CONSTRUCTION OF RESIDENTIAL FLATS, SBILD & OTHER COMMERCIAL OUTFITS AT HINJEWADI, PUNE, MAHARSHTRA, IN EPC MODE

PART E: CHAPTER E (FIRE FIGHTING)

SBI

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ARCHITECTURE, MASTER PLANNING, INTERIOR DESIGN, LANDSCAPING, PROJECT MANAGEMENT

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SECTION I: GENERAL INSTRUCTIONS

1.0 General Requirements

1.1 Scope of Work

- 1.1.1 The form of Contract shall be according to the "Conditions of Contract". The following clauses shall be considered as an extension and not in limitation of the obligation of the Contractor.
- **1.1.2** Work under this contract shall consist of furnishing all labor, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the Plumbing and other specialized services as described hereinafter and as specified in the Schedule of Quantities and/or shown on the Plumbing Drawings.
- **1.1.3** Without restricting to the generality of the foregoing, the sanitary installations shall include the following:
    - Fire Fighting Works
    - Hydrant System
    - Sprinkler System
    - Fire Extinguishers
- **1.1.4** Services rendered under this section shall be done without any extra charge.

1.2 Specifications

- **1.2.1** Work under this contract shall be carried out strictly in accordance with Specifications attached with the tender.
- **1.2.2** Items not covered under these Specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per Specifications of the latest Central Public Works Department (CPWD) with up-to-date amendments as applicable in the contract and/or as per the requirement of the client or its representative.
- **1.2.3** Works not covered above in paragraphs 1.2.1 and 1.2.2 shall be carried out as per relevant Indian Standards (IS) and in case of its absence as per British Standard Code of Practice.

1.3 Execution of Work

- **1.3.1** The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description will be allowed.
- **1.3.2** The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule.
- **1.3.3** On award of the work, Contractor shall submit a schedule of construction in the form of a PERT Chart or BAR Chart for approval of the Project Manager / Architect / Consultant. All dates and time schedule agreed upon should be strictly adhered to, within the stipulated time of completion/commissioning along with the specified phasing, if any.

1.4 Drawings

- **1.4.1** Fire drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the Architectural and other services drawings.

- **1.4.2** Architectural drawings shall take precedence over Plumbing or other services drawings as to all dimensions.
- **1.4.3** Contractor shall verify all dimensions at site and bring to the notice of the Project Manager all discrepancies or deviations noticed. Decision of the Project Manager shall be final.
- **1.4.4** Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.
- **1.4.5** All drawings issued by the Architects/Consultant for the work are the property of the Architects/Consultant and shall not be lent, reproduced or used on any works other than intended without the written permission of the Architects/Consultant.

1.5 Inspection and Testing of Materials

- **1.5.1** Contractor shall be required, if requested, to produce manufacturers Test Certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian Standards.
- **1.5.2** For examination and testing of materials and works at the site Contractor shall provide all Testing and Gauging Equipment necessary but not limited to the following:
    - Theodolite, Steel tapes
    - Dumpy level
    - Weighing machine
    - Plumb bobs, Spirit levels, Hammers
    - Micrometers, Tachometers
    - Thermometers, Stoves
    - Hydraulic test machine
    - Smoke test machine
- **1.5.3** All such equipment shall be tested for calibration at any approved laboratory, if required by the Project Manager.
- **1.5.4** All Testing Equipment shall be preferably located in a special room meant for the purpose.
- **1.5.5** Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Architects or kept at site in a sample room as prepared by the owners. Any materials declared defective by Project Manager / Architect / Consultant shall be removed from the site within 48 hours.

1.6 Metric Conversion

- **1.6.1** All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.
- **1.6.2** Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

1.7 Reference Points

- **1.7.1** Contractor shall provide permanent Benchmarks, Flag Tops and other reference points for the proper execution of work and these shall be preserved till the end of the work.
- **1.7.2** All such reference points shall be in relation to the levels and locations given in the Architectural and Plumbing drawings.

1.8 Reference Drawings

- **1.8.1** The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All-important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.
- **1.8.2** All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. All changes to be made shall be initialed by the Project Manager or Architects.

1.9 Shop Drawings

- **1.9.1** The Contractor shall submit to the Project Manager three copies of the shop drawings.
- **1.9.2** Shop drawings shall be submitted under following conditions:
    - Showing any changes in layout in the plumbing drawings.
    - Equipment layout, piping and wiring diagram.
    - Manufacturers or Contractor's fabrication drawings for any materials or equipment supplied by him.
- **1.9.3** The Contractor shall submit two copies of catalogues, manufacturer's drawings, equipment characteristics data or performance charts as required by the Project Manager.

1.10 Completion Drawings

- **1.10.1** On completion of work, Contractor shall submit one complete set of original tracings and two prints of "as built" drawings to the Project Manager. These drawings shall have the following information:
    - Run of all piping, diameters on all floors, vertical stacks and location of external services.
    - Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
    - Run of all water supply lines with diameters, locations of control valves, access panels.
    - Location of all mechanical equipment with layout and piping connections.
    - *Note:* No completion certificate shall be issued unless the above drawings are submitted.
- **1.10.2** Contractor shall provide two sets of catalogues, service manuals manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.
- **1.10.3** All "Warranty Cards" given by the manufacturers shall be handed over to the Project Manager.

1.11 Testing

- **1.11.1** Piping works shall be tested as specified under the relevant clause(s) of the specifications.
- **1.11.2** Tests shall be performed in the presence of the Project Manager / Consultant.
- **1.11.3** All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- **1.11.4** Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other byelaws in force.
- **1.11.5** Contractor shall provide all labor, equipment and materials for the performance of the tests.

1.12 Site Clearance and Cleanup

- **1.12.1** The Contractor shall, from time to time clear away all debris and excess materials accumulated at the site.
- **1.12.2** After the Fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition.
- **1.12.3** On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at Contractors risk and cost.

1.13 License Permits and Authorities

- **1.13.1** Contractor must keep constant liaison with the Municipal/statutory authority and obtain all approval of all drainage, water supply and other works carried out by him.
- **1.13.2** Contractor shall obtain, from the Municipal and other authority's necessary completion certificate(s) with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. Employer shall pay all fees/deposits as required to be paid to the authorities towards connection charges.

1.14 Recovery of Cost for Materials Issued to Contractors Free of Cost

- **1.14.1** If any materials issued to the Contractor free of cost are damaged or pilfered, the cost of the same shall be recovered from the Contractor on the basis of the actual cost to the Owner, which shall include all freight and transportation charges, excise duty, sales tax, octroi, import duty, etc., plus 100%. The decision regarding the actual cost, as determined by the Employer, shall be final and binding on the Contractor.

1.15 Cutting of Water Proofing Membrane

No walls or terraces shall be cut for making an opening after water proofing has been done without written approval of the Project Manager / Architects. Cutting of water proofing membrane shall be done very carefully to ensure that other portion(s) of water proofing is (are) not damaged. On completion of work at such place, the water proofing membrane shall be made good and ensured that the opening/cutting is made fully waterproof as per specifications and details of water proofing approved by Architects.

1.16 Cutting of Structural Members

No structural member shall be chased or cut without the written permission of the Project Manager.

1.17 Materials Supplied by Owner

- **1.17.1** The Contractor shall verify that all materials supplied by the Employer confirm to the specifications of the relevant item in the tender. Any discrepancy found shall be brought to the notice of the Project Manager.

1.18 Materials Quality and Approvals

Unless otherwise specified and expressly approved in writing by the Project Manager, only materials of makes and specifications mentioned in the list of approved makes attached with the specifications shall be

used. If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Project Manager and returned to the Contractor at the appropriate time.

SECTION II: FIRE HYDRANT SYSTEM

1.0 Scope of Work

- **1.1** The scope of work shall cover supply, fabrication, installation, testing and commissioning of the fire hydrant system covering the following but not limited to:
  - **a)** Fire Hydrant pumps, electric and diesel driven as shown in the equipment schedule, drawings and as required.
  - **b)** Jockey pump, electric driven as shown in the equipment schedule, drawings and as required.
  - **c)** Engine Control Panel.
  - **d)** Hydrant mains, external ring and yard hydrants.
  - **e)** Wet risers in the building as specified and shown on drawings.
  - **f)** Landing valves, hose reels, hose cabinets (with 2 Hose and nozzle) etc.
  - **g)** Fire brigade breeching, Siamese connections and connections to pumps and appliances.
- **1.2** The contractor shall get the Fire Fighting System approved by the Chief Fire Officer (CFO) of the Local Fire Service.

2.0 Standards

- **2.1** The fire hydrant installation shall conform to and meet with the requirements set out by the following:
  - **2.1.1** Relevant IS Code of practice for the safety of buildings (General) firefighting equipment and its maintenance.
  - **2.1.2** Relevant IS Code of practice for installation of internal fire hydrant in multistoried buildings.
  - **2.1.3** Compliance with the local fire brigade and the fire enforcing authorities as specifically laid down by them.

