

***Micro Biology Lab with BSL II facility at Palode (Phase II)-
Civil, Electrical, HVAC, Fire protection Works
Part A & B***

**PART-III
PRICE BID**

**TENDER NO. HLL/ID/14/64
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1 COMMERCIAL CONDITIONS

1.0.1 The tendered rate shall inter alia be deemed to include for the provision of all materials, process, operation and special requirements detailed in the particular specification irrespective of whether these are mentioned in the description of equipment schedule and Bill of quantities or not. It is an express condition of the contract that the tendered rates for various items in the Bill of Quantities shall be deemed to include for the full, entire and final condition of the contractor respective items of the works in accordance with the provision of the contract.

1.0.2 The tendered rate shall include for all taxes, duties, etc. as applicable and shall be quoted on the works contract basis for Civil, Electrical, HVAC, Fire Protection systems etc – PART A&B - At Microbiology Lab (Phase II) with BSL II facility at CDIO, Palode

1.0.2 The tendered rate shall remain firm and free from variation due to rise in the cost of materials/equipment, labour or any other reasons whatsoever during the contract period and valid extension on the case may be.

1.0.3 The quantum of excise duty included in the tendered price, the rate at which they were assumed etc. shall be indicated in the tender.

1.1 UNIT RATES

1.11 Only approved work will be measured on completion and priced as per rates quoted against the respective items.

1.2 BRIEF DESCRIPTION OF PRICING

1.2.1. Unforeseen difficulties for which provision has not been made in the tender will in no way relieve the successful tenderer from the full execution of the work.

1.2.2 The price quoted shall be the final amount for this finished work.

1.3 INCOME TAX

Any payment to the contractor as per contract, will be made after deducting income tax as per the rules and regulations.

1.4 SALES TAX AND EXCISE DUTY

The tenderer shall include all applicable taxes and duties in their quoted rates. The bid which mention that applicable taxes and duties shall be summarily rejected.

1.6. SUBMISSION OF BILL

- 1.6.1. The contractor shall from time to time prepare and submit interim bills of the work executed and on completion of the contract, he shall prepare and submit the final bill. The measurements sheets in support of the interim and final bills shall be prepared by the contractor on the basis of measurements taken by him jointly with the project engineer and the said measurement sheets shall be submitted by him with the relevant bill.

1.7. EXTRA ITEMS

The contractor is bound to carry out any items of work necessary for the completion of the job even though such items may not have been included in the schedule of probable quantities or rates, such items being necessary or essential for completing the job. Variation order in respect of such additional items and their quantities will be issued in writing by the employer.

- 1.7.1 All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of work and on completion including that of the sub-contractors and special tradesman and all materials condemned by the project engineer shall be cleared and removed from the site by the contractor without any extra charge.
- 1.7.2 All measuring steel taps, scaffolding, ladders instruments and tools that may be required for taking measurements shall be supplied by the contractor.

1.8. OVER TIME WORK

If the contractor is required to work night or on holidays in order to maintain the time schedule he shall take prior approval from the Engineer-in-charge. He should also provide and maintain at his own cost sufficient lights as may be necessary to enable the work to proceed satisfactorily during the night.

- 1.8.1. The contractor shall give full facilities to all other contractors working on site. He shall also arrange his programme of work so as not hinder the progress of other trades. The decision of the Engineer-in-charge on any point of dispute between the various parties shall be final and binding.
- 1.8.2. It is specifically pointed out that the contractor shall not be entitled to any compensation whatsoever on account of delay in procurement or supply of controlled materials and the rates quoted in the contract are fixed till the completion of the contract.
- 1.8.3. The contractor shall co-operate with other agencies appointed by the owners for the work to proceed smoothly with the least possible delay and to the satisfaction of the owners, architects and the consultants.
- 1.8.4. The owners shall provide a source for power supply at one convenient point at site. The contractor shall at his own cost install a separate meter at the said source and lay additional cables from the said source also at his own cost. For the electricity consumed by the contractor he shall pay the owner the actual cost at the rate charged by the local authority for power for constructional purposes. The contractor shall also obtain the necessary permit for utilizing power for constructional purposes.

