Schedule I
PART - 1

GENERAL REQUIREMENTS FOR FIRE SAFETY & LIFE SAFETY

As per the National Building Code 2005 and other IS and various Acts and Rules. The following recommendations are given for better life and fire safety of occupants and general safety of the buildings. :

1) Increased Structural Integrity:

The standards for estimating the load effects of potential hazards (e.g., progressive collapse, wind) and the design of structural systems to mitigate the effects of those hazards should be improved to enhance structural integrity. This aspect should be taken in to consider while finalizing the design and construction details of all high rise building in the complex.

The recommendations are:

- Relevant standards should be adopted to prevent progressive collapse;
- More reliable means of predicting the potential for complex failures in structures subjected to multiple hazards; and
- Adoption of accepted standards for wind tunnel testing of prototype structures and estimating wind loads for tall buildings.

2) Enhanced Fire Resistance of Structures:

The material used in the construction stage and for carrying out internal finished should have the fire resistance of structures should be enhanced by improving the technical basis for construction classifications and fire resistance ratings; improving the technical basis for standard fire resistance testing methods; using the "structural frame" approach to fire resistance ratings; and developing in-service performance requirements and conformance criteria for spray-applied fire resistive materials (commonly referred to as "fireproofing").

The recommendations are:

- Evaluating, and where needed, improving, the technical basis for determining appropriate construction classifications and fire rating requirements—especially for tall buildings—and making related changes by considering a variety of factors (including timely access by

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emergency responders, full evacuation of occupants and redundancy in fire protection systems critical to structural safety);

- Adoption of standard for fire resistance testing of building components, assemblies and systems—including establishing a capability for doing the improved testing under realistic fire and load conditions; and
- Implementing criteria, test methods and standards for measuring the in-service performance and as-installed condition of "fireproofing."

3) New Methods for Fire Resistance Design of Structures:

The procedures and practices used in the design of structures for fire resistance should be enhanced by requiring an objective that uncontrolled fires result in burnout without partial or global (total) collapse. Performance-based methods are an alternative to prescriptive design methods. This should include:

(1) Use of new fire resistive coating materials and technologies for limiting the spread of fire within the building, and

(2) Use of fire resistant steels and concretes should be done while construction of high rise buildings.

4) Active Fire Protection:

Active fire protection systems (i.e., sprinklers, standpipes/hoses, fire alarms and smoke management systems) should be enhanced through improvements to design, performance, reliability and redundancy of such systems.

Among the recommendations in this group are:

- Installation of fire protection systems to provide redundancy and accommodate the higher risks associated with tall buildings;
- Installation of advanced fire alarms and communications systems that provide continuous, reliable and accurate information on life safety conditions; and
- The real-time secure transmission of data from fire alarm and other monitored building systems for use by emergency responders at any location, and storage of that data off-site or in a black box.

5) Improved Building Evacuation:

The process of evacuating a building should be improved to include system designs that facilitate safe and rapid egress; methods for ensuring clear and timely emergency communications to occupants; better occupant preparedness for evacuation during emergencies; and incorporation of appropriate egress technologies should be implemented in high rise buildings.

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Among the recommendations are:

- Improving occupant preparedness for building evacuations through joint and wide public education and training campaigns;
- Designing tall buildings to accommodate timely full building evacuation of occupants if needed—including stairwell capacity and stair discharge door width that accommodates counter flow due to access by emergency responders;
- Maximizing the remoteness of egress components (i.e. stairs, elevators) without making them hard to reach;
- Using pagers and cell phones for broadcast warning systems and Community Emergency Alert Networks; and
- Incorporation of future use such current and next-generation evacuation technologies as protected/hardened elevators, exterior escape systems and stairwell descent devices etc. should be incorporated in high rise building.

6) Improved Emergency Response:

Latest Technologies and procedures for emergency response should be incorporated which will improve better access to buildings, response operations, emergency communications, and command and control in large-scale emergencies for high rise building.

Among the recommendations are:

- Installing fire-protected and structurally hardened elevators to improve emergency response activities, the evacuation of mobility impaired occupants—and preferably, all occupants—in tall buildings;
- Installing, inspecting and testing emergency communications systems, radio communications and associated operating protocols to ensure that the systems and their protocols will function in challenging radio frequency propagation environments and large-scale operations, and can be used to track emergency responders within a building; and
- Developing and implementing codes and protocols for ensuring effective and uninterrupted operation of the command and control system in large-scale building emergencies.

7) Improved Procedures and Practices:

The procedures and practices used in the design, construction, maintenance and operation of buildings should be improved to include encouraging code compliance by non-governmental and quasi-governmental entities; adoption and application of egress and sprinkler requirements in codes for existing buildings; and retention and availability of building documents over the life of a building.

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8) Education and Training:

The professional skills of building and fire safety professionals should be upgraded through an education and training effort for fire protection engineers, structural engineers and architects. The skills of building regulatory and fire service personnel also should be upgraded to provide sufficient understanding of what is needed to conduct the review, inspection and approval tasks for which they are responsible.

Along with strongly urging that immediate and serious consideration be given to these recommendations for the building safety and fire safety point of view.



CRITERIA FOR DESIGNING A FIRE STATION

Detailed synopsis

A. BAY

A Three bay fire station for accommodating one mini water tenders (fire tender of type fabricated as per IS 950, Aerial ladder platform to render the services to high rise buildings, One Bay for one ambulance & one jeep which would be usually a convenience for the fire officer in case of emergency.

A(a) The dimension of the main bay would be as under: -
Length 30 – 36 feet (Practically 36 ft)
Width 10 - 14.5 feet (Practically 14.5 ft)
Height 18 feet.

A(b) The dimension of the fire engine
Length 14.5 ft
Width 10.9 ft
Height 14 ft
It is preferable if all the bays should also have the same dimension as that of the main bay so that accommodation in the subsequent years could be utilized for the stationing of an additional appliance.

B. BUILT UP ACCOMMODATION

(1) Watch room cum control room

A spacious room covering an area of at least 15 sq m may be provided as the watch room cum control room. It would be equipped with all modern communication facilities including wireless system. It may also be provided with hot line communication system with the nearest fire station of Pune fire service, Pimpri Chinchawad Fire Service & MIDC Hinjewadi Fire Station.

(2) Store

Enough storage accommodation comprising of at least 2 rooms each measuring about 18 sq mtr (length about 5 – 6 mtrs, breath 3 – 4 mtrs with an height matching with the height of the bay). It should be constructed adjoining to the bay and the distribution will be as follows:

2(a) Fire Fighting equipment like suction, hoses, branches, delivery hoses, extinguishers, etc.

2(b) Foam and foam making equipment, dry powders, stretchers, Breathing Apparatus sets, rescue suits, blankets, etc.

2(c) It will be divided into two parts:

(i) First part will be fully used for serviceable equipment, which are required in any type of emergency and which should be readily available. The key of this store would be with the shift in charge and not with the store man

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(ii) In the second part, condemned and unserviceable equipments would be kept separately so that by mistake it should not be carried on the appliances in the emergency situations.

(3) Officer accommodation

3(a) Station Officer / in-charge of the fire station

The room covering an area of 120 – 130 sq feet roughly 12 to 13 sq mtr may be provided for officer in-charge with adequate furniture the receiving the visitors / officers. The room should be equipped with necessary communication facilities duly connected with control room, watch room through intercom.

3(b) Shift In-charge & other staff

As the station officer and his leading staff would be on duty during the day shift so that the evening and night shift would be supervised and controlled by and officer equivalent to the rank of sub-officer in the capacity of shift in-charge. Therefore, accommodation having a covered area of 40 sq mt may also be provided in the fire station for essential staff of 12 nos..

(4) Office accommodation

Generally a clerk and an officer assistant are made available for the performance of the official duty and to attend day-to-day work relating to the placement of indents and to submit and forward periodical reports, to take up repair and procurement of fire tenders and fire fighting equipments. To look after the pay, allowances, leave, etc. of the operational fire staff on duty.

(5) Work room for minor repairs

A room covering a suitable area of about 18 –2 sq mt would also be provided to carryout minor repair of fire fighting equipment like repair of delivery hoses, binding of coupling of hoses, repair of branches, hydraulic testing of extinguisher, fixing and fitment of branches in the hose reel and other allied equipments.