3.0 Fire Pump Technical Specifications

- **3.1** The fire pump shall be single stage / double stage suction centrifugal type with split casing type and direct driven by electric motor or diesel engine as specified. The pump rating and performance shall conform to the equipment schedule and meet the Tariff Advisory Committee (TAC) duty requirements.
- **3.2** Pump casing shall be of close-grained cast iron with bronze impeller. The shaft sleeve shall be brass or SS 304 and the trim shall be brass or bronze.
- **3.3** Pump shall be capable of delivering 150% of the rated capacity at 65% of the rated head and the no-delivery head shall be not more than 140% (150% in case of end suction type) of the rated delivery head. The pump casing shall withstand 1.5 times the no-delivery pressure or 2 times of the duty pressure whichever is higher.
- **3.4** The pump shall be either electrically driven or diesel driven with direct flexible coupling.
- **3.5** The electric drive motor shall be squirrel cage induction type conforming to IS 325 (Latest Edition) and rated for continuous duty (S1). Motor shall have not less than Class F Insulation, Class B temperature rise, and minimum enclosure protection of IP55. The starter shall be air-cooled fully automatic star-delta or auto-transformer type. Starters shall conform to IS 8544 and be rated for AC-3 duty conditions.
- **3.6** Drive rating shall be based on the largest of the following parameters:

  - **a)** Rated pump discharge at rated head
  - **b)** 150% of rated discharge @ 65% of rated head
  - **c)** Maximum power absorbed by the pump in its operating range (i.e., from no-delivery to free discharge).
- **3.7** The diesel engine shall be naturally aspirated (non-turbocharged) and electrically started. The engine shall be complete with starting batteries, full-wave selenium rectifier charger, isolator, leads, mounting frame etc. Engine rating shall be same as for the electric motor. The detailed specifications of the engine are stated under Clause 6.0.

4.0 Accessories

- **4.1** The Fire Pumps shall be complete with the following accessories:
  - **a)** Suction and discharge eccentric reducers
  - **b)** Pump coupling guard
  - **c)** Common base frame fabricated from mild steel or cast iron.
- **4.2** Each pump shall have an independent set of pressure switches. The pressure switch shall be a snap-action SPDT switch rated 10A @ 230V operated through a stainless-steel diaphragm. The switch shall have a pointer for manual adjustment of the set point, and all electrical connections shall be terminated in a screwed terminal connector. The entire unit shall be encased in a heavy-gauge cold-drawn steel enclosure. The diaphragm shall be designed for the maximum operating pressure of the system. Each pressure switch shall be provided with a pressure gauge in parallel as shown on the drawings; all gauges and pressure switches shall be mounted in an instrument panel with necessary control piping and drainage facility.

5.0 System Operation and Control Panels

- **5.1** The fire pump shall be started automatically on loss of pressure and the operation sequence of the booster and fire pumps shall be as follows:
  - **a)** Jockey Pump shall start when the system pressure drops by 0.35 kg/cm² and stop when the system pressure is re-established.
  - **b)** The Fire Pump shall start when the system pressure drops by 1.0 kg/cm² and shall continue to run until manually switched off.
  - **c)** Jockey and fire pump starting statuses shall be indicated on the panel via a red indication lamp.
- **5.2** The motor starters (Direct-On-Line (DOL) or Star-Delta type, as applicable) shall consist of electrically operated contactors and shall be suitable for the respective motor ratings. The starter assembly shall be complete with ON/OFF push buttons, timers (where applicable), thermal overload protection relays, and auxiliary contacts, operating fully automatically. An indicating lamp shall be provided for each pump to indicate its operating status. The fire pump control panel shall also be equipped with an ammeter and ammeter selector switch for monitoring the current of each fire pump. Automatic starting of the fire pump shall be annunciated through an electric siren. The control panel shall be designed to ensure reliable, safe, and uninterrupted operation of the fire pump system under all operating conditions.
- **5.3** The starter along with isolator shall be housed in a 14 SWG MS box duly rust-inhibited through a process of degreasing and phosphating.
- **5.4** All cabling to and from the pumps to the starter and control switch shall be carried out through armored PVC cables of approved makes. Cables shall be laid in accordance with section "M.V. CABLING". The pump motors and panels shall be double earthed in accordance with IS 3043-1966 or as shown on drawings and as approved.
- **5.5** The Fire Alarm System and Fire Pump System shall be integrated with the control room monitoring computer, enabling real-time display of alarms, faults, pump running, trip, and system status.

6.0 Diesel Engine

- **6.1** The diesel engine shall be of multi-cylinder type, four-stroke cycle with mechanical (airless) injection, cold starting type.
- **6.2** The engine shall be designed with regard to ease of maintenance, repair, cleaning, and inspection. This will also provide interchangeability of parts.
- **6.3** All parts susceptible to temperature changes shall have tolerance for expansion and contraction without resulting in leakage, misalignment of parts, or injury to parts.
- **6.4** The engine shall be capable of both automatic and manual start. Generally, the engine shall start automatically, but in case of auto-start system failure, it shall be capable of manual start. The engine shall be able to start without any preliminary heating of the combustion chamber; a cranking mechanism shall also be provided. All controls / mechanisms which have to be operated in the starting process shall be within easy reach of the operator. A day oil tank constructed from a minimum 1.6 mm thick MS sheet of 200 liters capacity shall be provided as per the engine manufacturer's guidelines.
- **6.5** A high-torque D.C. motor charged by battery shall initiate the automatic start of the diesel engine. The battery shall hold adequate retainable charge to provide the starting of the diesel engine. Starting power will be supplied from storage batteries. The battery capacity shall be adequate for ten consecutive starts without recharging with a cold engine under full compression. The battery shall be lead-acid type of 12V, 180 Ah capacity.
- **6.6** The battery banks shall be used for no purpose other than starting the engine and shall be fully charged at all times with provision for trickle & boost chargers. After the start of the engine, the charger shall be disconnected, and the battery will be fed from the engine dynamo.
- **6.7** The engine shall have a speed control device (Governor) which will control the speed under all conditions of load. The governor shall be suitable for operation without an external power supply.
- **6.8** The engine shall possess an adjustable governor to regulate engine speed within a range of 10% between shutoff and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.
- **6.9** The governor shall have an over-speed shutdown device to shut down 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.
- **6.10** The diesel engine shall be cooled by a Heat Exchanger, and the Contractor shall make arrangements for a continuous supply of cooling water.
- **6.11** The engine shall be mounted on a base plate of fabricated steel construction. Adequate access shall be provided to the big end and main bearings, camshaft and governor drives, water jackets etc.
- **6.12** The engine shall have a base plate made from M.S. sections. There shall be reasonable space at the big end, camshaft, water jackets, governor drives, and main bearings.
- **6.13** The engine shall be provided with intake and discharge ductwork, inlet filter and silencer, outlet muffler, expansion joints, dampers etc. as necessary for efficient operation. Intake air shall be taken from inside the building in which the engine is located, but the exhaust shall be discharged into the open air.
- **6.14** The diesel engine shall be provided with adequate instrumentation. The gauges etc. as required are provided for in the Engine Panel.

7.0 Diesel Pump Panel Technical Specifications

- **7.1** The Panel shall consist of the following sub-systems:
    - **7.1.1 Engine Starting System:** It shall be provided with a Lead Acid battery of minimum 180 Ah capacity to provide adequate throttle for starting.

- **7.1.2 Engine Instruments and Control Panel:** It shall be complete with required connections and comprise:
  - Inlet and outlet water temperature gauge (dial type)
  - Lubrication oil pressure gauge
  - Lubrication oil temperature gauge
  - Automatic Start/Stop Device
  - Manual Start / Stop Switch by means of Push Buttons
  - Start, Stop, and Failure Control Device
  - Start key for manual starting
  - Stop Push Button for manual stopping of engine
  - Starting failure indication by lamp and Horn Unit
  - Engine temperature control with failure indication by red lamp
  - Engine temperature 'very high' indication by audio alarm and automatic stopping of engine
  - Engine 'set in operation' indication by green lamp
  - Mains supply 'available' indicated by yellow lamp
  - Push Button for Audio Alarm reset
  - Push Button for Failure Indication by lamps
  - The Panel shall also have an Auto / Manual / Test / Off Selector Switch.

8.0 Fire Hydrants and Hose Reels

- **8.1** Hydrants shall be provided internally and externally as shown on the drawings. Internal hydrants shall be provided at each landing of an escape staircase and additionally depending on the floor area as shown on drawings. The landing valve shall be a single-headed gunmetal valve with 63 mm diameter outlets and 80 mm inlet conforming to IS 5290-1969. The landing valve shall have a flanged inlet and instantaneous type outlets, and be mounted at 1.0 m above the floor level. Instantaneous outlets for the hydrants shall be of a standard pattern approved and suitable for 63 mm diameter fire brigade hoses. Wherever necessary, a pressure reducing orifice plate shall be provided so as to limit the pressure to 3.5 kg/cm² or any other rating as required by the Local Fire Authority.
- **8.2** Each landing valve shall have a hose reel cabinet as shown on drawings containing:
  - **a)** Landing valve with single 63 mm diameter outlet and 80 mm diameter inlet.
  - **b)** The first-aid hose reel shall be provided with 30 m long, 25 mm nominal bore (NB), high-pressure, double-braided rubber hose conforming to IS 444 & IS 884. The hose reel shall be complete with a 25 mm gunmetal/bronze ball valve, Aluminum Nozzle ,hose guide, swinging wall mounting bracket, and 25 mm diameter SS 304 stainless steel shut-off nozzle capable of delivering both jet and spray patterns. The complete hose reel assembly shall be suitable for manual firefighting applications and shall be tested for the specified working pressure.
  - **c)** 2 Nos. 15.0 Meter long 63 mm diameter Reinforced Rubber Lined (RRL) hoses with gunmetal I.S. marked instantaneous couplings.
  - **d)** One gunmetal branch pipe.
- **8.3** The First Aid Hose shall conform to IS 884-1969 and be wound on a heavy-duty circular hose reel with a bracket. The hose shall be permanently connected on one end to the Wet Riser through a 25 mm Ball Valve with necessary hose adapter and a gunmetal nozzle at the other end.
- **8.4** Hoses shall be in two lengths of 15.0 m each, of RRL type with instantaneous couplings, neatly rolled into bundles and held in position with steel brackets. Hoses shall be tested and certified by the manufacturer to withstand an internal water pressure of not less than 35 kg/cm² without bursting. The hose shall also withstand a working pressure of 7 kg/cm² without leakage.
- **8.5** The hose cabinet shall be fabricated from 2.0 mm thick SS 304 stainless steel sheet with a satin/matte finish. The cabinet shall be of robust construction and provided with double-leaf

hinged doors fitted with 4 mm thick clear toughened glass for easy visibility of the equipment. The cabinet shall have suitable openings for the riser main and shall be provided with necessary brackets and supports for securely mounting all internal firefighting equipment. The cabinet shall be complete with a lock-and-key arrangement and shall be suitable for wall mounting or recessed installation, as specified in the drawings. All exposed edges shall be smooth and free from sharp burrs, and the complete assembly shall be corrosion-resistant and suitable for long-term indoor or outdoor service conditions.