2 SPECIAL CONDITIONS

2.1. EXECUTION WORK

2.1.1. The whole of the work as described in the contract (including bills of materials, specification and all drawings pertaining thereto) and as advised by the Engineer-in-charge from time is to be carried out and completed in all parts to the entire satisfaction of the Employer. Any minor details of construction which are obviously and fairly intended, or which may not have been definitely referred to in this contract, but which are usual construction practice and essential to the work, shall be included in this contract.

2.2. CERTIFICATE OF COMPLETION

- 2.2.1 The contractor shall intimate to the Engineer-in-charge in writing as and when the works are completed and put into beneficial use in order to enable the consultants to check certify to the owners to take over the plants.
- 2.2.2 The work shall not be considered as completed and put into beneficial use until the consultants have certified in writing that the same has been completed and put into beneficial use.
- 2.2.3 The defects liability period of one year shall commence from date of such completion or any specific date mentioned therein.

TECHNICAL SPECIFICATIONS

AIR CONDITINING SYSTEM

SECTION – I

BRIEF DESCRIPTION OF WORK

1.1 SCOPE OF WORK

The scope of work covers supply, installation, testing and commissioning of Clean room Air-conditioning System at CDIO Palode

1.2 SPACE TO BE AIR CONDITIONED

The space to be air-conditioned is as per the drawings attached. Tenderers are advised to visit the site before submitting their bids.

1.3 BILL OF QUANTITIES & EQUIPMENT

The details of equipment and the bill of quantities required are furnished in relevant sections of this document. The technical specifications are also described. The tenderers are required to fill in the prices item wise all inclusive, as per format and submit the Bill of Quantities. The rate quoted should be inclusive of taxes, duties, freight, packing and forwarding, Octroi entry tax, loading, unloading, handling at site, etc. The tenderer shall not be eligible for any extra amount due to change in taxes, duties, etc.

1.4 TECHNICAL DATA

The tenderers are required to submit technical data documents as per the format. The data proposal sheets are enclosed in the tender document. The tenderer shall fill in all the data required.

SECTION- II

TECHNICAL DETAILS

2.1 SCOPE OF WORK

The complete scope of work shall cover supply, installation, testing and commissioning of Air Conditioning System at Clean room Air-conditioning System at CDIO Palode including preparation of shop drawings based on actual site measurements, sizing of ducts, pipes routing & exhaust ventilation for toilets. The contractor shall submit the design & drawings for approval and obtain approval from Consultant/Client before commencement of works. The scope of work includes testing for air changes per hour with fresh air changes, Air velocity, Positive pressure, Air quality - air filtration - (particles test), temperature and humidity, validation of Hepa filters by appropriate tests like DOP.

2.2 Basis of Design

The entire system has been designed based on climatological data available as given under the section basis of Design. The technical requirements given under here are only indicative and not descriptive and the contractor shall ensure that the whole system supplied is complete in all respects for the smooth operation of the plant and should be suitable for the rated performance.

2.3 Terms and Definitions

The following terms have been used in the tender specifications, drawings, etc.

BIS Bureau of Indian Standards

ASHRAE American society of Heating, Refrigeration and Air-conditioning Engineers,
USA.

ASME American Society of Mechanical Engineers.

ASA American Standard Association.

B.S British Standards

CMH Cubic Meter per Hour

CFM Cubic Feet per Minute

US GPM US Gallons per Minute

IGPM Imperial Gallons per Minute.

RPM Revolutions per Minute

BTU/Hr. British Thermal Unit per Hour

KCal/Hr. Kilo Calories per Hour

HZ	Hertz
H.P.	Horse Power
Kg/CM ²	Kilo Gram per Square Centimeter
SG	Supply Air Grilles
SD	Supply Air Diffuser
SAF	Supply Air Filters
FD	Fire Damper
VCD	Volume Control Damper
RG	Return Air Grilles
RD	Return air diffuser
FAD	Fresh Air Damper
RH	Relative Humidity
DB	Dry Bulb Temperature
WB	Wet Bulb Temperature
MV	Mechanical Ventilation
DP	Drain Point.
RO	Rate Only

The design, manufacture, identification of material and testing of the equipment covered in this specification shall comply with the latest edition of the appropriate standard of the following:

- 1) Duct Work - IS:655 (latest edition)
- 2) Welding - IS:3589
- 3) Refrigeration and Air-conditioning - As per ASHRAE/ISI air-conditioning and refrigeration institute standards.
- 4) Sluice Valves for Water Lines - IS:778-1980
- 5) Copper alloy Gate/ Globe / Check Valve for water lines - IS:778
- 6) Colour code for the identification of pipe lines - IS:2379-1963
- 7) Specific requirements for the direct switching of the individual motors - IS:4064 (Part-II)-1978
- 8) PVC insulated (HD) Electric Cables for working voltage up including 1100 Volts - IS:1554 (Part I)
- 9) Starters - IS:8554 (Part-I) 1979
- 10) HRC Cartridge fuse links upto 650 Volts - IS:2208

- 11) Inspection and testing of installation
IS:732 (Part-III) 1979
- 12) Galvanized steel wire for fencing - IS:277-1977
- 13) Three phase induction motors - IS:325
- 14) Horizontal centrifugal pumps - IS:1620
- 15) Wrought aluminum and aluminum alloy sheet and strip for general engineering purposes - IS:737
- 16) Bourdan tube pressure & vacuum gauges - IS:3624
- 17) Glossary of terms used in refrigeration and air-conditioning - IS:3615
- 18) Code for practice for standard for selection of standard worm and helical gears - IS:7403
- 19) PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 watts: -IS:1554 (Part-I)
- 20) Expanded Polystyrene (EPS) : - IS 4671.
- 21) Resin bonded glass wool: - IS 8183.

2.4 Safety Codes

The following IS codes shall be followed:

- Safety code for mechanical refrigeration - IS:660
- Safety code for air-conditioning - IS:659
- Safety code for scaffolds & ladders -IS:3696
- Code of practice for fire precautions in welding & cutting operations - IS:3016
- Code for safety procedures and practices in electrical works - IS:5216
- Code of practice for safety and health requirements in electrical & gas welding and cutting operations - IS:3696
- Indian Electricity Act 1910
- Electricity Supply Act and Indian Electricity Rules.

2.5 MACHINERY

AIR COOLED PACKAGED/DUCTABLE AIR CONDITIONING UNIT

1. Cabinet

The packaged split air conditioning units shall have metal cabinet of min 1.6mm thick (16 gauge) galvanized sheet steel. The body should be machine pressed and adequately stiffened. The body should be chemically treated for corrosion resistance and Polyester powder coated.

2. Compressor

All compressors shall be hermetically sealed scroll type of suitable capacities. Compressor shall be suitable for R22 refrigerant. The compressor shall be electrically interlocked with indoor and outdoor fan motors, HP/LP cutouts and thermostat in the evaporator. The compressor shall be housed inside the Condenser.

3. Condenser (Air cooled)

The coils shall be made of copper hydraulically bonded with aluminium fins. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the face of the coil shall not exceed 200 m/min. The coils shall be designed for a maximum working pressure of 35 kg./sq.cm. The condenser coil shall be protected on the open end by a wire mesh duly powder coated/plastic coated.

4. Evaporator coil

The coils shall be made of copper hydraulically bonded with aluminium fins. The coils shall be hydrophilic in nature. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the face of the coil shall not exceed 170 m/min. The coils shall be designed for a maximum working pressure of 35 kg/sq.cm. The circuit should include a thermostatic expansion valve/capillary tube, distributor, liquid strainer, suction line shut off valve and liquid line shut off valve.

5. Condenser motor

The condenser motor shall be of IP-55 rating.

6. Refrigeration piping and accessories

Only hard drawn copper shall be used in piping with brass fittings wherever required. Brazing shall be with silver copper phosphorous alloy. Horizontal lines shall have a grading of at least 1:250 away from the compressor and towards condenser to prevent gravity draining of oil to compressor. Liquid lines shall be sized to ensure that flashing of liquid refrigerant does not

occur. The circuit should include a thermostatic expansion valve, distributors, liquid strainer, de-hydrator and liquid lines shut off valve and suction line shut off valve.