(6) Rest room / Recreation room

One crew rest cum recreation room for use by the fire staff who are on duty on the 2nd appliance and 3rd appliance. The room will also be utilized for placing the almirahs and cabinets allotted to the fire staff for the storage and upkeep of personal authorized equipments. The room will be also be used for making meals. The size of the room depends on the no. of person in each shift. For 6 persons - 660 x 550 cm area is required subsequently for 12 persons – 1320 x 550 cms should be given.

Note: Atleast one door from this room will open as direct entrance to the fire engine bay.

(7) Washroom / sanitary facilities

(a) For fire staff – One sanitary annexe with bath, WC and urinal facility will be provided next to the crew and rest room It should be quite spacious to meet the requirement of about 12 persons on duty.

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(b) For officers – One sanitary annexe with bath, WC and urinal facility
should be provided at suitable location for the officers. It should be well furnished, as it is likely to used by the visiting officers and inspecting staff.

(8) Fuel storage

It should be provided in accordance with the guidelines incorporated in the Indian Petroleum Act of 1934 and rules made there under of 1976. A suitable POL(Petrol Oil and Lubricants) room should be provided to meet the day-to-day requirement of vehicles / appliances / pumps at the fire station.

(9) Class room / Training room

A specious classroom with adequate furniture should be provided for imparting theoretical training to atleast 15 –20 persons. It should have desk / table with separate chairs so that the trainees could note down as written / displayed by the lecturer / instructor on the black board / white board or through displaying of transparencies.

Chair having a slightly boarder arm on the right hand side for placing the note book as a substitute it not acceptable as it does not facilitate a speedy recording of note. A spare is also required in the training class room for audio video means, for keeping cut-sections of equipments, models, models of the building and tender / fire engine, charts, OHPs, besides this leaflet / technical literature could be displayed on the walls. It would be advantageous if a small room of 15 sq mtrs were also annexed with the classroom, which could be used as library with furniture for providing reading and writing facilities for those who wish to enhance technical knowledge.

(10) Drill Ground

A drill ground measuring 200 x 100 ft with outdoor training facility should be provided near the fire station. 2 /3 hydrants duly connected with the feeder (Originated from the static water tank with potable pump). Overhead water reservoir or with city mains should be provided to carryout wet exercises /drills and live demonstration. To maintain the physical fitness of the fire crew the game items like horizontal / parallel bars, etc. should be provided in the drill ground.

(11) Residential Accommodation

It should be provided for some operating staff near the fire station so that a person could be called for manning the 2nd and 3rd appliances in times of emergency. The accommodation invariably may be provided for the STO and sub-officer in a separate officer block and for the resident family accommodation for other members of the fire staff in a separate block, which will be multi-story building.

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C. SOURCES OF WATER SUPPLY

A fire station for accommodating mini water tender (fire tender of type B fabricated as per IS 950 which would be usually a convince for the fire officer however would be used as jeep fire engine in case of emergency.

C1. A static tank of capacity 1 lack liters should be provided near fire station in a manner with pucca parking space enabling the fire tenders to fill the tanks from the open source of water supply.

C2. A portable pump of adequate capacity should also be provided to maintain the overhead supply.

C3 An overhead filling point may also be provided coupled with a portable pump.

C4 The portable pump would also meet the requirement of hydrant installation erected in the fire drill ground.

D. COMMUNICATION FACILITY

The communication facility should be very efficient and the communication center will be provided with all modern communication system. It should have telephones, radio sets, one hot line from each building / block. One line should be connected with city fire brigade beside this a repeater fire alarm panel from each high-rise building should also be installed.

E. FIRE PERSONNEL

E(a) *Station Officer*

One no. of station officer would be required to look after the complete station and he will be overall in-charge of fire station. He would remain on duty during the day shift.

E(b) *Fire fighting staff for the One appliances*

Leading hand fire / leading firemen (02), fire engine driver (01), Firemen (04). Thus total fire fighting staff in one shift could be 08, hence for three shifts 36 nos. For leave reserve / holiday / Sunday / Gazette Holiday, etc. 33% of the total staff required is 12, thus total fire fighting staff would be 38.

E(c) <u>Driver for Jeep & Ambulance (1 in each shift)</u>

E(d) <u>Staff for telephone duty</u>

At least one person in each shift would be required to man the communication center / watch room. Thus the total would be 4 nos. The rank of the telephone staff could be that of fireman.

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F. NUMBER OF APPLICANCES

As per the given information about the population and area, One no. of appliances will be required and these appliance will be of type B, IS 950.

G. LOCATION OF THE FIRE STATION

The fire station should be so located that they would meet the standard response time.

H. NUMBER OF FIRE STATION REQUIRED (01 No.)

As per the given information of land area and population, one fire station would be enough for township

I. LAND AREA REQUIRED FOR THE FIRE STATION

The land area required for this type of fire station would be 8000 – 10000 sq mtrs. With sufficient open space attached to fire station for carrying out fire drills and parade.

J. CONSTRUCTION OF THE STATION – CONCRETE

K. MISCELLANEOUS EQUIPMENT

Besides above equipments / system minor rescue equipment should also be provided that is hydraulic spreader and hydraulic cutting machine, salvage equipments, first aid equipments, different types of hydrants, etc. As there will be no city fire station at a distance of 5 Kms from the township.

It may please be appreciated that the necessary requisite information have been given in the above paragraph for meeting the urgent requirement envisaging the location of the fire station with necessary facility together with the fire appliances, inter area, manpower for the establishment of an independent fire brigade for the township. However, detailed informed together with drawing of the fire station and other facilities erected for achieving operational efficiency beside specification of the static tank, fire appliances, Jeep fire engine and the ancillary equipment and appurtenances would be made available after spot survey of the area or on the receipt of essential information as stated in above para.

We have tried our level best to give the latest information on the above subject, based on the standards formulated for the celebrated authorities because we firmly believe in fire protection as it is well-known that if fire snatches the upper hand, then it causes unimaginable magnitude of losses and in that context there is no remedy. Subsequently, save a weave off repentance.

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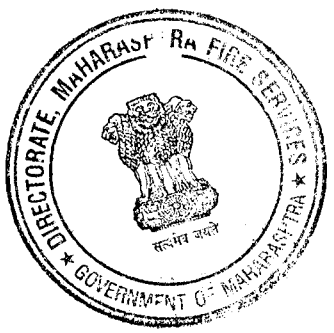
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PART 2

TECHNICAL SPECIFICATIONS – FIRE FIGHTING SYSTEM
For
Various Types of Buildings in Township.

I N D E X

SR .NO.	DESCRIPTION
1.	FIRE HYDRANT SYSTEM INSTALLATION
2.	SPRINKLER SYSTEM INSTALLATION
3.	PUMPS and ACCESSORIES
4.	HAND HELD FIRE EXTINGUISHERS and HAND APPLIANCES
5.	MISCELLENEOUS
6.	STATUTORY AUTHORITIES' TESTS & INSPECTIONS



1. FIRE HYDRANT SYSTEM

1.1 SCOPE OF WORK & SPECIAL CONDITIONS

The scope of work includes complete design, supply, installation, erection, testing, commissioning the fire hydrant system, Hose Reel system, Sprinkler system and first aid fire extinguishers with all necessary accessories as per FIRE BRIGADE AUTHORITY/Design drawings & specs. Further it shall include for getting the necessary approval from the FIRE BRIGADE AUTHORITIES if required.

1.2 APPLICATION CODES AND STANDARDS

The work shall be carried out in accordance with the regulations of local bodies, if any and the following specifications and codes which may govern the requirements of the system.

a. IS 901 - 1975 - Specification for couplings, double male and double female, instantaneous pattern for fire fighting.
b. IS 902 - 1974 - Specification for suction hose coupling for fire fighting purposes.
c. IS 13039 - - Butterfly valve for water works purposes.
d. IS 1239 - Mild steel tube and other wrought steel fittings.
e. IS 8423 - 1977 - Controlled percolating hose for fire fighting.
f. IS 5290 - 1983 - Landing valves
g. IS 2871 - 1983 - Branch pipe, universal for fire fighting purposes.
h. IS 884- - First aid hose reel for fire fighting
i. TAC Manual/NBC

1.3 DRAWINGS AND DESIGN CALCULATIONS

The drawings enclosed herewith are for the general guidance to the tenderer. The contractor shall upon the award of the work furnish detailed working drawings necessary to carryout the work at site with detail/design calculation. These shall be submitted to the consultant/statutory bodies for the approval and the work shall be commenced only after the approval of drawing by the consultants/statutory bodies.

