

TECHNICAL SPECIFICATIONS ON FIRE FIGHTING SYSTEMS

REVISION– R0

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PROJECT

JSW ACADEMIC BLOCK – NLSIU

CLIENT

NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

ARCHITECT

HUNDREDHANDS



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TECHNICAL SPECIFICATION PREPARATION & REVIEW

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TABLE OF CONTENTS

FIRE PROTECTION & DETECTION SYSTEM

SECTION-1: GENERAL SCOPE OF WORK

SECTION-2: DESIGN PHILOSOPHY

SECTION-3: WATER STORAGE & PUMP ROOM

SECTION-4: FIRE HYDRANT SYSTEM

SECTION-5: AUTOMATIC SPRINKLER SYSTEM

SECTION-6: PORTABLE FIRE EXTINGUISHERS & SIGNAGES

SECTION-7: FIRE ALARM SYSTEM

SECTION-8: PUBLIC ADDRESS SYSTEM

SECTION-9: TWO-WAY TALK BACK SYSTEM

SECTION-1: GENERAL SCOPE OF WORKS

National law school of India university requests for a quote from reputed firefighting contractors to carryout fire & life safety system works for their proposed **JSW ACADEMIC BLOCK-NLSIU, Bengaluru.**

Work to be extended & performed under this contract consists of supply, installation, testing, commissioning & warranty of below listed systems & equipment's which are further described in other sections of this specification:

- a) Fire pump room equipment's
- b) Fire hydrant system comprising of landing valves (Internal & external)
- c) Automatic sprinkler system
- d) Fire extinguishers & safety signage's
- e) Fire alarm system
- f) Public address system
- g) Two-way talk back system

STATUTORY REGULATIONS, BYE-LAWS & APPROVALS:

- Works, equipment & materials forming part of this contract shall comply in all aspects with any relevant statutory regulation, bye-laws & other regulations currently in force. In addition, current rules & requirements of the following bodies (latest edition) shall be complied with.

NBC	National Building Code of India 2016, Part – 4, Fire & Life Safety
IS-1239 / IS-3589	Standard for MS / GI pipes
API 600 / BS 5163 IS778 / 780 / 2906	Standard for ball, globe & check valves.
BS-5155 / IS: 13095	Standard for C.I. butterfly valve.
IS: 15105	Standard for Automatic Sprinkler.

IS: 884	Standard for first aid hose reel system.
IS: 903	Standard for fire hose couplings.
IS-5290	Standard for landing (hydrant) valves.
IS-636	Standard for RRL type synthetic, jacketed fire hose.
IS 2189	Standard for fire alarm & public address system
IS-5	Standard for painting.
IS-2189	Standard for fire alarm system.
IS- 2190	Standard for portable fire extinguishers
IS-694	Standard for PVC insulated cables for voltages up to & including 1100V
IS-9968 (Pt-1)	Rubber insulated braided wire.
IS-1554 (Pt-1)	PVC insulated cables.
Shade No.536 of IS-5	Paint shade for main equipment's/accessories.

Note: All IS codes latest year of publication/ revision to be considered.

- Contractor shall obtain & complete all notices required by the above authorities as necessary & shall obtain all consents necessary for the various works to be executed & shall pay all fees in connection therewith
- Installation shall be in conformity with bye-laws as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship than those required by any of above regulations & standards, then this specification shall take precedence over said regulations & standards. Wherever specifications & drawings require something that may conflict with regulations, regulations shall govern. This shall be confirmed from employer/ consultants before execution
- Contractor shall obtain & complete all notices required by authorities as necessary & shall obtain all consents necessary for various works to be executed & shall pay all fees in connection therewith
- All codes, acts, standards & regulations shall be of latest published edition unless otherwise stated
- Contractor shall bear the cost for all necessary arrangement to obtain approval for fittings, valves, equipment's & materials from the relevant authority if required
- **General note: Required water shall be arranged by fire contractor for following activities like Hydro test, flushing and commissioning of entire Fire protection system.**

NOISE LEVEL & SOUND CONTROL:

1. All installed equipment's shall be reasonably quiet in operation. Preference will be given to equipment operating at low noise level
2. Vibration isolators shall be installed where necessary so as to eliminate transmission of vibration
3. During initial testing operation, contractor is to correct for any undue noise & to make any adjustment, modifications necessary for this purpose
4. Noise/sound level in various areas due to operation of equipment shall not exceed recommended standard by local authority or IS codes whichever is the lowest

PERMITS & FEES:

Contractor shall procure all permits & pay all fees, charges incurred in connection with this sub-contract.

SPECIFICATION:

1. This specification is intended to set out in general outline minimum requirements & standards of installation for various units of equipment & work it covers. Provision set out or claim made in the successful tender which are in excess of or improved upon basic requirements of specification shall unless otherwise determined by client become part of requirements of specification whether or not they are subsequently incorporated in addenda to the specification
2. Client shall be the sole judge of what constitute an improvement upon or exceeds requirements of the specification
3. Specification shall be read in conjunction with tender drawings (as per drawing schedule) & are intended to be mutually explanatory & complementary to one another. All works & specifications called for shall be fully executed & complied within totality
4. Entire system shall be engineered by contractor based on guidelines furnished in the specification, various codes / standards with good engineering practice
5. This specification also includes supply, erection & commissioning of spares as specified along with special tools & tackles
6. Specification also makes it obligatory to contractor for arranging & obtaining necessary clearance / approval from all local / statutory authorities
7. It is not intent to completely specify all the details of design & construction herein. Nevertheless the equipment & installation shall confirm to high standard of engineering, design & workmanship in all aspects & shall be capable of performing continuous satisfactory operation & acceptable to the purchaser as well as to the various statutory authorities. In case of any violation of above contract, purchaser reserves right to change / reject / modify the equipment / system during detail engineering
8. Supplies & services to be covered under this tender specification & the conditions thereof are detailed in subsequent sections of the specification. In case of conflict among various sections, subsections, documents, drawings the same shall be referred to purchaser whose decision shall be final & binding to the bidder.

MATERIALS & WORKMANSHIP:

1. Unless expressed to contrary all materials & equipment supplied by contractor shall comply with applicable Indian standards (I.S) or various codes or specifications with good practice as approved by Indian standards
2. Where a standard is referred to, that standard shall be latest published edition thereof, unless otherwise stated
3. All materials & equipment's supplied shall be new & of best type for each particular purpose & of first quality with regard to design, manufacture & performance
4. Equipment & materials shall be suitably designed & constructed for safe, proper & continuous operation under all conditions described or implied in this specification without undue heat, strain, vibration, corrosion or other operating difficulties
5. Unless otherwise specified, equipment & materials within scope of this specification shall be of a standard proven design. Design incorporating components which may be considered prototype in nature will not be accepted
6. Parts subject to wear, corrosion or other deterioration or requiring any adjustment, inspection or repair shall be accessible & capable of reasonably convenient for removal, replacement & repair. All such parts shall be of suitable material for keeping maintenance to a minimum
7. Equipment shall be designed to permit replacement of parts & ease of access during inspection, maintenance & repair

8. Vibration, noise, mechanical & thermal stresses, susceptibility to corrosion & erosion shall not be greater than with similar plant of first-class design & workmanship operating under similar conditions
9. All works shall be carried out in accordance with the best engineering practice by experienced tradesmen of appropriate grades & as per Indian Standards
10. Where disagreement occur between drawings & specification or within either document itself, the item or arrangement of better quality, greater quantities, or higher cost shall be deemed to be included in this - contract

SHOP DRAWINGS:

1. Upon award of tender, contractor shall immediately prepare & submit the shop drawings to consultants for approval. All plant & equipment layout drawings showing full details within designated time by project team. Detailed calculations shall be submitted where applicable. All equipment & materials proposed shall be submitted for approval
2. Shop drawings shall cover complete details of the following but not limited to
 - a. Dimensions of panels, equipment's & accessories which include detailed drawings of superstructure construction necessary to finalize the superstructure requirements
 - b. Equipment room layout showing all clearances for operating, servicing & sufficient details to ensure that provision made in working drawings shall be adequate & satisfactory
 - c. Control equipment, system wiring, control diagrams & power requirements
 - d. Hangers & supports
 - e. Foundation details
 - f. Chases, openings in walls, floors, roof slabs & beams
 - g. Piping, ducting & electrical cable runs
3. These layout drawings shall be generally based on consultant GFC drawings, modified only as required to suit specified materials & equipment to be provided, to fit in with latest available information on building construction details & requirements of other services & equipment and also to incorporate any improvements proposed by the contractor
4. Drawings shall be drawn by fully qualified draughtsman with experience in relevant installation works. Drawings shall be done in ink, & shall be neat & clearly legible
5. All drawings shall be drawn in same scale as the consultant drawings. Details shall be drawn in larger scales. Wherever applicable, legends/symbols shall be followed as per consultant drawings & all other symbols shall confirm to acceptable local drafting practice
6. Legend for all symbols shall be shown on every drawing
7. Initial submission of shop drawings shall be in soft copy format. Hard copies shall be submitted after the approval
8. Upon approval of the drawings, the contractor shall deliver four (4) copies of each approved drawing to the project engineer for the purpose of contract administration
9. All drawings shall be submitted in ample time for review & approval by the project engineer & no work shall be carried out until such drawings are approved
10. Inspection of shop & working drawings is not to be considered as a guarantee of measurements or building conditions. Where drawings are inspected & approved by the project engineer, such approval does not in any way relieve the contractor neither from his responsibility nor from the necessity of furnishing material or performing work required by drawings & specification which shall in the event of a dispute, take precedence over shop drawings
11. Schedule for submission of shop drawings shall be submitted for approval not later than 2 weeks after award of the contract

APPROVALS:

All protection systems shall have proper listing and/or approval from IS standards.

Fire Alarm Control Panel shall meet modular listing requirements of EN listed, Inc. Each sub-assembly, including all printed circuits. It shall also include appropriate EN listed modular label. This includes all printed circuit board assemblies, power supplies & enclosure parts. Systems that do not include modular labels may require to be returned to the factory for system upgrades & are not acceptable

PROGRAM:

1. Contractor shall immediately upon award of contract liaise with the client to prepare & submit detailed time schedule for the progress of work to the project engineer for approval
2. Schedule shall be submitted with ample time for review & approval by the consultant. Contractor shall keep a buffer period of not less than 2 weeks for the consultant to study the schedule for approval
3. Schedule shall be based generally on client's program & shall end on the same contract dates
4. Schedule shall also indicate the dates of;
 - a) Submission of shop drawings
 - b) Delivery of materials
 - c) Installation program & cleaning up, etc
 - d) Testing, Commissioning & completion

SITE MANAGEMENT & SUPERVISION:

- 1) Contractor shall keep upon the works on a full-time basis in adequate numbers the following English-speaking key site personnel
 - a) One project site engineer with a minimum tertiary educational qualifications & at least 5 years of project experience in similar installation in building
 - b) Two site supervisors with a minimum qualification & have been involved in similar project with at least three years of experience
- 2) In addition to the above contractor shall arrange for services of a professional engineer/licensed worker experienced in this class of contract, who will be required to devote sufficient time to ensure
 - a) Whole work to be satisfactorily designed to comply with minimum requirements of specification & is suitable for its purpose
 - b) Work of contractor & his sub-contractors are properly coordinated & integrated with that of the contractor
- 3) Site management & supervision team shall be full time on site & not be replaced or absent for more than a week without the prior consent of the project manager. Team must be able to receive & carry out instruction by the project manager & must be able to make all decision pertaining to the project
- 4) Tenderer shall provide an organization chart showing full & detailed list of his site management & supervisory staff & their resume of the project for approval of project manager at the time of tender
- 5) Site management/supervision team as specified here & the provision of such organization chart & the project manager's approval thereof shall not limit the contractor's responsibility & obligation in respect of adequate staffing on the site. In the event that additional staff is considered necessary to properly & effectively manage & supervise the execution of works, contractor shall provide them at no extra cost to the clients
- 6) It is mandatory to capture that all skilled workers certificate shall be shown to respective Client engineer prior to start of works.

- 7) For welding activity - Sample welding shall be performed by skilled worker in presence of Client engineer and that sample weld piece required to be tested under laboratory, upon receiving of successful result/report of welder contractor can proceed with work.