Leaks shall be tested with soap solution at a minimum pressure of 21 kg/sq.cm. After all leaks have been repaired, system shall be tested with the test pressure maintained for a period of not less than 8 hours. No measurable drop in pressure should be detected after the pressure readings are adjusted for temperature changes. After satisfactory completion of the pressure test, the system shall be evacuated to reduce the pressure to 0.1 Kg/Sq.cm. for a period of 6 hours and vacuum broken. A vacuum pump connected to the refrigeration system shall be used to create the vacuum and the installed compressor shall not be used to create the purpose. The system shall again be evacuated and a vacuum of 0.01 Kg/Sq.cm. maintain for 24 hours before charging with correct quantity of refrigerant and oil. The system shall be operated for 12 hours and then again tested for leaks.

7.Drain Piping

Drain pipe shall be of 25/32mm dia. PVC pipes. All AHU's, Ductable and Split units shall be provided with independent drain lines. And all the drain line above false ceiling shall be insulated. The drain shall be taken to the nearest exit points.

8.Fan

Fan section including wheel and housing shall be of heavy gauge steel/aluminium. Fans shall be centrifugal, forward curved multi-blade type. Fan housing shall have inlets and guide vanes for smooth air flow. Fans shall be complete with drive motor. The fans should be statically and dynamically balanced. The fan motor should be resilient mounted. The fan should deliver a static pressure of 125 mm.

9.Dampers

All fresh air intakes shall be provided with dampers. The fan outlets should be controllable with a damper. The supply collars, wherever mentioned, shall be provided with collar dampers.

10. Filters

All evaporator units shall be provided with air filters capable for filtration unto 20 microns. The filters shall be of washable synthetic fibre type.

11. **Control Panel**

All units shall have independent electrical control panels housing contactors, overload relays, voltage cutouts, time delays, interlocks, strip connectors, indication lamps, and control fuse. All these have to be housed inside the Outdoor unit of each circuit.

12. **Thermostat**

The Thermostat shall be control wired with the control panel and shall be placed in the return air path inside the boxing.

13. **Installation**

Adequate vibration isolation using rubber/neoprene pads/vibration springs in order to reduce transmission of vibrations to the floor shall be provided for all condensing units. All units shall be properly supported from ceiling, floor or wall with suitable channels, threaded rods etc.

14. **Testing**

AHU's, Ductable and split units after installation shall be tested for its conformity to specifications. Units shall also be tested for the rated capacity and power consumption.

15. **Electric motor**

The electric motor driving the compressor shall be as per manufacturer's standard for this compressor and motor shall be suitable for operation on A.C. supply. The motor shall be continuous duty rated for the application. The motor shall be selected such a way that the motor rating is for actual requirement.

The motor shall be provided with suitable bearing to take care of loads/thrust. Necessary lubricators shall be provided to enable the bearings to be correctly greased as required. The tenderer shall also calculate KW/TR.

16. **AHU**

The AHU shall be ARI certified floor mounted/ceiling suspended type, double skinned type made of 0.8mm pre-coated GI sheets on both sides min 40mm thick PUF CFC free, 40kg/m³ between sheets, SS 304 drain pan with nitrile rubber insulation, GSS base channel. Suitable for DX coil of copper 6 rows min, Aluminum fins, with synthetic non woven type pre (EU4) and fine filters (EU 7) filtration up to 3microns. The AHU shall be with suitable static blower DIDW, centrifugal, forward curved blade, belt driven for hepa filter application comprising of suitable rated motor min EFF1 rated. The AHU shall also be provided with manual volume control damper on supply, return and fresh air sides to control the air volume or VFD. The AHU

shall be UL certified for safety. The AHU shall be provided with access doors for filter cleaning and maintenance etc. The sound level of AHU shall not exceed 60dB at 1m distance.

17. Electrical Connections

For every out door condensing unit suitable rated isolator will be provided within 1.5m from the unit by the electrical contractor and all connections to outdoor unit including cabling from isolator to ODU and between ODU and IDU shall be carried out by the HVAC contractor. In case of high static AHU suitable rated isolator will be provided within 1.5m from AHU by the electrical contractor and all connections to AHU including cabling from isolator shall be carried out by the HVAC contractor.

2.6 DUCTING SYSTEM

This section deals with supply, erection, testing and commissioning of all sheet metal ductwork conforming to specifications given below. The ducts shall be of factory machine fabricated.

