

VOLUME II

FIRE FIGHTING SYSTEM

FANIDHAR MEGA FOOD PARK

OWNER

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MEHSANA

CONSULTANT



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1. SCOPE OF WORK FOR FIRE FIGHTING SYSTEM

- 1.1** The scope of work shall include the Supply, Installation, Erection, painting, packing & forwarding, Testing and Commissioning of Fire protection and detection system as per the BOQ enclosed along with this document.
- 1.2** Unloading, shifting, erection & commissioning assistance for equipment like Fire water pumps etc as per enclosed BOQ along with this document.
- 1.3** Preparation of good for construction & As built drawings as per scope of work.
- 1.4** Preparation of Design Calculations, data sheets, erection philosophy and other relevant documents
- 1.5** Shop Drawings/documents & As Built Drawings 5 sets bound in a standard/readable size in Folder with Indexing. 2 Set in Soft Copy (auto cad+pdf format)
- 1.6** Operation & Maintenance manual 3 sets (1 original+ 2 copy) bound in a standard size folder with indexing and proper labelling. 2 Set in Soft Copy (auto cad / Word / Excel +pdf format)
- 1.7** Arrangement for labour, tools & tackles, erection equipment and necessary materials required for completion of work as per the tender document.
- 1.8** The Scope also covers design, supply, fabrication and erection of pipe supports including shoes, guides, stops/anchors, clips, cradles, hangers, turn-buckles, supporting fixtures, brackets, cantilever structural, tee posts, etc.
- 1.9** Final painting/labelling of approved shade of all piping, Valves, supports, vessels, ducting and tanks etc. Marking of direction of flows and labelling of piping etc would be done on pipe line as detailed out in subsequent clauses of this document.
- 1.10** Earthing of all equipment as per relevant Indian standards.
- 1.11** All statutory approval & third-party inspection as required to complete the assigned work.
- 1.12** Arrangement for utilities required for CONTRACTOR shall be as per Vol I of this tender.
- 1.13** CONTRACTOR shall submit a detailed write-up on how he proposes to plan his work, manning program and bio-data of key personnel he proposes to deploy at site and tools and tackles he proposes to deploy at site.
- 1.14** Spare Parts required for 1-year normal maintenance (specified List to be submitted by Supplier along with tender and the same would be finalised)
- 1.15** Site supervision, safety in charge and labours to carry out works on 24-hour basis with the Prior permission of Engineer In charge
- 1.16** Approval for Sub contractor and Engineers to be deployed at site for erection/commissioning would be taken only after approval from CLIENT/CONSULTNAT.

2. INSTRUCTIONS TO BIDDER

- a) Bidder shall submit the list of jobs intended to be sub-contracted along with the details of sub bidders. The bidder in the event of his tender being accepted, shall not assign or delegate the contract or any part thereof, without the prior approval of CLIENT/CONSULTANT.
- b) It will be the sole responsibility of the bidder to ensure that they abide by the various rules and regulations, bye-laws and other statutory requirements, etc., imposed by the Government / semi-Government and / or other local authorities governing execution of this job.
- c) Before submitting the bid, the bidder is advised to visit, inspect and examine the site and its surroundings. The bidder to look at access to the site and evaluate the site conditions of operation at his own cost. The bidder before tendering should clearly understand the scope of work and must satisfy himself with the required quantities of material, accommodation as may be required and no claim subsequently on account of ignorance shall be entertained. No consequent extra claims on any misunderstanding or otherwise shall be allowed by CLIENT.
- d) Bidders are requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Bidder's offer should specifically mention any clarifications, deviations, interpretations and/or assumptions required.
- e) The bid shall be evaluated as complete package and not on the basis of individual items.
- f) The quoted rates of each item shall remain firm.
- g) The bidder will have to make his own arrangement to transport the required materials outside and inside the working place and leaving the premises in a neat and tidy condition after the completion of the job to the satisfaction of CLIENT.
- h) The bidder will have to arrange for site office and temporary shed on his own expense for safe keeping of his materials and should provide necessary security arrangements for safe guarding the materials. CLIENT will not be responsible for any claims in this regard.
- i) The bidder shall get prior approval from CONSULTANT /CLIENT for release of purchase order to sub-vendors and bidders.
- j) The bidder shall furnish to the CONSULTANT /CLIENT the duplicate copies of all purchase orders placed for this project and the test reports received from the vendor to the CONSULTANT's check and information.
- k) The bidder shall arrange at his own expense for concerned Engineers to attend pre-bid meetings, technical discussions and project progress review scheduled by CONSULTANT /CLIENT. The venue for the meetings will be at CONSULTANT's office or at the project site.
- l) All material constructed or otherwise, shall be considered as the property of bidder till the handover of the project.

2.1 QUANTITY MEASUREMENT

- 2.1.1 The quantities of work shown in the tender schedule may vary during actual execution of work; so, payment shall be made as per actual measurement. The contractor is not entitled for any sort of compensation towards material procured/stored in excess of the measured and authorized quantities, whichever is less.

2.1.2 The Client reserve the right to increase or decrease the tendered quantity or replace specifications, drawings, design of any or every item or delete them at any stage of work. The contractor's claim for compensation or damages on account this shall not be entertained. Such deviation shall be adjusted at the rates contained in the contract or arrived at by calculation from contract rates.

2.1.3 Detailed measurement of the work carried out shall be taken jointly by the Contractor and Client/Site-in-Charge at every stage of work before proceeding to the next stage of work and shall be measured as per procedure laid down and payment shall be made as per measured quantities, subject to their conforming to the quantities ordered as per drawing/schedules and not as per tender schedule quantities.

2.2 TIME FOR COMPLETION OF WORK

The timeframe considered shall be as per Vol I, of this tender.

2.3 STOPPAGE OF WORK

In case it becomes necessary for the Client to temporarily suspend or postpone the work partly or fully due to unforeseen circumstances, Client shall not be liable for any compensation on account of the resultant delay.

2.4 INSPECTION AND TESTING

MATERIALS

2.4.1 All materials required for the execution of the work should conform to the standard specification and approved by the Client/Site-In-Charge before plant commissioning.

2.4.2 Commencement of work without prior approval shall be entirely at the risk and cost of the Contractor. No delay due to non-availability of the materials, tools, equipment, etc. will be entertained by the Client. In case of certain machinery/equipment, the Client/Site-in-Charge may inspect the item for approval before they are brought to site.

2.4.3 The Client/Inspector or any agency authorized by Client shall be entitled at all times at the risk of the Contractor to inspect and / or test or direct the Contractor to test any item supplied or proposed for supply for incorporation in the works and / or any work done by the contractor. Necessary assistance for this will be provided by the Contractor and all the expenses incurred in such testing / inspection will be borne by the Contractor.

2.4.4 The contractor shall on receipt of intimation or any communication from Client of any inspection or tests required to be carried out by the Client on his behalf, present himself or his authorized representative at the place of inspection and / or testing to receive an order or instruction consequent thereto as shall be necessary.

2.4.5 The Contractor shall furnish, to the Client/site-in-charge for approval when requested or as required by the specification or other contract documents, adequate samples should be submitted before the work is commenced as also permit sufficient time to the Client for tests, examination(s) thereto by the Client. All materials finished and incorporated in the works shall conform to the approved sample(s) in all respects.

2.4.6 The Site-in-charge shall be entitled to reject at any time any defective material supplied and /or work done by the contractor for incorporation in the works notwithstanding previous inspection and / or testing Upon such a rejection, the Contractor shall either perform such work again or improve thereon and inspect thereof as shall be necessary to bring the material to the requisite standard or if so required by the Site In charge

2.4.7 Test certificates including test records, performance curves and balancing certificates shall be supplied according to the Distribution Schedule.

WORKS

2.4.8 The contractor, at all time, shall ensure highest standard of workmanship, relating to the work to the satisfaction of the Site-in-Charge. The site-in-charge shall have the power to inspect the work in all respect at all times up to the completion of the work as also to test or give instruction to the contractor to test the works or any structure material or component thereto at the risk and cost of the contractor, either by the contractor or by any agency nominated by the Client/Site-in-charge in this behalf.

2.4.9 The contractor shall provide all facilities, instruments, materials/labour required for testing the work (including checking set out of work) and shall accord site-in-charge all assistance necessary to conduct the test whenever and wherever required.

2.4.10 Notwithstanding anything provided in the aforesaid clause hereto, the contractor shall be and remain liable at his own cost and initiate to conduct all tests at all times during supply, erection and installation of any work/structure material or component as shall be required in terms of the contract document or by the Site-in-Charge. Such tests to be conducted through agency(ies) or laboratory(ies) shall be approved by the Site-in-Charge.

2.4.11 The Site-In-Charge on inspection or test be not satisfied with the quality of workmanship of any work, structure, material item or component (decision of the Site-in-charge being final in this behalf), the Contractor shall re-perform, replace, reinstall and /or re-erect as the case may be such work structure, material or component and no such rejected work, structure, material item or component shall be re-used with reference to the work, structure, material item or component shall be reused with reference to the work accepted with the prior permission of the reference to the work accepted with the prior permission of the Site-in-Charge.

2.4.12 Notwithstanding anything provided in aforesaid clause hereto and notwithstanding the Site-in-charge or his representative has inspected, tested and/or approved any particular work, structure, material or component, such inspection, test or approval shall not absolve the Contractor of his full responsibilities under the contract inclusive or relative to the specification, performance guarantee, the said inspection and test procedure being intended basically for satisfaction of the Client prima facie erection and/or material and equipment supplied for incorporation in the work is in order.

2.4.13 If on any account the Contractor proceeds with the commencing of other work and foundation and superstructure by covering up or otherwise, before necessary inspection entries are filled in the Site inspection Register by the Sit-in-charge or his authorized representative, the same shall be uncovered at the Contractors risk and expense for carrying out the inspection and measurement.

2.5 INSURANCE REQUIRED

2.5.1 Contractor shall also provide and maintain any and all other insurance which may be required under any law or regulations from time to time. He shall also carry and maintain any other insurance which may be required by the Client.

2.5.2 The aforesaid insurance policy/policies shall provide that they shall not be cancelled till the Client / Site-in-charge has agreed to their cancellation.

2.5.3 The Contractor shall satisfy to the Client / Site-in-Charge from time to time that he has taken out all insurance policies referred to above and has paid the necessary premium for keeping the policies alive till the expiry of the defects liability period.

2.5.4 The contractor shall ensure that similar insurance policies are taken out by his subcontractor (if any) and shall be responsible for any claims or losses to the Client resulting from their failure to obtain adequate insurance protections in connection thereof. The contractor shall produce or cause to be proceed by his sub-contractor (if any) as the case may be, the relevant policy or policies and premium receipts as and when required by the Client /Site-in-Charge.

2.6 SITE SUPERVISION/FACILITIES AND WORK AT NIGHT

2.6.1 The entire work will be carried out under the supervision of the authorized representative of the Client, but this will not absolve the Contractors from his responsibilities for quality/period of execution of the work.

2.6.2 The successful tenderer shall arrange for at least one competent supervisor to be present at site at all times during the progress of the work and shall be duly authorized to take instructions and execute them on his behalf.

2.6.3 In absence of required supervision, ALL shall engage supervisors after due notification /intimation. Supervision charges shall be debited against the Contractors immediate RA bill.

- 2.6.4 In the event that the Contractor's "Scope of Work" does not include "erection" the Contractor will be required to provide supervisory services for the satisfactory erection, installation, testing and commissioning of the equipment/materials supplied by him. Contractor's supervisory services shall be requisitioned by the Client as and when required, on "per diem" basis during erection, installation, testing and commissioning. The contractor will be intimated in advance regarding the time and likely duration of the erection. Testing and commissioning of the respective equipment/material(s). it will be the duty of the contractor to depute his competent supervisory staff who will act independently on behalf of the Contractor. The supervision service will be deemed as "part and parcel" of the fabrication and supply contract. During the contractor's supervision at site necessary tools, tackles, implements, labour etc., will be provided. However, to maintain uninterrupted progress of work, Contractor's supervisor will prepare a Schedule and forward to the Site-in-Charge in writing sufficiently in advance.
- 2.6.5 In case the scope of work calls for working in pre-defined planned shutdowns, the Contractor shall prepare detailed programmed and shall deploy additional workman, supervisor, tools & tackles, machinery etc. along with additional project manager and safety supervisor throughout the working time including night shift, so as to complete the work as per plan.
- 2.6.6 If the Progress of the work is not up to the expectation / planned level of the Client, the Contractor shall be intimated to reinforce resources or work extra hours to cover / compensate the time loss. No additional claim shall be accepted by Client for this reinforcement or extra working hours. If the progress of work is still not satisfactory, Client shall advise the Contractor to enact to the shortfall. In case of failure to enact effectively, Client reserves the right to curtail the scope / annul the Contract. The curtailment shall be with a 15 days' notice to the Contractor to arrange appropriate Corrective Action. The annulment shall be done in case the Contractor fails to act effectively to the notice. The completed work according to Measurement sheets / SOR shall only be paid in such circumstances.

2.7 SAFETY / SECURITY OF EQUIPMENT / PROPERTY

- 2.7.1 The responsibility for the safety, security of the components, materials, equipment brought or installed by the contractor or handed over to him by the Client for completion of the work will remain with him till acceptance of the work by the Client. Any damage caused to the material/equipment during the execution of the work will be made good by the contractor to have a guarantee /indemnity bond executed for the value of the material supplied to him free of cost as per the terms of agreement.
- 2.7.2 The contractor should ensure the safety of adjoining property and shall prevent any loss to product/ property resulting from his negligence.

2.8 DISMANTLING/DAMAGE TO PROPERTY

- 2.8.1 During execution of work if it is found necessary to dismantle a portion of existing bund wall, enclosure wall, compound wall, fencing, etc. to facilitate the movement of materials and equipment, the same shall be carried out after obtaining permission in writing from

- 2.8.2 Client's authorized representative and shall also be made good by the contractor at his own cost.
- 2.8.3 Any material obtained by the contractor consequent upon dismantling of any building, structure or construction whatsoever at the job site other than any building, structure or construction dismantled by the contractor pursuant to the contractor's liabilities for defects as elsewhere herein provided, shall be exclusive property of the Client.
- 2.8.4 Contractor shall be responsible for making good to the satisfaction of the Client any loss of and any damage to all structures and properties belonging to the Client any loss of any damage to all structures and properties belonging to the Client or being executed or procured or being procured by the Client or of other agencies within the premises of all the work of the Client, if such loss or damage is due to fault and/or the negligence or wilful acts of omission of the contractor, his employees, agents representative or subcontractor.
- 2.8.5 The Contractor shall indemnify and keep the Client harmless of all claims for damage to property other than Client's property arising under or by reason of this agreement, if such claims results from the fault and/or negligence or wilful acts or omissions of the Contractor, his employees, agents, representative or sub-contractor.

2.9 WORKING CONDITIONS-SAFETY CODE

GENERAL

- 2.9.1 Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Client's safety rules as set forth herein.
- 2.9.2 First aid and Industrial Injuries: Contractor shall maintain first aid facilities for its employees and those of its sub-contractors.
- 2.9.3 Contractor shall make outside arrangements for ambulance or suitable service and for the treatment of industrial injuries. Names of those providing these services shall be furnished to Site-in-Charge prior to start of construction, and their telephone numbers shall be prominently posted in Contractor's field Office.
- 2.9.4 All critical industrial injuries shall be reported promptly to Site-in-Charge, and a copy of Contractor's report covering each personal injury requiring the report covering each personal injury requiring the attention of a physician shall be furnished to Client.