AS INSTALLED DRAWINGS & MANUALS:

1. Prior to completion of works & not later than date of practical completion, contractor shall submit to the satisfaction of project manager six (6) hard cover bound sets of comprehensive/non-comprehensive operation & maintenance manuals & data sheets published by the equipment manufacturers, six (6) hard cover bound sets of "As-Installed" drawings & one (1) set of "As-Installed" drawings in polyester film transparency (intermediates) and two (2) sets of "As-Installed" drawings in AutoCAD (latest release) compact discs subject to project managers approval
2. These instruction manuals shall be typed in good quality paper and neatly bound into a manual having rigid covers. A draft shall be approved before final submission
3. Operation manual & as-built drawings shall be bound with hard covers
4. All "As-Installed" single line drawings and control diagram shall be endorsed and signed by the contractor's professional engineer
5. Manuals shall contain & be set out as follows
 - a) Description of system: This section shall simply but clearly describe the operation of system & equipment
 - b) Equipment list: Section shall include all major equipment/components complete with makes, models, serial number with technical catalogues (at least one set to be original & others in legible print)
 - c) Spare parts, Special tools & Equipment list: Include manufacturer's list of all recommended spare parts for replacement and special tools and equipment for maintenance used
 - d) Operational Procedure: This section shall fully described start & stop sequence of operation; program for alternate running of plant to even out wear & testing procedures for all sections of plant, including emergency procedures & breakdown trouble-shooting
 - e) Manufacturer's Handbook: Include Manufacturer's technical literature on all components of the installation, particularly as applying to operation and maintenance. The technical literature shall include all major equipment, control instruments and equipment used and other related materials
 - f) Installation Instruction
 - g) Maintenance & Trouble Shooting Instruction
 - h) Include manufacturer's technical literature on all components of the installation, particularly as applying to operation and maintenance
 - i) Equipment Operation Instruction
 - j) Hang-up Instructions
 - k) Equipment/component Suppliers: This section shall comprise a full list of names, addresses & telephone numbers (including after office hours numbers) of all contractors & suppliers of equipment (local and overseas) incorporated in the installation
 - l) Maintenance & Breakdown Service: This section shall comprise a list of the names and telephone numbers of the company's maintenance & servicing section personnel for normal maintenance & breakdown request
6. In the event of contractor failing to full-fill the aforesaid requirements, project manager shall reserve the right to obtain all of the required operating & maintenance manuals by other means & shall deduct all cost incurred thereof from monies due to the contractor. In addition, project manager shall forfeit the rights of contractor in

relation to further payment & issue of Certificate of Practical Completion will also be withheld until he has so complied accordingly

FIXING TO BUILDING:

1. Suitable metal expansion devices shall be used where plugs are necessary for securing equipment, pipes, conduits and other fittings. Wooden plugs will not be allowed. Holes shall be drilled by electrical/ pneumatic rotary drills wherever possible
2. Any fixing device may on the roof struts shall not be acceptable unless certified by the structural professional engineer and approved by the project manager

METRIFICATION:

All gauges & indicators shall be provided with scales marked in SI units as well as in relevant Imperial units

SAMPLES:

1. Samples to be submitted by the contractor shall be for the following but not limited to;
 - a) Sprinklers
 - b) Extinguisher
 - c) Speakers
 - d) MS/GI Pipe
 - e) Hangers/modular supports/fasteners etc.
 - f) Welded type & threaded type fittings
 - g) MCP
 - h) Hooter cum strobe
2. In addition, contractor shall also submit any other samples as may be required by project manager

IDENTIFICATION & LABELING:

- 1) Complete identification & labeling shall be provided for various sections of the work in accordance with Building Control Division & other relevant authority's requirements & to the approval of consultants & project managers
- 2) Additional requirements as requested by fire safety bureau to suit local conditions shall also be complied with.
- 3) All equipment, valves, etc. shall be clearly & legibly labeled using engraved aluminum plates of minimum dimensions of 75 x 50 x 2 mm thick

WORK BY OTHER CONTRACTORS:

Following works will be provided by other contractors

1. Building Works (Main contractor)
 - a) Openings in floor, wall, beams, partitions for pipe work, ductwork or electrical cabling & making good around same with approved fire rated fillings. Fire contractor to share details of openings in the slabs, beams prior to slab casting
 - b) Concrete plinths, pads, supports or foundations as required for equipment's
 - c) Masonry/concrete ducts & shafts for pipe work where indicated in the drawings
2. Electrical Works (Electrical Contractor)
 - a) Electrical supply feeders to main fire alarm control panel, public address system, motor control panel in pump room & other equipment terminating with appropriate isolators near to control panels. Control panels being provided by fire protection contractor
 - b) Switched socket outlet next to equipment unless otherwise specified

PROVISION OF WORKS BY OTHER TRADES:

- 1) It shall be the contractor's responsibility to advice, check and confirm that the works listed above are provided to his requirements during the course of building construction. Failure on part of contractor to ensure that any or all of these services are provided will result in the contractor in having to carry out the respective works at his own expense
- 2) Contractor shall liaise closely with all other trades for such provisions & communicate all his requirements well in advance and confirm to the construction program

CO-ORDINATION OF WORK:

- 1) Contractor shall check & ensure that all equipment's provided are suitable for the space allowed. Contractor shall, if necessary, locate these equipment's before the erection of walls & doors. All abortive work arising from failure to comply with the above shall be paid by the contractor
- 2) Contractor shall be responsible for proper & accurate setting out of his work. He shall furnish all necessary information on installation to the employer/architect/consultant & civil contractor for work co-ordination purposes. Contractor shall also obtain information on routes of other services from the civil contractor before commencing any works to any floor of the building. He shall co-operate with the civil contractor & all other contractors on the job & his work shall be suitably pre-planned to ensure proper co-ordination with other contractors
- 3) He shall inform & check with civil contractor on all building works (such as holes, openings, grooves required on floors, walls, etc) that are required to be done as early as possible in order that holes, openings, etc, may be formed as the building work proceeds. Should the contractor neglect to give the civil contractor reasonable notice and full particulars of any building works required to be done, and thereby cause delay or additional expense to be incurred by the civil contractor, the contractor shall be required to indemnify the civil contractor against all charges or additional expense incurred in respect thereof
- 4) He shall inform employer/architect/consultant of any discrepancies in construction details installed on site (e.g. pipe size, etc) as compared with "approved" drawings owing to unforeseen site conditions. Contractor shall bear full cost of rectification if the failure to comply with above clause leads to a malfunction of the system.
- 5) Ceiling pattern as shown in tender drawing is given as a guide only, exact position of ceiling suspended equipment has to be verified on site or good for construction drawings and adjusted, if necessary, without additional cost to the contract

TESTING:

- 1) Contractor shall allow in his tender price for the cost of all acceptance tests required as hereinafter specified or as required by the authorities having jurisdiction over the installation
- 2) **All water & electricity (temporary or permanent supply) used during the testing & commissioning of systems in this contract shall be borne by fire contractor including supply, installation & dismantling of necessary pipe work meters & associated works**
- 3) All pipe works which are to be encased or concealed shall be tested & approved before they are finally enclosed
- 4) Contractor shall give employer/architect/consultant five (5) days' notice of his readiness to carry out acceptance test & shall submit for his approval a complete & detailed schedule of his tests to be carried out

- 5) Before commencement of acceptance tests, contractor shall have brought the installation to a state of practical completion & shall have completed all of his preliminary testing & adjust the equipment to its proper running order
- 6) During the testing period, no modifications, adjustment or other work on the installation shall be carried out without permission of employer/architect/consultant. Should there be any contravention of this requirement, the results of all tests completed may be rejected & a retest ordered
- 7) No acceptance test shall be carried out except in presence of employer/architect/consultant or the representative appointed for the purpose
- 8) Should the installation fail to perform in accordance with the requirements of specification and/or authorities, the employer/architect/consultant may reject whole or any part of it
- 9) Testing period shall form part of the contract period & no extension of time will be granted by reasons of any extension of testing period to permit rectification, modification, adjustment or retesting of installation except where testing has been delayed or retesting has been necessitated by circumstances beyond the control of contractor
- 10) Contractor shall also be required to conduct all tests as & when requested by authorities during the free maintenance & guarantee period

TOOLS & EQUIPMENT:

- 1) A complete set of tools and equipment for maintenance shall be supplied to the approval of the Employer/Architect/Consultant
- 2) Tools & equipment shall be contained in a standing lockable metal cabinet. Two sets of keys shall be provided. Design of cabinet shall be to the approval of Employer/Architect/Consultant.

QUALITY ASSURANCE**1) Manufacturer:**

- a) Manufacturer of extinguishing system hardware & detection components shall have experience in design & manufacture of similar types of detection systems and who refer to similar installations providing satisfactory service
- b) Name of the manufacturer, part numbers and serial numbers shall appear on all major components
- c) All detection devices, components and equipment shall be the products of the same manufacturer
- d) All devices, components and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended

2) Installer:

- a) Installing contractor shall show evidence that company carries sufficient liability & completed operations insurance policy. These limits shall supersede limits required in the general conditions of the specifications

CERTIFICATION BY CONTRACTOR

- 1) On completion of all performance testing as required in the specification, the contractor shall be required to submit all test reports to the Employer/Architect/Consultant for approval prior to acceptance of the installation. The contractor shall also be required to certify in writing to the Employer/Architect/Consultant that the installation is in full compliance with the requirements of the specification and the codes to which they are designed by a Professional Engineer/Licensed Worker
- 2) Contractor shall engage his own Professional Engineer to endorse & submit four (4) sets of original 'Certificate of Supervision' & drawings for the respective installation works one month before system handing over date. All tests & inspections required by the relevant authorities for his installation works for obtaining of NOC of the building shall be carried out by the contractor, if applicable
- 3) Contractor to note that, his tender price shall include all testing requirements
- 4) Certification of practical completion will not be issued unless the clauses as stated above are complied with to the satisfaction of the employer/architect/consultant

OPERATION & MAINTENANCE

Contractor shall train employer's operating personnel in operation & maintenance of systems

MAINTENANCE & GUARANTEE

- 1) Whole of the work to be performed under the contract shall be completed & left in running order to the satisfaction of Purchaser
- 2) Performance of whole installation shall be guaranteed to confirm to the requirements of this specification. The contractor shall, without additional charge replace any works which prove faulty from workmanship or materials and fully maintain the whole installation for a period of one year after the commencement of the Defects Liability Period
- 3) Defects Liability Period shall commence from the date of issuing the certification of practical completion
- 4) During defects liability period contractor shall be responsible for all costs involved in balancing, setting & adjustment of controls & supplying all test equipment & instruments deemed as necessary by employer/consultant. During this period, contractor shall also carry out maintenance work as shown in the schedules

SECTION-2: DESIGN PHILOSOPHY

Fire protection & alarm system for “**Proposed JSW ACADEMIC BLOCK-NLSIU**” shall be designed & installed as per I.S., National Building Code (NBC) 2016 Part IV, life safety standards & detailed specifications as noted above in this document.

CLASSIFICATION OF OCCUPANCY

Proposed building has been classified under educational building under Group “B” Category as per (NBC) 2016 Part IV, life safety standards.

SYSTEMS PROPOSED

Following fire protection systems are proposed for “**Proposed JSW ACADEMIC BLOCK-NLSIU**” project.

1. Fire water storage & pump room equipment's
2. Fire hydrant system comprising of landing valves (Internal & external)
3. Automatic sprinkler system

4. Fire extinguishers & safety signage's
5. Fire alarm system
6. Public address system
7. Two-way talk back system

DESIGN CONSIDERATIONS:

Design considerations for fire sump sizing are as below:

- Hazard classification: Moderate hazard (Basement floor) as per NBC & IS: 15105
- Occupancy: Educational building
- Design Density – 5.0 LPM/M²
- Assumed Maximum Area of Operation (AMAO) - 360Sq.m
- Minimum sprinkler pressure - 0.5bar
- Sprinkler K factor – K80 (5.6)

1. FIRE SUMP CAPACITIES

As per NBC-2016 guidelines, dedicated fire water storage of 50 cum shall be provisioned for every 100 hydrants with one set of pumps.

Based on above parameters, overall fire sump capacity has been arrived as follows & pump room will be placed in basement floor.

Sl. No	Description	Sump capacity	Remarks
01	UG sump for sprinkler /hydrant system	50CUM	Located at master plan level

Over Head Tank: As per NBC-2016, Overhead tank of capacity of "10Cum" is proposed at terrace level for wet riser system.

2. FIRE PUMPS CAPACITIES:

The pumping facility forms the heart of the fire protection system. The pumps are basically used to increase the velocity and the quantity of water required to fight fires.

Fire pumps shall be provided with soft starter. A common compartmentalized control panel for all pumps has been envisaged and located at pump room by pump set wise. Panel is designed to operate pumps automatically on pressure loss basis with timers, contactors, indicators etc. The power supply to the panel shall be from two sources i.e., electric city board (EB) power and diesel generator (DG) power.

The diesel engine exhaust system shall be complete with silencer, silencer piping including bends and accessories. This should take to outside the pump room at safe location. The total back pressure shall not exceed the engine manufacture's recommendation.

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.

As per NBC-2016 guidelines & local fire authorities, dedicated fire water storage of 50cum to be provided for every 100 hydrants with one set of pumps.