2.6.1 Material for Ducting

All ducts shall be fabricated from galvanized sheet of 120 gm/sq.m (Class VIII) confirming to IS 277-1962 (revised). The fabrication of duct shall strictly conform to ISS 655-1963. The thickness of the sheet shall be as follows:

Maximum size (mm)	Thickness of sheet (mm)	Type of transverse joint connections	Bracing (if any)
Upto 300	0.63 24 G	S-drive, pocket or bar slips, on 2.5m centres	None
301 to 600 601 to 750	0.63 24 G	S-drive, pocket or bar slips, on 2.5m centres S-drive, 25mm pocket or 25mm bar slips on 2.5m centres drive	None 25x25x3mm angle 1.2m from joint
751 to 1000 1001 to 1500	0.80 22 G	40x40mm angle connections, or 40mm pocket or 40mm bar slips, with 35x3mm bar reinforcing on 2.5m centres	40x40x2mm angle 1.2m from joint
1501 to 2250	1.00 20 G	40x40mm angle connections, or 40mm pocket or 40mm bar slips, 1 m maximum centres with 35x3mm bar reinforcing	40x40x3mm angle / 40x40x3mm angle 60mm from joint.
2251 & above	1.25 18 G	50x50mm angle connections, or 40mm pocket or 40mm bar slips, 1 m maximum centres with 35x3mm bar reinforcing	40x40x3mm angle / 40x40x3mm angle 60mm from joint.

The following points shall be also taken into account while fabrication& erection of ducts.

- a) All ducts shall be as per gauges, etc. indicated on the approved drawings.
- b) All ducts of size larger than 450 mm shall be cross broken.
- c) All ducts shall be supported from RCC/truss by means of MS rods, angles, etc and the distance between supports shall not exceed 2m.
- d) The ductwork shall not extend outside and beyond height limits as specified on the approved drawings.
- e) All ducts shall be reinforced, if necessary and must be secured in place so as to avoid shifting of the ducts on its supports.
- f) The vanes shall be provided and securely fastened to prevent noise and vibration.
- g) The rubber gasket shall be installed between duct flanges in all connections and joints.
- h) The ductwork can be modified in consultation with Purchaser to suit actual conditions in the building.
- i) All flanges and supports should be primer coated on all surfaces before erection and painted with aluminum paint thereafter.
- j) The flexible joints are to be fitted to the suction and delivery of all fans with double heavy canvass. The length of flexible joints should not be less than 150 mm.
- k) All sheet metal gauges and fabrication procedure as given in BIS specification shall be strictly adhered to. The BIS specification shall form part of this contract.
- l) Necessary wall openings for ducting shall be carried out by the HVAC contractor according to the shop drawings and same shall be properly closed with mortar after duct routing.

2.6.2 Grilles/Diffusers

Material of construction - Extruded Aluminum

Supply air and return air grilles shall be continuous type and shall be fixed as given in the approved drawing. The square/rectangular diffusers shall be flush or step down type to match false ceiling pattern. The diffuser blades shall be die formed, flush mounted with single or double direction airflow. Supply of frames for fixing the grilles/diffusers, if required, is also in the scope of the contractor.

Return air grilles shall be with blanks and return air provisions. The size and appearance shall match with supply air grilles. The supply air grilles shall form part of the continuous return air grilles. The fixing of grilles/diffusers should be done in close co-ordination with false ceiling work and as directed by Purchaser.

The aluminum grilles/diffusers, etc. shall be powder coated of colours to match the interiors. However, successful bidder shall have to obtain prior approval regarding colour, finish, shape, etc. of grilles/diffusers and sample should be submitted to Purchaser for approval.

2.6.3 Testing

The complete duct system shall be tested for air leakage and complete air distribution systems shall be balanced in accordance with the approved drawings for achieving designed values inside the building.

2.7 THERMAL / ACOUSTIC INSULATION

2.7.1 Material

- ◆ Insulation material shall be Closed Cell Elastomeric Nitrile Butadiene Rubber.
- ◆ Insulation material shall have anti-microbial product protection. The antimicrobial product protection shall be an integral part of insulation that is built-in during the manufacturing process and the product protection should not allow the microbes to function, grow and reproduce.
- ◆ Resistance towards microbiological growth on insulation surface should confirm to following standards: Fungi Resistance – ASTM G21 where the fungal growth on the surface is NIL after 28 days of incubation at 28 – 30 deg C and Bacterial resistance – ASTM E 2180 where the reduction of bacterial growth is minimum 99.9% after 24 hours of incubation at 34 – 38 deg C.
- ◆ Thermal conductivity of Elastomeric Nitrile rubber shall not exceed 0.035 W/m²K at an average temperature of 20°C in accordance to EN12667
- ◆ The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class ‘O’ Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990.
- ◆ Water vapour permeability shall not exceed 1.74×10^{-14} Kg/m.s.Pa, i.e. Moisture Diffusion Resistance Factor or ‘μ’ value should be minimum 10,000 according to EN 12086
- ◆ Density of Material shall be between 40 to 60 Kg/m³.