- **8.6** External hydrants shall be as per IS 5290 with handwheel control and an 80 mm diameter pipe stand post. Hydrants shall be located at least 2 m away from and within 15 m from the building wall.
- **8.7** Each external hydrant shall be provided with a hose cabinet containing 2 x 15 m 63 mm diameter RRL hoses with couplings. The cabinet shall contain a branch pipe and nozzle. The cabinet shall be 900 mm x 600 mm x 400 mm, fabricated out of 2 mm mild steel sheet duly rust-inhibited through a process of degreasing, phosphating etc. The cabinet shall receive two coats of red oxide primer, inside and outside, before 2 coats of final painting of approved shade. The cabinet shall be wall-mounted or free-standing with its own steel legs depending on the site conditions, as shown on drawings and as approved.
- **8.8** The fire brigade connection shall consist of a two/three/four-headed (as specified in BOQ) 63 mm diameter gunmetal outlet system with built-in check valves and drain plugs connected to a 150 mm diameter outlet connection to the water reservoir or to the hydrant main. The fire brigade collecting head shall conform to IS 904-1965.

9.0 Testing & Commissioning

- **9.1** The Jockey & fire pump starting and stopping parameters shall be tested by opening the test valve and recording values as furnished below:
  - **1) Jockey Pump Start/Stop:**
    - System pressure at start-up: 5.0 kg/cm²
    - System pressure at stop: 7.0 kg/cm²
    - Time elapsed from start to stop: 2 Seconds
  - **2) Hydrant Pump Start:**
    - System pressure at start-up: 4.0 kg/cm²
  - **3) Diesel Engine Pump Start:**
    - System pressure at start-up: 3.0 kg/cm²
- **9.2** Maintained system pressure while discharging the landing valve at the highest point:
  - **a)** Pump end: 7.0 kg/cm²
  - **b)** Highest outlet: 3.5 kg/cm²
  - **c)** Intermediate points: 5.0 kg/cm²

10.0 Mode of Measurement

- **10.1** Hydrant pump with mounting frame, excluding concrete foundation, shall be measured per unit.
- **10.2** Jockey pumps shall be measured the same as the hydrant pump.
- **10.3** Instrument panel with pressure gauges, pressure switches, control piping etc. shall be measured as one unit.
- **10.4** Control cabling from the pressure gauge panel to the respective starters shall be measured in running meters and paid at unit rates.

SECTION III: PIPING FOR FIRE FIGHTING SYSTEM

1.0 Scope

- **1.1** The scope of work covers supply, fabrication, laying, testing, painting and commissioning of the entire piping system for the firefighting installation, i.e., fire hydrant and sprinkler systems.

2.0 Piping

2.1 External Piping

- **2.1.1** Unless otherwise specified, all external fire-fighting pipes shall be Class C (Heavy Class) galvanized iron (GI) pipes conforming to IS 1239 (Part 1). The piping shall be installed using heavy-duty galvanized malleable cast iron (MCI) screwed fittings conforming to IS 1879. Flanged connections shall be provided at all valves, pumps, hydrants, strainers, and other equipment to facilitate installation, inspection, and maintenance. All flanges shall conform to IS 6392 and shall be of the screwed type. The flanges shall be pressure-rated for 2.0 N/mm² (20 bar / PN 20) and shall be complete with suitable EPDM/neoprene gaskets, galvanized high-tensile nuts, bolts, and washers to ensure leak-proof joints.
- **2.1.2** Black mild steel pipes, when laid underground, shall be protected against corrosion by two coats of hot bitumen and a 2 mm thick wrapping of Pypkote. Fittings shall be weldable wrought iron, suitable for butt welding, and 10% of the welded joints shall be radiographically tested and found in order. The welded joints shall be randomly selected for testing in consultation with the Engineer-in-Charge. All flanges shall be slip-on welded type to IS 6392 with a 3 mm fiber-reinforced Teflon gasket and rated for 2.0 N/mm².
- **2.1.3** Underground mains shall be laid not less than 750 mm below the ground level and shall be at least 2 m away from the building face, supported on concrete pedestals at every 3.5 m and held on with galvanized iron clamps. Concrete thrust anchors shall be provided at all bends and tees as shown on drawings and as directed. All excavation for pipe laying shall be carried out with sufficient width for making proper joints. Backfilling shall be done only after the piping is hydrostatically pressure tested. Piping shall be constantly kept clean until tested.
- **2.1.4** All valves shall be housed in brick masonry chambers over a 150 mm cement concrete (1:3:6) foundation. The brick walls of the chamber shall be plastered inside and outside with 20 mm cement sand plaster (1:4) with a floating coat of neat cement. Chambers shall be 650 mm x 650 mm clear for depths up to 1200 mm and 1000 mm x 1000 mm for depths beyond. Each chamber shall have a cast iron surface box approved by the Engineer-in-Charge.
- **2.1.5** Piping laid above ground shall be supported on cement concrete (1:2:4) pedestals raising the bottom of the pipe at least 150 mm over the ground level and held to the pedestals with galvanized clamps. Pedestals shall be made at 3.0 m center-to-center as shown on drawings. Cement concrete (1:2:4) thrust anchors shall be provided at all tee-off points and changes of direction as shown on drawings and as required. Pipes laid on walls and ceilings shall have galvanized steel brackets.

2.2 Internal Piping

- **2.2.1** All internal pipes shall be, unless otherwise specified, heavy quality mild steel tubes to IS 1239 using wrought steel heavy-duty screwed fittings. Flanges shall be provided to mate with valves and other equipment and shall conform to IS 6392. Flanges shall be of the screwed type and rated for 2.0 N/mm².
- **2.2.2** Valves shall be suitable for external piping configurations.
- **2.2.3** All pipes shall be of approved make and best quality without rust marks. Pipes and fittings shall be fixed in a manner that provides easy accessibility for repair and maintenance, and shall not

cause obstruction in shafts, passages etc. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat, workmanlike manner. Pipes shall be securely fixed to walls and ceilings by suitable supports at the intervals specified. Only approved types of anchor fasteners shall be used for RCC ceilings and walls.

- **2.2.4** All pipes shall be adequately supported from ceilings or walls through structural supports fabricated from mild steel structural elements (e.g., rods, channels, angles, and flats) generally as shown on drawings. Fasteners shall be shear-type anchor fasteners in concrete walls and ceilings, and wrought steel spikes of at least 75 mm length in brick walls. All pipe supports shall be painted with 1 coat of red oxide primer and two coats of black enamel paint.
- **2.2.5** All low point loops in the piping shall be provided with 25 mm Ball Valves with rising spindles for draining the system. All valves shall have screwed brass caps. Likewise, 25 mm gunmetal air vents shall be provided at all high point loops to prevent air-locking.
- **2.2.6** All piping shall have flanged joints at about 25 m intervals to facilitate easy maintenance.

3.0 Pipe Jointing

- **3.1** All pipes shall be provided with threaded joints up to 50 mm diameter and welded joints for pipes above 50 mm diameter. Holdtite or equivalent compound shall be used for sealing.
- **3.2** All welded joints shall be tested by radiography test where specified.
- **3.3** Joints between CI and GI pipes shall be made by providing a suitable flanged tail or socket piece and an MS flange on the GI pipe. Flanges shall have the appropriate number of holes and shall be fastened with nuts, bolts, and a 1.5 mm thick compressed asbestos gasket.

4.0 Valves and Accessories

4.1 Gate Valves

- **4.1.1** Sluice / Gate valves shall be used for isolation of flow in pipelines. For sizes up to 65 mm, gate valves shall be outside screw rising spindle type and shall be as per IS 778 Class I and Class II, as applicable. For sizes 80 mm to 300 mm, gate valves shall be as per IS 780, PN=1.0 and shall be of inside screw, non-rising type, and cast iron double-flanged.
- **4.1.2** Gate valves shall be provided with a handwheel, draining arrangement of seat valve, and locking facility (as required). Gate valves shall have a back-seating bush to facilitate gland renewal during full open conditions.
- **4.1.3** The body, bonnet, stuffing box, cap, and handwheel shall be of cast iron to IS 210, Grade FG 200 / 260. The non-rising spindle shall be of solid forged high-tensile brass or carbon steel to AISI 304 construction. The body seating and wedge ring shall be of solid leaded gunmetal. The bonnet gasket shall be of high-quality rubber.
- **4.1.4** The valve shall be PN 1.0 rated but shall withstand tests up to 20 kg/cm². The ends shall be flanged. The batch number of the valve shall be punched on the top of the flange. The spindle shall be of a removable type and easily rotated.

4.2 Pressure Switch

- **4.2.1** Pressure switches shall be employed for starting and shutting down operations of pumps automatically, dictated by line pressure. The pressure switch shall be of the diaphragm type. It shall be suitable for line pressures up to 15 kg/cm². The scale range for cut-in and cut-out shall be from 0 to 10 kg/cm².
- **4.2.2** The switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP66 water and environmental protection.
- **4.2.3** The enclosure shall be of aluminum and the pressure element and wetted parts shall be of stainless steel. The switch shall be snap-acting type with 1 number N.O. / N.C. contact.