Fire pump details

Sl. No	Description	Pump capacity	Duty points	No. of pumps
01	Electric motor driven horizontal mounted end suction top discharge pump for sprinkler system	1620 LPM	70M Head	1
02	Electric motor driven vertical inline jockey pump for sprinkler system	180 LPM	70M Head	1
03	Diesel engine driven horizontal mounted common stand by pump	1620 LPM	70M Head	1

3. FIRE EXTINGUISHERS:

- Design, selection of extinguishers shall be as per IS: 2190:2024 & products shall confirm to IS:15683.
- The fire extinguishers shall be placed where easily accessible near the normal path of travel and preferably near exits.
- The fire extinguishers shall be so distributed over the entire floor area, that a person has to travel not more than 15 m to reach the nearest extinguisher.
- Portable fire extinguishers shall be maintained in fully charged and operable conditions and shall be kept in their designated places at all time when they are not being used.
- All fire extinguishers shall be free from halon & other gases which have ozone depletion potential.
- Fire extinguishers shall be of stored pressure type.
- Water mist type extinguisher at stair case landing areas.
- Portable fire extinguishers such as ABC, CO₂, foam type extinguishers pump house, electrical rooms etc. as per statutory requirements & IS 2190.
- CO₂ extinguisher of 2kg is provided inside each lift machine rooms.
- CO₂ extinguisher of 4.5kg is provided inside electrical room.
- Mechanical foam extinguisher of 9ltrs & ABC extinguisher of 6kg are provided in fire pump room, transformer & diesel burning areas.

9 SELECTION OF FIRE EXTINGUISHERS

Various types of fire extinguishers specified in this standard are of value but all are not equally effective on all types of fire. For this reason, the nature of contents of a building, the processes carried out therein and the types of fire which may occur shall be taken into consideration while selecting fire extinguishers. For all practical purposes, the basic types of fires can be grouped into following four classes:

- a) **Class A fires** — Fires involving solid combustible materials of organic nature such as wood, paper, rubber, plastics, etc, where the cooling effect of water is essential for extinction of fires.
- b) **Class B fires** — Fires involving flammable liquids or liquefiable solids or the like where a blanketing effect is essential.
- c) **Class C fires** — Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporising liquid for extinguishment.
- d) **Class D fires** — Fires involving combustible metals, such as magnesium, aluminium, zinc, sodium, potassium, etc, when the burning metals are reactive to water and water



Sl. No	Type of fire extinguishers	Area of application
01	One ABC powder extinguishers of 6.0 kgs	Building common areas
02	One CO2 extinguishers of 4.5 kgs. Capacity	Electrical room and FCC room
03	One ABC powder extinguishers of 6.0 kgs, Foam Type fire extinguisher (9 litres) - Jet & spray (combination) along with the 2nos of fire buckets	Near transformer & diesel generator
04	One CO2 extinguishers of 2 Kgs. Capacity	Inside each lift machine room
05	One ABC powder extinguishers of 6.0 kgs	Pump room
06	One Water mist extinguishers of 9 litres	Staircase landing at each floor

4. FIRE HYDRANT SYSTEM:

The fire hydrant system is the most effective, efficient and ultimate means of extinguishing very large fires, which can prove to be devastating. The main advantage of fighting fires with fire hydrant system is its accessibility and penetration capability, since fires can be fought from a very large distance and to very high reach ability.

The hydrant network is pressurized with water at a definite pressure and is maintained in readiness for any eventuality. Once the hydrant valve is manually opened during the fire, the fall in pressure in the pipe line is sensed by the pressure switches activating the pumps, thereby ensuring continuous supply of water and pressure at the outlets (Hydrant Points).

- Piping material: System piping shall be “**Galvanized Iron (GI)**” ERW heavy grade (“C” class) pipes as per IS: 1239 Part-1 for sizes up to 150NB, sizes 200NB & above shall be as per IS: 3589 Gr. Fe 330 with minimum wall thickness of 6.35mm.
- Pipe fittings shall be ductile iron threaded fittings for pipe sizes up to 50NB & butt-welded type as per ASTM A234 Gr. WPB for sizes 65 NB & above.
- Pipes will be painted with one coat of etching primer & two coats of synthetic enamel paint as per IS 5 (Shade 536) – 1994.
- Underground pipes shall be laid 1.0m below the ground level & should be protected with wrapping & coating material (coal tar enamel & coal tar impregnated glass fiber) with an overlapping of 15mm as per IS: 10221 (2008).
- Hydrant pipes will be laid as ring at above ground level at all around the building with isolation valves.
- All road crossings places, fire pipe should be run through Hume pipes.
- Air release valves (vents) at specific locations.

4.1 INTERNAL FIRE HYDRANT SYSTEM:

The internal fire hydrant system is proposed as per IS – 3844:1989. However as per local authority acceptance, “One number of hydrant valve” for every 1000 Sq. mtrs of floor area will be considered. Location shall be preferably near fire exit doors and further it is based on the coverage of hose pipe from each hydrant valve. Further, number of hydrants shall be arrived based on the floor area and each hydrant valve comprising of the following:

- Single headed stainless steel (304) hydrant valve.
- 2 no's x 15Mtr. of reinforced rubber lined fire hoses in an enclosed MS box.
- Stainless steel (304) branch pipe with nozzle & couplings.
- Rubber hose reel drum with 40 meters length of 19 mm rubber hose and nozzle.

System Operation: Landing hydrants are intended to be used by fire brigade or trained fire men. Minimum flow of 900LPM at 3.5 kg/cm² shall be available at any point in the system. Fire hose reel (20mm) can be used by occupants to fight fire of smaller magnitude.

4.2 YARD HYDRANT SYSTEM:

For fighting fires from outside the building at strategic locations on perimeter of the building, single headed yard (external) hydrants have been proposed and 45 meters is the distance between two hydrants. The hydrant valve distance should not exceed 2 m to 15 m from building external line. Each external (yard) hydrant comprising of the following:

- Single headed stainless steel (304) hydrant valve.
- 2 no's x 15Mtr. of Controlled percolated fire hoses in an enclosed MS box.
- Stainless steel (304) branch pipe with nozzle & couplings.

4.3 FIRE BRIGADE CONNECTION:

One set of 4-way fire brigade inlet connection is provided which comprise of four instantaneous male inlet couplings, plugs & chain connected to system & Further 2-way FBIC is proposed for sump filling that comprises of 2 instantaneous male inlet couplings, plugs & chains with 100mm dia butterfly valve.

Further, one fire brigade draw-out connection along with foot valve is provided, near fire sumps to draw-out the water directly from tank.

5. AUTOMATIC SPRINKLER SYSTEM:

Automatic sprinkler system is considered to be the most effective and economical way to apply water from fixed systems. It is designed to act upon a fire at a pre-determined temperature by measure of water spray. It could either extinguish the fire or control its spread. The sensitivity of a sprinkler glass bulb varies and is identified by different color.

- Sprinklers have been designed with sprinkler riser, piping network, sprinkler control valve, flow switch, sprinkler alarm valve etc. complete.
- The sprinkler mains consisting with flow switch which will transfer audio / visual indications to fire alarm panel in case of water flow in the pipes.
- Isolation valve is considered at the tap off points with supervisory switch, from maintenance point of view at respective levels as applicable.
- For standard response pendent sprinkler coverage of 12sq.m (spacing of 3 X 4m interval) for all other areas as per NBC-2016.
- Areas with false ceiling depth of 800 mm or more shall have two layers of sprinklers for both voids and below false ceiling as per NBC-2016. Below false ceiling sprinkler shall be connected with SS braided flexible hose pipe.
- Minimum pressure of 0.5 kg/cm² will be ensured at the remotest sprinkler point.
- Pendent sprinklers installed on the false ceiling will have escutcheon plates (rosette plate) which provide decorative recessed sprinkler installation (Color of rosette plate shall be matched with false ceiling color).
- Piping material: System piping shall be "**Galvanized Iron (GI)**" ERW heavy grade ("C" class) pipes as per IS: 1239 Part-1 for sizes up to 150NB, sizes 200NB & above shall be as per IS: 3589 Gr. Fe 330 with minimum wall thickness of 6.35mm.

- Pipe fittings shall be ductile iron threaded fittings for pipe sizes up to 50NB & & butt-welded type as per ASTM A234 Gr. WPB for sizes 65 NB & above.
- Pipes will be painted with one coat of etching primer & two coats of synthetic enamel paint as per IS 5 (Shade 536) – 1994.
- Underground pipes shall be laid 1.0m below the ground level & should be protected with wrapping & coating material (coal tar enamel & coal tar impregnated glass fiber) with an overlapping of 15mm as per IS: 10221 (2008).

System operation: In the event of fire outbreak, bursting of sprinkler bulb will result in fall of pressure in the header & jockey pump shall come into operation for small drop of pressure in the system. Further, large drop of pressure the electric motor driven pump shall come into operation automatically through impulse from pressure switch. Fire pumps shall be stopped manually only (Only jockey pump will be auto-off). In case electric driven pump fails to start, diesel engine driven pump shall come into action automatically on further fall of pressure & receiving impulse from pressure switch.

The following type of sprinklers shall be used

SI. No	Sprinkler Type	K-factor	Bulb size	Temperature rating	Area of application
1	Standard response pendent sprinkler	5.6 (80)	5mm	68°	basement areas.

6. FIRE ALARM SYSTEM

Addressable type fire detection and alarm system will be designed and installed as per National Building Code and IS 2189. FA panel proposed to have a LCD display for indicating panel status, alarm location, fault conditions etc.

- Activates sounders & public addressable system
- De-activates access doors if any
- Shutdowns electrical power supply to the building & also brings all lifts to ground level
- Activation of basement ventilation system in the event of fire/emergency



SYSTEM OPERATION:

Proposed is a "Two stage fire alarm system". Activation of any detector inside patient ward room/OT's/labs generates "alert signal" at panel level & if this signal is not acknowledged within 2mins (delay time being programmable to suit the requirement) it results in automatic alarm to sound in all areas. This helps to avoid evacuation for false alarm which can create nuisance to patients/occupants & it also helps to achieve phased evacuation during emergency.

Operation of manual pull stations, water flow devices (flow switch) & corridor/lobby detectors causes immediate alarm signal for evacuation of floor/building occupants. Manual call points will be installed near all exits & in corridor at a travel distance of 45mts for convenient & quick way of raising an alarm. MCP's shall help occupants to inform security personnel about fire break out while they evacuate themselves from floor

Design Parameters:

- Main fire alarm panel shall have battery back up for 24 hours in normal operation & 15 minutes back up during alarm/emergency operation
- Hooters cum strobes (directional sounders) will be provided at exit door/level & across floor area
- Manual call points are located at each exit door/level & across floor area
- Sounders are provided for easy identification of fire exits
- Number of loops for respective fire alarm panels will be based on number of devices
- Fire alarm system is proposed with for graphic display unit highlighting locations of each detector & device on a floor plan
- Fire command center is proposed in ground floor
- Fire alarm panels shall be integrated with BMS through BACnet over IP protocol or potential free contact connection
- All emergency exit doors shall be provided with panic bars & EM lock. However, supply of fire rated door & panic bar will be in civil interior scope & necessary module (monitor/relay) required for integration will be considered under fire safety service scope
- HVAC, access control, PA system, nurse call system & electrical systems (power supply to building) are proposed to be integrated with fire alarm panel through control relay modules
- Main FA panel will be placed inside fire command center happening in ground floor at entrance.
- PVC insulated, PVC sheathed, armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I shall be used in complete fire detection and fire alarm system.
- Class A wiring provides an alternate route for signals to pass between detector / devices and the fire alarm panel in case of break the wire or fault occurs.

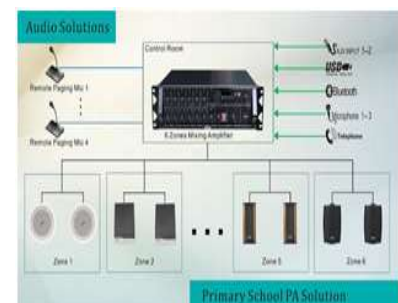
7. PUBLIC ADDRESS SYSTEM

Main objective of digital voice evacuation system is to convey clear & audible instructions to people on all floors in case of fire / other emergency to reach a place of safety. Sound output shall not be so loud that people nearest to speakers feel uncomfortable, nor so weak that people away cannot discern what is being broadcast. This can be achieved by working system at 60 to 75% power output & distributing speakers uniformly all over floor area.

PA controller & console shall be located with FACP shall contain all equipment required for all audio control, signaling & supervisory functions. This shall include speaker zone indication & control, digital voice units, microphone & main telephone handset.

System shall consist of the following:

- Controller & paging console.
- Amplifiers (class D type).
- Speakers of suitable type & wattage.
- Connecting cables & racks for mounting.
- 6W ceiling mounted speakers are proposed for toilets, as applicable.
- 6/ 10W wall mounted speakers are proposed in basement areas & all other areas.
- Built-in microphone shall be provided to allow paging through speaker circuits.
- Proposed public address shall be compatible with background music facility through music player/USB port.
- PVC insulated, PVC sheathed, armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I shall be used in complete public address system .



- Speaker circuit that will be Class B wired.

Audio Amplifiers: Will provide audio power (@70 Volts RMS) for distribution to speaker circuits. Multiple audio amplifiers (based on requirement) will be mounted in a single enclosure, either to supply incremental audio power or to function as an automatically switched backup amplifier(s).

Speakers: All speakers shall operate on 70 VRMS or with field selectable output taps from 3/6/10/12/15 Watts. Speakers shall produce nominal sound output of 85dBA at 10 feet (3m).

Audio message generator (pre-recorded voice)/speaker control: Intelligent device will interface with an emergency voice communication system capable of transmitting a pre-recorded voice message to all speakers in the floor & common announcement is done in the floor / area. Actuation of any alarm initiating device will cause a pre-recorded message to sound over the speakers.