2.7.2 Duct Insulation

External thermal insulation shall be provided as follow:

- ◆ The thickness of Nitrile rubber shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

- ◆ Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubbers sheets to size with sufficient allowance in dimension.
- ◆ Material shall be fitted under compression and no stretching of material shall be permitted. A thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The adhesive shall be strictly as recommended by the manufacturer.
- ◆ The detailed Application specifications are mentioned separately.

2.7.3 Insulation of Ducts Exposed Directly to Sunlight

For installations exposed to sunlight, after giving 36 hours curing time for the adhesive apply manufacturer's recommended UV/Mechanical Protection. Please refer the separate detailed guidelines on UV/Mechanical Protection.

2.7.4 Piping Insulation

All chilled water, refrigerant and condensate drain pipe shall be insulated in the manner specified herein. An air gap of 25 mm shall be present between adjacent insulation surfaces carrying chilled water or refrigerant. Before applying insulation, all pipes shall be brushed and cleaned. All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc. Nitrile Rubber insulation shall be applied as follows:

- ◆ Insulating material in tube form shall be sleeved on the pipes.
- ◆ On existing piping, slit opened tube of the insulating material (slit with a very sharp knife in a straight line) shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.
- ◆ Adhesive must be allowed to tack dry and then press surface firmly together starting from butt ends and working towards centre.
- ◆ Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.
- ◆ The insulation shall be continuous over the entire run of piping, fittings and valves.

◆ All valves, fittings, joints, strainers, etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

The detailed application specifications are as mentioned separately. The manufacturer's trained installer should only be used for installation.

2.7.5 Recommended Adhesive

In all cases, the manufacturer's recommended Adhesive should be used for the specified purpose.

2.7.6 Acoustic Insulation

Material shall be engineered Nitrile Rubber open cell foam.

The Random Incidence Sound Absorption Coefficients (RISACs) across the octave band frequencies; tested as per ISO 354, and Noise Reduction Coefficients (NRCs) for the Acoustic Insulation should be minimum as per the below chart:

Freq (Hz)	125	250	500	1000	2000	4000	NRC
10 mm	0.03	0.04	0.14	0.40	0.88	1.00	0.40
15 mm	0.01	0.09	0.29	0.74	1.08	0.83	0.55
20 mm	0.04	0.13	0.40	0.90	1.04	0.90	0.60
25 mm	0.05	0.25	0.86	1.14	0.88	0.99	0.80
30 mm	0.07	0.32	0.99	1.16	0.93	1.08	0.85
50 mm	0.23	0.73	1.29	0.99	1.09	1.11	1.05

- The material should be fibre free.
- The density of the acoustic insulation should be minimum 140 Kg/m³
- The insulation should have Microban[®]; Built-in Anti-Microbial Product Protection, and should pass Fungi Resistance as per ASTM G 21 and Bacterial Resistance as per ASTM E 2180.
- The insulation should be non-eroding & should pass Air Erosion Resistance Test in accordance to ASTM Standard C 1071-05 (section 12.7).
- The material should have a thermal conductivity not exceeding 0.047 W/m.K @ 20 Deg. C

- The material should withstand maximum surface temperature of +85°C and minimum surface temperature of -20°C
- The material should confirm to Class 1 rating for surface spread of Flame in accordance to BS 476 Part 7 & UL 94 (HBF, HF 1 & HF 2) in accordance to UL 94, 1996.
- The acoustic insulation should be tested and approved by Sound Research Laboratories Ltd., U.K.
- Thickness shall be 10mm for Duct Acoustic Lining
- Duct so identified and marked on Drawings and included in Schedule of Quantities shall be provided with internal acoustic lining for a distance of minimum 6 meters (or 30% of the duct length whichever is more)
- Thickness of the insulation material shall be as specified for the individual application. The insulation should be installed as per manufacturer's recommendation.