GENERAL RULES

- 2.9.5 Carrying/striking of matches, lighters and smokers inside the hazardous area, is strictly prohibited. Violators of the No Smoking Rules shall be discharged immediately. Within the operation area, no hot work shall be permitted without valid gas/safety/fire permits issued by the Client. The contractor shall be held liable and responsible for all lapses of his sub-contractor's employees in this regard.
- 2.9.6 Contractors Barricades: Contractor shall erect and maintain barricades required in connection with his operations to guard to protect:
- i. Excavations.
 - ii. Hoisting areas
 - iii. Areas adjacent by contractor's or Clients inspectors

iv. Client's existing property liable to damage by contractor's operations, in the opinion of Client/site-in-charge.

2.9.7 Contractor's employees and those of his sub-contractors shall become acquired with Client's barricading practice and shall respect the provisions thereof.

2.9.8 Barricades and hazardous areas adjacent to but not located in normal routes of travel shall not be marked by red flasher lanterns at night.

SCAFFOLDING:

2.9.9 Suitable scaffoldings shall be provided for workmen for all works that cannot safely be done from the ground or from solid constructions except such short period work, as can be done safely from ladders. When a ladder is used, an extra worker shall be engaged for holding the ladder and if the ladder is used for carrying materials as well as suitable footholds and hand-holds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 in 4 (a horizontal and 4 vertical).

2.9.10 Scaffolding or staging more than 30 cm above the ground or floor swing or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted braced and otherwise rewarded at least 1 m high above the floor or platform of scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery materials. Such scaffoldings or staging shall be so fastened, as to prevent it from swaying from the building structure.

2.9.11 Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform or the gangway or the stairway is more than 30 cm above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described above.

2.9.12 Every opening in the floor of a building or in a working platform be provided with suitable beam to prevent the fall of persons or materials by providing suitable fencing or failing whose minimum height shall be 1 meter.

2.9.13 Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 10 meter in lengths, while the width between the side rails in ring ladder shall in no case be less than 30 cm for ladder up to and including 3 meters in length. For longer ladders this width should be increased by at least 6mm for spacing shall not exceed 15 cm. adequate precautions shall be taken to prevent danger from the electrical equipment. No material on any of the site of work shall be so staked or placed as to cause danger or inconvenience to any person or public. The contractor shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defence of every suit, action or other proceedings, at law that may be brought by any person for injury sustained owing to negligence of the above precautions and to pay damages and costs which may be awarded in any such suit or action or proceedings to any such persons, or which may be with the consent of the contractor be paid to compromises any claim by such person.

EXCAVATION AND TRENCHING

- 2.9.14 All trenches 1.3 meter or more in depth shall all times be supplied with at least one ladder for each 33-meter length of trench or fraction thereof.
- 2.9.15 Ladder shall be extended from bottom of the trench to at least 1 meter above the surface of the ground. The side of the trenches which are 1.5 meter or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated material shall not be placed within 45 cm of the edge of the trench or half of the trench depth whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

SAFETY EQUIPMENT

- 2.9.16 All necessary personal safety equipment as considered adequately by the Site-in-Charge should be made available for the use to the persons employed on the site and maintained in a condition suitable for immediate use, and the Contractor should take adequate steps to ensure proper use of equipment by those concerned.
- 2.9.17 Those engaged in welding and cutting works shall be provided with protective face and eye-shields, hand gloves etc.
- 2.9.18 Hot work should be carried out only in the areas earmarked for the purpose after taking required safety precautions and only after obtaining written permission from the Site-in-Charge. Any provision required to be made e.g. wind screens of G.I sheets etc. to make the area safe for hot work, will be made by the successful tendered at his own cost.

RISKY PLACES

- 2.9.19 When the work is done near any place where there is a risk of drowning all necessary safety equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

HOISTING EQUIPMENT

- 2.9.20 All the lifting tools and tackles shall be tested from competitive authority as per local Factory Rules.
- 2.9.21 Use of hoisting machine and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions.
- 2.9.22 These shall be of good mechanical construction, sound materials, adequate strength free from patent defect and shall be kept in good conditions and in good working order.
- 2.9.23 Every rope used in hoisting or lowering materials or as a means of suspension shall be durable quality and adequate strength and free from patent defects.
- 2.9.24 Every crane driver of hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding, winch or give signals to the operator.

2.9.25 In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

2.9.26 In case of departmental machine, the safe working load shall be notified by the Site-in-Charge. As regards, Contractor's machines, the Contractor shall notify the safe working load of the machine to the Site-in-Charge, whenever he brings any machinery to site of work and get it verified by the Site-In-Charge, concerned.

ELECTRICAL EQUIPMENT

2.9.27 Motors, gear transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load; adequate precautions shall be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulation mats, wearing apparel, such as gloves and boots as may be necessary shall be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

MAINTENANCE OF SAFETY DEVICES AND TOOLS.

2.9.28 All scaffolding, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near place or work.

2.9.29 Each tool and tackle shall be clearly marked with its size and purpose. Each set of tools and tackles shall be suitably arranged in fitted boxes of mild steel construction; the number of boxes being determined in relation to the layout of the plant in question. The taps, stocks and dies shall be kept in approved mild steel boxes with compartments for individual items. If the weight of any box and its contents is such that it cannot be conveniently carried, it shall be supplied on steerable rubber-tired wheels.

2.9.30 Each tool box shall be provided with a lock and two keys and shall be painted navy blue and clearly marked, in white letters, with the name of the equipment, plant or system.

2.9.31 The tools and tackles with the appropriate boxes, are to be handed over to the OWNER/EMPLOYER at the time of issue of the taking-over certificate.

DISPLAY OF SAFETY INSTRUCTION

2.9.32 Safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at the work-spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

INSPECTION AND MONITORING

- 2.9.33 To ensure effective enforcement of the rules and regulations relating to safety precautions,
the arrangements made by the Contractor shall be open to inspection by the Site-in-Charge.

NO EXEMPTION

- 2.9.34 Notwithstanding the above Clauses 2, there is nothing in these to exempt the Contractor from the operations of any ACT or rules in force.
- 2.9.35 The works throughout including any temporary work shall be carried out in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpaths, at the site or in the vicinity thereto or any existing works, whether on the property of a third party.
- 2.9.36 No men/material equipment not covered by valid passes shall be permitted within the Project area and no material/equipment shall be permitted to be taken out of the Project area, unless authorized by the concerned authorities of the Project. The Contractor shall be held fully responsible for any or all delays/looses/damages that may result consequent on any lapse that may occur on the part of his sub-Contractors/employees in this regard.

2.10 MISCONDUCT / MISBEHAVIOUR OF CONTRACTORS EMPLOYEES

- 2.10.1 The Contractor is expected to co-operate/co-ordinate with other Contractors carrying out work allocated to them so as to avoid breaking up of work already done by them or causing any hindrance in the progress of their work. In case there is any difficulty/dispute the same should be immediately brought to the notice of the Site-in-Charge.
- 2.10.2 If an whenever the Contractors or Sub-Contractors employees, shall in the opinion of the Site-In-Charge be guilty of any misconduct of misbehaviour the Contractor if so directed by the Site-in-Charge shall at once, remove such person/persons from the employment.

2.11 PATENTS, ROYALTIES AND CONFIDENTIAL INFORMATION

If any requirement, machinery or material to be used or supplied or method of processes to be practices or employed in the performance of the Contractor is/are covered by a patent under which the Contractor is not licensed, the Contractor shall before supplying of using the equipment, machinery, materials, methods, processes, as the case may be, obtain such license (s) and pay such royalty (ies) and license fee (s) as may be necessary in connection with the performance of the contract. In the event that the Contractor fails to pay such royalty or obtain such license, the Contractor will defend at his own expense any suit for infringement of patent, which is brought against the Contractor to the Client, as a result of the failure, and shall pay any damage and costs awarded in such a suit and will keep the Client indemnified form the against all other consequences thereof.

2.11.1 Any information/drawing/specification data sheet/schedule provided to the contractor by Client in relation to this contract shall be regarded as confidential and Contractor shall not pass any of them to a third party without the Client's written consent. On completion of work, contractor will return all papers /documents / drawings and any such other material that may be construed as confidential information, to Client. The Contractor shall also undertake not to disclose any information related to the Contract and /or the Client to any party unless it is required to do so for the performance of the Contract.

2.11.2 The successful tenderer shall not sublet or assign any part of the work to another party without prior written consent of the Client. In any event, the successful tenderer will be solely responsible for the work so sublet or assigned.

2.12 DEFECT LIABILITY PERIOD

2.12.1 The Contractor shall guarantee the work done and any bought-out items supplied against defect, poor workmanship, improper design and failure from normal usage, for a period mentioned in tender Vol-I.

GUARANTEE PERIOD, REPLACEMENT OF DEFECTIVE PARTS

2.12.2 PERFORMANCE GUARANTEE

The Contractor shall guarantee the work done and any supplied bought-out items against defect, poor workmanship, improper design and failure from normal usage, for a period of 12 (twelve) calendar months after being placed in service/operation or 18 (eighteen) calendar months after final acceptance of the work by the Client, whichever is earlier.

2.12.3 WARRANTY

The Contractor will repair and/or replace all defective parts/components/fitting/accessories etc., which shall be notified to him in writing the "Guarantee Period" immediately on notification to the Contractor in writing by the Client. The Contractor shall provide similar warranty on the parts, components, fittings, accessories etc, so repaired and/or replaced.

2.13 WELDING

Welding of steel plates and other structures and accessories shall be carried out in accordance with approved procedures by qualified welders/ welding operators.

2.13.1 Welding Responsibility

The bidder is responsible for the welding done by welders employed by him. Tests required qualifying welding procedure and to qualify the welders and if, necessary qualification of welders and welding operators shall be conducted with the approval of the Engineer-in-Charge of DEC.

2.13.2 Welding Qualifications

Qualification for welding procedures and welders shall be in accordance with the requirements of ASME Code Section IX.

2.14 MARKING / LEGEND

- 2.14.1 Each item of plant shall be provided with a nameplate or label designating the service of the particular equipment. The size of the plate and inscriptions shall be approved by the EMPLOYER. Such nameplates shall be of 2-mm thick, 18-8 steel material having engraved black lettering. Alternatively, aluminium anodized plate may be used in place of SS plate. In case of indoor equipment like circuit breakers, starters, etc. the plate shall be of transparent plastic material with engraved black lettering on the back. The nameplates shall be screwed or riveted to the body of the equipment through a support bracket / plate where direct fixing to the equipment is not desirable.
- 2.14.2 All piping shall be marked with colour as specified in IS: 2379 or as per EMPLOYER specification. Besides these colour bands, Name of fluid and arrows shall also be marked at pre-defined intervals. Base colour for piping inside shop shall be as Code/Approved shade from Client.
- 2.14.3 All underground piping shall be marked with land markers/Caution Tape. The distance between the land markers shall be as approved by the Engineer In charge.

2.15 CALIBRATION

All instruments used for critical measurement such as pressure gauges for leak tests, instruments for measuring performance parameters; instruments for precision dimension measurements shall have valid calibration certificates traceable to national standards. This means that the calibrating agency engaged by the CONTRACTOR shall use instruments which are in turn calibrated by Government approved agencies and such information shall be recorded in the calibration certificate issued by the calibrating agency by giving the certificate number, date and date of validity of the certificate given by the Government approved agency.

2.16 PAINTING

- 2.16.1 The equipment supplied by the contractor shall be finished and painted with approved shade/colour of paint. Any damage shall also be repaired and Touch Up shall be done to the satisfaction of CLIENT.
- 2.16.2 The Contractor shall clean and prepare the surfaces as per SA 2 ½ sand blasting and then apply primer with 2 coat of zinc chromate primer (conforming to IS: 2074) with minimum dry film thickness (DFT) 40 microns per coat and final finish of 2 coats of synthetic enamel (conforming to IS: 2932) with minimum DFT 30 microns per coat, thus having total DFT 140 microns minimum for all uninsulated pipes.
- 2.16.3 The Contractor shall clean and prepare the surfaces as per SA 2 ½ sand blasting and then apply primer with 2 coat of zinc chromate primer (conforming to IS: 2074) with minimum dry film thickness (DFT) 40 microns per coat for Insulated pipes

2.17 PERFORMANCE / FAILURE OF CONTRACTOR

- 2.17.1 If the performance of the successful tenderer is found to be unsatisfactory, the company reserves the right to cancel in part or whole of the contract and gets the work executed through alternate means at the entire risk and cost of the successful tenderer.

- 2.17.2 The successful tenderer shall not consider independently, any change in specifications mentioned in the tender documents. In case of doubt he will refer the matter in writing to the Client/Site-In-Charge and act as per clarifications given by the Client/Site-in-charge. Any change in the work involving changes in original specifications quantities /additional items of work, should be covered by obtaining suitable variation order (s) from the Client/site in charge immediately.
- 2.17.3 If the contractor after receipt of written notice from the Site-in-charge requiring compliance within 7 days fails to carry out and execute any work in accordance with this contract and or to comply with Site-in-charge's instructions then the Client with the consent and may employ and pay other persons to execute any such work whatsoever that may be necessary to give effect thereto, and all costs incurred in connection there with shall be recoverable from the Contractor by the Client as a debit and may at the option of the Client be deducted from any money due to or to become due to the Contractor.
- 2.17.4 Performance tests shall be carried out as per relevant / mutually agreed / specified Codes and Standards. These tests may repeat the tests carried out at the MANUFACTURER's works and/or his SUB-VENDOR / SUB-CONTRACTOR's works and any other tests the ENGINEER may require in order to determine that the equipment is in accordance with the specification and guarantees.
- 2.17.5 A programme and write-up on 'Procedure for conducting the performance tests' shall be submitted by the Contractor to the Engineer In charge for approval, at least thirty (30) days before the commencement of the tests.
- 2.17.6 Performance tests shall be conducted by the CONTRACTOR on plant/equipment supplied by him. The CONTRACTOR at his own expense, shall make all preparations, furnish testing equipment and testing personnel and incur all expenses with such tests. The date for such performance tests shall be mutually agreed upon by CLIENT and CONTRACTOR.
- 2.17.7 If the CONTRACTOR so desires, the equipment may be run for a reasonable time, immediately before the performance test is conducted. A request for this run, stating duration and operating point must be made, in writing to the Engineer In Charge at least seven (7) days before the performance test.
- 2.17.8 During any performance and efficiency test, the plant shall be operated by the CLIENT's staff under the direction of the CONTRACTOR's representative, but under the general supervision of the ENGINEER IN CHARGE.
- 2.17.9 Test shall be carried out at steady state condition and at nearly the load point. The test may be conducted at convenient time of the day or night, when the condition can be held steady.