1.4 INSPECTION AND APPROVAL

The contractor shall arrange all necessary inspection by FBA. He shall also arrange for the tests and obtain and deliver to the owners any approval required as per local by laws/statutory requirements.



1.5 PAINTING

All piping equipment, cabinets etc., shall be properly painted with two coats of synthetic enamel paint over a coat of primer of approved color and make.

1.6 MATERIAL & WORKMANSHIP

The contractor shall guarantee both the material and workmanship of first class quality corresponding to standard engineering practice. Any defective materials/workmanship shall be rejected and the contractor shall rectify/replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the company.

1.7 INSTRUCTION MANUAL/COMPLETION DRAWING/TRAINING

The contractor shall furnish detailed instruction and operation manual in triplicate including detailed completion drawing on a tracing cloth to approved scale. Further it is the responsibility of the contractor to train the employer's personnel in the operation and maintenance of the system.

1.8 FIRE HYDRANT SYSTEM

Without restricting to the generality of the foregoing, the fire hydrant system shall include the following:

1. Galvanized Iron Class "C" fire riser main /M.S. Pipe within the building and M.S. Pipelines outside the building as per drawings / Bill of quantities
2. Landing valves, hose reels, hose cabinets, etc.,
3. All materials shall be of the best quality conforming to these specifications and subject to the approval of the Engineer-in- charge.
4. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.,
5. Pipes and fittings shall be fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceiling and walls.
6. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in neat workman like manner.
7. Valves and other appurtenances shall be so located that they are easily accessible for operations repairs and maintenance.
8. Pipes for wet risers within the Building shall be GI tubes conforming to IS 1239 (heavy duty 'C' class) / M.S. Pipes with flanged/welded joints.
9. Fittings for black steel pipes shall be Butt weld or approved type cast iron fittings with screwed/welded joints.
10. Joints for black steel pipes and fittings shall be metal - metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall be welded when approved by the engineer-in charge.
11. Standpipe (80mm Dia) shall be of GI class 'C' as per IS 1239 PI-90 and FBA/TAC approved make.

Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable / recognized authority.

1.9 PIPING

Providing and supplying spirally welded/ERW/SAW/fabricated M.S. pipes(Commercial Quality)including procurements of plates, gas cutting to required size rolling, tack welding assembling in suitable lengths to form pipes, welding on automatic welding machine and forming 'V' edge on both ends of pipes including all taxes(Central and Local),Railway freight, insurance unloading from railway wagon, loading into truck, transport to stores/site, unloading, stacking etc, complete as per IS-3589 and IS 5504 as applicable as per specifications(No negative tolerance in thickness is permissible) For Fire Fighting System All pipes inside the building and where specified, outside

the building shall be MS Pipes/ seamless pipes/ Fittings for MS pipes installed above ground shall be malleable iron or approved type cast iron fittings with screwed threads welded or flanged to IS 1554 or as per IS: 1239, Part II (heavy grade) pipes above 150mmdia shall be fabricated as per IS: 3589. The pipes shall be carefully laid to the alignment, levels and gradients shown on the plan and sections. Great care shall be taken during installation of pipes to prevent any sand, earth or other matter from entering the pipe. The pipe shall be kept thoroughly clean during the course of installation. The end of pipes shall be blocked by wooden plugs wedged home, at the end of each day's work to prevent dirt and animals from entering the pipe. For MS pipes up to 50mmdia tapered screwed jointing shall be adopted; while for pipes above 50mmdia welded or flanged connections shall be used. A small amount of red lead may be used for lubrication and rust prevention. Joints shall be welded when "approved by Engineer-in-Charge. Flanged joints shall be made with 3mm thick insertion rubber washer. Bolt holes in flanges shall be drilled. The drilling of each flange shall be in accordance with the relevant Indian Standard. Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipeline of strategic points to facilitate erection and subsequent maintenance work. Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered. Hangers and supports shall be thoroughly galvanized after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor braces, dampener, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultants. Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements. Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fiber glass and finished with retainer rings. The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used. Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall

be of 15mm pipe size and shall be associated with an equal size gate valves. Automatic air valves shall be provided on hot water risers. Discharge from the air valves shall be piped through a pipe to the nearest drain or sump. All pipes shall be pitched towards drain points. Pressure gauges shall be provided as shown on the approved drawings. Care shall be taken to protect pressure gauges during pressure testing.

1.9.1 JOINTING

Welded Joints:

Joints between MS pipes and fittings shall be made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. But welding without "V" groove shall not be permitted. All joints in the pipe line with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer. Flanged joints (65 mm Dia and above). Flanged joints with flanges conforming to IS: 6392 shall be provided on:

a. Straight runs at intervals not exceeding 25-30m on pipe lines of 50 mm Dia and above and as directed by the Project Manager.

b. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.

Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

Unions (up to 50 mm Dia); approved type of dismountable unions shall be provided on pipe lines of 40 mm Dia and smaller Dia, in locations similar to those specified for flanges.

1.9.2 AIR VESSEL

The air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter-acting pressure, surges, whenever the pumping sets come into operation. Air vessel shall conform to IS: 3844. It shall be normally half full of water, when the system is in normal operation. Air vessel shall be fabricated with 8 mm thick M.S. plate with dished ends and suitable supporting legs. It shall be provided with one 100 mm dia flanged connection from pump, one 25 mm drain with valve, one water level gauge and 25 mm sockets for pressure switches. The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5 times the shut-off.

1.9.3 AIR CUSHION TANK

Every wet riser shall be provided with an air cushion tank at its top most point. The air cushion shall be provided with an automatic air release cock, 20 mm dia drain pipe, drain valve and shut off valve.

1.10 EXCAVATION/THRUST BLOCKS

1. Excavation for pipelines shall be in open trenches to lines and grades shown on the drawings or as required at site. Pipelines shall be buried to a minimum depth of 1M suitable thrust blocks pf PCC 1:2:4 shall be provided at change of direction of pipelines both horizontally and vertically or and shall have 230 mm x 230 mm masonry or concrete supports at least 300 mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand : 8 stone aggregate) of size 380x380x75 thick resting on firm soil.
2. Wherever required contractor shall support all trenches or adjoining structures with adequate timber supports.
3. On completion of testing and painting of the pipe lines trenches shall be refilled with excavated earth in 20cms. layers and consolidated.
4. Contractor shall dispose off all surplus earth within a lead of 50m or as directed by Engineer-in-charge.

Mains below ground level shall be supported at regular intervals not exceeding 3.0 meters and shall be laid at least 2.0 meter away from the building. Pipe hangers shall be provided at the following maximum spacing:

Pipe Dia (mm)	Hanger Rod Dia (mm)	Spacing between Supports (m)
Up to 25	6	2
32 to 50	10	2.7
80 to 100	12	2.7
125 to 150	16	3.6
200 to 300	19	5.3

1.11 MASONRY BLOCKS

Contractor shall provide suitable Burnt Brick Masonry blocks in loose soil conditions of suitable dimensions at regular intervals of 3.0m to support the pipes. Masonry shall be of TM Class I Bricks in CM 1:6 and plastered in Cm 1:3, finished with a neat smooth coat of cement.

1.12 VALVES

Butterfly valves shall be provided for pipes 50mm dia and above. The valves shall confirm to IS: 13039 and shall be CI construction. The valve shall be tested to a pressure of 20Kg/sq.cm.

1.12.1 SLUICE VALVES

Sluice valves shall be double flanged valves with cast iron body. The spindle, wall seat and wedge nuts shall be of bronze. They shall generally have non-rising spindle and shall be of the particular duty and design called for. The valves shall be supplied with suitable flanges, non- corrosive bolts and asbestos fiber gaskets. Sluice valves shall conform to Indian Standard IS: 780-1969 and IS: 2906.