4.3 Air Vessel

- **4.3.1** The air vessel shall be fabricated from 6 mm thick, 300 mm x 1000 mm MS plate suitable for 7 kg/cm² working pressure complete with air release valve, safety valve, pressure gauge etc. as required. The air vessel shall be of continuous welded construction and painted with two coats of Postal Red enamel outside over a coat of primer, and epoxy paint inside.

4.4 Pressure Vessel

- **4.4.1** A Pressure Vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counteracting pressure surges whenever the pumping set comes into operation. It shall normally be partly full of water, with the remaining volume filled with air under compression when the system is in normal operation.
- **4.4.2** The pressure vessel shall be fabricated from 8–10 mm thick MS plate with dished ends and suitable supporting legs. It shall be provided with a 50 mm diameter flanged connection from the pump, one 25 mm drain with a ball valve, one water level gauge, and 25 mm sockets for pressure switches. The pressure vessel shall be hydraulically tested as required.
- **4.4.3** The Pressure Vessel shall be used for Hydrant Systems. Pressure switches shall be mounted on the drain end of each vessel. The vessel shall also be provided with an air release valve mounted at the top.

4.5 Pressure Gauge

- **4.5.1** The Pressure Gauge shall be constructed of die-cast aluminum and stove enameled. It shall be weatherproof with an IP55 enclosure. It shall be a stainless steel Bourdon tube type Pressure Gauge with a scale range from 0 to 16 kg/cm² and constructed as per IS 3624. Each pressure gauge shall have a siphon tube connection. The shut-off arrangement shall be managed via a Ball Valve.

4.6 Ball Valve

- **4.6.1** The Ball Valve shall be made from die-cast brass and tested to 14 kg/cm² pressure.
- **4.6.2** The valve shall be internally threaded to receive pipe connections.
- **4.6.3** The ball shall be made from brass, machined to a perfect round shape, and subsequently chrome plated. The seat of the valve body, bonnet gasket, and gland packing shall be of Teflon (PTFE).
- **4.6.4** The handle shall be of chrome-plated steel with a PVC jacket. The handle shall indicate the direction of 'open' and 'closed' positions. The gap between the ball and the Teflon packing shall be sealed to prevent water seeping up to 14 kg/cm² pressure.
- **4.6.5** The handle shall also be provided with a lug to keep the movement of the ball valve within 90 degrees. The lever shall be operated smoothly and without application of unnecessary force.

4.7 Non-Return Valve

- **4.7.1** Non-return valves shall be cast iron spring action swing check type. An arrow mark indicating the direction of flow shall be marked on the body of the valve. The valve shall bear IS 5312 certification.
- **4.7.2** The valve shall consist of a cast iron body and cover. The internal flap in the direction of water flow shall be of cast iron and hinged by a hinge pin of high-tensile brass or stainless steel. Cast iron parts shall conform to IS 210, Grade 200 / 260.

- **4.7.3** The gasket shall be of high-quality rubber and the flap seat ring of leaded gunmetal to BS 1400 LG 2C. At high pressure water flows, the flapper shall seat tightly against the seat. The valve shall be capable of handling pressures up to 15 kg/cm².

4.8 Butterfly Valve

- **4.8.1** The Butterfly Valve shall be suitable for waterworks and tested to a minimum of 16 kg/cm² pressure. The valves shall fulfill the requirements of AWWA C504, API 609, and MSS-SP-67.
- **4.8.2** The body shall be of cast iron to IS 210 in a circular shape and of high strength to take the minimum water pressure of 10 kg/cm². The disc shall be heavy-duty cast iron with an anti-corrosive epoxy or nickel coating.
- **4.8.3** The valve seat shall be of high-grade elastomeric or nitrile rubber. The valve in the closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long service life and shall not degrade under continuous water pressure. The shaft shall be of EN 8 grade carbon steel.
- **4.8.4** The valve shall be fitted between two pipe flanges. The valve edge rubber shall project outwards such that it wedges within the pipe flanges to prevent leakage.
- **4.8.5** The valves shall be supplied with a manual gear-operated opening/closing system managed by a lever.

5.0 Pipe Supports

All pipes, whether horizontal or vertical, shall be suitably supported using galvanized mild steel clamps/clevis hangers manufactured by M/s Hitech Support (India) Pvt Ltd or an approved equivalent product of good quality.

5.1 Vertical Pipes

- **5.1.1** Pipes running in vertical shafts shall be supported by galvanized mild steel rigid clamps fixed to the wall with anchor bolts and studs.
- **5.1.2** When the horizontal distance between the center lines of two adjacent pipes is less than 300 mm, a powder-coated HITECH or equivalent rail shall be fixed to the wall, and the pipes shall be independently clamped to the rail with 'U' bolt clamps.

5.2 Horizontal Pipes

- **5.2.1** Pipes running horizontally shall be supported from structural beams/slabs by using appropriate galvanized M.S. pipe clevis hangers.
- **5.2.2** The spacing of supports shall be executed according to the following schedule:

Pipe Type & Internal Dia (mm)	**Max Spacing (mm)**	**CI Spun Pipes Internal Dia (mm)**	**Max Spacing (mm)**
GI/MS - 15 mm	1800	75 mm to 150 mm	2700

Pipe Type & Internal Dia (mm)	Max Spacing (mm)	CI Spun Pipes Internal Dia (mm)	Max Spacing (mm)
GI/MS - 20, 25 mm	2400	200 mm to 250 mm	3000
GI/MS - 32 mm	2700	300 mm	3600
GI/MS - 40, 50 mm	3000	—	—
GI/MS - 65, 80 mm	3600	—	—
GI/MS - 100 mm	4000	—	—
GI/MS - 150 mm	4500	—	—

- **5.2.3** Supports for horizontal piping longer than 15 m in a single stretch shall be provided with swivel clamps. Otherwise, the clamps shall be universal clamps or rigid clamps as required by the project engineer.

5.3 Fixing of Clamps/Rails

All clamps, rails, and accessories shall be fixed to the structure (beam, slab, walls etc.) by using approved good quality anchor fasteners of appropriate size.

6.0 Painting

- **6.1** All exposed piping for firefighting shall be distinctly painted 'Fire Red', Shade 536 to IS 5-1978. Pipes shall first receive two coats of red oxide primer uniformly applied, followed by two coats of oil paint. All pipe supports shall be painted black as specified for supports & clamps.
- **6.2 Painting Schedule:** Equipment and piping shall be painted in accordance with the following color code matrix:

Equipment / System Component	Color Designation	Distinguishing Mark / Standard

Equipment / System Component	Color Designation	Distinguishing Mark / Standard
a) Pump motors	Fire Red	Shade No. 536 to IS 5-1978
b) Internal piping	Fire Red	Shade No. 536 to IS 5-1978
c) Landing valves & Hose reel cabinets	Fire Red	Shade No. 536 to IS 5-1978
d) External Hydrants	Fire Red	Shade No. 536 to IS 5-1978
e) Fire brigade connection	Fire Red	Shade No. 536 to IS 5-1978
f) Priming tank	Fire Red	Shade No. 536 to IS 5-1978
g) Air vessel	Fire Red	Shade No. 536 to IS 5-1978
h) Electric panels	Black & Red	Standard Manufacturer Coding
i) Fire Alarm Panel	Black & Red	Standard Manufacturer Coding
j) Repeater panel	Black & Red	Standard Manufacturer Coding
k) Break Glass Unit	Fire Red	Standard Finish

Equipment / System Component	Color Designation	Distinguishing Mark / Standard
l) Hooters/Speakers	Fire Red	Standard Finish
m) Sprinkler pipes	Fire Red	Shade No. 536 to IS 5-1978

- **6.3 Execution:** All surfaces to be painted shall be thoroughly cleaned with a wire brush to completely remove rust and other extraneous substances. Over the cleaned surfaces, one coat of red oxide primer shall be applied, completely covering the exposed surfaces. A finishing coat of enamel paint shall be applied one day after the prime coat, after ensuring that the paint is dry. The second finishing coat shall be done before the installation is handed over, following approval from the Engineer-in-Charge.

7.0 Testing & Commissioning

All piping after installation shall be tested for a hydrostatic test pressure of 10.5 kg/cm² or 1.5 times the working pressure (whichever is less) maintained for 24 hours. All joints and valves shall be checked for leaks, rectified, and retested. During testing, all valves except drain & air valves shall be kept fully open.

8.0 Makes of Materials

For approved makes of materials, refer directly to the compiled list of approved makes of materials attached to the tender documents.

9.0 Mode of Measurement

- **9.1** All external piping shall be measured along the center line of the pipe and paid per unit length, inclusive of:
  - **9.1.1** All pipes & fittings.
  - **9.1.2** Bituminous coating application.
- **9.2** All internal piping shall be measured similarly but shall factor in and include the pipe supports and clamps within the baseline assessment.
- **9.3** All valves, air valves, and drain valves together with flanges or tailpieces shall be measured per unit.
- **9.4** All excavation, concrete supports, and thrust blocks shall be measured as per drawings and paid for per cubic meter (cum).
- **9.5** The cost of pipe supports described above forms an integral part of the rate quoted for piping; no extra amount shall be payable on this account. All painting works shall form part of the baseline cost of equipment piping; no separate payment shall be admissible.

SECTION IV: SPRINKLER SYSTEM

1.0 Pendent Type Sprinkler Head

- **1.1** Sprinkler heads shall be of the quartzoid bulb type consisting of the bulb, valve assembly, yoke, and deflector. The sprinkler shall be of an approved make and type with 15 mm nominal diameter outlets.
- **1.2** The bulb shall be made of corrosion-free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches 68°C / 79°C (Quick response 3 mm bulb).
- **1.3** The nominal bore shall be 15 mm diameter and the color of the liquid within the bulb shall be Red / Yellow.
- **1.4** The Sprinkler head shall be approved by UL / FM.