- 2.17.10 The plant / equipment shall be continuously operated at full load for at least seventy-two (72) hours to prove its performance. For the period of the test, the time of operation shall be counted. Minor interruptions, not exceeding four (4) hours, attributable to the CONTRACTOR are acceptable. However, the test shall be prolonged for such periods of interruptions. If the interruptions are more than four (4) hours, the CONTRACTOR shall repeat the test for the full period of seventy-two (72) hours. If the interruptions are not attributable to CONTRACTOR, and the period of such interruptions is less than twelve (12) hours, the test shall be prolonged for such period of interruptions. If the interruptions not attributable to the CONTRACTOR exceed twelve (12) hours, the test shall be prolonged for a period of twelve (12) hours only. Further if the interruptions not attributable to the CONTRACTOR occur after sixty-five (65) hours of effective test period, the TENDERER / CONTRACTOR need not carry out the test thereafter.
- 2.17.11 In case the test conditions deviate from design values, the results of performance tests shall be correlated to the specified conditions by correction factors, which shall be defined by means of correction curves. These correction curves shall be submitted with the Bid and shall be reproduced and incorporated in the operating and maintenance manuals. Each correction curve must have a minimum range from 15% below to 15% above the specified conditions.
- 2.17.12 Should any Plant or equipment or any portion thereof fail, under the tests, to give the guaranteed performance, the CONTRACTOR shall be given the option of making rectification / correction after which the tests shall be repeated at the CONTRACTOR's expense. The repeat tests shall be carried out within 21 days or such extension of time as may be allowed by the ENGINEER IN CHARGE to remedy the deficiencies. All expenses for the modifications in the equipment shall be done by the Contractor, who shall have no right to claim the same from CLIENT.
- 2.17.13 The values used in the performance calculations shall be the arithmetic average (or as otherwise agreed upon) of the observations made and recorded for the agreed test period.
- 2.17.14 After the results of the performance tests have been submitted to and approved by the ENGINEER IN CHARGE, a summary of the test readings and the performance calculations shall be incorporated in the final version of the Operating and Maintenance Instruction Manuals.
- 2.17.15 Any damages / breakages during the trial operation shall be repaired / replaced by the CONTRACTOR at no additional cost. This has to be done with the written approval from ENGINEER and, if so advised by the ENGINEER IN CHARGE, the performance tests shall be repeated.

2.17.16 The CLIENT reserves the right to carry out further tests to check the performance and efficiency of the plant at the end of the guarantee period. The Contractor will be notified so that he can be present, if he so desires. Such adjustments to the plant as may be considered part of normal operating routine shall be carried out prior to these tests. Should the results of such repeat tests carried out by the CLIENT indicate that performance values deviate from guaranteed values within permissible units, then the CONTRACTOR shall be given the opportunity to take corrective measures and carry out further test, all at his own expense. Should the test indicate performance values below and auxiliary power consumption values above guaranteed value then a reduction in the Contract Price may be claimed by the CLIENT

2.18 TERMINATION OF CONTRACT BY THE CLIENT

2.18.1 The Client may terminate the contract at any stage of the construction for reasons to be recorded in the letter of termination. The Client inter alia may terminate the Contract for any or all of the following reasons that the contractor

2.18.2 Has abandoned the work/Contract.

2.18.3 Has failed to commence the works or has without any lawful excuse under these conditions suspended the work for 15 consecutive days.

2.18.4 Has failed to remove materials from the site or to pull down and replace the work within 15 days after receiving from the Client / Site-in-charge written notice that the said materials or work were condemned and/or rejected by the Engineer under specified conditions.

2.18.5 Has neglected or failed to observe and perform all or any of the term's acts, matters or things under this Contract to be observed and performed by the Contractor.

2.18.6 Has to the detriment of good workmanship or in defiance of the Client's / Site-in-charge's instructions to the contrary sub-let any part of the Contract.

2.18.7 Has acted in any manner to the detrimental interest, reputation, dignity, name or prestige of the Client.

2.18.8 Has stopped attending to work without any prior notice and prior permission for a period of 15 days.

2.18.9 Has become untraceable.

2.18.10 Has without authority acted in violation of the terms and conditions of this contract and has committed breach of terms of the contract in best judgment of the Client.

2.18.11 Has been declared insolvent/bankrupt.

2.18.12 In the event of sudden death of the Contractor.

2.19 LEGEND PLATES

Each supplied equipment shall be provided with a nomenclature name plate / Tag / name printing soon after completion of installation.

2.20 DRAWINGS & MANUALS

2.20.1 Good for execution drawings shall be prepared by successful bidder and submit to consultant for approval. Submission of Hard copy of as Built drawings in 5 sets in standard size as specified by CLIENT. The soft copy of all the as built drawings shall also be submitted in software as specified by CLIENT.

2.20.2 Submission of Hard copy of Operation & Maintenance manual including all bought out items in 3 sets in standard size as specified by CLIENT. The soft copy of all these shall also be submitted in software as specified by CLIENT.

2.21 SPARE PARTS

2.21.1 The scope of work shall include supply of normal maintenance Spares required for 1-year normal maintenance. The TENDER shall submit a list of spares as proposed by him along with his offer. Any offer without spare parts list shall be liable to be rejected.

2.21.2 All spares and maintenance tools and tackles shall be designed to enable maintenance to be carried out in the least time and at the least cost and support resources without affecting the performance and safety aspects.

2.21.3 For all major equipment including pumps, drives, large valves etc., and appropriate structural steel members shall be provided for mounting various handling devices which are necessary for the dismantling and re-assembly of the equipment components during maintenance.

2.21.4 All the spares and maintenance tools and tackles supplied shall be new and unused.

The CONTRACTOR shall guarantee that before going out of production of spares and maintenance tools and tackles for the equipment furnished, he shall give at least 12 months advance notice to the CLIENT, so that the later may order his requirement in one lot, if he so desires.

2.22 TESTING

All metal pipes shall be tested for radiography, dye penetrant testing, flushing, cleaning, hydro/air testing, purging with inert gases, commissioning, including consumables required for same shall be included in the unit rate for erection of piping/valves/equipment. All testing shall be done as per ASME standard. Holding time of minimum 2 hrs shall be provided for hydrotest.

2.23 MINOR CIVIL WORKS

Minor civil works like wall opening, jari work, chipping of foundation, grouting of foundations and repairing of wall opening made shall be carried out at no extra cost. It is the responsibility of the contractor that all the chasing, drilling, excavation(if applicable), done for all mechanical works to be completed and the final surface of the wall / ceiling/ floor/ ground be finished as per the Architectural finishing.

2.24 COORDINATION WITH OTHER SERVICES

The Contractor shall be required to coordinate his activities with all other services such as Mechanical Piping Contractor, Electrical and Civil (Trenches, Road Crossing, and Hume Pipes etc.)

2.25 STANDARDS & CODES

All equipment and work covered under this specification shall comply with currently applicable status, regulations and safety codes in the locality where the equipment will be installed. They shall comply in all respects with the requirements of the latest editions of the codes and standards. The Contractor shall obtain prior written approval of Client. on safety regulations to be followed before taking up any fabrication, erection, dismantling, testing and commissioning work. In case of conflict between codes and standards referred to in this specification or documents enclosed with specification and requirements of this specification, the more stringent specification shall govern.

ANSI: 70.2	American National Standards Institute Control Valve Seat Leakage classifications.
ASME:	American Society for Mechanical Engineers
BS:	British Standards
ASME B16.34	Ratings of Valves-Flanged, Threaded and Welding Ends
API 594	Wafers and Wafer - Lug Check Valves
API 600	Steel Flanged and Butt-Welding End Gate Valves
API 602	Steel Gate Valves, Threaded and Socket Welding Ends
API 609	Butterfly Valves
BS 1414	Steel Gate Valves, Flanged and Butt-Welding Ends
BS 1868	Steel Check Valves, Flanged and Butt-Welding Ends
BS 5351	Steel Ball Valves
BS 5352	Steel Gate, Globe and Check Valves, 50 mm and Smaller
IS 778	Bronze Valves
MSS-SP 67	Butterfly Valves
IS: 554	Dimensions for pipe threads where pressure tight joints are required on the threads.
IS: 638.	Sheet rubber jointing and rubber insertion jointing.
IS: 778	Copper alloy gates globe and check valves for water work purposes.
IS: 780.	Sluice valves for water-works purposes (50 mm to 300mm).
IS: 901.	Couplings double male and double female, instantaneous pattern for firefighting.
IS: 1239	Mild steel tubes, tubular and other wrought (Part I & II) steel fittings.
IS: 884.	Swinging type wall mounted hose reel with drum,
IS: 388.	Hose tubing.
IS: 10221	Anti corrosion treatment for underground MS pipes.
IS: 5312	Swing check type reflux (non-return) valves.
IS: 10221	Wrapping and Coating for Underground Pipes
ASME Sec VIII	Unfired pressure Vessels
IS: 554	Galvanized piping threads
ANSI B31.3	Welders and welding procedure
API STD 598	Test pressure applied to valves
ASME Sec. IX	Inspection of all welds
API Code 1104	The procedure and quality of Radiographic Exam
ASTM E-94 & 142.	
IS 816.tests	Evidence of welder's qualification
IS-800	Codes of practice for Structure
IS-226	Structural steel (standard quality)
IS-2062	Structural steel
IS: 2379	Color Code for Identification of Pipe Lines
IS: 1520/IS: 5120	Pump Design
IS: 14846,	Gate valves
IS: 5312	Non-return valves
SA 194 Gr. 4	Nuts
SA 320 Gr.4	Studs
IS: 1520	Horizontal centrifugal pumps for clear, cold and fresh water.
BS: 599	Methods of testing pumps.

PTC: 8	ASME Power Test Codes - Centrifugal Pumps.
IS: 325	Induction motors, three phases
IS: 7816	Guide for testing insulation resistance of rotating machines.
IS: 4029	Guide for testing three phase induction motors.
IS: 3043	Code of practice for earthing.
IS-2189	Code of practice for selection, installation and maintenance of automatic fire detection system.
IS-5	Color for ready mixed paints and enamels
IS-9537	Specification for conduits for electrical wiring PART-11
IS-1554	PVC insulated (heavy duty electric cables part-I working Voltage up to & including * 11QOV
IS-10810	Method of test for cables part-53-flammability test PART-53
ISA 255A 983	Code of practice for installation and maintenance Power cables up to and including 33kV rating
IS-3043-1987	Code of practice for Earthing.
UL-50	Cabinets and Boxes
UL-864	Control Units for Fire Protective Signaling Systems
UL-521	Heat Detectors for Fire Protective
UL-228	Door Closers-Holders for Fire Protective Signaling Systems
UL- 464	Audible Signaling Appliances
UL-38	Manually Actuated Signaling Boxes
UL-1481	Power supplies for Fire Protective Signaling Systems.
UL-1971	Visual Notification Appliances
NBC, 2016	National Building Code of India
Local AHJ	All requirements of Authorities Having Jurisdiction.
BS-5308 Part-I	Specification for Polyethylene insulated cables.
IEC:	International Electro technical Commission
IEC 79	Electrical Apparatus for Explosive Gas atmosphere
IEC-332	Test on bunched wires or cables.
IEC 529	Classification of degree of protection provided by Enclosures
IEC 584-2	Thermocouple Tolerances
IEC 751	Industrial RTD Sensors.
IEC 801	Electromagnetic compatibility for industrial for industrial Process measurement and control.
ISA:	Instrument Society of America
ISO:	International Organization for Standardization.
NEC:	National Electric Code
NEMA:	National Electrical Manufacturer's Association
ICS-6	Enclosures for industrial control system
IS: 13947	Low voltage switchgear and control gear General Part-1 rules
IEC 326.	Printed Circuit Boards
IS: 277-1977	Galvanized Steel Sheet (plain & Corrugated) (Amendment-1)
IS: 655-1963	Metal Air Ducts (Amendment-2)
IS: 659-1964	Safety Code for Air-conditioning (Amendment-1)
IS: 660-1963	Safety Code for Mechanical Refrigeration
IS: 900-1992	Code of Practice for installation and Maintenance of Induction Motors. (Amendment-1)
IS: 2441-1984	Code Practice for Fixing Ceiling Covering
IS: 4894-1987	Test Code for Centrifugal Fans
IS: 5111-1993	Code of Practice and measurement Procedure for Testing Refrigerant Compressors (Amendment-1)
IS: 7613-1975	Method of Testing Panel Type Air Filters for Air-conditioning and Ventilation Purpose.
IS: 3588-1987	Specification for Electrical Axial Flow Fan
DW 142	Testing of Leakages in ducting
BS. EN 779:1998	Air filters
ANSI/ASHRAE	Gravimetric and dust procedures for 52.1/52.2:1992 testing air cleaning devices.

3. TECHNICAL PARTICULARS: PIPING, VALVES & PIPE FITTINGS

3.1 PIPES & FITTINGS

3.1.1 M S ERW

Sr No	Item Description	Specification
1	Service	Fire Fighting system
2	Standards	
	For Pipes 150NB & below	IS: 1239 Part-1
	For Pipes 200 NB & Above	IS: 3589
3	Dimensional standard	ANSI B 36.10
4	Class / Pressure Rating	
	For Pipes 150NB & below	Heavy Class ('C' Class)
	For Pipes 200 NB & Above	6.3 mm thick as per IS 3589
	Grade for 200 NB & Above	FE-330
5	Fittings	
	For sizes 50NB & below	ASTM A105, SW as per ANSI B 16.11
	For Pipes 65NB & above	ASTM A234, WPB as per ANSI B 16.9
6	Flanged Ends	
	For Pipes 50NB & below	ASTM A105 as per ANSI - B-16.5, 150#
	For Pipes 65NB & Above	ASTM A234, WPB AS PER ANSI -B-16.5, 150#
7	Welded Ends	
	For sizes 50 NB & below	Socket Weld Fittings
	For sizes 65 NB & above	Butt Weld Fittings
8	Nuts & Bolts	IS: 1367 (Galvanized)
9	Gaskets	IS: 2712- 2mm thick to ANSI - B - 16.21 - Rubber
10	Testing Requirement	
	a) Test Pressure during erection	Firefighting: 10.5 Kg / cm ²
	b) System Working pressure	Firefighting: 7 Kg / cm ²
11	Working Temperature	Firefighting: Ambient
12	MARKING	The Pipe and fittings / flanges shall be clearly marked with Manufacturer Name, Trade Mark & ISI Mark
13	Painting	As described in above 2.16
14	Underground piping	Underground pipes to wrapped and coated with min. 4 mm thick, 2-layer factory-made tape as per IS:15337 after the application of primer on clean pipe surface PYPKOTE over two coats of primer / Anticorrosive paint.