1.12.2 BUTTERFLY VALVE

The butterfly valve shall be suitable for waterworks and rated for 300 P.S.I, the body shall be of cast iron to IS: 210 in circular shape and of high strength to take the water pressure. The disc shall be heavy duty cast iron with anti corrosive epoxy or nickel coating. The valve seat shall be of high grade elastomer or nitrite rubber. The valve is closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be EN 8 grade carbon steel. The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

1.12.3 BALL VALVE

The ball valve shall be made forged brass and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections. 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. The handle shall be provided 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. The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

1.12.4 GUN METAL VALVES

Gun metal Valves shall be used for smaller Dia pipes, and for threaded connections. The Valves shall bear certification as per IS: 778. The body and bonnet shall be of gun metal to IS: 318. The stem gland and gland nut shall be of forged brass to IS: 6912. The hand wheel shall be of cast iron to IS: 210. The Hand wheel shall be of high quality finish to avoid hand abrasions. Movement shall also be easy. The spindle shall be non rising type.

1.12.4 NON-RETURN VALVE

Non-Return valves shall be cast iron double flanged with cast iron body and gunmetal internal parts conforming to IS: 5312.

1.12.5 PRESSURE RELIEF VALVE

Each System shall be provided with a Pressure Relief Valves. The Valve shall be spring actuated and set to operate as per field requirement. The Valve shall be constructed of bronze and provided with an open discharge orifice for releasing the water. The Valve shall be open lift type.

1.12.6 PRESSURE GAUGE

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 50 mm Dia gunmetal bourdon type with gun mental isolation ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

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1.13 EXTERNAL HYDRANTS

Yard hydrant valves shall be as per IS: 5290. The valve should be complete with hand wheel, quick coupling connection, spring and blank cap. The hydrant shall be laid on 100mmdia main tee off to 100mm/80mmdia and stand post of 80mmdia for single headed hydrant at 1.0M from ground level. The external hydrant valve shall be single headed type as specified in B.O.Q. Each external hydrant hose cabinet shall be provided with a drain in the bottom plate. Each external hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. This shall be measured and paid for separately. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

1.14 RUBBER HOSE REEL

Contractor shall provide standard fire hose reels 30.0 m long with 19mmdia high pressure reinforced rubber hose of specified length with gunmetal nozzles and control valve, shut off valve, all mounted on a circular hose reel drum of mild steel construction and cast iron bracket.

1.15 HYDRANT VALVE AND CP HOSE PIPE

The landing valve (internal) shall be gunmetal single headed type confirming to IS: 5290, complete with hand wheel, quick coupling, spring and blank cap heavy duty CP hose pipe 63mmdia (2nos. 15.0m. length in FHC and 2 nos. of 15m. length in external hose cabinet) with 63mmdia. Instantaneous pattern single headed hydrant valve, branch pipe and nozzle to be provided in the fire hose cabinet. The branch pipe shall be gunmetal and confirm to IS: 903. The fire hose cabinet shall be as per B.O.Q.

1.15.1 Internal Hydrants

a. Contractor shall provide on each landing and other locations as shown on the drawings double headed gunmetal landing valve with 100 mm Dia inlet as per IS:5290, with shut off valves having cast iron heels as shown on the drawings. Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.

b. Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses.

c. Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric lined hose pipes with gunmetal male and female instantaneous type coupling machine would with GI wire (hose to IS:636 type 2 and couplings to IS:903 with IS certification), fire hose reel, gunmetal branch pipe with nozzle to IS:903. This shall be measured and paid for separately.

d. Contractor shall provide standard fire hose reels of 20mm Dia high pressure Dunlop rubber hose 36.5 m long with gunmetal nozzle, all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall conform to IS: 884 and shall be mounted vertically. This shall be measured and paid for separately.

e. Each internal hydrant hose cabinet shall be provided with a drain in the bottom plate. The drain point shall be lead away to the nearest general drain.

f. Each internal hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. The cabinet shall be recessed in the wall as directed. This shall be measured and paid for separately.
g. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

1.15.2 Hose Reel
Hose reel shall conform to IS: 884, heavy duty, 20 mm Dia length shall be 36 meter long fitted with gun metal chromium plated nozzle, mild steel pressed reel drum which can swing up to 170 degree with wall brackets of cast iron finished with red and black enamel complete.

1.15.3 Fire Hose
All hose pipes shall be of 63 mm diameter RRL/ CP as required, conforming to IS: 636 or IS: 8423. The hose shall be provided with copper alloy delivery coupling. The hose shall be capable of withstanding a bursting pressure of 35.7 Kg/Sq.cm without undue leakage or sweating. Hose shall be provided with instantaneous spring-lock, type couplings.

1.15.4 Branch Pipe, Nozzle
Branch pipes shall be of gun metal with loaded tin bronze ring at the discharge and to receive the nozzle and provided at the other with a leaded tin bronze ring to fit into the instantaneous coupling. Nozzle shall be of spray type of diameter of not less than 16 mm and not more than 25 mm. Nozzle shall be of loaded tin bronze branch pipe and nozzle shall be of instantaneous pattern conforming to Indian Standard - 903.

1.15.5 Hose Cabinet
Hose cabinet shall be provided for all internal and external fire hydrants. Hose cabinets shall be fabricated from 16 gauge MS powder coated sheet of fully welded construction with hinged double front door partially glazed (3 mm glass panel) with locking arrangement, stove enameled fire red paint (shade No. 536 of IS:5) with "FIRE HOSE" written on it prominently (size as given in the schedule of quantities). Cabinet surfaces in contact with the walls shall not be powder coated but instead given two coats of anti-corrosive bit mastic paint.

1.15.6 Internal Hose Cabinet
Hose cabinet shall be of glass fronted with hinged door & lock. The cabinet shall be made of 16 gauge thick MS sheet and spray painted to shade No. 536 of IS:5. The hose cabinet shall be of size to accommodate the following:
i. Landing Valves (Single/double headed)
ii. Hose pipe
iii. Hose reel (36.5 mtr.)
iv. Branch pipes, nozzles (2 sets)
v. Fire man's axe and hand appliances
External Hose Cabinet
The hose cabinet shall be of size to accommodate the following:

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i. Single/Double headed yard hydrant valve
ii. Hose pipe (2 lengths of 15 m)
iii. Branch pipes, nozzles (2 sets)
iv. Fire man's axe

1.16 AIR VALVES
Provide 25mm screwed inlet GM single acting air valve on all high points in the system or as shown on drawings.

1.17 DRAIN VALVES
Provide 50mmdia GI pipe conforming to IS 1239 heavy class with 50mm butterfly valve for draining any water in the system in low pockets.

1.18 HYDRANT/VALVE CHAMBERS
Contractor shall provide suitable brick masonry chambers in cement mortar 1:4 (1 cement: 4 coarse sand) on cement concrete foundations 6" thick 1:5:10 mix (1 cement : 5 fine sand : 10 graded stone aggregate 1 ½" nominal size) ½" thick cement plaster inside and outside finished with a floating coat of neat cement inside including excavation, back filling, providing heavy duty FRC frame & cover etc., complete. Valve chambers shall be of following sizes: For depths up to 1200mm= 600mmx600mm.

1.19 PIPE 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. The below ground pipes shall be coated with bitumen paint and wrapping with plastic coated Hessian cloth.

1.20 PIPE SUPPORTS
All pipes shall be adequately supported from roof or walls from existing inserts by structural clamps fabricated from MS structures, expansion bolts, channels, angles and flats or hi-tech supports capable of carrying the loads. All clamps shall be painted with a coat of red lead and two coats of black enamel paint.

1.21 PAINTING
All Hydrant and Sprinkler pipes shall be painted with post office red color paint. All M S pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc. Painting shall be expertly applied; the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue. Under ground pipes to be provided with coal tar epoxy base paints of approved make.

1.22 TESTING

All piping in the system shall be tested to hydrostatic pressure of 2 1.5 times the working pressure or 1.5 time shut-off pressure including testing for water hammer effects. With out drop in pressure for at least 30 minutes. Rectify all leakage, make adjustment and retest as required and directed to the satisfaction of the FBA authorities and the consultants/client's representative.

2.0 SPRINKLER SYSTEM

2.1 SCOPE OF WORK:

The sprinkler system shall be provided in Basement. The system shall include the following:

1. Sprinkler main, branch and internal piping complete with valves and supporting arrangements.
2. Sprinkler heads with spare sprinklers.
3. Connections to risers etc.

