

TECHNICAL SPECIFICATIONS ON FIRE PUMP ROOM & RELATED ITEMS

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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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) External piping

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-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) MS/GI Pipe
 - b) Hangers/modular supports/fasteners etc.
 - c) Welded type & threaded type fittings
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 ASSURANCE1) 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 PHILOSOPY

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. External Piping

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. EXTERNAL PIPING:

- 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).

3.1 FIRE BRIGADE CONNECTION:

One set of 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.

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 clad 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: EXTERNAL HYDRANT PIPING:**GENERAL**

- 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 confirm 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 15-50mmdia 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.

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