3.2 VALVES

3.2.1 SULICE VALVE

Sr No	Item Description	Specification
1	Service	Firefighting system
2	Specification	Valve design conforming to IS:14846
3	Type	Double flanged Sluice Valve (OS & Y Type)
4	Sizes	50 NB & ABOVE
5	Pressure Rating	PN 16
6	Material of Construction	
	Body, Wedge, Dome	Cast Iron
	Spindle	SS. as per IS:6603 Gr. 12Cr12
	Stem Nut	Leaded tin Bronze as per IS:318 Gr. LTB-2
7	End Connection	IS:1538 Table 4 & 6
8	Hydrostatic Test	
	Body	1.5 times of design pressure
	Seat	1.1 times of design pressure

3.2.2 BUTTERFLY VALVE

Sr No	Item Description	Specification
1	Type	Double Flanged
2	Size	65 to 150 NB
3	Design standard	B 16.34/EN593/ IS:13095
4	Pressure Rating	150#
5	Service	Fire Protection
6	Size	65 NB & above
7	Qty.	As per BOQ
8	Hydrotest	-Body 1.5 times of design pressure -Seat 1.1 times of design pressure
9	End Connection	Flanged ANSI B16.5
10	Material of Construction:	
A	Body	Cast Iron IS 210 GR. FG 260
B	Shaft	SS. as per IS:6603
C	Stem	SS 410
D	Disc	Cast Iron
E	Seat	EPDM
F	Gasket	Sq. Braided Non-Asbestos
G	Operation	150 NB and above shall be gear operated & less than 150 NB shall be manually operated.

3.2.3 NON-RETURN VALVE

Sr No	Item Description	Specification
1	Service	Fire Protection
2	Type	Swing check valve
3	Design standard	BS 1868/ASME B16.34
4	Testing standard	API 598
5	Size	65 NB & above
6	Operating temperature	10 - 250 °C
7	Pressure Rating	150#
8	Operating pressure	7 kg/cm ²
9	End connection	Flanged
10	Material of Construction:	
A	Body	ASTM A 216 Gr. WCB
B	Disc	ASTM A216 GR WCB + 13% CR STEEL
C	Seat ring	ASTM A105
D	Hinge	ASTM A216 GR WCB
E	Gasket	SPIRAL WOUND SS316 WITH GRAPHITE FILLER
F	Cover	ASTM A216 GR WCB

3.2.4 BALL VALVE

Sr No	Item Description	Specification
1	Type	3 Piece type
2	Size	Up to 50 NB
3	Qty	As per BOQ
4	Design standard	B 16.34
5	Testing standard	API 598
6	Pressure Rating	800#
7	Service	Firefighting system
8	Operating pressure	7 kg/ cm ²
9	Operating Temperature	5-50 °C
10	Valve Operation	Lever operated
11	End Connection	Screwed ended
12	Material of Construction:	
A	Body	ASTM A 105
B	Ball	SS 304
C	Seat	PTFE
D	Stem	SS
E	Other supply	Vendor to specify

3.2.5 PRESSURE REDUCING VALVE

Sr No	Item Description	Specification
1	Service	Firefighting system
2	Specification	Valve design conforming to IS
3	Type	Globe Type
4	Sizes	150 NB
5	Pressure Rating	PN 10
6	Material of Construction	
	Body	Cast Steel ASTM A216-WCB
	Plug	PTFE soft seal max. 220 °C · Metal seal, max. 350 °C
7	Pressure balancing	Pilot operated diaphragm type
8	Pressure Range	Inlet: 7 bar Outlet: 3.5 bar

3.2.6 AIR RELAEASE VALVE

Sr No	Item Description	Specification
1	Service	Firefighting system
2	Pressure rating	PN 16
3	End Connection	Threaded
4	Size	25 mm
5	Type	single ball type
6	Material of Construction	
	Body	Brass alloy
	cap	Brass alloy
	Float	SS 410
	Internals	SS 410

3.2.7 PRESSURE GAUGE

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Bourdon Type Pressure gauge
3	Accuracy, & FSD	± 1% of FSD
4	Size of dial, mm	100 mm
5	Range, Kg/cm ²	0 to 16 Kg/cm ²
6	Protection against turbid water Provided	Yes
7	Connection size, mm	3/8" BSP (M)
8	Case construction & material	Die cast Aluminium stove enamel black, weather proof with screwed inner of ABS plastic. IP-65
9	Measuring Element type & Material	Phosphor Bronze / Brass
10	Bourdon Material	SS – 316
11	External zero adjustment provided?	Yes. Micrometer type provided on the pointer
12	Coating on movement material	Brass
13	Over range protection	Blow out disc
14	Provided complete with all accessories?	Yes. (3-way cock, union nut, nipple & tail piece)
15	Code to which conforms	IS:3624 (CL-I)
16	Connectors between sensing element and socket	Bracing
17	Neoprene safety diaphragm on the back of the casing.	Provided
18	Upper range pointer limit stops	Provided at 120% of range span
19	Dial	White with black lettering in metric units

3.2.8 PRESSURE SWITCH

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Bellow Type
3	Range	0 to 16 Kg/sq.cm
4	Differential	Fixed
5	Maximum working pressure	10 bars
6	Sensor	Phosphor bronze bellows & brass wetted Parts
7	Enclosure	Die cast Aluminium – weatherproof – IP 66
8	Contact	SPDT (1 NO + 1 NC)
9	Contact rating	15 A, 230 V AC
10	Process Connection	½" NPT (F) with adapter
11	Repeatability	± 0.5 % FSR

4. TECHNICAL PARTICULAR: FIRE FIGHTING SYSTEM

4.1 FIRE HYDRANT SYSTEM

- a) The Hydrant System consists of an external Hydrant Piping Rings and Branches as per Drawing.
- b) There shall be hydrant Stations on the external Ring Main as marked on the plan.
- c) The external hydrant Station shall have one number Hydrant, 2 numbers RRL Hose and a Branch Pipe.
- d) The internal hydrant station shall also be provided with a first aid hose reel consisting of a 36-meter, length 25 mm dia., double braided rubber hose wound on a drum.
- e) For internal & external hydrant total two no. of hose shall be provided having length of 15 Mtr are provided with hose box.
- f) All internal risers and external piping shall be M.S. "C" class ERW Heavy gauge and shall have welded jointing for pipes above 50 mm dia. Underground Pipe shall be with Wrapping & Coating for hydrant system.

TECHNICAL SPECIFICATION

4.1.1 HYDRANT VALVE

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Single Headed Hydrant Valve
3	Design Standard	IS: 5290:1993, Type-A
4	Size	Inlet: 80 mm, OD 200, PCD160, 4holes Ø19mm. Outlet: 63 mm Female Inst. Coupling
5	Approval	BIS
6	Material of Construction	
	Body, Bonnet, Female Inst., Gland Bush, Gland Nut, Check Nut, Valve Seat, Cam tooth, Knurling Bush, Threaded Lug	S.S.-304, IS:3444, Gr.-I
	Spindle	S.S.-304, IS:6528
	Spring	S.S.-304, IS:6528
	Hand Wheel	C.I., IS: 210
	Coupling Washer	Rubber, IS:937, Type A.
	Flat Washer, Seat Washer, Bonnet Washer	Synthetic Rubber
	Chain	SS
	Blank Cap	S.S.-304, IS:3444, Gr.-I
8	Hydro Test	
	Hydraulic Test Pressure	Body: 21 Kg/cm ² for 2 ½ min. Seat: 14 Kg/cm ²
	Flow Test	900min LPM @ 7 Kg/cm ²
	Painting	As per IS:5290 & Painted with Fire Red as Per IS:5
	Marking	MFG NAME, ISI, SR. NO., YEAR OF MFG.

4.1.2 HOSE REEL

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Wall Mounted Swinging
3	Design Standard	As per IS: 884 – for Hose Reel Drum
4	Inlet Size	1" BSP. (M) Thread
5	Material of Construction	

	Side drum	M.S., Galv. Sheet (18 SWG.)
	Strip (Hub)	M.S., Galv. Sheet (16 SWG.)
	Water ways- Arm, Inlet Elbow, Mounting bracket, Tee	Alu. Alloy
	Hose (Ø 25 mm x 36 Mtrs. Long)	PVC
	Shut-off Nozzle	Bronze
6	Hydrostatic Test Pressure	1.5 times design pressure
7	Performance @ 6.8 bar (100 PSI)	Flow Rate- 24 LPM min. Throw Range – 6 Mtrs. Min.
8	Painting	Powder coated, Fire Red Shade.
9	Marking	Hose Reel, Mfg. Name, Sr. No.

4.1.3 BRANCH PIPE

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Branch pipe with Nozzle
3	Design Standard	IS:903
4	Inlet Size	63 mm Inst. (M)
5	Nozzle Bore	Ø20mm.
6	Working Pressure	7 Kg. / cm ²
7	Approval	BIS (ISI).
8	Material of Construction	
	Branch pipe Body, Nozzle	S.S.-304, IS:3444, Gr.-I
	Washer	Rubber, IS: 937, Type B.
9	Hydrostatic Test	
	Hydraulic Test Pressure	21 Kg/cm ² for 2 ½ Minutes min.
10	Finish	Polished
11	Marking	Mfg. Name, IS:903, Year of Mfg., Sr. No.

4.1.4 FIRE HOSE BOX

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Wall / Floor Mounted Double Door Type to Accommodate 2 nos. Hoses of 15m & 1no Branch Pipe (spanner & hammer).
3	Canopy	Required
4	Design Standard	IS
5	Size	750 X 250 X 600
6	Supporting frame	Required from Gr. Level.
7	Approval	BIS (ISI).
8	Material of Construction	
	Cabinet	16g M.S sheet
	Hinges	S.S.
	Front Window	Glass
	Handle	Brass
	Key	M.S., Galv.
	Nozzle Clamp	M.S.
9	Painting	Internally & Externally Painted with fire red color.
10	Marking	"FIRE HOSE BOX"

4.1.5 RRL HOSE

Sr No	Item	Specification
1	Service	Firefighting system
2	Specification	IS:636, Type-A
3	Approval	BIS (ISI).
4	Inside diameter	63 mm
5	Length	15 Mtrs.
6	Burst Pressure	40 Kg/cm ²
7	Working Pressure	14 Kg/cm ²
8	Proof Pressure	22 Kg/cm ²
9	End Connection	Pair of male & female instantaneous couplings IS: 903
10	Type of Coupling	SS 304 Instantaneous type ISI marked couplings
11	Size of Coupling	63 mm x 63 mm
12	Marking	Mfg. Name, IS:636, Year of Mfg., Sr. No.

4.1.6 FOUR WAY FIRE BRIGADE CONNECTION

Sr No	Item	Specification
1	Service	Firefighting system
2	Specification	IS:904
3	Inlets	63 mm male instantaneous coupling with NRV
4	Outlet details	Flange O.D. 280 mm, PCD 240 mm, 8 holes of 22 mm diameter.
5	Isolation Valves & NRV	Required on Inlet
6	Material of Construction	
	Body	C.I. IS: 210
	NRV male part, Valve	G.M., IS: 318, LTB-2
	Spring	Phosphor bronze IS: 7608
	Seat Washer	Rubber IS: 937
	Blank Cap	Rubber IS: 937
7	Hydrostatic Pressure Test	At 21 Kg/cm ²
8	Painting	Each Breeching will be painted with 2 coats of fire red paint shade number 536 of IS: 5 over single coat of primer. The paint shall conform to IS: 2932.
9	Marking	Each breeching shall be clearly and permanently marked. i). Manufacturers name or trademark

4.1.7 DRAWL OFF POINT

Sr No	Item	Specification
1	Service	Firefighting system
2	Specification	IS:902
3	Outlet	100 mm male coupling
4	Inlet details	Flange O.D. 200 mm, PCD 160 mm, 4 holes of 19 mm diameter.
5	Material of Construction	
	Body	C.I. IS: 210
	Spring	S.S, IS:6528
	Seat Washer	Rubber IS: 937
	Blank Cap	Rubber IS:937
6	Hydrostatic Pressure Test	At 21 Kg/cm ²
7	Make for Foot valve	Normex / Kirloskar

8	Painting	Each Breeching will be Painted with 2 coats of fire red paint shade number 536 of IS: 5 over single coat of primer. The paint shall conform to IS: 2932.
9	Marking	Each breeching shall be clearly and permanently marked. Manufacturers name or trademark

4.1.8 WRAPPING & COATING

Sr No	Item	Specification
1	Service	Firefighting system
2	Thickness/width/length	4 mm/250mm/10000mm
3	Heat resistance	Should not drip @ 100 Deg C
4	Tensile strength	300N/5 Cm & 100N/Cm cross wise

TESTING

At the time of taking over, the Hydrant System shall fulfil the following acceptance tests:

- At discharge of each pump, a pressure switch has been provided. Fire system pressure is 7 kg/cm².
- If pressure goes down by 0.5kg/cm² i.e.6.5 kg/cm², pressure switch at discharge of jockey pump will give signal to MCC to start jockey pump. If further, pressure goes down by 1.5 kg/cm² i.e.5 kg/cm², pressure switch at discharge of main electric driven pump will give signal to MCC to start main electric driven pump and to stop jockey pump automatically.
- In addition to signal from pressure switch, in case Main Pump does not start, the standby diesel driven pump shall come into operation automatically after further drop of 1 Kg / cm² pressure.
- The system maximum operating Pressure is 7 kg/cm². The hydraulic Test Pressure shall be 1.5 times of working pressure without any pressure drop up to 4 hrs. of hold up.
- After the firefighting pump has been commissioned and the system has been taken over by testing it according to the performance parameters laid down for the tire pump, this should be recorded in a maintenance register, to be kept in the pump house.
- The initial test should show the following:
Flow obtained at 7 kgf/cm²
Flow obtained at 4.55 kgf/cm² (65 percent of 7 kg)
Pressure gauge recording at 120 percent of 7 kg.

4.2 FIRE SPRINKLER SYSTEM

Sprinkler system is provided in complete warehouse area.

TECHNICAL SPECIFICATION

4.2.1 SPRINKLER

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Upright & pendent type
3	K -Factor	11.5 (storage class)
4	Temperature rating	68 'C
	Temp. Response	3 mm glass bulb
5	Minimum operating pressure	As per manufactures datasheet
6	Maximum Working pressure	12 bar
7	Finish	Natural brass

4.2.2 ALARM CHECK VALVE

Sr No	Item	Specification
1	Service	Firefighting system
2	Size	150 NB
3	Application	For wet pipe sprinkler system
4	Type of Actuation	Quartzoid Bulb Detectors and Manual Release Valve
5	End Connection	Flanged End to ANSI B 16.5 Class 150 Dimensions, Flat Face
6	Maximum Service Pressure	175 PSI
7	Hydrotest Pressure	350 PSI
8	Material of Construction	
	Housing, Clapper & cover	Ductile Iron
	Clapper Bush	Brass
9	Trim Particulars	wet pilot basic trim, test and alarm trim and manual release trim
10	Water Motor Gong	provided (part of test and alarm trim)
11	Instruments	a) pressure gauge (part of basic trim) b) Pressure switch (make and spec. as per manufacturer)
12	Approval	IS / FM approved

4.2.3 FLOW SWITCH

Sr No	Item	Specification
1	Service	Firefighting system
2	Type of flow switch	Vane type
3	Flow range	
4	End connection	
5	Terminal box protection class	IP 55
6	Maximum working temperature	Ambient
7	Sensing Element	SS 316

TESTING

- a) Start the fire water pump and develop the required pressure in the sprinkler pipes.
- b) Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler water gong alarm shall also operate when the test valve is open. This operation is to be done for each and every section of the sprinkler system and the alarm for each section (via flow switch) shall be checked for operation.
- c) After satisfactory operation of the pump the contractor shall set up mock fire and test the system. Check all annunciation's by simulating the alarm conditions at site. The Sprinkler system shall be tested as per the NFPA 13/IS.