2.0 Upright Type Sprinkler Head

- **2.1** Upright sprinkler heads shall be similar to Pendent type sprinkler heads in material construction and performance, but designed to throw water droplets upwards in an umbrella fashion to cool the underside of the ceiling and extinguish any fire involving combustibles on the floor below.
- **2.2** The Sprinkler head shall be approved by UL / FM. The nominal bore shall be 15 mm diameter and the color of the liquid shall be red (Quick response 3 mm bulb).
- **2.3** Upright Sprinkler heads shall be utilized in lower and upper basement parking areas and above false ceilings.

3.0 Side Wall Type Sprinkler Head

- **3.1** Side wall sprinkler heads shall be similar to Pendent type heads in material construction and performance, but explicitly designed to project water droplets horizontally.
- **3.2** The Sprinkler head shall be approved by UL / FM. The nominal bore shall be 15 mm diameter and the color of the liquid shall be red (Quick response 3 mm bulb).
- **3.3** Side wall sprinkler heads shall be used in staircase landings and along building ramps.

4.0 Water Curtain Sprinkler System

- **4.1** For basement car parking, compartmentation can be achieved via a fire barrier, water curtain nozzles (K-23), or a combination thereof. An automatic deluge system comprising a deluge valve, piping, and nozzles shall be utilized to zone the compartment in case of a water curtain system application.
- **4.2** In the case of a water curtain configuration, the existing water storage capacity shall be supplemented by the water demand required for water curtain nozzles for a duration of 60 minutes, considering the largest compartment's perimeter out of all compartments of the car parking layout in any of the basements.
- **4.3** The water supply for the water curtain nozzles shall be routed through an independent electric pump of adequate capacity (flow and head) with dedicated piping/riser runs for the water supply to the nozzles.
- **4.4** The water curtain shall be operated automatically by the actuation of a flow switch serving the sprinkler system.
- **4.5 Installation Guidelines:** Spray nozzles must be handled with due care. For best results, storage and subsequent shipments must be maintained in original packaging only. Nozzles which are visibly damaged should not be installed. Use Teflon tape or an approved soft thread sealant on the

male threads of the nozzle. The nozzles must be tightened cleanly into the fitting. Excessive tightening torque may result in serious damage to nozzle arms and the deflector, which can critically affect the spray pattern and operational performance. Spray nozzles are to be installed in accordance with the latest published standards of the NFPA or similar organizations, alongside provisional governmental codes, ordinances, and standards.

- **4.6 Inspection, Tests & Maintenance:** It is recommended that the window spray system be inspected regularly by authorized technical personnel. Nozzles must be checked for atmospheric degradation, external and internal obstructions, or blockages. Nozzles should be cleaned or replaced if required. The system must be operated with optimum water flow at least twice a year or as per the provisions of NFPA / local authority regulations. The owner is solely responsible for maintaining the water spray system and its components to guarantee proper operation when called upon.

5.0 Powder Coated Sprinkler with Twin Plate Rosette

- **5.1** Most areas below false ceilings shall be provided with a powder-coated pendent sprinkler with a twin plate sliding rosette. The sprinkler head shall be technically identical to the Pendent type described above, but powder-coated white. The sprinkler head shall be provided with a double-plate powder-coated rosette that seals the gap between the false ceiling and the sprinkler head structure.
- **5.2** The maximum allowable adjustment shall be 12 mm. The lower part shall feature flared ends that fit tightly into the upper piece.
- **5.3** The Sprinkler head shall be approved by UL / FM. The nominal bore shall be 15 mm diameter and the color of the liquid shall be red.

6.0 Installation Control Valve (ICV) for Sprinklers

- **6.1** The Installation Control Valve shall be a 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 manufactured from bronze conforming to IS 318, Grade LTB II. Sealing to the seat shall be achieved via a neoprene gasket. The hinge pins and ball shall be fabricated from stainless steel.
- **6.2** The valve shall be vertically mounted, and the direction of water travel shall be clearly indicated on the surface. It shall be rated to 12 kg/cm² and tested to withstand 25 kg/cm² pressure.
- **6.3** A bypass check valve shall be fitted to adjust for minor and slow variations in water pressure for system balancing, preventing false alarms.
- **6.4** The valve shall be provided with a Test Control Box housing a lever to test and operate the ICV. A brass strainer shall be provided at the point of water supply to the alarm gong. A Retarding Chamber shall also be provided to balance water pressure variations during line surges. Each Installation Control Valve shall have two sets of Pressure Gauges with brass ball valve type shut-off mechanisms.
- **6.5** A mechanically operated Water Motor Alarm shall be provided, driven by the discharge of water through an impeller. The drive bearing shall be weather-resistant. A strainer shall be provided online before the nozzle. The Gong piece shall be constructed from bronze to IS 318, Grade LTB II, with a base of cast iron. The Motor Housing, Rotor, and Housing Cover shall be pressure die-cast aluminum.

7.0 Flow Switch

- **7.1** The flow switch shall have a paddle made of flexible material sized to fit within the pipe bore. The terminal box shall be mounted over the paddle/pipe assembly through a connecting socket. The switch shall be potential-free, providing either N.O. or N.C. positions as required. The switch

must be capable of tripping and making/breaking contact upon the operation of a single sprinkler head. The terminal box shall contain connections for wiring directly to the Annunciation Panel. The seat shall be stainless steel, and the Flow Switch assembly shall possess IP55 protection.

- **7.2** The Flow Switch shall work at a minimum flow rate of 100 LPM. Further, it shall feature an adjustable 'Retard' mechanism to compensate for minor line leakages or intermittent pressure flows.

8.0 Makes of Materials

For approved component makes, refer directly to the compiled list of approved makes of materials attached to the specifications.

9.0 Mode of Measurement

- **9.1** Sprinkler heads, including internal supports and clamps for fixing, shall be measured per unit.
- **9.2** All alarm control valves including drain valves, butterfly valves, and associated accessories together with flanges/tailpieces shall be measured per unit.
- **9.3** All floor control valves including drain valves, butterfly valves, sight glasses, and associated accessories together with flanges/tailpieces shall be measured per unit.

SECTION V: PORTABLE FIRE EXTINGUISHERS & EXIT SIGNAGES

1.0 Scope

- **1.1** The scope of work covers the supply and installation of portable fire extinguishers. The following types are envisaged in these specifications and provided as shown in the project schedule of portable fire extinguishers:
  - Dry Powder Extinguisher
  - Carbon-Dioxide (CO_2) Extinguisher
  - Mono Ammonium Phosphate (MAP) Extinguisher
  - Water Expelling Type Extinguisher

2.0 Standards

- **2.1** The following standards, rules, and regulations shall be strictly applicable:
  - **2.1.1** Fire Protection Manual of the Tariff Advisory Committee (TAC), Fire Insurance Association of India.
  - **2.1.2** IS 2190:2024 - Selection, installation, and maintenance of portable first-aid fire extinguishers — Code of practice.
  - **2.1.3** National Building Code (NBC) 2026 guidelines.
  - **2.1.4** IS 2171: Portable fire extinguishers, dry powder type.
  - **2.1.5** IS 2878: Portable fire extinguishers, carbon-dioxide type.
  - **2.1.6** Rules of the Local Fire Brigade / Fire Authority.
  - **2.1.7** IS 15683:2018 - ABC Dry Chemical Powder (stored pressure type) filled with 90% MAP.
- **2.2** All reference standards cited shall mean the latest updated edition with up-to-date amendments.

3.0 Extinguishers Technical Specifications

3.1 ABC Dry Chemical Powder Type (Stored Pressure)

- **3.1.1** Extinguishers shall be of **2 kg, 4 kg, 6 kg and 9 kg** capacity and shall be of the **stored-pressure type**, suitable for extinguishing **Class A, B & C fires** and electrically energized equipment. The extinguisher shall conform to **IS 15683 (Latest Revision)** and shall bear the **BIS Certification Mark (ISI Mark).**
- **3.1.2** The cylinder shall be manufactured from high-quality deep-drawn steel and hydraulically tested as per **IS 15683**. The cylinder shall be provided with a durable polyester powder-coated external finish in **Signal Red (RAL 3000)** or approved equivalent.
- **3.1.3** The extinguisher shall be charged with **ABC Dry Chemical Powder (Mono Ammonium Phosphate based)** having a minimum **55% MAP content** (or as specified), pressurized with dry nitrogen. The extinguisher shall provide the minimum fire rating specified in IS 15683 for the respective capacity.
- **3.1.4** The operating head shall be of corrosion-resistant brass or high-strength aluminum alloy fitted with a squeeze-grip operating lever, safety pin with tamper seal, pressure gauge indicating serviceable pressure, and a discharge hose with nozzle. The discharge hose shall be flexible, abrasion-resistant, and suitable for the extinguisher capacity.
- **3.1.5** The extinguisher shall be capable of discharging not less than **85% of its contents** and shall meet the minimum discharge performance requirements prescribed in **IS 15683**.
- **3.1.6** All metallic components shall be adequately protected against corrosion. Internal surfaces shall be treated with corrosion-resistant coating where required, and external surfaces shall be finished with high-quality epoxy/polyester powder coating suitable for indoor and outdoor service conditions.
- **3.1.7** Each extinguisher shall be supplied complete with wall mounting bracket, operating instructions permanently printed on the cylinder, safety pin, tamper seal, pressure gauge, manufacturer's identification, date of manufacture, serial number, and BIS certification marking.