2.2 MATERIALS:

All materials shall be of the best quality conforming to specifications and subject to the approval of Engineer-in- charge. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes required in neat workman like manner.

2.2.1 Pipes shall be fixed in a manner as to provide easy accessibility for repair, maintenance and shall not cause obstruction in shafts, passages etc.,

2.2.2 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceiling and walls.

2.2.3 Valves and other equipment shall be so located that they are easily accessible for operation, repairs and maintenance.

2.3 SPRINKLER HEADS:

The sprinkler heads are of fixed temperature type with a quartzite bulb containing liquid having high vapor pressure held in position by forged GM yoke and a deflector. The rated temperature of quartzite bulb shall be 68deg. C. Sprinkler heads shall be provided at approximate spacing so ac to cover about 80 Sq. Ft. area/ sprinkler and as shown on drawing. The spacing shall however conform as per the detailed drawing, in co-ordination with electrical and other allied services at the ceiling level. Contractor shall supply 12 spare sprinkler heads and 2 nos. spanners neatly installed in a steel box with glass shutter at an appropriate position approved by the engineer-in-charge.

2.4 PIPES AND FITTINGS:

Pipe for sprinkler system shall be GI pipes conforming to IS 1239 (heavy class) Fittings for GI pipes shall be approved type, with flanged/threaded fittings.

2.5 JOINT

For jointing of pipes, butterfly valve, check valves etc., refer specifications given for fire hydrant system.

3.0 PUMPS AND ACCESSORIES

3.1 The pumps shall be exclusively used for fire fighting purposes and shall be approved by the Fire Authority. One set of Diesel engine driven direct coupled centrifugal pump and 1no. Electrical driven pump of adequate HP shall be provided. The pumping capacity of main hydrant pump shall be 2820Lpm. at 70.0m head, and that of Jockey pump on shall be 180Lpm. @ 70.0m head, terrace level pumps one each on Hotel Bldg., Business Bldg. and Center Hall. 900Lpm @ 35.0m head. Should include Suction strainers and accessories. Vibration eliminator pads and foundation bolts. Leak-off drain shall be led to the nearest floor drain.

3.2 GENERAL REQUIREMENT

3.2.1 The head vs. capacity, input power vs. capacity characteristics, etc., shall match to ensure load sharing and trouble free operation throughout the range. In case of accidental reverse flow through the pump the driver shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed. The contractor under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.

3.2.2 The rated capacity of the pump shall be 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shut off head shall not exceed 120 percent of total rated head on the pump.

3.2.3 An automatic air release valve shall be provided to vent air from the pump discharge and also to admit to the pump to dissipate the vacuum there, upon stopping of the pump. This valve shall be located at the highest point in the discharge line between the pump and the discharge check valve.

3.2.4 Pump coupled with motor or engine on a common platform shall perform smoothly without any excessive noise or vibration.

3.2.5 The main hydrant pump is working on positive suction

3.3 Pump Shaft-Motor Shaft Coupling

All shafts shall be connected with adequately sized flexible couplings with spacer of suitable approved design. Necessary guards shall be provided for couplings.

3.4 BASE PLATE

A common base plate mounting both for the pump and drive shall be provided. The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc.

3.5 VIBRATION AND BALANCING

The rotating elements shall be so designed to ensure least vibration during start and throughout the operation of the equipment. All rotating components shall be statically and dynamically balanced at workshop. All the components of pumps of identical parameters supplied under these specifications shall be interchangeable.

3.6 INSTRUCTION MANUAL AND TOOLS/SPARES

A comprehensive instruction manual shall be provided by the contractor indicating detailed requirements for operation, dismantling and periodic operation and maintenance procedures. Recommended tools/spares shall be provided and their rate breakup shall be provided by the contractor.

3.7 ELECTRIC MOTORS

The motor shall be rated not to draw starting current more than 6 times normal running current. Motor shall be capable of driving the pumps at 150% of its rated discharge and shall be designed for continuous full load duty. The motor shall be capable of handling the required starting torque of the pumps Speed of motor shall be compatible with the speed of the pump. The cooling fans shall be directly driven from motor shaft. Motor situated outdoors or exposed to the weather shall be weather protected. Motors shall be enclosed type and shall have dust tight construction with suitable means of breathing and of drainage to prevent accumulation of water from condensation. Drain holes shall exclude bodies greater than 6mm diameter. All components shall be of adequate mechanical strength and robustness and shall be constructed of metal unless otherwise approved. All motors shall be dynamically balanced. The enclosure shall be designed to provide an affective sealing between the primary and secondary air circuits. Winding insulation shall be class B 415V AC motor and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated. Two independent earthing points shall be provided in accordance with IS: 3043 on opposite sides of the motor for bolted connection. The cable boxes and termination shall be designed to enable easy disconnection and replacement of cables.

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3.8 DIESEL ENGINE

3.8.1 General

The diesel engine shall be of multi-cylinder type four stroke cycles with mechanical (airless) injection cold starting type. The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection. This will also provide interchangeability of parts. All parts susceptible to temperature changes shall have tolerance for expansion and contraction without resulting in leakage, misalignment of parts or injury to parts.

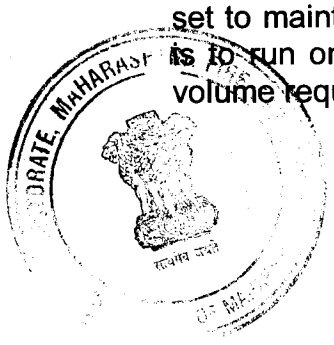
3.8.2 Starting

The engine shall be capable of both automatic and manual start. Generally the engine shall start automatically but in case of the auto-start system failure the engine shall be capable of manual start. Engine shall be able to start without any preliminary heating of combustion chamber; cranking mechanism shall also be provided. All controls/mechanism which have to be operated in the starting process, shall be within easy reach of the operator. A high DC motor charged by battery shall initiate automatic start of diesel engine. The battery shall hold adequate retaining charge to provide the starting of the diesel engine. Starting power will be supplied from two sets of storage batteries.

One set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch will be provided at automatic starting control panel to select any of the two sets of battery for manual/auto starting of the engine. The battery capacity shall be adequate for ten consecutive starts without recharging with a cold engine under full compression. The battery banks shall be used for no other purpose other than starting of the engine and shall be fully charged at all times with provision for trickle and boast charges. After start of the engine the charger shall be disconnected, the battery being fed from the engine dynamo. The two battery charger of air cooled type shall be able to charge on battery bank at a time. The D/E starting panel along with the battery changers should be approved by FBA.

3.8.3 Governing System

The engine shall have a speed control device which will control the speed under all conditions of load. The governor shall be suitable for operation without external power supply. The Governor shall offer following features: An adjustable governor to regulate engine speed within a range of 10% between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load. The diesel engine is to run on high speed diesel, the tank provided being enough to hold the volume required for 6 hours (minimum) continuous operation.



3.8.4 Cooling Water System

Direct cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and after passing through the engine, the outlet water shall be taken directly to the sump through an elevated funnel. Re-circulating Thermo siphon system of cooling using a fan cooled radiator or indirect cooling system using head exchange shall not be accepted.

3.8.5 Accessories

The engine shall be mounted on a base plate of fabricated steel construction. Adequate access shall be provided for the big end and main bearings, camshaft and governor drives, water jackets etc. The engine shall have a base plate made from MS sections. There shall be reasonable space at the big end, camshaft, water jackets, governor drives and main bearings.

The engine shall be provided with intake and discharge duct work, inlet filter and silencer, outlet muffler, expansion joints, dampers etc., as necessary for efficient operation. Intake air should be taken from inside the building in which the engine is located, but the exhaust should be discharged outside the building and exhaust duct shall be adequately sized for minimum pressure drop as per relevant code/standard, and shall be housed clearing man height. The flywheel shall have graduated marking around the periphery to facilitate checking of valve and fuel pump timings. Full set of diesel engine spares as per Standard requirement to be provided along with tool kit.

3.8.6 Instrumentation

The diesel engine shall be provided with adequate instrumentation. The gauges etc., as required are provided for in the Engine Panel.