4.3 FIRE EXTINGUISHER SYSTEM

TECHNICAL SPECIFICATION

4.3.1 ABC TYPE FIRE EXTINGUISHER - 6 KG.

Sr No	Item	Specification
1	Service	Firefighting system
2	Standard Code	IS 15683:2006
3	Type	Portable Cartridge Operated
4	Whether Seal is provided to indicate that Extinguisher has not been used	Yes
5	Materials of Construction	

	Extinguishing Medium	Mono Ammonium Phosphate based dry powder (Confirms to IS 14609)-90%
	Body	Mild Steel Sheet having Max. of 0.25% Carbon, 0.05% Phosphorous and 0.05% Sulphur
	Neck Ring	M.S. Pipe
	Valve	Brass
	Siphon Tube, Discharge nozzle	Plastic
	Pressure Gauge/indicator	As per IS 15683:2006
	Discharge hose	Rubber Braided EPDM Hose
	Wall mounting Bracket	Mild steel (Powder Coated)
6	Capacity	6 kg (Tolerance $\pm 2\%$ by mass)
7	Minimum effective Discharge Time	Minimum: 8 Sec.
8	Bulk Range of Discharge	Minimum 2 meter
9	Percentage of Discharge	Not Less than 85 %
10	Fire Rating	3A: 21B
11	Temperature Range	30 °C to +55 °C
12	Service Pressure	15 bar
13	Maximum Service Pressure	18 bar
14	Routine Tests	
	Pressure test (Pt)	35 bar (3.5 MPa)
	Minimum Burst Pressure test (Pb)	55 bar (5.5 MPa)
	Leakage Test	By applying soap solution leakage to be checked
	Partial discharge	The second pressure or weight shall not be less than 75% of the first after interruption of the Discharge.
	Burst pressure test for Discharge Hose	Not less than 35 bar (3.5 MPa)
15	Extinguishers also pass through the Following Tests (Type tests)	
	Resistance to Temperature changes, Impact, vibration test	Yes
	Resistance to Corrosion test -External, tapping & intermittent test, crushing & pressure cycling test	Yes
	Thickness of Sheet	1.8 mm (Min.)
	Anti - Corrosive Treatment	Phosphate Treatment Followed by epoxy powder coating of body DFT Not less than 50 Micron
	Accessories (brackets & screws)	Provided
16	Miscellaneous	
	Inspection & Testing	As per approved IS Standard
	Finish	PO Red as per IS: 5 (Shade 538)
	Marking	As per IS 15683:2006
	Approvals	Helium Leak Detection Tested, ISI and CE Approved
	Maintenance, Care and Refilling	As per IS 2190

4.3.2 CO2 TYPE FIRE EXTINGUISHER - 4.5 KG.

Sr No	Item	Specification
1	Service	Firefighting system
2	Standard Code	IS 15683:2006

3	Type	Portable High Pressure
4	Whether Seal is provided to indicate that Extinguisher has not been used	Yes
5	Materials of Construction	
	Extinguishing Medium	CO ₂ - Of purity 99.5% As per IS: 15222
	Body	Seamless Manganese Steel – ISI Marked confirms to IS 7285
	Discharge Valve (Wheel type)	Confirms to IS 3224
	Discharge Horn	Nonconductor of Electricity- Polyethylene
	Siphon Tube	Aluminum
	Discharge hose	Wire Braided of length 1 m. ID 10 mm
	Wall mounting Bracket	Mild steel (Powder Coated)
6	Capacity	4.5 kg (Tolerance 0 to -5% by mass)
7	Minimum effective Discharge Time	Minimum: 8 Sec. (Actual: 31 Sec. Approx.)
8	Bulk Range of Discharge	Minimum 2 meter (Actual:6.0-meter Approx.)
9	Percentage of Discharge	Not Less than 85 % (Actual: 92.9% Approx.)
10	Fire Rating	21 B
11	Temperature Range	-30 °C to +55 °C
12	Working Pressure	60-70 bar
13	Pressure test (Pt)	250 bar
14	Fire density	Not to exceed 0.667
15	Routine Tests	
	Leakage Test	By Dipping in water leakage to be checked
	Partial discharge	The second pressure or weight shall not be less than 75% of the first after interruption of the Discharge.
	Burst pressure test for Discharge Hose	Minimum Burst pressure 275 bar
16	Extinguishers also pass through the Following Tests (Type tests)	
	Resistance to Temperature changes	Yes
	Resistance to Impact test	Yes
	Resistance to Corrosion test -External	Yes
	Tapping Test	Yes
	Intermittent Discharge test	Yes
	Special test for Horn	Yes
18	Thickness of Sheet	4.0 mm (Min.)
19	Full weight of cylinder	Vendor to Specify
20	Accessories (brackets & screws)	Provided
21	Miscellaneous	
	Inspection & Testing	As per approved IS Standard
	Finish	PO Red as per IS: 5 (Shade 538)
	Marking	As per IS 15683:2006
	Approvals	Helium Leak Detection Tested, ISI and CE Approved
	Maintenance, Care and Refilling	As per IS 2190

4.3.3 FIRE SAND BUCKETS WITH CANOPY & STAND _ 9 L.

Sr No	Item	Specification
1	Service	Firefighting system
2	Standard Code	IS: 2546
3	Type	Galvanized mild steel fire bucket with Weather Proof Canopy & Stand
4	Materials of Construction	
	Buckets	Mild steel black sheets confirming to grade ST42 of IS:1079
	Handles	Mild steel Rod confirming to IS: 226
	Wires Used for stiffening of top rim	Mild steel, confirming to IS:280
	Stand & Weather Proof Canopy	Site Fabricated MS angle & MS sheet
5	Painting	
	Fire Bucket	Inside - Two coats of white paints (enamel finish), as per IS: 2932. Outside - Two coats of fire red paints, confirming to Shade No. 536 of IS: 5 (enamel finish), as per IS: 2932. Ears, Handles & Letters - Two coats of black paints, as per IS: 2932.
6	Stand & Weather Proof Canopy	Two coats of fire red paints, confirming to Shade No. 536 of IS: 5 (enamel finish), as per IS: 2932
7	Anti - Corrosive Treatment	Phosphate Treatment Followed by epoxy powder coating of body DFT Not less than 50 Micron
8	Accessories	Provided
9	Miscellaneous	
	Inspection & Testing	As per approved IS Standard
	Marking	Standard Instructions

4.3.4 AUTO GLOW SAFETY SIGNAGES

Sr No	Item	Specification
1	Service	Firefighting system
2	Standard Code	IS 12349 / BS 5499 & DIN: 67510
3	Type	Photo luminescent Type
4	Required For	Fire Extinguishers : Emergency Exits and Escape Routes : Assembly Points : Fire Hydrant Points, Fire Hose Box & Hose reels : Manual Call Points and Hooters : Fire alarm Panel & Repeater Panel : Means of Fire Fighting : Areas of Materials of Special Fire Risk : Supplementary Signs : Evacuation Plans and any other
5	Service Temperature	-40 °C to 80 °C
6	Application	Suitable for Indoor / Outdoor use
7	Luminance Intensity	Minimum 215/30(mcd/sqm) after 10 Minutes
8	Light Decay	3100 minutes
9	Service Temperature	-20 to 80 °C
10	Surface Color	As Per Standard

11	Visibility	Glow lasts > Min 10 hrs. in total darkness	
12	Materials of Construction		
	Sheet Material	Rigid photo luminescent based glow-in—the dark rigid sheet with high intensity luminous properties enclosed in a transparent weather proof UV resistance with Aluminium Framing / Sheet with Self Support arrangements	
	Sheet Thickness	2mm ± 10 %	
13	Special Feature		
	Photo luminescent, highly rigid, weather proof, scratch resistant and durable	Required	
14	Inspection Tests		
	Before starting bulk production, a sample piece of PVC self-adhesive sheet for Safety posters shall be offered for inspection. All items shall be offered for dimensional and quality of work at Manufacturer place before dispatch.		

4.3.5 TESTING (Hydrostatic Testing)

4.3.5.1 General.

- a) This standard requires hydrostatic testing of pressure vessels used as fire extinguishers and specified components of fire extinguishers.
- b) Hydrostatic testing shall be performed by persons trained in pressure testing procedures and safeguards who have suitable testing equipment, facilities, and appropriate servicing manual(s) available.
- c) A hydrostatic test shall always include both an internal and external visual examination of the cylinder.
- d) Hydrostatic testing shall be conducted using water or some other non-compressible fluid as the test medium. Air or other gases shall not be used as the sole medium for pressure testing. All air shall be vented prior to hydrostatic testing to prevent violent and dangerous failure of the cylinder.
- e) If, at any time, a fire extinguisher shows evidence of dents, mechanical injury, or corrosion to the extent as to indicate weakness, it shall be condemned or hydrostatically retested subject to the provisions. But shall be discharged and discarded where the fire extinguisher

4.3.5.2 Examination of Cylinder Condition.

- a) Where a fire extinguisher cylinder or shell has one or more of the following conditions, it shall not be hydrostatically tested, but shall be condemned or destroyed by the owner or at the owner's direction:
- b) Where repairs by soldering, welding, brazing, or use of patching compounds exist.
- c) Where the cylinder threads are worn, corroded, broken, cracked, or nicked.
- d) Where there is corrosion that has caused pitting, including pitting under a removable nameplate or name band assembly.
- e) Where the fire extinguisher has been burned in a fire.
- f) Where a calcium chloride-type of extinguishing agent was used in a stainless-steel fire extinguisher.
- g) Where the shell is of copper or brass construction joined by soft solder or rivets.
- h) Where the depth of a dent exceeds 1/10 of the greatest dimension of the dent if not in a weld or exceeds 1/4 in. (0.6 cm) if the dent includes a weld.
- i) Where any local or general corrosion, cuts, gouges, or dings have removed more than 10 percent of the minimum cylinder wall thickness.
- j) Where a fire extinguisher has been used for any purpose other than that of a fire extinguisher.
- k) When a fire extinguisher cylinder, shell, or cartridge fails a hydrostatic pressure test, or fails to pass a visual examination as specified it shall be condemned or destroyed by the owner or the owner's agent. When a cylinder is required to be condemned, the re-tester shall notify the owner in writing that the cylinder is condemned and that it cannot be re-used. Condemned cylinders shall be stamped "CONDEMNED" on the top, head, shoulder, or neck with a steel stamp. Minimum letter height shall be 1/8 in. (0.3 cm).

- l) A condemned cylinder shall not be repaired. No person shall remove or obliterate the "CONDEMNED" marking.

4.4 FIRE ALARM & DETECTION SYSTEM

This specification covers the design, manufacturing, testing, painting, packing, forwarding, supply, unloading, storing, erection, testing, commissioning, Performance Trial, Personal Training, handing over and necessary statutory approvals of continuous duty operation (in site conditions) of fire alarm & detection system.

4.4.1 SUPPLY

- a) The scope of work of the TENDERER includes the complete design, Manufacture, Supply, Installation, Testing, Commissioning, packing, transportation to site, storage, handling of Analogue addressable microprocessor-based fire alarm system and its associated equipment's, cables and installation accessories required on a turnkey basis.
- b) System shall broadly consist of following sub systems installed in free standing panel.
- c) Analogue addressable microprocessor-based fire alarm Panel.
- d) Battery backup for fire alarm system with stabilizer for 24 Hr. Normal condition & 30 Min. Alarm Condition.
- e) Interfaces and Group Alarms to PA system & Third-Party System.
- f) Interface of repeater panel with main fire alarm panel and Group Alarms to PA system & Third-Party System
- g) Repeater Panel in Security Cabin and its interface with MFAP Alarm system & Integration with Third Party System & electric Sirens.

4.4.2 ERECTION TESTING & COMMISSIONING

- a) Transportation to the place of erection from store, erection, testing and commissioning of Fire Alarm and detection System under TENDERER scope of supply.
- b) The scope shall broadly cover but not limited to the following:
- c) State of art microprocessor based intelligent addressable analogue fire detection and alarm system comprising of Addressable analogue intelligent multi detectors for Admin building, complete with Manual call point, hooters with strobe, Response Indicators, Microprocessor based intelligent fire alarm control panel, Monitor modules, control modules, repeater panel and all standard accessories.
- d) SMF Battery backup for 24 Hr. Normal condition & 30 Min. Alarm Condition and float cum boost charger in – built to the panel.
- e) All types of FRLS cables & cabling accessories.
- f) GI Pipes / GI Conduits / Metallic trucking and other accessories wherever required for laying of cables. (refer Bill of Quantity)
- g) Minor civil work required for installing fire alarm system equipment.
- h) All erection accessories, consumables and miscellaneous material not indicated in specification but required for completing the job in all respects.
- i) Preparation of Design and detailed engineering drawings.
- j) Submission of operation and maintenance manuals.
- k) Submission of as built drawings.
- l) Earthing – Extension of nearest available power earth ring to the panel location and connecting the equipment's to the earth ring as per IE rules and safety guidelines. Provision of special earth for equipment electronics.

TECHNICAL SPECIFICATION

4.4.3 Design Parameters

The ambient temperature and relative humidity details are as follows:

I. Temperature : 55° C Max.

II. Relative Humidity : 95% Max.

The system shall be designed with following particulars:

Primary Power Supply : 230 V + / - 10 %, 50 Hz + / - 5% Single

Operating Temperature : 48 deg C max.

Alarm for fire condition : Two tone distinct audible alarm

Alarm for system fault : Single tone distinct audible alarm Condition

- a) The system shall have in-built facilities for deriving power-supplies required for Operation of the system from the main supply.
- b) Suitable protection shall be incorporated on the input sides of derived supplies against over current, accidental reversal of polarity and over voltage. Automatic recovery shall be possible or the removal of overload/fault.
- c) Suitable backup power supply system, adequate to supply backup power to the system for a period, not less than 24 hours (30 Minutes for alarm condition) in case of normal power failure shall also be provided. Battery used for backup power shall be sealed maintenance free type. Battery Power calculation shall be provided by TENDERER.