3.2 Carbon Dioxide Type

- **3.2.1** Extinguishers shall be rated for 2.0 kg and 4.5 kg by weight of carbon dioxide gas unless stated otherwise. The contents shall be filled with a filling ratio not exceeding 0.667.
- **3.2.2** The body shall be a high-pressure steel cylinder manufactured according to IS 2872 and formally approved by the Chief Controller of Explosives (CCOE/PESO).
- **3.2.3** The discharge head shall be simple and safe to operate, conforming to IS 3224, with a safety release mechanism conforming to IS 5903 set to 18.0 to 20.0 N/mm². A siphon tube of copper or PVC shall be fitted internally. A non-conducting discharge horn and a high-pressure hose (rated for 27.5 N/mm² working pressure) shall be fitted to each extinguisher.
- **3.2.4** The discharge system shall be designed to expel 95% of the chemical contents in continuous discharge according to the following durations:
  - **2.0 kg Capacity:** 8 – 18 Seconds
  - **3.0 kg Capacity:** 10 – 20 Seconds
  - **4.5 kg Capacity:** 10 – 24 Seconds

3.3 Mono Ammonium Phosphate (MAP) Type

- **3.3.1** The capacities envisaged are 2 kg & 5 kg. The nominal filling pressure shall be $0.95 \pm 0.055 \text{ N/mm}^2$.
- **3.3.2** The body shall be cylindrical in shape and made of cold-rolled carbon steel Grade D/DD or hot-rolled steel plate with radiographically tested welded construction. Plate thickness shall conform strictly to IS 11108.

- **3.3.3** The discharge valve mechanism shall be a simple, safe squeeze-grip valve. Units of 4.5 kg and above capacity shall have a high-pressure (0.5 N/mm²) hose and non-conducting horn, and shall be provided with an integrated pressure gauge. 95% of the chemical contents shall be discharged according to the following criteria:
    - **2.00 kg Capacity:** Time: 8 – 16 sec | Throw: 2 m
    - **6.00 kg Capacity:** Time: 15 – 24 sec | Throw: 4 m
- **3.3.4** The internal and external components and surfaces shall be treated for anti-corrosion matching the protocols specified for dry powder type extinguishers.

3.4 Water CO_2Fire Extinguisher

- **3.4.1** The extinguishing medium shall be primarily water stored under normal pressure, with discharge effected by the release of carbon dioxide gas from an integrated 60-gram CO_2 gas cylinder.
- **3.4.2** The capacity of the water cylinder when filled shall be 9 liters $\pm$ 5%.
- **3.4.3** The cylinder shall be fabricated from MS sheet, welded cleanly at the seams, with the dish and dome being of identical material thickness. The neck shall be externally threaded with leaded tin bronze.
- **3.4.4** The cap, cartridge holder, knob, discharge fittings, and plunger shall be made of leaded tin bronze, with the plunger spring fabricated from stainless steel. The discharge tube shall be of braided nylon, 10 mm in diameter and 600 mm in length, ending in a brass nozzle.
- **3.4.5** The extinguisher shall be treated for anti-corrosion internally and externally, and finished in fire red enamel paint. The cylinder and gas cartridge shall be IS marked. The extinguisher body shall be hydraulically tested to 25 bar pressure for 2 minutes and bear the IS 940 mark.
- **3.4.6** Modular stored pressure automatic type units shall be provided where noted in the drawings/BOQ

3.5. Automatic Fire Extinguisher Modular

- Ceiling mounted modular Automatic Fire Extingusher.

3.6 General Requirements for Extinguishers

- **3.5.1** All extinguishers shall be standard production items approved by the Tariff Advisory Committee and the Local Fire Authority, manufactured and tested in accordance with relevant Indian Standards. All markings and test results shall be permanently stamped or marked on the body.
- **3.5.2** All extinguishers shall feature a structurally designed galvanized steel carrying handle and be supplied with a matching heavy-duty wall-mounting bracket.

4.0 Illumination Signs and Exit Signage

- **4.1** The illuminated signs shall display the letters "FIRE EXIT" or "NO FIRE EXIT" painted in red on a 6 mm thick white Perspex sheet, serving as the front face of a sheet steel enclosure constructed with a minimum 1.5 mm thick sheet. The MS box shall be finished with white powder coating. The Perspex sheet shall be backlit with a rechargeable, maintenance-free sealed battery integral with a built-in battery charging circuit.
- **4.2** The battery backup system shall operate independently of the mains supply in the event of a power failure. The batteries shall possess an adequate rating to support the illumination of the signage for a minimum period of 1 hour without mains power. The dimensions of the illuminated signs shall be 450 mm length and 225 mm height with 100 mm high lettering. They shall be

suitable for surface, recessed, or ceiling-hung mounting as required, including all arrangements for suspension, cutting/chasing, and making good.

- **4.3** Supply and install all required Fire & Life safety signages including Fire Extinguisher location text, MCP, HYDRANT, REFUGE AREA, Assembly Area, Pump Room, Floor Number signs for all staircases, Emergency Window markers, and "In case of emergency do not use lift" etc warnings as per NBC 2026, IS 12349, and IS 9457 standards.

5.0 Mode of Measurement

- **5.1** Each extinguisher with its mounting bracket shall be measured and paid for per unit.
- **5.2** Exit signages with mounting plates shall be measured per square inch or per unit as specified in the BOQ and paid for accordingly.
- **5.3** For component makes, refer directly to the list of approved makes.

SECTION VI: ELECTRICAL WORK

1.0 Scope

- **1.1** The scope of this section comprises the fabrication, supply, erection, testing, and commissioning of electric panels, wiring, and earthing of all equipment components and accessories, including the supply, installation, and wiring of remote-mounted push-button stations.
- **1.2** All electrical cables, terminations, wires, and installation accessories are included in the Scope of Work. The main incoming power cable from the main distribution board will be supplied and laid by another external agency.

2.0 General Technical Directives

- **2.1** All electrical works shall be carried out strictly in accordance with the specifications of the CPWD, the Indian Electricity Act 1910, and the Indian Electricity Rules 1956, as amended up to date.

3.0 Construction Features of Panels

- **3.1** The control panel shall be a metal-enclosed sheet steel cubicle, indoor type, floor-mounting/wall-mounting type as per BS 5486 Part 1 and IEC 439-1. The control panel shall be totally enclosed, completely dust and vermin-proof. Neoprene gaskets shall be provided between all adjacent units and beneath covers to render the joints dust-proof. Control panels shall be arranged in multi-tier formations. All doors and covers shall feature sealing and padlocking arrangements. All mild steel sheets used in the construction of control panels shall be a minimum of 2 mm thick, folded and braced to provide a rigid support for all internal components. Joints in sheet metal shall be continuous seam welded, with all slag ground off and welding pits wiped smooth.
- **3.2** All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal provided with hank nuts. Self-threading screws shall not be used in panel construction. A base channel of 75 mm x 40 mm x 5 mm thickness shall be provided at the bottom. A minimum clear space of 250 mm between the top of the channel and the bottom-most component unit shall be maintained.
- **3.3** Control panels shall be of adequate size with a provision of 10% spare space to accommodate future additional switchgear expansion. Knockout holes of appropriate size and number shall be provided in the control panels for incoming and outgoing conduits/cables. All equipment such as

meters and indicating lamps shall be located adjacent to their associated switchgear unit to ensure a neat, symmetrical arrangement. Facility shall be provided for the termination of cables from both above and below the control panel. Where cables enter from below, cable boxes shall be fitted at the rear and arranged in tiers to facilitate connections. Clamps shall be provided to support the weight of the cables. All incoming and outgoing feeders shall be brought out to a terminal block of adequate size at a suitable location inside the panel. All wiring inside the control panel shall be color-coded and labeled with plastic ferrules for identification. Circuit diagrams showing the arrangement of circuits shall be pasted on the inside of the panel door, covered with a transparent plastic sheet.

4.0 Circuit Compartments

- **4.1** Each circuit breaker, contactor, and relay shall be housed in a separate, completely enclosed compartment. Sheet steel hinged lockable doors shall be mechanically interlocked with the breaker in the 'ON' position. Safety interlocks shall be provided to prevent the breaker or contactor from being drawn out when the unit is energized. Instruments and indicating lamps shall not be mounted on the moveable panel compartment doors. Sheet steel barriers shall be provided between the tiers in each vertical section.

5.0 Instrument Accommodation

- **5.1** Separate and adequate compartments shall be provided to accommodate instruments, indicating lamps, control contactors, and control fuses. These shall be completely accessible for testing and maintenance without danger of accidental contact with live parts of the main circuit breaker and busbars.

6.0 Busbars and Busbar Connections

- **6.1** The main busbars and interconnections shall be fabricated from rectangular cross-section aluminum, rated for full load current for phase busbars and half-rated current for the neutral busbar, and shall be extensible on either side. The bars and interconnections shall be fully insulated with PVC heat-shrinkable sleeves and color-coded. All busbars shall be supported on unbreakable, non-hygroscopic insulated SMC/DMC type supports at regular intervals not exceeding 400 mm to withstand short-circuit forces. Busbars provided in separate chambers of main control panels shall be connected by clamping; no holes shall be drilled in main busbars unless absolutely necessary, in which case extra cross-section area shall be provided to compensate for the drilled holes.
- **6.2** All busbar connections in smaller control panels shall be executed by drilling holes and connecting with brass bolts and nuts, with additional cross-section provided to cover the loss of area.
- **6.3** Connections between the busbar and breaker, and between the breaker and contactor, shall be managed through copper strips of proper size to carry full rated current, insulated with colored PVC heat-shrinkable sleeves.

7.0 Terminals

- **7.1** Outgoing terminals and neutral links shall be routed to a terminal block suitably located within the control panel. Current transformers for instruments, metering, and protection shall be securely mounted directly on the terminal blocks. Separate cable compartments shall be provided for incoming and outgoing cables.

8.0 Wireways

- **8.1** A horizontal wireway with screwed covers shall be provided at the top of the panel assembly to route the connecting control wiring between different vertical sections.

9.0 Cable Compartments

- **9.1** Cable compartments/alleys of adequate size shall be provided in the control panels for easy termination of all incoming and outgoing cables entering from the bottom or top, utilizing detachable gland plates with proper knockouts. Adequate DMC supports shall be provided in cable compartments to support the weight of cables.