8. TWO-WAY COMMUNICATION SYSTEM

It is a system specialized for 2 way communication that builds up convenient & prompt 2-way communication in case of fire & other abnormal conditions. System comprises of following features as mentioned below.

- Easy wall mount installation
- 24V DC power supply
- 6W addressable wall mounted hands-free speaker with talk back facility (Push to talk switch) on landings of staircases (near the fire tower lobby) on all floors.
- Speaker loops are monitored for fault, short & open circuit conditions.
- Panel located in fire command centre located at ground floor for communication.
- PVC insulated, PVC sheathed PVC insulated, PVC sheathed, armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I shall be used in complete for two-way communication system .

9. FIRE EXIT & SAFETY SIGNAGE'S

As per NBC-2016, battery operated exit signage's with minimum 90mins power backup are proposed as directional exit signage's for easy identification of exits.

- Battery operated (90mins backup) directional exit signage's are provided in basement floor & in all exit paths where they will help people to find a safe escape route. Signs on exit routes will have directional arrows according to the route to be taken.
- Photo luminescent type identification signages that glows in darkness are proposed. This will guide the occupants for easy identification of safety equipment's even in case of power failure. Photo luminescent identification signage's are provided near staircases, lift lobby, extinguisher location, fire hydrant & hose reel etc.
- Fire safety plan: Indicating all fire exit points, extinguisher locations, you are here point, manual call point & hydrant location shall be prepared & located at strategic locations (wall mounted) in the floor. Size shall be either A2/A3. Safety plan shall be made of acrylic sheet with SS studs.

SECTION 3: FIRE PUMP EQUIPMENT'S**GENERAL:**

- Pumps shall be exclusively used for firefighting purposes & shall be provided as per requirements of IS15105: 2021
- Motor driven horizontal end suction type pump for hydrant & sprinkler system (IS standard) capable of delivering adequate flow of 1620LPM at desired head of 70MWC shall be provided
- Common stand by diesel engine driven horizontal end suction type pump capable of delivering adequate flow of 1620LPM at desired head of 70MWC shall be provided
- Motor driven vertical inline Jockey pump for hydrant & sprinkler system capable of delivering adequate flow of 180LPM at desired head of 70MWC shall be provided
- Valves shall be IS approved.

GENERAL REQUIREMENT:

- Electrical sprinkler pump shall be horizontal end suction top discharge type with gland packing, pump designed for continuous operation and shall have a continuously dropping head characteristic without any zone of instability. Power capacity characteristic shall be non-over loading type
- Electrical hydrant pump shall be horizontal end suction top discharge type with gland packing, pump designed for continuous operation and shall have a continuously dropping head characteristic without any zone of instability. Power capacity characteristic shall be non-over loading type
- Head v/s capacity, input power v/s 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.
- Contractor under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.
- Capacity of pump shall be a minimum of 150% of rated capacity at a total head of not less than 65 percent of the total rated head. Total shut off head shall not exceed 120% of total rated head on the pump.
- An automatic air release valve shall be provided to vent air from pump discharge and also to admit to the pump to dissipate vacuum there, upon stopping of pump. This valve shall be located at highest point in the discharge line b/w pump and discharge check valve.
- Pump coupled with motor or engine on a common platform shall perform smoothly without any excessive noise or vibration.

PUMP CASING:

- Casing shall be of Cast Iron conforming to IS 210 capable of withstanding to the maximum pressure developed by the pump at the pumping temperature.

IMPELLER:

- Impeller shall be of standard bronze & shall be dynamically balanced. It shall be secured to shaft & shall be retained against circumferential movement by keying, pinning or lock rings. All screwed fasteners shall tighten in the direction of normal rotation.

SHAFT

- Shaft size shall be selected on the basis of maximum combined shear stress.
- It shall be of stainless steel AISI-410 (ASTM – A – 276 Type 410) (BS 970 410 S 21) ground and polished to final dimensions and shall be adequately sized to withstand all stresses from motor weight, hydraulic loads, vibrations and torques coming in during operation.
- Pump Shaft-Motor shaft coupling shall be connected with adequately sized flexible couplings with spacer of suitable approved design. Necessary guards shall be provided for couplings.

BASE PLATE

- A common base plate mounting both for pump & drive shall be provided with anti-vibration mounting pads. Base plate shall be of rigid construction, suitably ribbed and reinforced.
- Base plate & pump supports shall be so constructed & pumping unit shall be so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc.,
- Fire protection system contractor shall give all necessary details, drawings, foundation bolts, necessary templates and other relevant details to the civil contractor for carrying out the structural foundation for installing all the pumps.

VIBRATION & BALANCING

- Rotating elements shall be so designed as 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 components of pumps of identical parameters supplied under these specifications shall be interchangeable.

INSTRUCTION MANUAL & TOOLS/SPARES

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

ELECTRIC MOTORS

- 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.
- 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.

- Cooling fans shall be directly driven from motor shaft. Motor situated out door or exposed to the weather shall be weather protected.
- Motors shall be enclosed type & shall have dust tight construction with suitable means of breathing & 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, robustness & shall be constructed of metal unless otherwise approved.
- Motors shall be dynamically balanced. Enclosure shall be designed to provide an effective sealing b/w primary and secondary air circuits.
- Winding insulation shall be class B 415V AC motor & winding shall be vacuum impregnated with heat & moisture resistant varnish glass fibre insulated.
- Two independent earthing points shall be provided in accordance with IS: 3043 on opposite sides of the motor for bolted connection.
- Cable boxes & termination shall be designed to enable easy disconnection & replacement of cables.

DIESEL ENGINE, BATTERY & OTHER ACCESSORIES

- Pump driven by diesel engine: The diesel engine shall be of multi cylinder type with individual head assemblies, four-stroke cycle with mechanical (airless) injection, cold starting type.
- Engine shall be horizontal mounted end suction top discharge type with gland packing.
- Engine shall be water-cooled & shall include radiator, water pump & connecting piping, strainer, isolating & pressure reducing valves, by-pass line complete in all respects.
- It shall be direct injection type with low noise & exhaust omission levels. Speed of engine shall match the pump speed for direct drive.
- It shall be designed with regard to ease of maintenance, repair, cleaning & inspection. This will also provide inter changeability of parts.
- All parts susceptible to temperature changes shall have tolerance for expansion & contraction without resulting in leakage, misalignment of parts or injury to parts.
- Starting: Engine shall be capable of both automatic and manual start. Generally, engine shall start automatically but in case of auto-start system failure 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 retainable 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.
- System should be designed in such a way that both batteries are connected and are individually able to provide automatic pump starting. The battery circuits should be arranged to alternately attempt starting on one circuit first, then the other battery could be charged by an alternator on the engine with the other one charged by an independent means.
- Battery banks shall be used for no other purpose than starting of the engine and shall be fully charged at all times with provision for trickle and boost charges. After start of the engine the charger shall be disconnected,

the battery being fed from the engine dynamo. Two battery chargers of air-cooled type shall be able to charge one battery bank at a time.

- Governing system: Engine shall have a speed control device that will control the speed under all conditions of load; governor shall be suitable for operation without external power supply.
- 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. Governor shall be set to maintain rated pump speed at maximum pump load.
 - Fuel system: Diesel engine is to run-on high-speed diesel, capacity of the day oil tank provided shall be minimum 200 litres or can supply fuel up to 6hr operation whichever is higher. Providing one fully mounted & supported day oil tank fabricated from 5mm thick MS sheet of capacity 200 litres with inlet, outlet with valves, gauge glass, manhole cover. Cost of MS frame work for staging to be included.
 - Fuel tank shall be double wall type, so that over flow of the fuel shall be collected in the secondary tank. Fuel supply & return piping shall be metal with necessary valves. Fuel tank shall be fabricated type consisting of air vent, over flow, drain, filling & manhole etc. & shall be mounted on an elevated platform.
 - Overflow from fuel tank shall be connected to a collection tank of capacity 50lts along with necessary over flow piping connection, drain valves etc. as required.
 - Re-circulating thermo siphon system of cooling using a fan cooled radiator or indirect cooling system using heat exchange shall not be acceptable.
 - Entire system shall be mounted on a common structural base plate with anti-vibration mounting and flexible connections on the suction & delivery piping.
 - Provide one exhaust pipe of MS 3mm thick with suitable muffler to discharge the engine gases to outside open air as per site conditions duly painted. Exhaust pipe to be insulated & GI sheet cladded from engine outlet up to muffler & located outside the building.
 - Exhaust pipe shall be adequately sized for minimum pressure drop as per relevant code/standard & shall be housed clearing man height.
 - Provide all accessories, fittings & fixtures necessary & required for a complete operating engine set.
 - Pressure switches/sensing devices to be mounted on its own independent discharge header for all the three pumps to achieve automatic operation.
 - Flywheel shall have graduated marking around periphery to facilitate checking of valve & fuel timings.
 - Instrumentation: Diesel engine shall be provided with adequate instrumentation. The gauges etc., as required are provided in the engine panel. Also, bidder shall supply one set of spare parts recommended by the manufacturer for maintenance purposes.

Pump operating sequences:

Pumps	Start	Stop
Jockey Pump	6.0 bar	7.0 bar
Main Pump	5.0 bar	Manual
DG Engine Pump	4.0 bar	Manual

COOLING SYSTEM

- Direct cooling system shall be employed for diesel engine. Water shall be tapped from fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then 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 heat exchanger shall not be accepted.

ACCESSORIES

- 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., engine shall have a base plate made from MS sections.
- There shall be reasonable space at the big end, camshaft, water jackets, governor drives & main bearings. 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 should be taken from inside the building in which the engine is located, but exhaust should be discharged outside the building & exhaust duct shall be adequately sized for minimum pressure drop as per relevant code/standard & shall be housed clearing man height.
- Flywheel shall have graduated marking around the periphery to facilitate checking of valve & fuel pump timings. Full set of diesel engine spares as per Standard requirement to be provided along with tool kit.

TESTS AT SITE

- On completion of installation works at site, complete system shall be tested for satisfactory performance in-line with specifications as per tender of Consultants. Pumps should test for Sequential Auto start in case of using the Hydrants / sprinklers system. Also, pump shall deliver minimum required flow & pressure at top most hydrant point. All instruments for testing should be arranged by the Contractor. Performance test includes commissioning spares like, diesel oil, engine oil, coolant, grease, gland packs & spare refills for fire extinguishers etc. complete.

SECTION-4: FIRE HYDRANT SYSTEM:

GENERAL

Hydrant system shall include the following.

- Landing valves, hose reels, hose cabinets, fire duct shutters, fire brigade connections & connection to pumps & appliances
- GI pipes Class "C" (heavy grade) inside & ring main outside the building.
- All materials shall be of best quality conforming to these specifications & subject to the approval of Client/Consultant
- Isolation valves shall be provided in the yard hydrant ring main at all change in directions of the header main.
- Pipes shall be fixed in a manner as to provide easy accessibility for repair & maintenance and shall not cause obstruction in shafts, passages etc.
- Pipes & fittings shall be fixed to walls and ceilings by suitable supports at intervals specified. Only approved types of anchor fasteners shall be used
- Pipes & fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat manner
- Pipe fittings shall be butt welded type as per ASTM A234 Gr. WPB for sizes 65 NB & above. Fittings 50mm dia & below shall be DI threaded type.
- Valves & other appurtenances shall be as located that they are easily accessible for operation, repairs & maintenance. Valves / other equipment's fitted above the false ceiling shall be provided with trap / access doors
- Pipes for wet risers within the building shall be GI pipes conforming to IS 1239/3589 part-1 (heavy duty 'C' class) with flanged / welded joints

- Single headed hydrant valves shall be (stainless steel) as per IS: 5290 type-A
- Whole of the works covered in this section of specification shall be carried out strictly in compliance with NBC 2016 Part-4 & other relevant IS codes

MATERIALS FOR INSTALLATION

- System piping shall be "Galvanized Iron (G.I)" ERW heavy grade ("C" class) pipes as per IS: 1239 part-1 for sizes up to 150NB. Pipes sizes 200NB & above shall be as per IS: 3589 Gr. Fe 330 with minimum wall thickness of 6.35mm.
- Pipe fittings shall be ductile iron threaded fittings for sizes up to 50mm dia & butt-welded fittings as per ASTM A234 Gr WPB for sizes 65NB & above.
- Above ground piping shall be supported by suitable hanging wire supports, channels, angles, fasteners as required etc.,
- Pipes shall be carefully laid to the alignment & levels shown on the plan and sections & great care shall be taken to prevent any sand, earth or other matter from entering the pipes during laying
- Pipes shall be kept thoroughly clean during the course of lying. Ends of pipes shall be blocked with wooden plugs wedged home, at the end of each day's work to prevent dirt, rodents & insects etc., entering the pipe
- Flanged joints shall be used for connections to vessel equipment, flanged valves & also on suitable straight lengths of pipeline at strategic points to facilitate erection & subsequent maintenance work
- All vertical / horizontal pipes shall be fixed by G.I / M.S clamps truly vertical. All horizontal pipes running below intermediate slab shall be supported by wire hangings for a sufficient length to adjust height of support for holding pipes of anchor fastening arrangement design
- Structural clamps shall be fabricated from M.S structural members e.g. rods, angles, channels, flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding & paint clamps with one coat of etching primer & two coats of epoxy paint. Wooden saddles shall be provided free of cost
- Slotted angle / channel supports on walls shall be provided wherever shown on drawings or as required. Angles / channels shall be fixed to brick walls and bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiseling will be allowed
- Wherever M.S clamps/ brackets are required to be anchored directly beams or columns, nothing extra shall be payable for clamping arrangement & making good with cement concrete 1:2:4 as directed by the engineer
- All holes to be drilled & pipe cutting to be done using power saw. Boring hole's using welding rods or Gas burning, cutting pipes using Gas cutter are not accepted

EXCAVATION

- Excavation for pipelines shall be in open trenches to line & grade shown on the drawings or as required at site as per the instruction of the engineer. Pipelines shall be buried to a depth of minimum 1000mm in all types of soil including soft rock, hard rock and disintegrated rock for laying fire water supply pipes.
- Contractor shall support all trenches or adjoining structures with adequate wooden/steel supports wherever required. On completion of testing, anti-corrosive treatment with wrapping & coating of pipelines, trenches shall be refilled with selected earth available from the trench excavation including watering and consolidation in layers of 15cms layers and consolidated.
- Back fill soil shall be graded soil, free from stones, pebbles, clay lumps & vegetation & any organic matter. Surplus earth after backfilling shall be deposited to an initial lead of 30 m or as directed by the Engineer.