4.4.4 General Conditions

- a) The Fire Detection & Alarm System shall be UL certified & FM Approved; Designed, manufactured, supplied, erected and tested as per the requirement laid in relevant NFPA/ Indian Standard specifications.
- b) The Microprocessor based, Analogue addressable Fire Detection & Alarm system shall be complete in all respects and any device not included in the specification but essential for proper operation of the system shall be deemed to be within the scope of the TENDERER whether specifically mentioned in this specification or not.
- c) The system shall be designed keeping in view the spare capacity in the hardware wherever possible and logical, in order to accommodate for future expansion and / or modification.
- d) All nameplates, drawings, operating and maintenance instructions etc. shall be in English language. The dimensions, weights shall be in metric units.
- e) All equipment, materials and components supplied shall be newly manufactured and without loose or temporary cabling. Wired options used in the system hardware shall be minimum.
- f) All components shall be rated for continuous operation.
- g) All metal parts of frames, support etc., shall be mechanically rugged and constructed of corrosion resistant material or treated with anti-corrosive finish.
- h) Adequate ventilation and cooling arrangements shall be provided; for heat dissipation.
- i) All cables for inter bay connection shall be of plug in type.
- j) All power supply shall be through. MCBs with suitable marking for the different ratings to enable easy identification and replacements.
- k) The system shall be protected against malfunctioning on account of noise from electromagnetic or electrostatic sources like power supplies, radio system, fluorescent tubes, motors, electric) mechanical relay circuits etc.
- l) All imported items shall bear UL, FM, USA certificate/ approvals and BIS approval certificate for any Indian Supply. All detectors shall have UL & FM approval.
- m) The detectors shall be located and spaced as per latest IS codes.
- n) For the items not covered in the specification, the TENDERER shall furnish the full details of such items that he proposes to offer with the details of the standards followed.
- o) The Fire Detection & Alarm System equipment shall be suitable-for operating at 240 V + 10 +/- 15 %, single phase, 50 Hz + / - 5 % power supply. If the equipment is required to, operate at any other voltage level, then necessary transformation / conversion and distribution of required power supply shall be in TENDERER's scope.
- p) All terminal blocks shall have at least 25% spare terminals (minimum being 4).
- q) All bought out items like cables and other accessories shall be supplied by the successful TENDERER strictly as per the list of preferred makes indicated in the specification.
- r) Point/ clause-wise compliance of the specification shall be furnished by the TENDERER along with his offer
- s) No separate payment will be made for supply of any material required for installation of equipment like mounting. Structures etc., as such the cost of the installation material required shall be included along with respective equipment.
- t) It is the responsibility of the TENDERER to assess the type and magnitude of work involved based on information furnished by the owner in this document and general: field conditions.
- u) TENDERER shall clearly indicate deviation; if any, from this specification, in the offer.

4.4.5 System Features

- a) The Fire Detection and Alarm system shall be State of the art microprocessor based, software controlled automatic system with necessary programming functions, annunciation and controls. The system will consist of a UL listed Microprocessor based Fire Alarm Panel, Analogue addressable multi detectors, Analogue addressable fixed temperature cum rate – of – rise heat detectors, addressable manual call Points with the necessary enclosures including explosion proof call points, Electronic sounders/hooters Addressable Fault Isolation Modules, Response indicators, Repeater panel, Control modules and Other units/accessories as required.
- b) In the event of fire, detectors shall, sense and transmit the signal to the Main Control Panel. Audio-visual alarms shall be initiated simultaneously on main control panel, repeater panel, if any and locally. Main control panel shall display the address of the detector where the smoke / fire has been sensed: Main fire alarm panel shall be provided with a block type mimic display/ backlit LCD display for indicating fire zones, detector address and LED's for fire and fault conditions.
- c) The total area under surveillance shall consist of suitable number of detector loops. Detectors and Local Response Indicators shall be installed depending upon the area under monitoring. Local response indicators shall be provided for detectors installed either above false ceiling or below false flooring, if any, and shall be installed at a place where it is easily visible.
- d) Various detectors used with the system shall continuously report about the general condition of the area being monitored.
- e) Cross zoning, of detectors shall be- provided preferably in all the areas to be covered under fire detection system.
- f) Repeater panel shall be provided at the Fire station of terminals, required at Main Security Cabin or any other place. Supply and laying of required cables from Main panel to Repeater Panel shall be included in the scope.
- g) The system fault audio alarm shall be differentiated from the fire audio alarm.
- h) A test switch shall be provided at the main panel to check the proper functioning and healthiness of the system.
- i) Provision shall be kept in control panel to add detector loops, if required in future.
- j) A number of control modules shall be included in each loop of the system (at least two nos. unless specified for more) so that the system can be suitably interlocked with ventilation / air conditioning system to prevent further spreading of fire.
- k) There shall be provision for automatic operation / actuation of firefighting – system e.g. fire protection systems etc. after detection / confirmation of fire through fire detection and alarm system.

The fire detection and alarm system shall have following functions/ provisions:

- Detection of fire in the incipient or smoldering stage.
- Facility of interchanging photoelectric and heat detectors.
- Suitable battery back-up and FCBC for un-interrupted performance.
- Dual tone hooters for differentiating between fire and fault audible alarms.
- Fully supervised for all fault conditions i.e. fail-safe operation.
- Automatic uninterrupted changeover to backup power source in the event of main supply failure.
- Pinpoint indication of location of fire.
- Exclusive wiring, independent of Mains power and other wiring.
- Decade/ micro switches on the detectors for addressing.

4.4.6 Mandatory Approvals

- a) UL listing
- b) ULC listing
- c) FM approval

4.4.7 Generic System Capabilities

- a) Analogue addressable microprocessor-based fire alarm system with initiating devices, notification appliances, monitoring and control devices as indicated on the drawings and as specified herein.
- b) The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
- c) All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
- d) Panels shall be capable of full system operation during new site-specific configuration download.
- e) Remote panel site-specific software and executive firmware downloads shall be capable of being performed over proprietary fire alarm network communications and via TCP/IP Ethernet network communications. Ethernet access to any fire alarm panel shall be capable of providing access only to authenticated users through a cryptographically authenticated and secure SSL tunnel.
- f) Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
- g) Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.
- h) The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control panel.
- i) The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

4.4.8 Wiring & Signal Transmission

- a) Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.
- b) System connections for initiating device circuits shall be Class A, Style A.
- c) System connections for signaling line circuits shall be Class A, Style 6.
- d) System connections for notification appliance circuits shall be Class A, Style Z.
- e) Initiating device circuits/detection loop shall be wired with 2-core, Copper Conductor, 1.5 sq mm (16 AWG), multi-strand (15 strands or above), twisted pair FRLS cable of approved makes.
- f) Notification Appliance Circuits shall be wired with 2-core, Copper Conductor, 1.5 sq.mm (14 AWG), multi-strand (15 strands or above), twisted pair (min 3 twists per foot or equivalent) FRLS cable of approved makes.
- g) Speaker Circuit shall be wired with 2-core, Copper Conductor, 1.5 sq mm (16 AWG), multi-strand (15 strands or above), twisted pair FRLS cable of approved makes.
- h) Terminations shall be done with proper ATC lugs with insulated sleeves.
- i) Circuit faults shall be indicated by a trouble signal at the FACP. The system shall provide a distinctive indicating audible tone and alphanumeric annunciation.
- j) Addressable Short-Circuit Isolators shall be provided at an interval of every 20 devices on a detection loop as a general thumb rule. However, it shall be ensured that a single short circuit or open-circuit fault on an automatic fire detector circuit/detection loop shall neither disable protection within an area of more than 2,000m², nor on more than one floor of the building plus a maximum of five devices (automatic detection, manual call points, sounders or a combination of these) on the floor immediately above and five devices on the floor immediately below that floor.
- k) Circuit faults shall be indicated by a trouble signal at the FACP. The system shall provide a distinctive indicating audible tone and alphanumeric annunciation.

- l) When provided, audio notification appliance circuits shall be supervised during standby by monitoring for DC continuity to end-of-line resistors.
- m) In case of distributed system with multiple control panels/network nodes, the network pathway/circuit between nodes shall have fault tolerant redundant ring topology and shall be capable of tolerating a single open- or short-circuit without loss of communication between the network nodes/control panels. It shall be a 'peer to peer' network that is not wholly dependent on a single, centralized processor or control panel. In the event of failure of the network, each control panel on the network shall be capable of operating in a 'stand-alone' mode and thus generating fire alarm warnings in response to activation of a device connected to it.
- n) When provided, audio notification appliance circuits shall be supervised during standby by monitoring for DC continuity to end-of-line resistors.

4.4.9 Cable Laying

- a) Cables shall be laid in underground/ trenches, ducts, channels, tunnels, racks, trays, in GI pipes and PVC conduits as per site conditions and plant practice. Trenches shall be made exclusively for cables of this package and shall not be combined with any other cables.
- b) Trenches shall be 700mm deep and 300mm wide. 100mm thick river sand cushion layers shall be provided above and below the cables. One layer of good quality burnt bricks shall be provided above the sand cushion.
- c) All cables shall be tested for proper continuity and insulation before laying.
- d) Care shall be taken that kinks, twists or mechanical damage do not occur to the cables during laying.
- e) All cable bends shall be made with due consideration to the minimum permissible bending radius of the cables.
- f) Care shall be taken that during laying of cables, loops are not formed.
- g) While pulling of cables, they shall not be allowed to be dragged along the ground or over a second cable already laid.
- h) Cable markers shall be provided on either side of rail / road crossing, at each turning and at regular interval of 30 meters on straight runs for underground cables.
- i) Joint markers shall be provided at every joint on the cable. Normally joints shall not be permitted.
- j) Where cables are required to cross under roads, railway lines, surface drains and pipe lines they shall be taken through GI pipes.
- k) Special care shall be taken for; protection of cables against chemical and mechanical damage
- l) All cables shall be tested for the healthy condition after laying.
- m) All cables shall be tagged for proper identification.
- n) Where cables leave panel for external buildings making use of structures available shall support it.

CABLES

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	PVC Insulated Copper Cables
3	IS Code	IS: 1554
4	Core & Size	2 Core & 1.5 mm ² FRLS twisted armored cable and 4 Core & 2.5 mm ² FRLS twisted armored cable.
5	Description	1.1 KV Power & Control Cables

4.4.10 Remote Access

- a) Fire Alarm Control Panel (FACP) shall have the capability to provide a remote service access feature using Ethernet and TCP/IP communications protocol. The Remote Access feature shall provide automatic notification of system faults and remote diagnostics of system status for responding technicians prior to arrival on site.
- b) The internet remote access service function shall provide automated real time off-site reporting of discrete system events to a remote service support center with details of internal FACP fault conditions allowing a pre-site visit analysis of repair requirements.

- c) Existing FACP controls shall be capable of retrofitting the Remote Service module as a plug-in upgrade feature.
- d) The remote service network shall work on the customers Ethernet infrastructure and be Fire-Wall friendly for two-way communications for off-site reporting. The feature shall be compatible with existing proxy servers and firewalls shall not require any special changes or modifications.
- e) The remote service system shall be a non-Windows based application to protect against conventional virus attacks.
- f) The remote service system shall be compatible with virtual LANS (VLAN).
- g) The remote service system shall work on an outbound communication premise (panel calls home) in order to eliminate the possibility of any inbound connection into the network (from trusted or non-trusted sites).
- h) The remote service system shall have capability to provide an audit trail of all events and service connections.
- i) The FAS shall be compatible to Remote Service program that provides the following requirements if asked for:
 - j) 24/7 recording of FACP service activity
- k) Off-site diagnostics by a technical specialist to provide repair and parts guidance to the service technician prior to a site visit.

4.4.11 Network Communication

- a) Network node communication shall be through a token ring, hub, or star topology configuration, or combination thereof.
- b) A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.
- c) If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.
- d) Fiber optics communication shall be provided as an option via a fiber optics modem. Modem shall multiplex audio signals and digital communication via full duplex transmission over a single fiber optic cable, either single mode or multi-mode.
- e) The communication method shall be in accordance to NFPA 72 style 7.
- f) Network communication shall be "Peer-to-Peer" and the complete or filtered event indication shall be possible in keeping with the system architecture and requirements of this document.
- g) Initiating device signals, voice signals and cause-n-effect logic shall travel in seamless and hassle-free manner over the FDA network communication channel and even the worst condition load / full load shall keep the response time within the limit specified by NFPA-72 / 2013 edition.

4.4.12 Required Functions

- a) Operator Console/HMI: The operator console/HMI shall offer the means to display, monitor and control all the ALARM, TROUBLE and SUPERVISORY signals from the initiating devices connected to the FACP. The operator console/HMI shall meet the specifications mentioned for it under "Product Specification" part of this document.
- b) Annunciation: Operation of ALARM, TROUBLE and SUPERVISORY initiating devices shall be annunciated at the FACP and the Remote Annunciator indicating the type of device, the operational state of the device (Alarm, Trouble or Supervisory) and shall display the custom label associated with the device.
- c) Priority of Signals: Fire Alarm events shall have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second, third, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. However, all the events shall be annunciated regardless of priority or order received.

- d) Non-interfering signals: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.

Alarm: A system alarm shall include:

- e) Indication of alarm condition at the FACP and at the annunciator.
- f) Identification of the device / zone triggering alarm at the FACP and the annunciator.
- g) Operation of audible and visible notification appliances until silenced at FACP.
- h) Selectively closing doors normally held open by magnetic door holders on the fire floor, floor above and floor below.
- i) Unlocking designated doors.
- j) Transmission of signal to the supervising station.

Alarm Silencing: If the "Alarm Silence" button is pressed, all audible signals shall cease operation. The visible signals shall be off at Panel Reset.

System Reset: The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows

- k) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
- l) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
- m) Record the event in the FACP historical log.
- n) Transmission of supervisory signal to the supervising station.
- o) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

Walk Test: The system shall have the capacity of 8 programmable pass-code protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one-person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:

- p) The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
 - q) Control relay functions associated with one of the 8 testing groups shall be bypassed.
 - r) The control unit shall indicate a trouble condition.
 - s) The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
 - t) The unit shall automatically reset itself after signaling is complete.
 - u) Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
- **Spoken Walk Test:** In case the system is equipped with Integrated Voice Evacuation and Public Address System, the Walk Test shall have an option to notify the findings of each device through voice notification. (Refer Bill of Quantity)
 - **Install Mode:** The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
 - It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
 - It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.

- **Service Gateway:** The system shall be compatible to a service gateway as described. If asked for a Service Gateway software application shall be provided that allows an authorized service person to remotely query panel status during testing, commissioning, and service without the need to return to the panel using standard email / Instant Messaging Tools / Smart Phones / Tablets / I Pads etc.

4.4.13 Fire Alarm Control Panel (FACP)

- a) Microprocessor based Fire Alarm Control Panel (FACP) with Quarter VGA Display/HMI displaying at least 960 or more characters in multiple lines at a time and shall accommodate the no. of detection loops and the quantity of field devices mentioned in the commercial BOQ. The HMI shall have at least 5 or more customer programmable buttons with LED indication in order to freely configure its programmed response as per project requirement.
- b) Each Detection Loop of FACP shall accommodate, monitor and control a minimum of 150 intelligent addressable devices in any combination. The exact combination of the field devices in a detection loop shall be at the discretion of the design consultant based on the project requirement & System Design. However, the System Proposed by the Solution Provider / System Integrator shall accommodate all the field devices/components and shall meet all the requirements mentioned in the commercial BOQ.
- c) FACP shall connect all the field devices (Detectors, MCPs, Control Modules, Monitor Modules, and Hooter cum Strobes etc.), shall fully monitor them and communicate to them for their status and shall be able to take intelligent decision of ALARM, TROUBLE, SUPERVISORY based on the programmed cause-n-effect logic. It should have an interactive HMI (display cum operation interface), with status monitoring LEDs for AC Power, Fire Alarm, System Trouble, System Supervisory, Ground Fault and shall have at least 5 programmable switches with LED for seamless operation & maintenance.
 - FACP shall be UL and ULC listed and FM approved.
 - FACP shall comply with UL-864 9th edition.
 - 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 NFPA-72, 2013 requirements. The memory shall be fully monitored by the FACP CPU and shall be password-protected.
- d) FACP shall support multiple System Power Supplies and Expansion Power Supplies in cascade to ensure the optimum power as required by the system load and system design.
- e) 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.
- f) FACP shall house 2 nos. of 50 AH batteries in its own housing and shall have the 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 and system load.
- g) FACP shall have the networking capability with the other control panels of same family with a network module.
- h) FACP shall be compatible to Modbus over RS-232, Modbus over RS-485, and Modbus over IP and BACnet over IP as different open protocol variants for 3rd party Integration. Exact variant and module shall be considered as mentioned in commercial BOQ. The selection of exact protocol variant shall be at sole discretion of the design consultant based on the project & system requirement. Any deviation in this regard needs a prior formal approval of the design consultant.
- i) FACP shall be compatible to seamless integration of aspiration system via application specific interface module. The FACP shall be able to view, monitor and control the aspiration system from its HMI.
- j) FACP shall have peak value logging capability and shall be able to analyses the peak value of individual sensors for individual sensitivity selection.
- k) FACP shall provide min 5 or more RS-232 ports for printers and other serial port utilities.
- l) FACP shall have IP communication capability.
- m) FACP shall have battery brackets for seismic area protection.
- n) FACP shall support the intelligent Cause-n-Effect programming based on the Boolean logic or equivalent to ensure the achievement of complete system functionality as required by this document.