10.0 Electrical Component Materials Specifications

- **a) Rotary Switches:** Switches up to 60 Amps shall be rotary type with compact, robust construction, built up from one or more stacks with contacts and a positioning mechanism. Terminals shall be shrouded with insulation. Rotary switches shall be backed up with molded type HRC fuse fittings of appropriate rating.
- **b) Selector Switches:** Rated capacity selector switches shall be provided in control panels to allow choice of operating equipment in selective modes (Auto/Manual/Test).
- **c) Molded Case Circuit Breakers (MCCB):** MCCBs shall be quick-make, quick-break, preferably utilizing a double-break contact system, complete with an arc extinguishing device and independent manual tripping features with mechanical ON, OFF, and TRIP indications. A manual trip button shall be provided. The MCCB enclosure shall be a heat-resistant, flame-retardant insulating molded case. All MCCBs shall be capable of defined variable overload adjustment.
- **d) Switches:** Switches beyond 60 Amps shall be panel-mounted double-break type suitable for load-break duty, featuring quick-make and quick-break action. Switch contacts shall be silver-plated and backed up with HRC fuses of appropriate rating. Handle mechanisms shall be located at the front of the panel.
- **e) HRC Fuses:** Fuses shall be High Rupturing Capacity type rated for not less than 20 MVA at 415 Volts. The backup fuse rating for each motor/equipment shall be selected so that the fuse does not operate during the starting surge of the motor.
- **f) Starters:** Each motor shall be provided with a starter of suitable rating. Direct-On-Line (DOL) starters shall be provided for motors up to 10 HP. Operating coils of contactors shall be suitable for $220/415 \text{ V} \pm 10\%$ AC, 50 Hz supply systems. The contactor shall trip out when voltage drops to 90% of the rated voltage.
- **g) Overload Relays:** Contactors shall be provided with a three-element, positive-acting, ambient-temperature-compensated, time-lagged, hand-reset type thermal overload relay with adjustable current settings.
- **h) Current Transformers:** Current Transformers (CTs) shall be of Accuracy Class 1.0 and possess a suitable VA burden for the operation of connected meters and protection relays.
- **i) Single Phase Preventer:** Single phase preventers shall be provided for all starters. The preventer shall actuate and trip the starter when the supply voltage drops below 90% of the rated voltage or upon the loss of any phase.
- **j) Indicating Lamps and Metering:** All meters shall be flush-mounted, draw-out type. Indicating lamps shall be neon or LED type of low VA burden. Each phase indicating lamp shall be backed up with a 2 Amp fuse.
- **k) Push Button Stations:** Stations shall be provided for manual starting and stopping of motors/equipment. Red and Green color push buttons shall be provided for stop and start operations respectively. Push buttons shall be suitable for panel mounting and accessible from the front without opening the compartment door.

- **m) Cables:** M.V. power cables shall be PVC insulated aluminum conductor armored cables suitable for laying in trenches, ducts, or on cable trays.
- **n) Wires:** 650/1100 Volt grade PVC insulated copper conductor wires routed in conduits shall be utilized for control wiring.

11.0 Cable Laying

- **11.1** Easy access to all cables shall be provided to allow cable withdrawal or replacement in the future. Where more than one cable runs along a route, proper physical spacing shall be provided to minimize thermal loss in current-carrying capacity, complete with necessary saddling and clamping.

12.0 Earthing

- **12.1** The earthing of the Motor Control Center (MCC) and allied equipment shall be executed as per BIS Specifications and tied into the main electrical earth bus. Loop earthing shall be carried out using G.I. or Copper strips/wires as specified.

13.0 Painting for Panels

- **13.1** All sheet steel work shall undergo a rigorous seven-tank pre-treatment process followed by powder coating paint finishing of an approved shade.

14.0 Cable Work Detail Requirements

14.1 General Directives

- **14.1.1** MV cables shall be supplied, inspected, laid, tested, and commissioned in accordance with drawings, specifications, relevant Indian Standards, and manufacturer instructions. Cables shall be delivered to the site in original drums with the manufacturer's name clearly marked.

14.2 Material

- **14.2.1** MV power cables of 660/1100V grade shall be PVC insulated, aluminum conductor, armored cable conforming to IS 1554 (Part 1). Cables shall be 3.5 or 4 core type of sizes specified in the BOQ. MV control cables shall be PVC insulated, copper conductor, armored type.

14.3 Storage and Handling

- **14.3.1** All cables shall be inspected upon receipt at the site to check for any transit damage. Cable drums shall be stored on a well-drained, hard surface (preferably concrete) so that drums do not sink into the ground. Periodic rolling of drums through 90° shall be executed once every 3 months. Rolling must be done in the direction of the arrow marked on the drum.
- **14.3.2** It must be ensured that both ends of the cable are properly sealed with watertight caps to prevent ingress of moisture. Sufficient ventilation between cable drums shall be ensured during storage. Drums must always rest vertically on their flanges and never flat on their sides.
- **14.3.3** When transferring cable from one drum to another, the barrel of the new drum shall have a diameter not less than that of the original drum. Cables shall not be bent sharply. The minimum safe bending radius for PVC cables shall be taken as 12 times the overall diameter of the cable. At joints and terminations, the bending radius of individual cores shall not be less than 15 times their overall diameter. Cables with kinks or apparent defects like defective armoring shall be rejected.

14.4 Installation Methods and Routes

- **14.4.1** Cable installations including necessary joints shall be carried out in accordance with IS 1255. No straight-through joints shall be permitted in the system unless expressly authorized. Before cable laying is undertaken, the exact route shall be approved by the Architect/Owner representative. Cable runs shall generally follow fixed developments such as roads or footpaths with proper offsets to render future maintenance easy. Corrosive soils and areas surrounding sewage lines shall be strictly avoided.
- **14.4.2** Cables of different voltages, as well as power and control cables, shall be kept in separate trenches with adequate separation. Where space is restricted, MV cables shall be laid above HV cables. Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

14.5 Way Leave

- **14.5.1** The Contractor is responsible for obtaining way leave approvals for the cable route from appropriate authorities including Drainage, Public Health, Water Works, Telephones, Telegraphs, and private property owners under Section 12/51 of the Indian Electricity Act. Power and communication cables shall cross at right angles, maintaining a minimum clearance of 60 cm.

14.6 Detailed Laying Methodologies

- **14.6.1 Laying in Pipes/Closed Ducts:** At road crossings, building entries, or paved areas, cables shall be laid in GI or Hume pipes (spun reinforced concrete pipes). Hume pipes shall be laid over a 10 cm thick cement concrete (1:5:10) bed, followed by complete concrete embedding. The top surface of the pipes shall be at a minimum depth of 1.0 meter from ground level when laid under roads. Pipe ends shall be completely smoothened to prevent injury to the cable and sloped downwards away from buildings, sealed using a waterproof and fireproof compound.
- **14.6.2 Laying on Cable Trays:** Overhead cables shall be supported on suspended ladder or perforated trays as indicated in shop drawings. The Contractor shall supply all installation accessories including bends, tees, reducers, coupler plates, trefoil clamps, and structural steel supports (channels, angles, flats, rods).
- **14.6.3 Termination & Testing:** Brass single compression glands shall be provided for all MV cable terminations. All 650/1100 Volt grade cables shall be tested with a 500V or 2500V megger prior to laying and insulation resistance values between conductors and to earth must be recorded and verified.

15.0 Cable Trays Material Specifications

- **15.1** Prefabricated ladder-type cable trays and associated accessories (tees, bends, elbows, reducers) shall be fabricated from 12 Gauge (2.6 mm thick) mild steel. Perforated cable trays and accessories shall be fabricated from 14 Gauge (2.0 mm thick) mild steel.
- **15.2** Cable trays, accessories, and matching covers shall be painted with one shop coat of red oxide zinc chromate primer followed by two coats of Aluminum alkyd paint finish.

16.0 Detailed Earthing Specifications

16.1 General Bonding

- **16.1.1** All non-current carrying metal parts of the electrical installation shall be bonded together and connected to an efficient earthing system conforming to Indian Electricity Rules 1956 and IS

3043. Every switch, lighting fixture, and 5 Amp outlet shall be earthed using a 1.5 mm² insulated copper conductor. Computer workstations shall be earthed with a 2.5 mm² insulated copper wire. Separate independent copper earth pits shall be provided for UPS, EPABX, and Networking equipment. Structural raceways shall not be used as a grounding conductor.

16.2 Connections and Protection from Corrosion

- **16.2.1** Main earthing conductors shall run from the main Power Distribution Board (PDB) directly to the earthing pits. The electrical resistance of metallic enclosures measured between the earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit immediate circuit breaker operation and shall never exceed 1.0 Ohm.
- **16.2.2** Connections between copper and galvanized steel equipment shall be executed on a vertical face and heavily protected with paint and anti-corrosive grease. Only copper fixing clamps shall be used to secure copper earth conductors.

16.3 Earthing Station Configuration Options

- **16.3.1 Plate Electrode Earthing:** Electrode shall consist of a Copper plate ($600\text{ mm} \times 600\text{ mm} \times 3\text{ mm}$) or a G.I. plate ($600\text{ mm} \times 600\text{ mm} \times 6.3\text{ mm}$) buried set vertically not less than 3 meters below ground level, clear of foundations by at least 2 meters. The plate shall be surrounded with a 150 mm thick layer of charcoal dust and salt mixture. A 20 mm diameter GI watering pipe with a mesh funnel shall run to ground level, housed in a $300\text{ mm} \times 300\text{ mm} \times 300\text{ mm}$ masonry chamber fitted with a cast iron cover and test links.
- **16.3.2 Pipe Electrode Earthing:** Electrode shall consist of a medium class, 40 mm diameter, 4.5-meter long continuous G.I. pipe. The pipe bottom shall be tapered and provided with 12 mm diameter holes drilled at intervals not less than 7.5 cm up to a length of 2 meters from the bottom. The pipe shall be set vertically, surrounded by a 150 mm charcoal and salt layer, and complete with a watering funnel and a matching $300\text{ mm} \times 300\text{ mm} \times 300\text{ mm}$ masonry chamber with CI cover and test links.
- **16.3.3 Artificial Treatment of Soil:** If the measured earth resistance exceeds the parameters specified, the soil resistivity immediately surrounding the electrodes shall be artificially reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt, and soft coke or charcoal in approved proportions. The total resistance to earth for each system shall not exceed 1.0 Ohm.