3.8.6.1 Engine instrumentation shall include the following:-

i) Lub. oil pressure gauge.
ii) Lub. oil temperature gauge.
iii) Water pressure gauge.
iv) Water temperature gauge.
v) Tachometer.
vi) Hour meter.

The instrumentation panel shall be suitably resident mounted on the engine.

3.8.6.2 Engine Protection Devices- 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.

3.8.6.3 Pipe Work - All pipe lines with fittings and accessories required shall be provided for fuel oil, lub.oil and exhaust systems, copper piping of adequate sizes, shall be used for Lub.oil and fuel oil. M.S. piping will be permitted for exhaust.

3.8.6.4 Anti Vibration Mounting- Suitable vibration mounting duly approved by Project Manager 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.

3.8.6.5 Battery Charger-Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery in trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

3.9 OPERATING CONDITION FOR PUMPS (START-STOP).

Operating Pressure 8.5kg/sqcm
Jockey Pump 6.0kg/sqcm 5.50kg/sqcm
Elec. Pump 5.50kg/sqcm Manual
Diesel Engine pump 4.0kg/sqcm Manual
Terrace Pump 1.5kg/sqcm Manual

3.9.1 Flexible connectors

On all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors shall be provided. Connectors should be suitable for maximum working pressure of each pipe line on which it is mounted and tested to a test pressure of 1:5 times the operating pressure. Length of the connector shall be as per manufacturer's standard.

3.9.2 Interlocking

The following inter-locking between the two main fire pumps (i.e. wet riser pump & sprinkler pump), the jockey pump and the diesel engine driven pump. Only one category of pumps will work at a time i.e. either jockey pump or main fire pumps (wet riser and sprinkler, both the wet riser and sprinkler can come up at a time) or diesel driven pump.

3.9.3 Jockey wet riser diesel driven

	PUMP	PUMP	PUMP
i.	ON	OFF	OFF
ii.	OFF	ON	OFF
iii.	OFF	OFF	ON
iv.	OFF	ON	ON

3.9.4 Annunciation panel

One solid state electronic annunciation panel fully wired with visual display and audible alarm unit shall be provided to indicate:

a. Flow condition in any flow switch indicating the area of distress and fire alarm.
b. Starting and stopping of each hydrant pump.
c. Starting and stopping of each jockey pump.
d. Starting and stopping of each sprinkler pump.
e. Failure of Hydrant / Sprinkler pumps to start.

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f. High level in fire water storage tank compartment.
g. Low level in fire water storage tank compartment.
h. Low level in HSD day tank of the fire pump.
The panel shall be factory fabricated, wired and tested. All details shall be submitted with the tender. The annunciation panel shall be located in the security office / reception on the ground floor or as instructed by the Project Manager.

3.9.5 Vibration isolation
The pump set shall be mounted on rolled steel channels and 150 mm thick inertia block spring and ribbed neoprene vibration isolation mounting shall support the inertia block onto a 100 mm thick concrete plinths. The spring mountings shall have a maximum deflection of15 mm. Reference shall be made to the section on "Nose and Vibration" for further technical requirements.

3.10 CODES AND STANDARDS FOR PUMPS, MOTORS, AND DIESEL ENGINE

3.10.1 Pumps
The pumps shall perform to the standards and codes as given below:
IS: 1520 Horizontal centrifugal pumps for clear, cold and fresh water.
BS: 599 methods of testing pumps.
PTC: 8 ASME Power Test Codes - Centrifugal Pumps.

3.10.2 Motor
The following codes shall be applicable for the motor IS: 325 Induction motors, three-phase.
IS : 900 Induction motors, installation and maintenance, code of practice for
IS : 4029 Guide for testing three phase induction motors.
IS : 3043 code of practice for earthing.
Further to those stated above, the design, manufacture, installation and performance of motors shall be conform to the latest Indian Electricity Act and Indian Electricity Rules. The motor shall also be acceptable to the Tariff Advisory Committee.

3.10.3 Diesel Engine
The following codes are to be followed in the design, manufacture, erection and testing of the diesel engineer:
IS: 1600 Codes for type testing of constant speed internal combustion engines for general purposes.
IS: 1601 Performance of constant speed internal combustion engines for general purposes. Code of diesel Engine Manufacturer's Assn. USA.

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4. HAND HELD FIRE EXTINGUISHERS and HAND APPLIANCES

4.1 SCOPE

Work under this section shall consist of furnishing all labor, materials, appliances and equipment necessary and required to install fire extinguishing hand appliances as per relevant specification of various authorities. Without restricting to the generality of the foregoing, the work shall consist of the following: Installation of fully charged and tested fire extinguishing hand appliances of A B C powder type as required and specified in the drawings and schedule of rates.

4.2 GENERAL REQUIREMENTS

Hand appliances shall be installed in easily accessible locations with the brackets fixed to the wall by suitable anchor fasteners. Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data. All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations. Distribution / installation of fire extinguisher to be in accordance to IS:2190.

4.2.1 MEASUREMENT

Fire extinguishers shall be counted in numbers and include installation of all necessary items required as given in the specifications.

4.2.2 ABC TYPE DRY POWDER EXTINGUISHER

The Extinguisher shall be filled with ABC grade 40, Mono Ammonium Phosphate 40% from any approved manufacturer. The capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 4308, Part II, shall be 5 Kg +/-2% or 10 Kg +/- 3%. The distribution of fire extinguishers to be as per IS 2190 – 1992. It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety clip, fitted with a pin, to prevent accidental discharge. It shall be pressurized with Dry Nitrogen, as expellant. The Nitrogen to be charged at a pressure of 15 Kg/cm^2. 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 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.

4.2.3 WATER TYPE EXTINGUISHER (Gas Pressure Type)

The Extinguishing medium shall be primarily water stored under normal pressure, the discharge being affected by release of Carbon Dioxide Gas from a 120 gms cylinder. The capacity of Extinguisher, when filled up to the indicated level, shall be 9 liter +/- 5% The skin thickness of the Cylinder shall be minimum 4.0 mm, fabricated from Mild Steel sheet, welded as required, with dish and dome, being of same thickness, and of size not exceeding the diameter of body. The diameter of body to be not less than 150 mm and not exceeding 200 mm. The neck shall be externally threaded up to a minimum

depth of 16 mm, and leaded tin bronze. The cap shall be of leaded tin bronze, and screwed on the body up to a minimum of 1.6 cm depth, with parallel screw thread to match the neck ring. The siphon tube to be of brass or G.I. and the strainer of Brass. The cartridge holder, knob, discharge fittings and plunger to be of Brass/Leaded tin bronze, and plunger of stainless steel, spring of stainless steel. The cap to have a handle fixed to it. The discharge hose shall be braided nylon, of 10 mm Dia and 600 mm long, with a nozzle of brass fitted at end. The extinguisher shall be treated for anti-corrosion internally and externally, and externally painted with Fire Red paint. The paint shall be stove enameled/powder coated. The cartridge shall be as per IS, and have 60 gm net carbon dioxide gas for expelling. The extinguisher, body and cap shall be treated to an internal hydraulic pressure of 25 Kg/cm2. It shall have external marking with letter A, of 2.5 cm height, in block letters within a triangle of 5 cm each side. The extinguisher shall be upright in operation, with the body placed on ground and discharge tube with nozzle held in one hand to give a throw of not less than 6 mtr, and continue so for at least 60 secs. The extinguisher body shall be clearly marked with ISI stamp (IS: 940).

4.2.4 CARBON DIOXIDE EXTINGUISHER

The Carbon Dioxide Extinguisher shall be as per IS: 2878. 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 overall height shall not exceed 720 mm. The discharge mechanism shall be through a control valve conforming to IS: 3224. The internal siphon tube shall be of copper aluminium conforming to relevant specifications. 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 meter 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 hand grip of Discharge horn shall be insulated with Rubber of appropriate thickness.

The gas shall be conforming to IS: 307 and shall be stored at about 85 Kg/cm2. The expansion ratio between stored liquid carbon dioxide to expanded gas shall be 1:9 times and the total discharge time (effective) shall be minimum 10 secs and maximum 25 secs. The extinguisher shall fulfill the following test pressures:

Cylinder: 236 Kg/cm2

Control Valve: 125 Kg/cm2

Burst Pressure of Hose: 140 Kg/cm2 minimum

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. The Extinguisher including components shall be IS marked.