- o) FACP shall be capable of indicating different events of varying priority and shall be able to map those events in intelligent cause-n-effect logic to achieve “Positive Alarm Sequence” and notification activation & deactivation as required by “Cause-n-Effect” programming. The exact requirement of cause-n-effect will depend at sole discretion of design consultant in line with the code requirement and protected premise requirement.
- p) FACP shall be capable of delivering all the functionalities mentioned under “Required Functions” of this document in “General Specification” part.
- q) FACP shall support priority setting of various events.
- r) FACP shall support the password protected authority level & assignment.
- s) FACP shall have forward and backward compatibility with various generations of devices in its family to protect client’s investment.
- t) FACP shall support distributed architecture / arrangement for the components of the same control panel / Network Node where it shall allow the mounting of various components like analogue addressable detection loop interfaces, amplifiers, fire fighter telephones, power supplies and other accessories in multiple remote enclosures at different locations away from the main FACP to facilitate effective and efficient field wiring terminations, avoid unnecessary cable runs. However, the functionality of the FACP shall be intact. A single communication failure between FACP and remote enclosures shall not affect any system performance (but report the trouble condition at FACP) and complete communication failure (by multiple discontinuities or short-circuits) of a remote enclosure shall enable it to operate as a conventional system and report the complete status of the trouble at the FACP.

The control panel shall have necessary hardware and software modules for the following:

- a) Alarm output and control output for various control functions.
- b) Facility to process the input data received from addressable analogue type detectors addressable interface unit.
- c) Electronic filters to ignore false alarm and increase sensitivity to real fires from-sensors. The electronic filters shall recognize the unwanted alarm from detectors due to electrical spikes.
- d) Separate backlit display area to indicate the address of each device and clear text about the location of alarm / trouble.
- e) The facility to support a graphic workstation comprising of PC, Printer, Keypad, Mouse, Peripherals etc.
- f) Printer facility to print out the alarm / trouble occurrences.
- g) Modbus communication with TAS system with necessary software.

Control Panel shall have the following features –

- a) Logging and storage of alarms and faults.
- b) Status checks of disabled alarm addresses before they are restored.
- c) Programming facility to “create” “add”, “delete”, “modify” the loops and detector addresses. For this purpose an alphanumeric keyboard shall be preferably integrated with the Control panel.
- d) Programmable activation of control output relays for tripping ventilation system, AC system and closing of fire doors in the event of fire.
- e) The possibility of connecting to non-addressable detectors, manual call points, alarm initiating devices etc.
- f) The fire alarm control panel display shall have facilities of brief -user guide menu to enable the operator for proper use of various menu functions.
- g) The sensitivity of each addressable analogue detector shall be changeable and readable at the control panel.
- h) Each addressable detector, interface units-can be disabled from panel for maintenance purpose and restore the same whenever required.
- i) The status check of each detector, interface units for alarm, prior warning, trouble, disabling shall be possible from control panel.

FIRE ALARM PANEL

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Intelligent Addressable Microprocessor supervised
3	Required	Complies Fully User Definable Zone, Zonal or Common

		Alarm Operation, I/O operation, Alarm Verification, User selectable Languages - Sets of changeover relay contacts for Fault & Fire conditions, Event Log (Fire & Fault), Fully integrated QWERTY keypad & Flame proof, One-man test Mode, Zone or device disablement.
		Internal power supply capacity, Network Communication Card, Communication Card, Liquid Crystal Display & Signature Driver Controller Module
4	Power Supply	230 V AC +/- 10%
5	System Voltage	24 V DC (Nominal)
6	Fault Output	28 V Repeat Output to drive relay
7	Fire Output	28 V Repeat Output to drive relay
8	Numbers of Zones	1, 2, 3.....5
9	Numbers of Loop	2 Loop & Expandable up to 1 Loop
10	Loop Capacity	Minimum 150 Devices & 150 Detectors
11	Operating Temperature	(-)0 °C to 50°C
12	Connectivity / Networking	Copper, Fiber & Copper + Fiber - Any combination

REPEATER PANEL

Sr No	Item	Specification
1	Service	Firefighting system
2	Power Supply	24 V DC (Nominal)
3	Operating Temperature	(-)0 °C to 50°C
4	Terminals	Plug in terminals
5	Circuit voltage	5 V DC
6	Connectivity / Networking	Copper, Fiber & Copper + Fiber - Any combination

4.4.14 Manual Pull Station

- j) Manual Pull Station shall be addressable and shall sit on the detection loop of the FACP and shall communicate to the FACP to report its status.
- k) Manual Pull Station shall require dual action to generate a manual fire alarm.
- l) Manual Pull Station shall have an operating temperature range of 0°C to 49°C and humidity range up to 93% RH non-condensing.
- m) Manual Pull Station shall have manual DIP switch addressing method that does not require any special tool from manufacturer and commissioning activity for replacing the Manual Pull Station in case it goes faulty.

MANUAL CALL POINT

Sr No	Item	Specification
1	Service	Firefighting system
	Description	Single Action - One stage
	Addressing Requirements	Uses 1 Module Address
	Storage and Operating Environment	Operating Temperature: 32°F to 120°F (0°C to 49°C) Storage Temperature: -4°F to 140°F (-20°C to 60°C) Humidity: 0 to 93% RH
	Operating Voltage	24 V DC (Nom)
	Operating Current	250 micro A (Standby), 400 micro A (Activate)
	Diagnostic LEDs	Status LEDs; flashing GREEN shows normal polling; flashing RED shows alarm state.
	Construction & Finish	Die cast Zinc – Red Epoxy w / Aluminum marking
	Compatibility	with respective panel make
	ADA Compliant	Should Meet ADA requirements for manual pull stations.

Designed for high ambient temperature operation	Install in ambient temperatures up to 120 °F (49 °C).
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4.4.15 Hooter with Strobe

- n) Hooter with Strobe unit shall have both audible and visual output units housed within the same device. The audible output shall be multi-tone horn output up to 98DB and strobe output shall have selectable intensity of 15, 30, 75 and 110 candelas.
- o) Strobe unit shall have a flash rate of 1Hz synchronized throughout the Fire Alarm Network.
- p) Hooter with Strobe unit shall be connected to the NAC of FACP and it shall be fully monitored by FACP.
- q) Hooter with Strobe unit shall report its status with configured parameters of each unit (hooter and strobe) to FACP.
- r) Hooter with Strobe unit shall support individual field testing in “Silent Mode” and “Non-Silent Mode” (full operational mode).
- s) If asked for, it shall be possible for FDA system to generate, print and e-mail the diagnostic report of notification devices with tested and verified parameters.
- t) 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 FACP for its activation and deactivation criteria as required.
- u) In absence of any specific mention of activation and deactivation criteria, the hooter shall stop at “Alarm Acknowledge” or “Alarm Silence” and the strobe shall stop at “System Reset” or “Panel Reset”. This requirement shall not be deviated from unless otherwise stated cause-n-effect configuration or unless a formal written approval is taken from the design consultant.
- v) It shall be possible to poll each and every hooter with strobe unit from the HMI / Display / Operator Console at FACP, isolate and include in the circuit (NAC), activate and deactivate, view the voltage received by it from the HMI / Display / Operator Console at the FACP & Network Repeater.
- w) It shall be ensured that the last notification device at respective NAC receives at least 20Vdc (or 3 V above the min operating voltage) to ensure the desired performance. There shall be a provision to verify the same either from FACP or a hand-held testing device.
- x) Hooter with Strobe unit shall support individual performance check by a hand-held testing tool during in “Silent-Mode” or “Sound-Mode” to facilitate performance check during normal working hour.
- y) Hooter cum Strobe shall have an operating temperature range of 0°C to 50°C and humidity range up to 93% RH non-condensing.

HOOTERS CUM STROBES

Sr No	Item	Specification
1	Service	Firefighting system
	Type	Addressable, Intelligent
	Lens	Optical Grade Polycarbonate (Clear)
	Wire Connections	Screw Terminals: Single input for both Horn & Strobe
	Dimensions (H x W x D)	
	Signal	113 mm x 68 mm x 21 mm
	Trim plate	127 mm x 149 mm x 13 mm
	Operating Environment	
	Temp	32°F to 120°F (0 to 49°C) ambient temperature
	Humidity	93 % Relative Humidity
	Operating Voltage	Non-Coded, filtered 16-33 Vdc or unfiltered 16-33 Vdc FWR
	Compatible synchronization modules	Intelligent Synchronization Grouped Output Module
	Application	Indoor Use

	Agency Listing/Approvals	Meets or exceeds ULC-S525 & ULC-S526, year 2004 UL requirements for standards UL1638 and UL1971, and complies with UL1480. All horn-strobes comply with ADA Code of Federal Regulation Chapter 28 Part 36 Final Rule. CSFM, MEA, FM.
	Mounting	Flush mount, Surface mount
	Temporal audible pattern	½ sec ON, ½ sec OFF, ½ sec ON, ½ sec OFF, then repeat cycle

4.4.16 Programmable Control Module

- Control Module shall be addressable and shall sit on the detection loop of the FACP and shall communicate to the FACP to report its status.
- Control Module shall provide programmable, power limited, potential-free, Form-C, SPDT Relay to control external 3rd party utilities in case of fire alarm.
- Control Module shall have the contact rating of 2A@24Vdc (resistive) and 1A@24Vdc (inductive).
- Control Module shall have an operating temperature range of 0°C to 49°C and humidity range up to 93% RH non-condensing.
- Control Module shall have manual DIP switch addressing method that does not require any special tool from manufacturer and commissioning activity for replacing the control module in case it goes faulty.
- Control Module shall be UL and ULC listed and FM approved.

CONTROL & CONTROL RELAY MODULE

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Addressable, Intelligent
3	Addressing Requirements	Uses one Module Address
4	Description	Single Input Signal Module
5	Storage & Operating Environment	
	Temp	0° C to 49°C
	Humidity	0% to 93 % RH,
6	Operating Voltage	24 V DC (Nom)
7	Operating Current	223 micro A (Standby), 100 micro A (Activate)
8	Ground fault detection by address	Detects ground faults right down to the device level.
9	Led Operation	On Board Green Led-Flashes when Polled (Normal) On Board Red Led-Flashes when in Alarm / Active

4.4.17 Programmable Monitor Module

- Monitor Module shall be addressable and shall sit on the detection loop of the FACP and shall communicate to the FACP to report its status.
- Monitor Module shall supervise potential-free, NO (Normally Open) dry contacts in order to monitor the status of an external 3rd party device.
- Monitor Module shall be configurable to report supervisory signal and alarm signal.
- Monitor Module shall have an operating temperature range of 0°C to 70°C and humidity range up to 93% RH non-condensing.
- Monitor Module shall have manual DIP switch addressing method that does not require any special tool from manufacturer and commissioning activity for replacing the monitor module in case it goes faulty.

MONITOR MODULE

Sr No	Item	Specification
1	Service	Firefighting system

2	Type	Addressable, Intelligent
3	Multiple applications	Including Alarm, Alarm with delayed latching (retard) for Sprinkler waterflow applications, Supervisory, and Monitor. The installer selects one of four "personality codes" to be downloaded to the module through the loop controller.
4	Storage & Operating Environment	
	Temp	-20° C to 60°C
	Humidity	0% to 93 % RH,
5	Operating Voltage	24 V DC (Nom)
6	Operating Current	Standby = 250µA; Activated = 400µA
7	Ground fault detection by address	Detects ground faults right down to the device level.
8	Led Operation	On-board Green LED - Flashes when polled; On-board Red LED - Flashes when in alarm/active. Both LEDs - Glow steady when in alarm (stand-alone)

4.4.18 Addressable Fault Isolator Module

- a) Fault Isolators shall be addressable and shall sit on the detection loop of the FACP and shall communicate to the FACP to report its status.
- b) Fault Isolators shall be dual port, bidirectional communication isolator so that it isolates the short-circuited wire of any side (left side or right side).
- c) Fault Isolators shall be compatible to isolation from the FACP for the field diagnostic purposes.
- d) Fault Isolator shall power up in isolated mode and shall be directed by FACP to connect the detection loop segment. It shall connect the detection loop segment only if the segment is short-circuiting free and acceptable else shall remain in isolated mode to impart short-circuit survivability and tolerance to the remaining detection loop.
- e) Fault Isolator shall be fully monitored and addressable by FACP. It shall report its status to the FACP and shall be controlled from FACP.
- f) Fault Isolator shall have an operating temperature range of 0°C to 49°C and humidity range up to 90% RH non-condensing.
- g) Fault Isolator shall have manual DIP switch addressing method that does not require any special tool from manufacturer and commissioning activity for replacing the fault isolator in case it goes faulty.

FAULT ISOLATOR MODULE

Sr No	Item	Specification
1	Service	Firefighting system
2	Type	Addressable, Intelligent
3	Addressing Requirements	Uses one Detector Address
4	Circuit Resistance	6 ohms maximum between isolators
5	Storage & Operating Environment	
	Temp	-20° C to 60°C
	Humidity	0% to 93 % RH,
6	Operating Voltage	24 V DC (Nom)
7	Operating Current	45 micro A (Standby), 45 micro A (Activate)
8	Ground fault detection by address	Detects ground faults right down to the device level.
9	Finish	White
10	Led Operation	On Board Green Led-Flashes when Polled (Normal)

4.4.19 Battery Requirements

- Tenderer to provide battery calculation considering 24 hrs. Normal & 30 min. alarm condition.