PIPE PROTECTION**1) Above ground pipes:**

- All pipes above ground & in exposed locations shall be painted with one coat of etching primer & two coats of synthetic enamel paint of "POST OFFICE" red color with shade no. 536 as per IS-5. Pipes shall be initially brushed to remove all foreign matter before applying paint / primer

2) Underground pipes:

- All underground pipes shall be laid 1.0m below ground level protected with wrapping & coating of material "bitumistic anticorrosive tape" with a minimum overlap of 15 mm.

PIPE SUPPORTS

- Contractor shall provide suitable burnt brick masonry blocks of suitable dimensions at regular intervals of 2.5 meters to support pipes & at every change in direction of pipes running on terrace.
- Masonry blocks shall be constructed using table molded class I bricks in cm 1:6 & plastered in cm 1:3, finished with a neat smooth coat of cement.
- Supports for above ground pipes of 80mm dia & above shall be fabricated by structural steel of suitable sections with suitable fasteners. Spacing of supports shall be 3mts minimum & painted two coats of enamel paint of approved color over a coat of primer.
- Hanger supports shall be used for pipes up to 65mm dia with clamps, anchor fasteners & suspended rods etc. In any case size of fasteners shall not be less than 10mm.
- Structural supports with L-angle/C-channel for pipe sizes 100mm dia & above.

BUTTERFLY VALVES

- Butterfly valves shall be provided for pipes 50mm dia & above. Valves shall conform to BS 5155 & shall be CI construction, including nuts, bolts, washers, 3mm thick insertion rubber gasket complete as per the specifications.
- Butterfly valves up to 150NB shall be lever operated type, from 200NB & above are gear operated.
- Valves shall be tested to a pressure of 16 Kg/sq.cm. Butterfly valves shall confirm the following specification:
 - Body: High duty cast iron to IS 210 Gr. FG 220 & BS 1452 Gr. 220.
 - Seating: Molded in-situ resilient lining of black nitrile rubber.
- Disk: Nylon coated S.G. Iron to IS 1865/SG 400/12 & BS 2729 Gr.420/12.
- Shaft: Shafts are made of stainless steel AISI 431. Only flanged end valves to be used with flanges drilled to BS 10 Table F. Valves shall be capable of being locked in open position.
- Hand wheel shall be with vertical gear unit for smooth opening & closing of valve for gear operated valves. Key rods with M.S. coated extended spindles to be provided wherever the valves are not approachable from the ground surface.
- Valves shall be provided with the supervisory switch for monitoring of open / closed position of the valves.

GATE VALVES

- Rising spindle gate valves shall be BIS approved with C.I. body & bronze / brass internal parts & shall be used on suction side of the pumps & also at various locations as applicable. Valve shall be flanged end type PN 10 with non-rising spindle type with C.I hand wheel etc.

STRAINERS

- Strainers shall be preferably of approved 'Y' type as specified in the tender schedule with Cast Iron body. Pressure rating of strainers shall be PN-10
- Strainers up to 50 mm shall be of gun metal type, 65NB & above shall be Cast Iron. Strainers shall have a removable stainless steel (SS) screen with 3mm perforations & permanent magnet. Strainers shall be provided with flanges.

- They shall be designed so as to enable blowing out accumulated dirt & facilitate removal & replacement of screen without disconnection from the main pipe.
- Strainers shall be provided with isolating valves so that they may be cleaned without draining the entire system.

NON-RETURN VALVE

- Non-return valve shall be with flange end swing check type as per IS: 5312 of Cast Iron material. Spring-loaded valves shall not be used. Valves shall be flanged end type with PN 16 rating.

BALL VALVES

- Forged brass ball valve of 15-50mm dia with fittings as required for instruments / draining any water in the system / risers in low points. Pressure rating of valves shall be PN-25.

FLOW METER

- Flow meter shall be electro-magnetic type on test line to measure 150 % of main pump flow. Size of flow meter shall be based on pump discharge capacity.

AIR RELEASE VALVES

- Air release valve shall be of 25mm screwed inlet forged brass single ball type & shall be fixed on all high points in the system (wet riser) with ball valves or as shown on drawings. Pressure class shall be PN-16 rating.

PRESSURE GAUGE & PRESSURE SWITCH

- Pressure gauge shall be glycerine filled die cast aluminium body & SS 316 bourdon type of 150mm dial size & calibration 0-16kg/cm² with accuracy of 1% of full scale with necessary fittings.
- Pressure switches shall be bellows type of suitable range (0-16Kg/cm²) as per pumps discharge pressure.

HOSE REEL

- Rubber hose reel: Contractor shall provide standard fire hose reels with 19mm diameter high pressure rubber hose of 40m length with SS nozzles & control valve, shut-off valve, all mounted on a circular hose reel drum of mild steel construction and cast-iron bracket.
- Hose reel shall be swinging type of 180deg with mounting base plate. Hose reel drum shall be as per IS: 884 with a rubber hose reel tube as per IS: 444.
- Hose reel shall be tested by a recognized testing laboratory to meet the requirements.
- Care should be exercised when fixing & positioning recessed swing type hose reels so that they can swing in & out freely & easily from their normal position to operating position.

LANDING HYDRANT VALVE

- Landing valve shall be of SS single headed type confirming to IS: 5290 type-A complete with hand wheel, quick coupling, spring and blank cap.
- All landing valves shall be fitted with instantaneous coupling conforming to IS: 903. Coupling shall be fitted with an internal plug secured by a chain.
- Landing valves shall be installed on wet risers at a height of 1.0 to 1.2 m from finished floor level.
- Valves shall be connected to wet riser stand pipes by means of a suitable tee, cost of which is deemed to be included in the unit rate for piping.

FIRE HOSE

- Reinforced Rubber Lined (RRL) type hoses of 02 no's x 15mts length confirming to IS: 636 shall be used for internal & external. Landing hydrants with 63 mm dia, Hoses shall be bounded by G.I wire to heavy-duty instantaneous SS couplings as per IS standards.

BRANCH PIPE

- Branch pipe shall be SS, 63mm dia with nozzle of 19mm dia made as per applicable IS standard & suitably fitted with hoses as specified.

HOSE CABINET

- Hose cabinet for landing valves within building (outside fire shaft) shall be glass (4mm thick) fronted with double hinged door and lock. Cabinet shall be made of 16 SWG M.S sheet, 750mm(H) x 600mm (L) x 250mm (D) size or fabricated to size as per architectural requirement & spray painted to scarlet red color with word "FIRE". Hose box shall have necessary provision of key box with hammer for break glass.

Cabinet shall be of suitable size to accommodate the following:

- 63 mm hose pipe (2 lengths of 15mts each)
- Branch pipe & nozzles
- Two keys of break glass recess for keys

FIRE BRIGADE CONNECTION

- FBIC shall be as per IS 5131 & four way connecting head (SS material) with 4 x 63 mm dia instantaneous type inlets with built in check valve & 150mm dia outlet connection to the fire main grid with 150mm dia butterfly valve & non-return valve. Fire brigade inlet shall be feed water in to the system.
- Fire brigade draw-out connections (SS material) with foot valve are proposed for connecting underground fire sumps with the fire fighter's vehicle in case of emergency.
- Two-way FBIC connections (SS material) is proposed for connecting underground fire sump to fill the water in case of emergency

TESTING

- After laying & jointing piping shall be pressure tested by hydrostatic method. Piping shall be slowly filled with water in order to expel all the air. Piping shall then be allowed to stand full of water for 24 hours. Any leakages at flanges or elsewhere shall be rectified. Pressure shall then be applied by means of a test pump (either electric or hand operated). Test pressure shall not be less than 1.5 times the working pressure of the system.
- Pressure gauges used for test shall be accurate & shall preferably have been recalibrated before test. Open ends of piping shall be plugged during test. Capacity of pumps shall be checked with respect to contractor's piping & equipment layout.
- All test results shall correspond to the performance curves. All the leaks & defects in joints revealed during the testing shall be rectified to the satisfaction of the engineer.
- System shall also be tested for its desired performance & function by opening hydrant valves on each floor separately & four landing valves simultaneously. Flow of water at the top most hydrants shall be checked when three landing valves below are open. Cutting in & cutting out pressure setting of starting devices shall also be checked for its correct operation.
- Contractor to rectify all leakage, make adjustment & retest as required, directed to satisfaction of authorities & employer. Test results shall be recorded & countersigned by engineer and the same shall be submitted in triplicate for approval to the engineer.

MAINTENANCE:

- Hose reels shall be subjected to regular inspection to ensure that the inlet valve, the automatic on/off valve (if any), glands, tubing & shut-off nozzle are sound & free from leaks, & also to ensure that the outlet of the nozzle is not choked.
- Some nozzles, in addition to giving a jet stream, are also capable of producing a cone spray. In these cases, the correct functioning of each role shall be checked.
- Pumps & their associated mechanical & electrical equipment shall be checked monthly for their proper functioning as required in the specification.
- Once a year the hose shall be completely run out & subject to operational water pressure to ensure that the

hose is in good condition & that all couplings are water-tight. A flow test shall be carried out to ensure that a water discharge of at least 0.4 l/s can be achieved.

- All defects shall be rectified in shortest possible time to ensure that installed equipment is restored to a satisfactory condition in as short a time as possible

SECTION-5: AUTOMATIC SPRINKLER SYSTEM:

GENERAL

- Sprinkler system comprising system components & equipment's like sprinkler main, branch & internal piping complete with valves, alarms & supporting arrangements. Sprinkler heads shall be fixed as per the requirement and also supply spare sprinklers.
- All material shall be of best quality conforming to specifications & subject to approval of engineer-in-charge.
- Pipes and fittings shall be fixed truly vertical/horizontal or on slopes required in a neat manner. Pipes shall be fixed in such a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc., Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved types of anchor fasteners shall be used for ceilings and walls.
- Valves & other equipment shall be so located that they are easily accessible for operation, repairs and maintenance.

SPRINKLER HEADS

- Sprinkler heads shall be of quartzoid bulb type with standard bulb, valve assembly, yoke & deflector. Sprinkler shall be of approved make & type.
- Pendent pattern: These sprinklers shall be designed to produce a hemispherical type of discharge below plane of deflector with little or no water being discharged upwards to wet the ceiling.
- Spray patterns: Spray type sprinklers shall produce a hemispherical discharge below the plane of the deflector.
- Construction bulb: 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 a pre-determined level.
- Yoke: It shall be made of high quality gunmetal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector.
- Deflector: Shall be suitable for pendent/upright erection. Deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.
- Color code: Following color code shall be adopted for classification of sprinklers according to nominal temperature ratings:

Sl. No	Sprinkler Type	K-factor	Bulb size	Temperature rating	Area of application
01	Standard response pendent sprinkler	5.6 (80)	5mm	68°	Basement areas.