5.0 MISCELLENEOUS

5.1 METERS

i. All voltmeters and indicating lamps shall be through MCB's.

ii. Meters and indicating instruments shall be plug type.

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iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
iv. CT ratio and burdens shall be as specified on the Single line diagram.

5.2 CURRENT TRANSFORMERS

Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary for operation of associated metering. The CTs shall confirm to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

5.3 SELECTOR SWITCH

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

5.4 STARTERS

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta and ATS Starters shall be fully automatic.

5.5 CABLES

M.V. Cables shall be PVC insulated aluminum conductor and armored cables conforming to IS Codes. Cables shall be armored and suitable for laying in trenches, ducts, and on cable trays as required. M.V. Cables shall be termite resistant. Cable glands shall be double compression glands. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armored cables.

5.6 CABLE LAYING

Cable shall be laid in accordance with IS code of Practice. Cables shall be laid on 14 gage factory fabricated perforated galvanized sheet steel cable trays, and cable drops / risers shall be fixed to ladder type cable trays factory fabricated out of galvanized steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running on a cable tray, one Dia spacing shall be provided between cables to minimize the loss in current carrying capacity.

Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250mm thick layer of soft sifted sand & protected with bricks/tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable.

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5.7 DRAWINGS

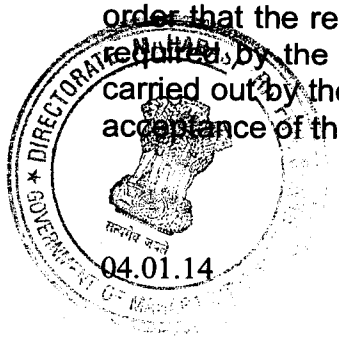
Shop drawings for control panels and for wiring of equipment showing the route of conduit & cable shall be submitted by the contractor for approval of Project manager/Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

6. STATUTORY AUTHORITIES' TESTS AND INSPECTIONS

As and when notified in writing or instructed by the Project manager, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Project manager as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect. The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest project architectural plans submitted to and kept by these Authorities. The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Project manager for checking before submission. The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Project manager may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary. The Contractor shall notify the Project manager at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Project manager without delay.

6.1 FINAL ACCEPTANCE TESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Project manager. Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained. Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.



6.2 REJECTION OF INSTALLATION / PLANT

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Project manager either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Project manager so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Project manager. After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Project manager/Employer.

6.3 WARRANTY AND HANDOVER

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

6.4 HANDING OVER OF DOCUMENTS

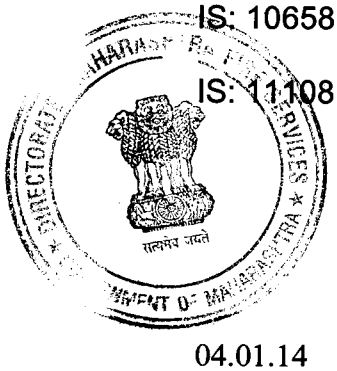
All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative. The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.



PART 3

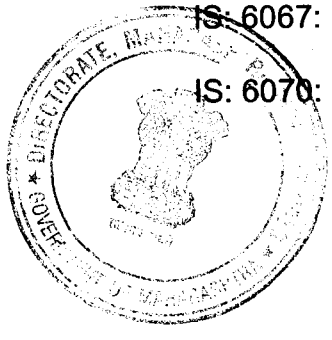
Applicable BIS standards on Fire Prevention and Fire Protection

Standard	Topics
Fire Extinguishers	
IS: 933:1989	Portable chemical fire extinguishers, foam type (third revision)
IS: 934: 1989	Portable chemical fire extinguishers, soda acid type (fourth revision)
IS: 940: 1989	Portable chemical fire extinguishers, water type (gas cartridge) (third revision)
IS: 2171: 1985	Portable chemical fire extinguishers, Dry Powder (Cartridge type) (third revision)
IS: 2190: 1992	Code of practice for selection, installation and maintenance of portable first - aid fire extinguisher (third revision)
IS: 2878: 1986	Portable fire extinguishers, carbon dioxide type (second revision)
IS: 4562: 1968	Portable chemical fire extinguishers, foam type, for marine use
IS: 4862: 1986	Portable chemical fire extinguishers, for aircraft.
IS: 4947: 1985	Gas cartridge for use in fire extinguishers (second revision)
IS: 5490	Refills for portable fire extinguishers and chemical fire engines.
Part I: 1977	For soda - acid portable fire extinguishers (first revision)
Part II: 1977	For foam type portable fire extinguishers (first revision)
Part III: 1979	For soda - acid chemical fire engines, 50 liter capacity (first revision)
Part IV: 1979	For foam chemical fire engines, 50 liter capacity (first revision)
IS: 6234: 1986	Portable fire extinguishers water type (stored pressure) (first revision)
IS: 8149: 1976	Functional requirement for twin CO2 fire extinguisher (trolley mounted)
IS: 10204: 1982	Portable fire extinguishers mechanical foam type
IS: 10472: 1983	150 liter capacity chemical fire engine, foam type
IS: 10658: 1983	Higher capacity dry powder fire extinguisher (trolley mounted)
IS: 11108: 1984	Portable fire extinguishers - Halon 1211 type.



Appliances

IS: 942: 1982	Functional requirements for 275 liter/min. portable pump set for fire fighting (second revision)
IS: 943: 1979	Functional requirements for 680 liter/min. trailer pump
IS: 944: 1979	Functional requirements for 1800 liter/min. trailer pump for fire brigade use (second revision)
IS: 946: 1977	Functional requirements for motor fire engine (first revision)
IS: 947: 1985	Functional requirements for towing tender for trailer fire pump for fire brigade use (first revision)
IS: 948: 1983	Functional requirements for water tender, type "A" for fire brigade use (second revision)
IS: 949: 1985	Functional requirements for emergency (rescue) tender for fire brigade use (second revision)
IS: 950: 1980	Functional requirements for water tender, type "B" for fire brigade use (second revision)
IS: 951: 1987	Functional requirements for crash fire tender for fire brigade use (first revision)
IS: 954: 1987	Functional requirements for CO2 tender for fire brigade use (first revision)
IS: 955: 1980	Functional requirements for dry powder tender for fire brigade use (first revision)
IS: 956: 1975	Functional requirements for rescue tender for fire fields (first revision)
IS: 957: 1987	Control van for the fire brigade use
IS: 2696: 1974	Functional requirements for 1125-l/min. light fire engine (first revision)
IS: 2930: 1980	Functional requirements for hose laying tender for fire brigade use (first revision)
IS: 3947: 1966	Code of practice for testing, installation and maintenance of marine portable fire appliances.
IS: 5506: 1979	50-ltr capacity chemical fire engine, soda-acid type (first revision)
IS: 5507: 1979	20-ltr capacity chemical fire engine, foam type (first revision)
IS: 5896	Code of practice for selection, operation and maintenance of fire fighting appliances.
Part-I:	1970 Combined, foam, and crash tender
Part-II :	1975 Turntable ladder.
IS: 6067: 1983	Functional requirements for water tender type-X for fire brigade use (first revision)
IS: 6070: 1983	Code of practice for selection, operation and maintenance of trailer fire pumps portable pumps, water tender and motor fire engines (first revision)



IS: 7577: 1986	Gas testing flame safety lamps (first revision)
IS: 8150: 1976	45-ltr capacity chemical foam for marine engine use.
IS: 10460: 1983	Functional requirements for small foam tender for fire brigade use.
IS: 10999: 1984	Functional requirements for 2000 kg. Dry powder tender for fire brigade use.

