testing to the entire satisfaction of Engineer-in Charge, the installation shall be offered for inspection by Chief Fire Officer or his representative. Testing as desired by the Fire Officer shall be carried out. The contractor will extend all help including manpower during testing. The observation of Chief Fire Officer which are a part of agreement shall by attended by the contractor. Nothing extra is to be paid for testing as above.

20.0 COMMISSIONING

a) Flushing the System:- Before commissioning, the entire system shall be flushed to ensure that any earth/ foreign matters which might have entered during installation are taken out. For this, pump may be operated and valves opened at different locations.

b) As soon as the work is complete, the system shall be commissioned and made available for use. Requirement of fire fighting installations is equally important during occupation of the building. If the building is to be occupied in part, fire fighting system of building completed shall be commissioned by isolating the system of under construction portion of the building.

c) The fire fighting system shall be maintained and manned from the very first day of its commissioning.

d) Any defects noticed during the warranty period shall be promptly attended by the contractor and availability of the system at all time is to be ensured.