- Temperature ratings: For normal conditions and temperature climates, rating of 68° C shall be used. However, the temperature rating shall be as close as possible to, but not less than 30°C above the highest anticipated temperature conditions.
- Sprinklers provided below polycarbonate sheets used in roof for day light penetrations shall be installed with GI base plates (600mmx600mmx01mm thick) to prevent sprinkler activation due to roof heat

INSTALLATION OF SPRINKLER PIPING

- System piping shall be "Galvanized Iron (G.I)" ERW heavy grade ("C" class) pipes as per IS: 1239 part-1 for sizes up to 150NB. Pipes sizes 200NB & above shall be as per IS: 3589 Gr. Fe 330 with minimum wall thickness of 6.35mm.
- Pipe fittings shall be ductile iron threaded fittings for sizes up to 50mm dia & butt-welded fittings as per ASTM A234 Gr WPB for sizes 65NB & above.
- Pipes shall be carefully laid to the alignment & levels shown on the plan & sections and great care shall be taken to prevent any sand or foreign particles entering into the pipes. Pipes shall be kept thoroughly clean during the course of laying.
- Flanged joints shall be made with 3mm thick insertion rubber washer / gaskets. All bolt holes in flanges shall be drilled & making hole by using gas cutting is not acceptable. Drilling of each flange shall be in accordance with relevant Bureau of Indian Standards. Bolts/nuts/washers used in the system shall be galvanized as per IS 1367 & suitable length of not more than 25mm beyond nut.
- Piping shall be so installed that, system can be thoroughly drained. All pipes shall be arranged to drain to the installation drain valve.
- Sprinklers should have range pipes 25mm dia of 150mm length forming part of the fitting. Balance piping from branch/sub header will be measured part of piping works.

INSTALLATION CONTROL VALVE

Installation control valves shall comprise of the following:

- One main stop valve of full way pattern with gunmetal pointer to indicate whether open/shut. One automatic alarm valve, fitted with handle and cover.
- One hydraulic alarm motor and gong bell for sounding continuous alarm upon out-break of fire.
- One combined waste and testing valve including 5 meters of tubing and fittings.
- Alarm stop valve.
- Strainer.
- Drain plug.
- Padlock and Strap.
- Wall box for housing all of above.

PRESSURE GAUGE

Glycerin filled bourdon type pressure gauges confirming to IS/BS specifications shall be provided at the following locations.

- Just above alarm valve.
- Just below alarm valve, on the installation stop valve.

PIPE SUPPORTS

- All above ground piping shall be installed on All above ground piping shall be installed on suitable pipe hangers/supports as required. Hangers shall be made of MS angles, channels, etc., and painted to the required finish.
- Hangers & components for all piping shall be as per the drawing. Additional supports shall be provide at bends etc., angles for pipe support should not be less than 40x40x6mm size. Cutting shall be by gas cutter. All cut edges & weld surfaces shall be grounded to a smooth finish.
- Angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls & bolts embedded in cement concrete blocks & to RCC walls with

suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiseling will be allowed.

- Anchor fasteners used for sprinkler piping supports shall be as follows:
- Pipes up to 50mm dia – M8 anchor with threaded rod at 2.5m interval
- 65mm dia – M10 anchor with threaded rod.
- Pipes above 80mm dia shall use 75 x 75 x 8mm angle.
- MS angle/channel supports shall be provided at every 3mt interval for higher pipe sizes (80dia & above). Further pipe sizes of 50 to 80dia shall have threaded rod with hangers at an above said distance. However, contractor shall submit piping support detail drawing along with the shop drawings for consultant's approval.

PIPE PROTECTION

Above ground pipes:

- All pipes above ground & in exposed locations shall be painted with two coats of etching primer & two coats of synthetic enamel paint of "POST OFFICE" red color with shade no. 536 as per IS-5. Pipes shall be initially brushed to remove all foreign matter before applying paint / primer

Underground pipes:

- All underground pipes shall be laid 1m below ground level protected with wrapping & coating of material "bitumistic anticorrosive tape" with a minimum overlap of 15 mm.

FUNCTIONAL TESTS

- Upon the completion of the installation, contractor shall conduct functional tests with simulated fire conditions in the space to be decided by the owners. Contractor shall supply all materials, labor & personnel required for the functional tests. Rate quoted in the BOQ shall be deemed to include cost of the above.

SECTION- 9: PORTABLE FIRE EXTINGUISHERS & SAFETY SIGNAGES:

GENERAL

- 1) Section covers supply, delivery, installation & 12 months free maintenance & warranty of the various types of fire extinguisher along with furnishing all labor material appliances & equipment necessary as required to install fire extinguishing hand appliances. It shall consist of the following.
- 2) Location, type & capacities of all fire extinguishers are as indicated in the drawings.
- 3) All mounting brackets shall be of suitable type for location where they installed. Performance of all extinguishers shall be to approval of applicable local authorities.
- 4) Fire extinguishers shall be confirmed to Indian standard as revised & amended up-to-date
- 5) Fire extinguishers shall be of stored pressure type & of "MAP 90" class
- 6) Design, selection of extinguishers shall be as per IS: 2190 & products shall confirm to IS:15683
- 7) Fire extinguishers are placed for every 15m radial distance of floor area as per statutory requirements & IS 2190
- 8) All fire extinguishers shall be free from halon & other gases which have ozone depletion potential

Sl. No	Type of fire extinguishers	Area of application
01	One ABC powder extinguishers of 6.0 kgs	Building common areas
02	One CO2 extinguishers of 4.5 kgs. Capacity	Electrical room and FCC room
03	One ABC powder extinguishers of 6.0 kgs, Foam Type fire extinguisher (9 litres) - Jet & spray (combination) along with the 2nos of fire buckets	Near transformer & diesel generator
04	One CO2 extinguishers of 2 Kgs. Capacity	Inside each lift machine room

05	One ABC powder extinguishers of 6.0 kgs	Pump room
06	One Water mist extinguishers of 9 litres	Staircase landing at each floor

SAFETY SIGNAGES

- 1) Exit signage's are proposed in confirmation with
 - National building code of India SP- 7 2007.
 - IS 123490-1988 Fire protection - safety signage
 - IS 1644 - 1988 Exit requirements.
- 2) Exit signs indicating exit routes will be provided where they will help people to find a safe escape route. Signs on exit routes will have directional arrows according to the route to be taken.
- 3) Exit signs shall be with green background with white lettering and text should be in English & local language.
- 4) Location & text:
 - Other signs shall be with minimum text of 15 mm. Refer the list below.
 - FIRE ESCAPE - KEEP CLEAR
 - FIRE EXTINGUISHER
 - MANUAL CALL POINT
 - HOSE REEL DRUM
- 5) Fire safety plan: Indicating all fire exit points, extinguisher locations, you are here point, manual call point & hydrant location shall be prepared & located at strategic locations (wall mounted) in the floor. Size shall be as directed by consultant.
- 6) Fire order highlighting actions to be taken in case of fire shall be placed near to entrance. Text height of 15 mm, size shall be minimum of 750 x 450 mm.
- 7) Battery operated exit signage's are proposed & mounted above the exit doors with the battery backup of 90 minutes to ease out the identification of staircases/exit routes during emergency& sizes shall be 190mmx365mmx50mm.
- 8) Battery operated directional exit signages are proposed in the exit path showing the exit doors with the battery backup of 90 minutes to ease out the identification of staircases/exit routes during emergency& sizes shall be 180mmx300mmx25mm.

SECTION- 10: FIRE ALARM SYSTEM:**GENERAL:**

- 1) This section of the specification includes the furnishing, installation, and connection of a microprocessor controlled, addressable fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciator, power supplies, and wiring as per shop drawings and specified herein.
- 2) The system shall be designed such that each loop shall limited to only 80% of its total capacity at initial installation.
- 3) All equipment/components shall be new & the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- 4) All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
- 5) All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- 6) Fire alarm panel shall have BACnet over IP protocol for integration with BMS.

SUBMITTALS AND SHOP DRAWINGS:

- 1) Sufficient information shall be clearly presented and shall include manufacturer's name, model numbers, power requirements, equipment layout, device arrangement and complete wiring.
- 2) Sequence and description of operation.
- 3) Product data for each type of equipment, initiating device, signal device, peripheral device and cable provided on the project.
- 4) Shop drawings shall include battery calculations, floor plans and wiring diagrams.

OPERATION MANUAL:

Operation manual shall include:

- Installation instructions for use by installing contractor.
- Operational instructions or manual for use by building personnel, including Name and phone number of service representative.
- Maintenance instructions as required for use by building personnel.
- Copy of approved shop drawings.

BASIC SYSTEM:

Distributed intelligent addressable fire alarm& detection system panel shall function as a fully stand-alone panel as well as providing a communication interface to the central station. FACP shall have its own microprocessor, software and memory.

- Memory data for panel configuration and operation shall reside in non-volatile memory.
 - It shall be possible to command test, reset and alarm silence from both the FAP and the central console.
 - FAP switches shall allow authorized personnel to accomplish the following independent of the central console:
 - Initiate a general alarm condition.
- 1) Silence the local audible alarm.
 - 2) It shall be possible to acknowledge (Silence the local FAP audible without silencing the alarm indicating devices (hooters).
 - 3) Reset all zones (Logical Point Group) / points, after all initiating devices have returned to normal.
 - 4) Perform a complete operational test of the microprocessor and memory with a visual indication with each board.
 - 5) Test all panel LEDs for proper operation without causing a change in the condition of any zone (Logical Point Group)
 - 6) Walk Test:
 - Software zones/loops shall be circuited and protected by Fault Isolation Modules such that in the event of a zone/loop short-circuit, not more than twenty (20) devices shall be left non-functional.
 - Individual loop card shall have a capacity of min. 159 detectors/devices after considering 25% spare/buffer in the loop.
 - Future expansion capacity shall be provided for the control panel by means of spare capacity in current loop card or allowance for additional loop card connection.
 - Monitor modules shall be provided to monitor and address contact-type input devices. The monitor module shall be supervised by FAP.
 - FACP shall have Drift Compensation facility to compensate for environment. It shall be backed up with its own 48hour built-in battery.
 - Fire alarm panel shall be provided with following features:
 - 7) Charger Rate Control
 - 8) Control-by-Time
 - 9) Non-Alarm Module Reporting
 - 10) Day/Night Sensitivity
 - 11) Periodic Detector Test
 - 12) Device Blink Control
 - 13) Remote Page
 - 14) Drift Compensation
 - 15) Trouble Reminder
 - 16) NFPA 72 Sensitivity Test
 - 17) Verification Counters
 - 18) System Status Reports
 - 19) Walk Test
 - 20) Security Monitor Points

- 21) Maintenance Alert
- 22) Alarm Verification
- 23) System Configuration Report
- 24) System Point Report
- 25) Event Historical log
- 26) Programmable Automatic Timed and Manual Signal Silence
- 27) Programmable Manual Signal
 - FA Panel should be field programmable
 - Power supply unit of FADSP shall have following characters:
- 28) Main power supply shall be 240 VACS \pm 10%, 50 Hz \pm 1% and shall in turn provide all necessary power of the FADSP.

FIRE ALARM CONTROL PANEL (FACP)

- 1) Main FACP central console shall contain a microprocessor based Central Processing Unit (CPU). CPU shall communicate with & control following types of equipment used to make up the system. Intelligent smoke, heat & multi sensor detectors, addressable modules, panel modules including initiating circuits, control circuits & notification appliance circuits, local & remote operator terminals, printers, annunciator & other system-controlled devices.
- 2) Each detection loop of panel shall accommodate, monitor & control a minimum of 159 detectors & 159 devices. However, product proposed by system integrator shall accommodate all field devices/components & shall meet requirements as mentioned in the BOQ.
- 3) Panel shall connect all field devices (detectors, MCPs, control, monitor modules, hooter cum strobes etc.) shall fully monitor them & communicate to them for their status & shall be able to take intelligent decision of ALARM, TROUBLE, SUPERVISORY based on programmed cause-n-effect logic. It shall have interactive HMI (display cum operation interface), with status monitoring LEDs for AC Power, Fire Alarm, System Trouble, System Supervisory, Ground Fault & shall have at least 5 programmable switches with LED for seamless operation & maintenance.
- 4) FACP shall have a dedicated mass storage memory to store project related critical back-up like Auto-CAD as-built drawings, reports, logs, customer-text files etc in line with IS 2189 requirements. Memory shall be fully monitored by panel CPU & shall be password-protected.
- 5) It shall support multiple system power supplies & expansion power supplies in cascade to ensure optimum power as required by system load & system design.
- 6) Each power supply shall provide total of 9 Amp current out of which 2 Amp per NAC shall be dedicated to the current requirement of Notification Appliance Circuit.
- 7) Panel shall house 2 nos. of 50 AH batteries in its own housing & shall have proper, trouble-free charging capacity for them. However, the FACP shall be able to charge up to 110AH of batteries if required by the system design & system load.
- 8) Panel shall have networking capability with other control panels of same family by adding a network module.
- 9) Panel shall be compatible to BACnet over IP as an open protocol variant for 3rd party Integration. Selection of exact protocol variant shall be at sole discretion of design consultant based on project & system requirement.
- 10) Panel shall be compatible for integration with 3rd party services using specific control relay module.

- 11) It shall have peak value logging capability & shall be able to analyze peak value of individual sensors for individual sensitivity selection.
- 12) Panel shall support "Cause-n-Effect" programming based on Boolean logic or equivalent to ensure achievement of complete system functionality as required by this document.
- 13) It shall be capable of indicating different events of varying priority & shall be able to map those events in intelligent cause-n-effect logic to achieve "Positive alarm sequence" & notification activation & deactivation as required by "Cause-n-Effect" programming. Exact requirement of cause-n-effect will depend at sole discretion of design consultant in line with code requirement & protected premise requirement.
- 14) Panel shall support distributed architecture for components of same control panel / network node where it shall allow mounting of various components like addressable detection loop interfaces, power supplies & other accessories in multiple remote enclosures at different locations away from main panel to facilitate effective & efficient field wiring terminations, avoid unnecessary cable runs.