4.4.20 Drawings & Documents to be furnished:

- a) Technical write – up on the proposed system including all its components along with Manufacturer's catalogues.
- b) Certificate of approval from UL / FM / BIS.
- c) Details of cables to be used and the length restrictions.
- d) Reference list and address of contact persons for similar installations.
- e) Power supply requirement for different units.
- f) Technical specification of each component, units/ sub-units and cables.
- g) General arrangement and mounting details of all units/sub-units.
- h) Configuration diagram of complete system showing detector and other field devices connection.
- i) QAP and inspection procedure for main control panel and other units and system as a whole.
- j) Cable routing and detector layout.
- k) Technical specifications/ Data sheets for each component of fire detection & alarm system.
- l) Manufacturer's catalogue for the above.
- m) General arrangement / system configuration drawing for fire detection and alarm system.
- n) Wiring diagram for fire alarm panel.
- o) Cable schedule routing drawing, cable termination details etc. For fire alarm system.
- p) Layout details of Detectors and other field devices. Safety features-for fire alarm system.
- q) Instruction manuals for maintenance and operation as well as erection of the equipment supplied.
- r) Power supply scheme.
- s) Total power requirement.
- t) Battery capacity calculations

4.4.21 TESTING

4.4.21.1 FACP

- a) The FACP shall be checked for basic tests such as visually checking input voltage and amperage. All zones one by one shall be de wired to check for fault signal indication in the FACP.
- b) The Power Source shall be cut off and checked for stand by Supply from the Batteries. After six hours the FACP Source shall be switched on to check for auto switch over to the Mains mode.
- c) Tests shall be conducted for AC fail, charger fail, DC fail, Battery Disconnect or Battery fail. In all such cases the relevant L E D should glow, and the piezo sound shall also give sound output.

4.4.21.2 HEAT/MULTI DETECTOR

The same tests in the same sequence shall be carried out for this Detector but with the application of hot air from a hair dryer held at approximately 60 cm distance.

4.4.21.3 COMBINED TEST

The next test will be in combination of Photoelectric / Heat Detectors simultaneously with time lapse between application of smoke or heat or as required by the Client.

4.4.21.4 ADDITIONAL TEST

- a) One detector of each type will be disconnected and subjected to slow dust build - up by means as desired by the Bidder and again connected in the circuit.
- b) The FACP shall indicate the changed ambient levels and automatically adjust the analogue values for the same. These Detectors are to be replaced by new Detectors of identical type and the FACP shall then be programmed accordingly and checked. The Bidder will take custody of the removed detectors without additional cost to the Owner.

- c) Any part of the Loop shall be short-circuited. The FACP shall indicate the communication failure of all the devices connected in the short-circuited segment. After the short circuit is corrected, the Fault Isolator shall return to its normal status automatically, this being reflected in the FACP. The Loop shall then be in normal operation again. Any part of the Loop shall be de wired and tested as given above.

4.4.21.5 GENERAL REQUIREMENT OF QUALITY ASSURANCE:

- a) All materials, components and equipment covered under the Technical specification for this Project shall be procured, manufactured, tested, erected and commissioned as per a comprehensive Quality Assurance Program. It shall be the primary responsibility of the contractor to draw up and implement such a program which shall be duly approved by the EMPLOYER / Consultant / their authorized Inspection Agency.
- b) The detailed Quality Assurance Plan (QAP) for manufacturing and testing of equipment shall be prepared by the contractor and submitted for approval by the EMPLOYER/Consultant/their authorized Inspection Agency.

4.4.21.6 INSPECTION AND TESTING:

- a) The equipment shall be inspected by the TPI appointed by the TENDERER at the manufacturers/supplier's works prior to dispatch. The equipment will be inspected as per the tests pre-identified in the approved QAP to ensure conformity of the same with relevant approved drawings, data sheets, technical specification, National/International Standard.
- b) The contractor shall finalize the QAP within the stipulated schedule mentioned in the Purchase Order and the QAP shall be submitted in four sets (QAP formats shall be furnished to the successful vendor). In case of any sub-contracting, the QAP shall be prepared by the contractor in consultation with his sub-contractor to avoid any lapse in quality and disputes and misunderstanding.
- c) The contractor shall provide full and free access of the Inspection Agency to the manufacturer's works to carry out any stage inspection to ensure the quality of the equipment being manufactured.
- d) Only on readiness of the equipment and approval of all relevant drawings & QAP, the contractor shall give "Inspection Call" to the- EMPLOYER & the Inspection Agency with a clear notice of 10 days for inspection. The Inspection Call shall be accompanied by the manufacturer's internal inspection report, test certificates, purchase order, sub-purchase order, technical specification, approved QAP and approved drawings / data sheets. The Inspection Call without above documents shall be ignored. In case of any approved sub-contracting, only the main contractor shall give the Inspection Call enclosing internal inspection/ test reports of the sub-contractor duly verified by the main contractor. In case the equipment offered for inspection is found not ready, all the cost of the visit of the Inspection Agency shall be borne by the contractor.
- e) The contractor shall furnish all relevant documents and test certificates as required by the Inspection Agency during inspection. Materials shall be tested only in recognized Test House / Laboratory.
- f) No equipment shall be dispatched before inspection and issue of Inspection Certificate and dispatch clearance from the EMPLOYER / Inspection Agency.
- g) In case of waiver category items, the same shall be pre-identified in the QAP itself. For such items, the contractor shall furnish necessary certificate, test reports, etc., as agreed upon and indicated in the QAP. For these items also the contractor shall obtain "Inspection Waiver Certificate" and dispatch clearance from the EMPLOYER Inspection Agency before effecting dispatch of equipment.
- h) The issue of Inspection Certificate / Waiver Certificate for any equipment or component. Thereof does not absolve the contractor from his contractual obligations towards subsequent satisfactory performance of the equipment at site. Should any equipment be found defective in whole or part thereof after receipt at site or during erection/ commissioning and testing shall be made good by the contractor free of cost.

4.4.21.7 GUARENTEE & WARANTEE

All the equipment supplied, and jobs carried out by the TENDERER shall be guaranteed for satisfactory performance for a period of 24 months from the date of commencement of stabilization period of the system.

4.4.21.8 RESPONSIBILITY

The contractor is fully and solely responsible for timely completion and guaranteed performance of the equipment and system despite any APPROVAL / CONCURRENCE given by Employer / Consultant.

4.5 LIST OF APPROVED MAKE / MANUFACTURER OF FIRE & UTILITY SYSTEM

Sr. No.	Item Description	Makes
1	Pipes	
	M S	Tata / Jindal
	Fittings	Micro metal / Nish Trading Co./ Rajdhan
2	Enamel Paint & Primer	Asian/Berger/Jenson
3	Structural Steel	Tata / Jindal
4	Fasteners	Hilti/Ficher
5	Welding Rods	Advani/Esab
6	Rubber Gaskets	C I C/Varuna
7	Mechanical Seal	Burgmann/Dura/Selol
8	Pressure switch & gauge	Switzer / H Guru / Baumer /Danfoss /Wika
9	Ball Valves, Butterfly valve, Gun Metal valve, Sluice & Non return valve	L & T/ Audco / Kirloskar/Leader/kitz
10	Strainer	Emerald/Grandprix/Scientific Device/Leader
11	Nuts& Bolts	Lakshmi/Unbrako/GKW/TVS
12	Auto Air Release Valve	Giacomini/ Spirax Sarco
13	Single headed Hydrant valves	Safex / Sukan Equipments pvt Ltd / AAAG (shah bhogilal)/Newage Fire protection Pvt.ltd (Mumbai)
	Four-way fire Brigade Point & Drawl-off	
	Shut Off Nozzle/Branch pipe	
	Rubber pipe for hose reel	
	Hose Drum	
14	RRL Hose	
14	Fire Extinguishers	Safex/Kanex/Cease Fire
15	Sprinkler System	Tyco / Viking
	ELECTRICAL ITEMS	
1	Power Cables	Finolex / RR-Kabel / Polycab / Avocab
2	Conduit ERW	Precision Plastic / Nihir / Akg
3	Contactors & Overload Relays	L&T / Schneider / ABB / SIEMENS
4	Voltmeter/Ammeter	AE / Rishabh / MECO / Trinity / HPL / Secure
5	CT/PT Transformer	Pragati/ECS
6	S.F. Unit	Siemens/ABB/Schneider
7	Cable Trays	Vatco / Bilmal / Baroda Galvenizers / Repputed Equivalent
8	Indicating Lamps	BCH / Siemens / L&T / Precifine / TEKNIK / Schneider
9	Electrical Pump Panels	L&T / Schneider / ABB / SIEMENS
10	Switch Fuse Unit	L&T / Schneider / ABB / SIEMENS
11	Control fuse	L&T / Schneider / ABB / SIEMENS
12	MCB / ELCB	Schneider / LEGRAND / L&T / SIEMENS /Indo Asian
13	Terminals	Elmex / Connectwell
14	Control switch	BCH / L&T/Switron/Kaycee/Siemens
15	Push buttons	BCH / Siemens / L&T / Precifine / TEKNIK / Schneider
16	Flexible wires	Finolex / RR-Kabel / Polycab / Avocab
	FIRE ALARM & DETECTION SYSTEM	
1	Fire Alarm Panel / Repeater Panel / Display Unit	Siemens/Honeywell-Notifier/Simplex/Hochiki
2	Monitor Modules / Signal Control Module / Control Relay Module	Siemens/Honeywell-Notifier/Simplex/Hochiki
3	PVC insulated copper FRLS cables (armored or otherwise).	Finolex / RR-Kabel / Polycab / Avocab
4	PVC insulated copper wire	Finolex / RR-Kabel / Polycab / Avocab
5	Battery	Polycab/National/KEI

6	Manual Call Box	Siemens/Honeywell-Notifier/Simplex/Hochiki
7	Hooter / Strobe	Siemens/Honeywell-Notifier/Simplex/Hochiki
8	Response Indicator	Siemens/Honeywell-Notifier/Simplex/Hochiki
9	Conduit PVC/MS	ISI Mark/As per IS standard

NOTE:

- a) The **Client / Architect / Consultants / PMC** reserve the right to **select the manufacturer or approved make from above list, no change to be permitted in this make during the execution of the contract.**
- b) No make is being approved for following items. Such items require to be used, then sample shall be submitted for approval.

ANNEXURE I - APPROVAL OF THE ENGINEER

The contractor shall have necessary license issued by licensing authority. The license shall be valid during the tenancy of the contract. The contractor shall have his own project cell for carrying out Contracts and shall have adequate qualified and experienced Engineers to carry out the job.

Complete details of the Contractor / Sub Contractor for works shall be provided with the Offer / Tender document in a separate sheet in the following format.

General Information of the Fire Protection Contractor: (MUST BE SUBMITTED ALONG WITH TECHNICAL BID)

Name of the firm: _____.

Office Address: _____.

Telephone no.

Fax no.

Mobile no.

Factory / work shop Address. _____.

Telephone no.

Fax no.

Type of organization: _____.

Sole proprietorship. / Partnership / Private Ltd./Public Ltd.

Name of Proprietor / Partners/ Directors etc, with bio data of key persons.

Last Three years' Business turn over (with break up indicating value for supply of material).

Date of establishment.

Company registration no:

VAT - Sale tax Registration No.

Income Tax (PAN)no.

Contract License No.

Supervisor License No.

EPF Registration NO.

Name and address of the bankers.

Solvency of the firm:

Litigation History:

ANNEXURE II - DETAILS OF WORK EXPERIENCE

Work Order Reference.

Value of contract.

Year of execution

Name of the Client

List of similar type of project executed in last three Year.

Value of largest project ever executed for last three year. (Minimum Project Cost 150 to 200 Lacs – single Project)

List of Projects On hand.

Technical capacity (Regular Staff)

No. of Engineers with more than five years' experience:

No. of Trade technician with more than three years of experience.

Total Strength of staff.

List of equipment, tools, tackles.

Three References of Client / Architect / Consultants

ANNEXURE III- MATERIAL APPROVAL SHEET

Before the supply of any item to site the Contractor shall obtain written approval of the same from the Architect / Consultant in the format enclosed. The format shall include all information as asked by it. Relevant Literature of the item shall also be included. This shall be supplied in 2 copies.

MATERIAL APPROVAL SHEET		
PROJECT: Fanidhar Mega Food park, Mehsana		
CONTRACTOR: _____		
	Sheet No	(Contractor shall indicate the submittal in sequence)
	BOQ Item Reference	(To indicate the Item No as per the Tender)
	Material Description	(Short Item Description)
	Make of Item	
	Date of Submission	
	Delivery Period	
	Approvals	(Contractor to indicate approvals from IS/ NBC/ FM/ Local Fire Authorities, as necessary)
	Lead time for delivery	
	Deviation from tender	
	Literature attached	(Contractor to indicate number of pages of literature attached with each submittal)
	Signature of Contractor	
	Comments / Approval from Architect	

**ANNEXURE IV- DETAILS OF EQUIPMENTS, TOOLS TACKLES PROPOSED TO
BE DEPLOYED FOR THIS WORK**

NAME OF WORK:

NAME OF BIDDER:

DETAILS OF EQUIPMENT, TOOLS TACKLES PROPOSED TO BE DEPLOYED
FOR THIS WORK

**TENDERERS shall submit herein details of equipment, tools, tackles, etc.
proposed by him to perform the work under this contract.**

Sr. No. of Item	Description of item, of Model & Capacity	Year of Manufacture	Category Remarks	Nos/Qty
1	2	3	4	5

Contractor agrees to augment the above chart with additional number / categories of equipment, if required, to complete the work within the agreed time schedule of completion and directed by the Engineer-in-charge.

TENDERER

SIGNATURE OF

ANNEXURE V- DETAILS OF MINIMUM DAILY MANPOWER PROPOSED TO BE DEPLOYED ON THIS WORK

Sr. No.	Details of Man-power	Average No. per day week wise							
		M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8
1	Fitter								
2	Helper								
3	Welder								
4	Supervisor								
5	Engineers								
6	Site Manager								
7	Safety Officer								

Minimum manpower deployment shall be based broadly as above and shall be modified as mutually agreed to suit the detailed construction programme jointly worked out. Further if any additional manpower is required for completion of work in time, the same shall be provided by the Contractor as directed by Engineer-in-charge without any extra cost.

SIGNATURE OF TENDERER

ANNEXURE VI- ORGANIZATION CHART AND LIST OF QUALIFIED

ENGINEERS & SUPERVISORY PERSONNEL ETC. PROPOSED TO BE DEPLOYED FOR THIS WORK

- a. Please enclose the organization chart on separate sheet
- b. List of key personnel

S.N.	Name	Designation	Qualification	Experience		Remarks
				Total	With the Contractor	

Name and short resume of the experience for key personnel may be enclosed in separate sheets.

The tentative chart of site organization as above furnished shall be subject to variation to suit the construction programme / requirement and as directed by the Owner / Engineer-in-charge.

SIGNATURE OF TENDERER

ANNEXURE VII- SCHEDULE OF DEVIATION

- Bidder shall submit deviations in the format given below. The deviations submitted other than the format given below shall not be considered.
- In absence of any deviation statement it will be assumed that the requirement of specification is met without any deviation.

S.N.	Clause No.	Description	Bidder's Deviation	Remarks

SIGNATURE OF TENDERER

ANNEXURE VIII- LIST OF DRAWINGS

SR. NO.	DWG. NO.	DRAWING TITLE
FIRE FIGHTING SYSTEM		
1	MF.40.301	External Hydrant layout_ Warehouse
2	MF.40.302	Hydrant layout_ Warehouse
3	MF.40.311	Sprinkler layout_ Warehouse
4	MF.40.312	Extinguisher & FAD layout_ Warehouse
5	MF.40B.301	External Hydrant layout _CP area
6	MF.40B.302	Internal Hydrant layout _CP area
7	MF.40B.303	Internal Hydrant layout-section _CP area
8	MF.40B.312	Extinguisher & FAD layout _CP area