SECTION VII: COMMISSIONING & GUARANTEE

1.0 Baseline Scope of Work

- **1.1** All works under this section shall be executed by the Contractor without any additional cost, with rates quoted in the tender deemed fully inclusive of commissioning requirements. The Contractor shall provide all specialized tools, instruments, metering, and testing devices required.
- **1.2** On award of work, the Contractor shall submit a detailed methodology giving specific testing and gauging parameters for evaluating the performance of all equipment. At least five working days' notice in writing shall be given to the inspecting parties prior to performing any final system test.
- **1.3 System Balancing:** The Contractor shall ensure proper hydraulic balancing of the entire system by regulating flow rates via calculated valve operations. Permanent Tee connections (complete with plugs) shall be installed in water supply lines for ease of mounting pressure gauges, temperature gauges, and rotameters. The Contractor shall supply all required gauges and

rotameters for system commissioning. Three copies of all final test results shall be formally compiled and submitted in A4 size formats within two weeks of test completions.

2.0 Pre-Commissioning Protocols

- **2.1** Prior to start-up and hydrostatic testing, the Contractor shall flush out the entire piping installation. Pumping systems shall be flushed and drained at least once to eliminate contaminating debris. All strainers shall be inspected and thoroughly cleaned or replaced.
- **2.2** Check all structural clamps, supports, and hangers. Operate every valve on the system to verify smooth mechanical operation before applying final hydrostatic pressure as detailed in the technical specifications. If any leakages are discovered, the system shall be immediately isolated, repaired, and re-tested.

3.0 Final Acceptance Tests

- **3.1** Prior to the issuance of the formal Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with the program agreed upon with the Architect. Should the results show that systems or equipment fail to perform to the efficiencies or capacities detailed in this specification, the Contractor shall adjust, modify, or replace the defective equipment at their own expense. All official tests required by local statutory codes must be completed successfully before hand-over.

4.0 Rejection of Installation / Plant

- **4.1** Any item of the plant, system, or component which fails to comply with the requirements of this technical specification at any stage of manufacture, test, erection, or commissioning may be rejected by the Architect either in whole or in part. Corrective modification work shall be executed by the Contractor at his own expense.

5.0 Warranty and Handover

- **5.1** The Contractor shall warrant that all plant, materials, equipment supplied, and workmanship performed are free from defects of any nature for the duration of the specified defects liability period before formal handover to the Owner.
- **5.2 Documentation Hand-Over:** All testing and commissioning reports, operations and maintenance (O&M) manuals, warranty certificates, and statutory approval documents shall be compiled and handed over to the Owner's site representative.

SECTION VIII: LIST OF STANDARD CODES

S.No.	IS Code Number	Description of Standard
1.	IS 780:1984	Specification for sluice valve for water works purposes (6th revision) (50 to 300 mm size) (with Amendment 3)

S.No.	IS Code Number	Description of Standard
2.	IS 13095:1991	Butterfly valves for general purposes
3.	IS 5312 (Part 1):1984	Swing check type reflux valves (non-return valve): Part 1 Single door pattern (1st revision) (with Amendment 1)
4.	IS 884:1985	First-aid hose reel for fire fighting
5.	IS 901:1988	Coupling double male and female instantaneous pattern for fire fighting
6.	IS 903:1984	Fire hose delivery coupling, branch pipe, nozzles and nozzle spanners
7.	NBC-SP-7-1983 Part IV	National Building Code of India, Amendment No. 3
8.	CPWD Part-V	Central Public Works Department Specifications Part-V, Wet Riser System for Fire Fighting (1985), Govt. of India
9.	IS 3844-1989	Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises
10.	IS 2190:1992	Code of practice for selection and maintenance of first-aid fire extinguishers
11.	IS 6382:1984	Code of practice for design and installation of fixed carbon dioxide fire extinguishing systems

S.No.	IS Code Number	Description of Standard
12.	SP 35 (S&T)-1987	Handbook on water supply & drainage by Bureau of Indian Standards (BIS)
13.	NBC Section IX	National Building Code (Section IX)
14.	IS 933-1989	Specifications for portable chemical foam fire extinguishers

17.0 APPROVE MAKES

FIRE SUPRESSION		
A	2 Kg capacity Novec 1230 /FK-5-1-12.	Siemens /Minimax / SIEX / Arkonex/ Pyroquench/ Defender
B	4 Kg capacity Novec 1230 /FK-5-1-12.	Siemens /Minimax / SIEX / Arkonex/ Pyroquench/ Defender
C	Pneumatic Heat detection tube.	Siemens /Minimax / SIEX/ Arkonex/ Pyroquench/ Defender
D	Master Control Unit.	Siemens /Minimax / SIEX / Arkonex/ Pyroquench/ Defender
E	120 ltrs capacity CCOE	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus
F	Electric Control Head.	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus
G	Pressure Switches	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus
H	Nozzles	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus
I	Rack - Wall Mount / Floor mounting	Poweride/MTS/Rittal/APC/APW
J	Flexible discharge Hose route	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus
K	warning signage	Tyco/Ansul/Hygood/Pyroquench/Hampton/Janus

L	M.S. Seamless pipes	TATA/Jindal/MST
M	2 Zone Conventional Gas Release panel	Tyco/Ansul/Ravel/Hochiki/Hampton/Janus
N	conventional type multi sensors	Tyco/Ansul/Ravel/Hochiki/Hampton/Janus
O	conventional type sounder/ hooter cum strobe	Tyco/Ansul/Ravel/Hochiki/Hampton/Janus
P	manual release switch	Tyco/Ansul/Ravel/Hochiki/Hampton/Janus
Q	abort switch	Tyco/Ansul/Ravel/Hochiki/Hampton/Janus
R	aspiration type smoke detector	Tyco/Xtralis/Honeywell/Hochiki/Hampton/Janus/ Securiton
U	Aspiration pipe	Arkonex/Pyroquench/Defender

LIST OF MAKES OF FIRE FIGHTING WORKS

1	2 Kg capacity Novec 1230 /FK-5-1-12	kalpex/Honeywell /Arkonex/ ASES/Pyroquench /Defender
2	4 Kg capacity Novec 1230 /FK-5-1-12	kalpex/Honeywell /Arkonex/ Pyroquench/ASES/ /Defender
2	Pneumatic Heat detection tube	Honeywell /Arkonex/ ASES/Pyroquench /Defender
3	Master Control Unit	Honeywell /Arkonex/ Pyroquench /Defender
4	120 ltrs capacity CCOE	Honeywell /Tyco/Ansul/ASES/ /Hygood / Pyroquench
5	Electric Control Head.	Honeywell /Tyco/Ansul/ Hygood /Pyroquench
6	Pressure Switches	Honeywell /Tyco /Ansul/Hygood /Pyroquench
7	Nozzles	Honeywell /Tyco /Ansul/Hygood /Pyroquench
8	Flexible discharge Hose route	Tyco/Ansul/Hygood /Pyroquench

9	warning signage	Prolite / Tyco/ Ansul/ Hygood /Pyroquench
10	M.S. Seamless pipes	TATA/Jindal/Sail
11	Gas Release panel	Honeywell /Siemens/Bosch
12	manual release switch	System Sensor / Tyco/ Ansul/Ravel/ Hochiki
13	abort switch	Tyco/Ansul/Ravel/Hochiki
14	Pipes (MS/GI)	Tata /Jindal (Hisar)/SAIL
15	RRL Hose	Newage /kalpex /Omex /Minimax/safe gaurd
16	First AID hose Reel	kalpex/ Newage / Minimax /safe guard/Omex
17	Single headed Hydrant valves, four-way Fire Brigade inlet &shut off	Newage / Minimax / Superex/safe guard/Omex
18	Sprinkler	kalpex/HD/TYCO/Viking/(UL Aproved)
19	CI Sluice valve, non returnvalve , Ball Valve, Butter fly valve & strainer	Honeywell / Kirloskar /Sant /castle/Zoloto
20	Pressure switch	Indfoss / Switzer / Danfoss
21	Pressure Gauges	Fiebig / H-Guru / switzer/Danfos
22	Fire Pump/ drinking water pump/ de –watering pump	Mather & Platt / Kirloskar / KSB / Grundfos/Wilo/Armstrong
23	Motor	Ksb /ABB / Siemens / Crompton Greaves / Kirloskar
24	Paint Primer	Asian / Jenson Nicholson / Berger
25	Flow sches	System sensor/plotter/jhonson control/h-guru
26	Rubber Gaskets	C I C / Varuna/ Danfoss
27	Branch pipe	kalpex/Newage/Bombay / Superex
28	Vibration Elimenetor Connector/Metalic Expansion Bellows	Resisto Flex/EasyFlex /D.wren
29	Fire Existinguiser	Cease fire/life guard/ kalpex/suprex/omex/minimax
30	Installation Control Valve	kalpex/HD fire/Newage/Safex/Tyco

31	First Aid Hose Drum	kalpex/Ashok / Newage Bombay / Eversafe
32	Battery	Exide/Amaraja /lumminus
33	Air vessel	kalpex/LG /chawla fire/Getech
34	Signaling Line Circuit Cable	RR kabel/ polycab/Finolex
35	Fire Fighting Pump	Kilosker/ksb/willo/Lubi