SYSTEM SOFTWARE:

- 1) All necessary software to form a complete operating system as described in this specification shall be provided.
- 2) The software programs specified in this section shall be provided as an integral part of the unit and shall not be dependent upon any higher-level computer for execution.
- 3) Status Change Report: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
- 4) Report Routing: Alarm reports shall be archived for future recall.
- 5) Alarm Messages: In addition to the point's description and the time and date, the user shall be able to print, display or store a custom alarm message to more fully describe the alarm condition or direct operator response.
- 6) Each control unit shall be capable of storing a library of at least 1000 events. The event log shall have the ability to be printed via a parallel printer port built-into the FACP.
- 7) The FACP shall have a parallel printer port which allows the internal software the ability to print the following reports:
 - a. System event log
 - b. Sensitivity for all devices
 - c. Relation routing, this shows all input and output relationships of the entire system
- 8) Alarm Verification: The alarm verification feature shall be used to delay acceptance of alarms until they can be confirmed, and shall meet all applicable code requirements and standards. Any or all circuits may be selected for verification through field configuration, which shall be done without removal of an EPROM. If a circuit is selected for alarm verification, it will only verify two-wire smoke detectors. Contact devices, such as manual stations, connected to a verified circuit will be discriminated and will not be verified.
- 9) When the unit detects an alarm on an initiating circuit programmed for alarm verification, the unit shall automatically reset the power to that circuit.
- 10) If the alarm condition is still present after a pre-set time period of 30 seconds, then the system will automatically enter the Alarm mode.
- 11) History Mode: The system shall be able to store and display at least 1000 system events that have occurred in a non-volatile buffer memory. Display of these events shall be accomplished on-site through the use of the front control panel indicators and switches.
- 12) Field Configurable: The system shall be fully configurable and expandable at the owner's site without the need for EPROM programmers. All configurations shall be accomplished through downloading of

programs from a computer. Reconfiguration shall not require knowledge of any programming languages or require any special training. All programs shall be stored in non-volatile memory. Entry into program mode shall require a special key and a special password entered the front panel.

- 13) Releasing Function: The notification appliance circuit shall be software configurable for Continuous Output, Strobes, Door Holders and releasing functions. The panel will support Abort and Hold operation as well as have Cross Zoning.
- 14) The software residing in the FACP shall be capable of reporting initiating devices even if they are not in the database. In the event that an initiating device, which is not in the database, reports an alarm state, the FACP shall turn on all Notification Appliance Circuits. This ensures all devices are active, whether they are programmed in the database or not. Panels which do not respond to un-programmed devices in alarm shall not be considered equal.

NETWORKING:

- 1) If utilized or for future use, the network shall be style 7 wiring, with each control unit talking directly with two other units and the network will be a closed loop. Units which require a host or head end controller will not be accepted.
- 2) The network will be "peer-to-peer" with each unit generating commands to other units as required.
- 3) System architecture in networked configuration shall eliminate dependence upon any single control unit for alarm reporting and control execution. Each control unit shall operate independently by performing its specified control, alarm management, and historical data collection. The failure of any single component or network connection shall not interrupt the operation of the balance of the system.
- 4) Control units on the network shall be able to send control commands directly to any other unit on the network without dependence upon a central processing unit.
- 5) Optionally, each unit can, through programming, send operating commands, such as Acknowledge, to other units on the network.
- 6) Prioritization: Each unit shall send commands to other units on the network based upon the priority of the initiating signal. Alarm events/commands shall be sent before supervisory conditions, which will be sent before commands for a Trouble condition.
- 7) In case of a partial communications failure, each unit will continue to send commands to those units it can still communicate with.
- 8) Each unit will be able to work in a stand-alone mode in case of a total loss of network communications.
- 9) Any control unit in the network can be made the master unit of the network by software changes only.
- 10) Each control unit will have error detection, correction, and retransmissions to guarantee data integrity.
- 11) Remote Annunciator/Command Centers will be an equal peer in the network.

CABLING:

- 1) All fire alarm system cabling must be new.
- 2) Cabling shall be in accordance with local, state and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.
- 3) All cables shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- 4) Cable shall be PVC insulated, PVC sheathed armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I.

- 5) The system shall permit the use of detectors and notification devices wiring in the same conduit with the multiplex communication loop.
- 6) All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring, a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

SYSTEM CAPACITY AND GENERAL OPERATIONS:

- 1) The control panel shall be of as mentioned in BOQ. Each loop shall support addressable devices for a maximum system capacity.
- 2) The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
- 3) All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
- 4) The FACP shall be able to provide the following software and hardware features:
 - Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

Note: The time delay shall be adjustable at site if the end users require it.

- Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel, alert and action.
- Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
- Action: If programmed for action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder/Flasher bases installed with multi-sensor detectors shall automatically activate on action Pre-Alarm level, with general evacuation on alarm level.
- The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
- Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
- Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements.
- Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
- On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The

system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.

- The system shall provide means for all devices on any loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
- Drill: The system shall support means to activate all silence able fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function
- Passwords and Users: The system shall support two password levels, master and user. Up to 5 (minimum) user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
- Two wire detection: The system shall support standard two wire detection devices.
- Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
- Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity adjust based on Occupancy schedules including a Holiday list of up to 15 days. The panel should have the feature to adjust the sensitivity at site.
- Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
- Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
- Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
- Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security type code activates. If silenced alarms exist, a Security alarm will re-sound the panel sounder. The system shall indicate a supervisory alarm when a monitor module point programmed with a supervisory type code activates. If there are silenced alarms, a Supervisory alarm will re-sound the panel sounder.
- Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
- Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
- Active Event: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to –
 - Initiate the monitor module Control-by-Event,
 - Shall not light an indicator at the control panel,

- Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
 - NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel loop. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
 - Security Monitor Points: The system shall provide means to monitor any point as a type security.
 - One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while Annunciator can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
 - Control by Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
 - 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
 - 10 trouble equations per device: The system shall provide support for up to 10 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
 - Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
 - Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector or indicating panel module input. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
- 1) Central Processing Unit.
- a) The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
 - b) The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
 - c) The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

- d) The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
 - e) Consistent with EN standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.
 - f) Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
 - g) The CPU shall provide an (RS 232) interface between the fire alarm control panel and the EN Listed Electronic Data Processing (EDP) peripherals.
 - h) The CPU shall provide two ports (RS 485) for the serial connection to annunciation and control subsystem components.
 - i) The RS 232 serial output circuit shall be optically isolated to assure protection from earth ground.
 - j) The CPU shall provide one high-speed serial connection for support of network communication modules.
 - k) The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.
- 2) Display.
- a) The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
 - b) The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
 - c) The system display shall provide a backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and CPU FAILURE.
 - d) The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
 - e) The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on the 640-character LCD.
- 3) Loop Control Module.
- a) The Loop Control Module shall monitor and control addressable devices. This includes intelligent detectors and fault isolation / monitor / control / control relay modules.
 - b) The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
 - c) The Loop Control Module shall provide power and communicate with all intelligent addressable

detectors and modules on a single pair of wires.

- d) The loop interface board shall be able to drive an NFPA Style 4 twisted shielded circuit up to maximum length. The loop Interface shall also be capable of driving an NFPA Style 4, no twist, no shield circuit up to maximum length. In addition, loop wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.
- e) The loop interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each Loop shall be isolated and equipped to annunciate an Earth Fault condition. The loop interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

4) Enclosures

- a) Control panel shall be housed in a EN-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- b) Back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
- c) Door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
- d) The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

5) Power Supply

- a) The system Power Supply/Charger shall be of appropriate-amperage capacity with battery charger. The power supply shall be filtered and regulated. The system power supplies have facility to expand. The auxiliary power supply module shall share common batteries with the primary power supply. System power supply shall have 4 or more relays, minimum one for common alarm, one for common trouble and two programmable relays. Power supply shall be rated for 240 VAC 50 Hz.
- b) The battery charger shall be suitable to charge Lead Acid batteries of appropriate Ah. Battery charging shall be maintained and controlled through a micro processor based controller to enable and to achieve buck, boost and trickle charging facility.
- c) The power supply shall have a plug for an AC adapter cable, which allows a technician to plug in a laptop computer for up or down loading program information or test equipment.
- d) The Addressable Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 25-200 amp-hours within a 48-hour period.
- e) The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
- f) The Addressable Main Power Supply shall be power-limited per EN requirements.

6) Field Wiring Terminal Blocks

- a) All wiring terminal blocks shall be the plug-in/removable type and shall be capable of terminating up to 1.5 sq.mm wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

7) Field Programming.

- a) The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or Annunciator programming/information.
 - b) It shall be possible to program through the standard FACP keyboard all system functions.
 - c) All field defined programs shall be stored in non-volatile memory.
 - d) Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
 - e) The system programming shall be "backed" up on a CD ROM, utilizing an upload/download program. This system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
- 8) Electronic Hooters cum strobes:
- a) Hooter with strobe unit should be a true addressable system that shall have both audible & visual output units housed within the same device. Audible output shall be multi-tone horn output up to 98DB & strobe output shall have selectable intensity of 15, 30, 75 & 110 candela.
 - b) Strobe unit shall have a flash rate of 1Hz synchronized throughout the fire alarm network.
 - c) It shall report its status with configured parameters of each unit (hooter & strobe) to the fire alarm panel.
 - d) Hooter with Strobe unit shall support individual field testing in "Silent Mode" & "Non-Silent Mode" (full operational mode).
 - e) Hooter with Strobe unit shall be controlled independently on the same 2-Core NAC as per programmed activation and deactivation criteria or from the FACP. Audible (hooter) and Visible (strobe) outputs shall be independently configurable from panel for its activation & deactivation criteria as required.
 - f) Shall be flush or surface mounted as shown on plans.
- 9) Remote Annunciator:
- a) The remote Annunciator shall be of system display. The System Status Display shall be a 120 /640-character display with backlit screen for easy viewing. The module shall be connected to the network allowing it to be placed anywhere on the system. The system display shall have local sounder with silence control, local acknowledgement, local scrolling.
 - b) Annunciator shall receive vectored information such as; all events, Alarm only, Supervisory only, Trouble only, or Security only.
- 10) Manual Call Points OR Pull stations.
- a) Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
 - b) All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

- c) Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- 11) Monitor Module.
- a) Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
 - b) The two-wire monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or with an optional surface back box.
 - c) The IDC zone shall be wired for operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel & shall be FM approved
- 12) Addressable Control Module.
- a) Addressable control modules shall be provided to supervise and control the operation of one conventional device of compatible, 24 VDC powered polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.
 - b) The control module shall mount in a standard 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box, or to a surface mounted back box.
 - c) The control module shall be wired with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay may be energized at the same time on the same pair of wires.
 - d) Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised, EN listed remote power supply.
 - e) The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
- 13) Addressable Relay Module.
- a) Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay may be energized at the same time on the same pair of wires.
- 14) Isolator Module.
- a) Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on a loop Class A. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
 - b) If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
 - c) The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
 - d) The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted back box. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

15) LCD Alphanumeric Display Annunciator.

- a) The alphanumeric display Annunciator shall be a supervised, back-lit LCD display for alarm annunciation in clear English text.
- b) The LCD annunciator shall display all alarm and trouble conditions in the system.
- c) Annunciator may be connected to an BACnet interface. LCD annunciator shall not reduce the annunciation or point capacity of the system. Each LCD shall include vital system wide functions such as, System Acknowledge, Silence and Reset.
- d) LCD display annunciator shall mimic the main control panel 80-character displays and shall not require special programming.
- e) The LCD annunciator shall have switches which may be programmed for System control such as, global acknowledge, global signal silence and global system reset. These switch inputs shall be capable of being disabled permanently or by a key lockout function on the front plate.

16) Graphic software

- a) Proposed software should be from the same manufacture of fire alarm system to provide annunciation, status display, monitoring & control of each & every element connected to fire alarm system & networks.
- b) Software shall have a capacity of 62,500 points or point lists shall be able to store 5,00,000 event logs.
- c) Quad Monitor supports should support multiple active windows such as putting alarm list window in one monitor & graphic window in another monitor.
- d) It should be able to customize alarm, messages & shall operate on "Windows 7/8/10 32bit" operating system.
- e) Graphics shall have option of "pan & zoom" features within a graphic screen for rapid & convenient selection.