Alarm systems and other systems and media

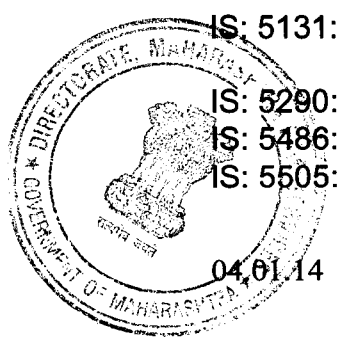
IS: 21775: 1988	Heat sensitive fire detectors for use in automatic electric fire alarm system (second revision)
IS: 2189: 1988	Code of practice for selection, installation and maintenance of automatic fire detection and alarm system (second revision)
IS: 3844: 1989	Code of practice for installation of internal fire hydrants in multistory buildings.
IS: 4308: 1982	Dry powder for fire fighting (first revision)
IS: 4861: 1984	Dry powder for fighting fires in burning metals (first revision)
IS: 4989	Foam concentrate (compound) for producing mechanical foam for fire fighting.
Part-I: 1985	Protein foam (second revision)
Part-II: 1984	Aqueous film forming foam (AFFF)
Part -III: 1987	Flouro-protein foam
IS: 6382: 1984	Code of practice for design and installation of fixed carbon dioxide fire extinguishing system (first revision)
IS: 7676: 1985	Glossary of terms for fire fighting equipment
IS: 9668: 1990	Code of practice for provision and maintenance of water suppliers for fire fighting.

Accessories, Hoses, Hydrants

IS: 636: 1988	Non-percolating flexible fire fighting delivery hose (third revision)
IS: 884: 1985	First-aid hose reel for fire fighting (first revision)
IS: 901: 1988	Couplings, double male and double female, instantaneous pattern for fire fighting (third revision)
IS: 902: 1992	Suction hose couplings branch pipe, nozzles and nozzle spanner (third revision)
IS: 903: 1984	Fire hose delivery couplings branch pipe, nozzles and nozzle spanner (third revision)
IS: 904: 1983	2-way and 3-way suction collecting heads for fire fighting purposes (second revision)
IS: 905: 1980	Delivery breeching, dividing and collecting, instantaneous pattern, for fire fighting purposes (second revision)
IS: 906: 1988	Branch with revolving head for fire fighting purposes (second revision)

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IS: 907: 1984	Suction strainers, cylindrical type for fire fighting purpose second revision.
IS: 908: 1975	Fire hydrant, stand post type (second revision)
IS: 909: 1992	Underground fire hydrant sluice-value type (third revision)
IS: 910: 1980	Combined key for hydrant, cover and lower valve (second revision)
IS: 926: 1985	Firemen's axe (second revision)
IS: 927: 1981	Fire hook (second revision)
IS: 928: 1984	Fire bells (second revision)
IS: 930: 1977	Wooden extension ladder for fire brigade use (first revision)
IS: 931: 1973	Wheeled fire escape (first revision)
IS: 937: 1981	Washers for water fittings for fire fighting purposes (second revision)
IS: 939: 1977	Snatch block for use with fibre rope for fire brigade use (first revision)
IS: 941: 1985	Blower and exhauster for fire fighting (second revision)
IS: 928: 1984	Fire bells (second revision)
IS: 952: 1986	Fog nozzle for fire brigade use (first revision)
IS: 1941: 1976	Functional requirements for electric motor
Part-I: 1976	Sirens: Part-I AC, 3-phase, 50 Hz, 415 volts type (second revision)
IS: 2097: 1983	Foam-making branch pipe (first revision)
IS: 2298: 1978	Single barrel stirrup pump for fire fighting purposes (second revision)
IS: 2546: 1974	Galvanized mild steel fire bucket (first revision)
IS: 2871: 1983	Branch, pipe, universal fire the fighting purposes (first revision)
IS: 3582: 1984	Basket strainers for fire fighting purpose (cylindrical type) (first revision)
IS: 3614: 1966	Part-I Fire-check doors: Part-I, Plate metal covered and rolling type.
IS: 3744: 1985	Hose binding machine (first revision)
IS: 4571: 1977	Aluminum extension ladders for fire brigade use (first revision)
IS: 4643: 1984	Suction wrenches for fire brigade use (first revision)
IS: 4927: 1992	Unlined flax canvas hose for fire fighting (first revision)
IS: 4928: 1986	Delivery valve for centrifugal fire pump outlet (first revision)
IS: 5131: 1986	Dividing breeching with control, for fire brigade use (first revision)
IS: 5290: 1983	Landing valves (second revision)
IS: 5486: 1985	Quick-release knife (first revision)
IS: 5505: 1985	Multi-edged rescue axe (non-wedging) (first revision)



IS: 5612:	Hose-clamps and hose-bandages for fire brigade use.
Part-I: 1977	Hose clamps (first revision)
Part-II: 1977	Hose bandages (first revision)
IS: 5714: 1981	Hydrant, stand pipe for fire fighting (first revision)
IS: 6026: 1985	Hand operated sirens (first revision)
IS: 8090: 1976	Coupling, branch pipe, nozzle used in hose reel tubing for fire fighting. IS: 8096: 1992 Fire beaters.
IS: 8423: 1977	Controlled percolating hose for fire fighting
IS: 8442: 1977	Functional requirements for stand post type water for fire fighting
IS: 5714: 1981	Hydrant, stand pipe for fire fighting (first revision)

Fire Safety in Buildings

IS: 1641: 1988	Code of practice for fire safety of buildings (general): General principles and fire grading and classification (first revision)
IS: 1642: 1989	Code of practice for fire safety of buildings (general): General Materials & details of construction (first revision)
IS: 1643: 1988	Code of practice for fire safety of buildings (general) : General Exposure hazard (first revision)
IS: 1644: 1982	Code of practice for fire safety of buildings (general): General hazard. (first revision)
IS: 1646: 1982	Code of practice for fire safety of buildings (general): General Electrical installations (first revision)
IS: 1891:	Rubber conveyor and elevator textile belting.
Part 4: 1978	Hygienic belting (first revision)
IS: 2726: 1988	Code of practice for fire safety of industrial buildings: Cotton ginning and pressing (including cotton seed) factories (first revision)
IS: 3016: 1982	Code of practice for fire precautions in welding and cutting operations (first revision)
IS: 3034: 1981	Code of practice for fire safety of industrial buildings: Electrical generating and distributing stations (first revision.
IS: 3058: 1990	Code of practice for fire safety of buildings: Viscose rayon yarn/staple fibre plants (first revision)
IS: 3079: 1990	Code of practice for fire safety of industrial buildings Cotton textile mills (first revision)
IS: 3181: 1992	Conveyor belts, fire resistant belting for underground mines and such other hazardous applications (second revision)
IS: 3594: 1991	Code of practice for fire safety of industrial buildings: General storage and warehousing including cold storages (first revision)
IS: 3595: 1984	Code of practice for fire safety of industrial buildings: Coal pulverizes and associated equipments (first revision)
IS: 3808: 1979	Method of test for non-combustibility of building

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	materials (first revision)
IS: 6809: 1979	Fire resistance test of structure (first revision)
IS: 3836: 1979	Code of practice for fire safety of industrial buildings: Jute mills (first revision)
IS: 4226: 1988	Code of practice for fire safety of industrial buildings: Aluminum/magnesium powder factories (first revision)
IS: 4355: 1977	Fire resistance brattice cloth (first revision)
IS: 4886: 1991	Code of practice for fire safety of industrial buildings: Tea factories (first revision)
IS: 5509: 1980	Fire retardant plywood (first revision)
IS: 6329: 1971	Code of practice for fire safety of industrial buildings: Saw Mills and woodworks.
IS: 7820: 1975	Method of test for ignition temperatures
IS: 8757: 1978	Glossary of terms associated with fire safety
IS: 9109: 1979	Code of practice for fire safety of industrial buildings, paint and varnish factories.
IS: 11457:	Code of practice for safety of chemical industries: Part-I
Part-I : 1985	Rubber and plastic.
IS: 11460: 1985	Code of practice for fire safety of libraries and archives.
IS: 11871: 1986	Methods for determinations of flammability and flame resistance of textile fabrics.
IS: 11884: 1986	Fire-resistant brattice sheeting made from unsupported plastics.
IS: 12307: 1988	Graphic symbols for fire protection.
IS: 12349: 1988	Fire protection safety signs.
IS: 12456: 1988	Fire protection of electronic data processing installations.
IS: 12459: 1988	Fire protection of cable runs.
IS: 12467: 1988	Methods for determination of the ignitability of upholstered composites for seating for furfures by smoker's materials.
IS: 12722: 1989	Textile floor covering - Determination of flame resistance by table test. IS: 13045: 1991 Fire safety of flour mills.
IS: 12459: 1988	Fire protection of cable runs.