17) Integration:

- a) In an event of fire alarm detected by detectors or manual call points, the fire alarm panel shall send a signal through a potential free contact (addressable relay modules) to the nearest access door controller and in turn the access controller will transmit the door open command to all the doors for automatic opening of all doors.
- b) During the fire condition the respective zone or floor HVAC units shall be tripped/shut down from the fire alarm control panel by sending a signal through a potential free contact (addressable relay modules).
- c) The fire alarm system shall be integrated with the public address system to generate the prerecorded evacuation messages during the fire condition.
- d) In the event of fire alarm, detected by detectors or manual call points, fire alarm panel shall send a signal through a potential free contact (addressable relay modules) to floor AHU's & fire dampers to automatically close & cut the fire air supply into the floor
- e) In the event of fire alarm or cause of fire condition detected by detectors or manual call points, fire alarm panel shall send the respective relay through addressable control relay modules to shut down all electrical power supply for the building

Note: Contractor to prepare cause & effect matrix & get it approved from consultant for project execution

18) Installation & testing

- a) Verification Testing: Contractor to provide the service of a factory-trained technician authorized by the manufacturer of the system to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA and the manufacturer.
 - Check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - Open initiating and indicating device circuits and verify trouble signal activation.
 - Ground all circuits and verify response of trouble signals.
 - Check for audibility of tone at all alarm notification devices.
 - Verify the proper alarm and trouble receipt and processing of signals at the FACP.
 - Perform all tests in accordance with the manufacturer's testing procedures.
 - Correct any deficiencies discovered as a result of the testing and retest the work affected by such corrections.
- b) Final inspection and instruction
 - Factory trained representative of the manufacturer shall demonstrate that the system functions properly.
 - Instructions for operating the system shall be provided in a hands-on demonstration as stated elsewhere in the specification or as indicated on the drawings.
 - Written operating instructions shall be provided.
 - Record of Completion indicating certification of the fire alarm system installation and testing shall be submitted to the Consultant at completion in accordance with Tender Requirements. A copy of all Record of Completion certificates together with Inspections and Testing Forms shall be delivered to the Owner's Representative. Photocopies shall be included in the Operating and Maintenance Manuals.
- c) Warranty
 - The FACP shall have a 2year manufacturer's warranty against product defects. This warranty shall be for material only. Installation and labor shall be warranted for a period of 1 year or as indicated elsewhere in this specification. Manufactures that do not provide a standard 2-year warranty, must provide an extended warranty with their bid package.

19) Field quality control

- a) All alarm initiating devices shall be observed & logged for correct zone/loop & sensitivity. These devices & their bases shall be tagged with adhesive tags located in an area not visible when installed, showing initials of installing technician & date.
- b) Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current & voltage readings shall be made as work progresses.
- c) A systematic record shall be maintained of all readings using schedules or charts of tests & measurements. Areas shall be provided on logging form for readings, dates and witnesses.
- d) Client shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

- e) Test reports shall be delivered to the client/PMC's as completed.
- f) Contractor shall make instruments, tools & labour required to conduct system tests available.
- g) Following equipment shall be a minimum for conducting the tests:
 - Ladders & scaffolds as required for accessing all installed equipment.
 - Multi-meter for reading voltage, current & resistance.
 - Two-way radios & flashlights, decibel meter.

20) Tests at site

- a) Following test shall be conducted:
 - Loop Checking
 - Checking of smoke detectors, Heat detectors etc. by simulation.
 - Functional tests for fire alarm panel.
 - Mock trial of the complete fire detection & alarm system.

21) Testing & commissioning

- a) Combined Test:
 - Next test will be in combination of ionization/heat detector, simultaneously with a time gap between application of smoke or heat or as required by employer's representative.
 - Panel shall be checked for basic tests such as, visual checking of input voltage and amperage. All loops one by one, shall be D-wired to check for fault signal indication in the panel.
 - Subsequently, in every loop of panel, a detector shall be subjected to smoke or heat test & signals shall be checked on the panel.
 - Hooter shall sound automatically & piezo sounders shall also sound. It shall also be possible to check that hooters of all panels sound automatically when panels are auto mode.
 - Power source shall be cut off & checked for standby supply from batteries. After six hours power source shall be switched on to check for auto switch over to mains mode. Trickle charger shall take over charging of battery to its maximum cut off level with auto cut off. A set of discharged batteries shall be connected to panel in place of new batteries & trickle/boost switch checked for charging of batteries.
 - Tests shall be conducted for AC failure, charger failure, battery disconnected or battery failure. In all such cases the relevant indication should come & the sounder shall also sound alarm.
- b) Manual Call Box:
 - Manual call box glass shall be removed by unscrewing the back. Micro switch shall instantaneously give a fire signal in panel.
- c) Random Sample Testing:
 - About 5% of all fire alarm components shall be subjected to random testing by connecting to the panels.
 - All smoke detectors shall be tested as given above & later cleaned with a vacuum cleaner.
 - Hooters shall also be tested through direct 24V supply. It shall be tested for 10 minutes.

22) DOCUMENTATION

System documentation shall be supplied to the owner and shall include but not be limited to the

following:

- a) System record drawings & wiring details including one set of reproducible drawings & a DVD with copies of record drawings in DXF format for use in a CAD drafting program.
- b) System Operating, Installation and Maintenance Manuals.
- c) System matrix showing input signals to output commands.

SECTION- 11: PUBLIC ADDRESS SYSTEM:

GENERAL

System will comprise of a microphone of suitable for voice communication / announcements, music through speakers on various areas, floors/buildings. System shall consist of:

Control consoles with Microphones

- Digital Controller & paging console
- Class D Amplifiers & speakers of suitable type & wattage
- Connecting cables and Racks for mounting above.

Local control console shall be placed in reception area in main building. Announcement shall be made from the reception area.

1. System shall be with essential EVAC functionality – such as system supervision, spare amplifier switching, loudspeaker line surveillance, digital message management and a fire alarm panel interface shall be combined.
2. A 240 VAC power supply is provided for the controller operations and a 24Vdc output shall be available as a backup. A LED VU-meter shall allow for monitoring of the master output.
3. The maximum/rated output power of the internal booster shall be 240W / 360W. max mains inrush current shall be 8A @ 230 VAC / 16A @ 115 VAC.
4. Frequency response shall be 60 Hz – 18 kHz (+1/-3 dB, @ -10 dB based on manufacturers rated output. The distortion shall not exceed 1% at the rated output, 1 kHz.
5. Controller shall have tone controls to allow for adjustment of the BGM sound. It shall have separate bass and treble controls. The controller shall have two BGM source inputs and a MIC /line input with configurable priority, speech filter, phantom power and selectable VOX activation.
6. Operating temperature range shall be -10°C to +55°C. Storage temperature range shall be -40°C to +70°C
7. The system shall comply to the following standards:
 - EVAC compliance acc. to IEC 60849
 - EMC emission acc. to EN 55103-1
 - EMC immunity acc. to EN 55103-2
 - Safety acc. to EN 60065

CONTROLLER:

Controller is hereinafter referred to as the DCS. DCS is control equipment in the system designed for extending number of loudspeaker zones & can support multiple sound source files for broadcasting. System integrates with functions such as the sound source file storage system, the network audio broadcasting system, the loudspeaker zone control system, and the system for monitoring and diagnosing faults.

DCS offers various features, which are listed below:

- 1) Supports the manual selection of sound source files, zone buttons & can be directly operated.

- 2) Supports emergency microphone input for emergency broadcast in the event of, for example, a fire evacuation.
- 3) Performs remote paging and broadcasting operation through the Configurable Network Paging Console.
- 4) Includes 8/12 zone outputs, number of zones can be configured through the software.
- 5) 4 auxiliary inputs that can connect to external sound source equipment such as a CD player or tuner
- 6) 4 auto volume control input ports that can set the phantom power supply and gain of each input.
- 7) Auto loudspeaker circuits' short-circuit and open-circuit detection
- 8) A fuse protects the main power supply. In the case of a power supply short circuit within the DCS, the system automatically disconnects the main power supply
- 9) Contains 1GB of built-in flash memory that can store recorded voice files so as to fulfill functions such as voice information broadcasting and voice synthesis
- 10) Can simultaneously broadcast four types of sound sources, such as voice audio sources and external input or network audio sources
- 11) Can automatically record operation and fault logs, and can store up to 10,000 logs of each log type (operation and fault log types).
- 12) Supports switching between the main and backup power amplifiers, and is capable of configuring the standby mode.
- 13) Contains a self-test function
- 14) Supports automatic fault diagnosis
- 15) Supports broadcasting volume adjustment
- 16) Can define the zone and sound source functions. Button function description labels are also easy to install.
- 17) An audio matrix enables broadcasting any audio source in any zone.
- 18) Supports fire emergency broadcast mode so as to improve personnel evacuation efficiency in case of an emergency.

HIGH EFFICIENCY POWER AMPLIFIER:

Digital Amplifier has following main characteristics:

Energy-efficient CLASS-D power amplifier

1. Contains 1/2/4 independent channels
2. Each channel has 100V or 70V of output
3. Supports balanced or unbalanced audio input
4. The DA is cooled through forced air-cooling
5. Provide automatic re-settable over current, overload, overheating, overvoltage, under-voltage and DC protection

CONFIGURABLE PAGING CONSOLE:

Network paging microphone (NPM) connects to the system & related devices to transmit audio and control information through the Ethernet network. The NPM is used for paging, controlling broadcasts, monitoring zones, and for using the bidirectional intercom function. NPM has the following characteristics:

1. 4.3-inch color LCD screen. Can display system status and be operated for zones and groups' division or global paging and broadcast control
2. Simple and intuitive user interface
3. Can connect with up to 20 units, button numbers can be added via software configuration
4. Built-in monitor loudspeakers can utilize functions like zone monitoring and two-way intercom between stations.
5. Digital audio processing to avoid acoustic fidelity distortion
6. Can intercommunicate with other paging microphones and DCS in the network even when the connected DCS is not running
7. 3 shortcut buttons: microphone talk mode switch, select all function and emergency broadcast
8. Has one audio input and output port for playing BGM from a CD source or for recording an output.

EQUIPMENT RACK:

1. Equipment shall be housed in a standard rack of suitable height, with Plexiglas door or metal mesh and lock. Ventilation panels of 1U height shall be provided between each item of equipment.
2. Details of the proposed equipment shall be forwarded to the Consultant with performance specifications, dimensions, construction and finish for approval.

SPEAKERS

Following type of speakers shall be used in public address system.

1. CABINET LOUDSPEAKERS – 6W/10W

- a) The cabinet loudspeakers are intended for clear production of speech, fore ground & background music to be used in outdoor applications. These speakers are supplied with adjustable mounting bracket for quick and easy wall mounting.
- b) The speaker should be made of solid MDF (medium density fiber board) enclosures are covered with a durable, easy-to-clean vinyl in a choice of white or black. The ABS fronts are covered with fine woven cloth in matching color. The angled front baffle results in improved high frequency reproduction in the listening area.
- c) The cabinet loudspeakers should be designed to withstand at their rated power for 100 hours in accordance with IEC 268-5 Power Handling Capacity (PHC) standards.

Rated power	06/10W
Power tapping	10/06/03 W
Sound pressure level at rated power/ 1 W (1 kHz, 1 m)	84 dB
Effective frequency range	95 Hz to 19.5 kHz (-10dB)
Dispersion angle	160°

Rated input voltage	100/70 V
Rated impedance	8/326/667 ohm
Connection	2m (78.8 in) two-wire cable

2. CEILING SPEAKERS – 6W

1. Parameters	2. Values
Max power	9 W
Rated power	6 W
Power taps @ 100V	6W / 3W / 1.5W
Sound pressure level at 6W/1W (4kHz, 1m)	96dB / 88 dB
Frequency range (-10dB)	80 Hz -20 kHz
Dispersion angle (1kHz/-6dB)	160°
Rated input voltage	100 V / 70 V
Rated impedance	1.7 kΩ / 3.3 kΩ
Connection	Plastic terminal blocks
Dimensions (Φ x H)	Φ180 mm x 55 mm
Hole cut-out size	150 mm
Size of speaker	5"
Weight	0.71 kg
Color	White (RAL 9010)
Weight of Magnet	117 g

CONDUITS

These shall be 16 SWG mild steel, welded, thread type and having perfectly circular tubing and capable of being cleaned and tight-fitting joints. Conduits shall be laid either surface or in recess as required. All conduits / junction / fittings should be painted with approved color and shall be marked for easy identification.

CABLE

- Cables proposed for PA system shall be PVC insulated, PVC sheathed armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I.

DOCUMENTATION

1. Prior to placing order for any equipment, the contractor shall submit comprehensive document comprising working drawings, catalogues and descriptive literature of components, acoustic calculation to meet with BS5839 (part8) requirements
2. Contractor shall be required to train and instruct client's personnel in the correct use, operation and supervision of the system, preferably prior to the handing over of the project.
3. Contractor shall make sure that all power tapping of the speakers must be carried out as specified, even if the acoustic calculations indicates less power tapings.

SECTION-12: TWO-WAY TALK BACK SYSTEM

It is a system specialized for 2 way communication that builds up convenient & prompt 2-way communication in case of fire & other abnormal conditions. System comprises of following features as mentioned below.

- Easy wall mount installation
- 24V DC power supply
- 6W addressable wall mounted hands-free speaker with talk back facility (Push to talk switch) on landings of staircases (near the fire tower lobby) on all floors.
- Speaker loops are monitored for fault, short & open circuit conditions.
- Panel located in fire command centre located at ground floor for communication.
- PVC insulated, PVC sheathed armored FRLS 2C x 1.5 sq.mm copper cables as per IS: 1554 part-I. shall be used in complete for two-way communication system .