2.7.7 Accessories

Adhesive to adhere insulation to the inside walls of the duct shall be from the Insulation manufacturer only.

2.7.8 Under deck insulation

- ◆ Insulation material shall be Closed Cell Elastomeric Nitrile Rubber
- ◆ Density of Material shall be between 40 to 60 Kg/m³
- ◆ Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/m°C at an average temperature of 0°C
- ◆ The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990
- ◆ Material should be FM (Factory Mutual), USA approved.
- ◆ Water vapour permeability shall not exceed 0.017 Perm inch (2.48×10^{-14} Kg/m.s.Pa), i.e. Moisture Diffusion Resistance Factor 'μ' value should be minimum 7000.
- ◆

2.7.9 Installation procedure:

- The ceiling surface shall be cleaned with brush to remove all dirt, cement etc. If surface is uneven it should be made smooth prior to carrying out insulation work.
- A layer of synthetic rubber adhesive should be applied on the ceiling with the help of brush so that all the pores are filled and surface becomes smooth and allow it to dry.
- Allow an additional 5 mm to the total dimensions while cutting Insulation sheet. Ensure you measure the cutting dimensions on the top surface of the insulation sheet. This can be identified by the products markings; “they are always on the top surface. This surface is the one you will see after installation.
- All Insulation sheet and ceiling surfaces shall have all-over adhesive coverage. Adhesive should be applied on the side that has no product markings and identification printing. This side is the one that curves inwards.
- During installation avoid air bubbles. Always apply pressure while fixing the Insulation sheet, this action will ensure maximum bond strength.
- All cut Insulation sheet edges shall be of a “clean cut nature and not cut rough”.
- All seams and joint shall be sealed with synthetic rubber adhesive.
- Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubbers sheets to size with sufficient allowance in dimension. Material shall be fitted under compression and no stretching of material shall be permitted. A thin film of adhesive shall be applied on the ceiling with brush and then on to the back of the insulating material sheet with brush/small piece of sheet metal having smooth edges. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All joints shall be sealed. The adhesive shall be strictly as recommended by the manufacturer. There is no need to make holes for wires etc. as no supporting wires/screws are required.

While doing installation on the metal roofing, it is important to ensure that metal roof should not face direct sun light, as metal sheets becomes very hot and adhesive may not work. In such conditions work should be done in the evening / night

2.8 FIRE DAMPERS

This section deals with supply, erection, testing and commissioning of fire dampers and box type dampers, conforming to general specification and suitable for duty selected, indicated in schedule of equipment/material.

2.8.1 Dampers

- a) The fire dampers of at least two hour rating shall be provided in all return air ducts at wall crossing. All fire dampers shall be fire tested by CBRI Roorkee for 120 minutes fire rating as per UL555-1995.
- b) 6G GSS sheet blade and frame with 165mm casing, heavy duty interlocking blades and fully enclosed blade linkage mechanism, SS lateral seal blade seals, self lubricating sintered bronze bushes, fire rating as per UL555-1995 tested as per BS-476 part 20 with 18G extended sleeve 450mm and with fusible link, spring mechanism control panel temp sensor, smoke sensor, limit switch with lever for auto shut off in case of fire/smoke
- c) In the normal position the blades of the dampers shall remain open to allow maximum air to flow. The dampers shall be actuated using fusible link and spring mechanism. The fire damper shall also close due to temperature rise above 74°C.
- d) All fire dampers shall be mounted on wall with a duct sleeve 400 mm long depending on the wall thickness. The sleeve shall be factory fitted on the fire damper. The joint at the sleeve end shall be slip on type. Minimum thickness of GI sheet used for sleeves shall be 18G.

2.8.2 Exhaust Air Blowers

line exhaust air flow duct blowers suitable for single phase operations with direct driven class F motor, IP 54 insulation, max 1400rpm, necessary steel frame, and complete with GI box, with an operating sound level not exceeding 60dB at 3m distance.

2.8.3 Hepa Filter

Hepa Filter shall be of efficiency 99.97%. HEPA filters shall be aluminium corrugated and Mini pleat style. All filters shall be made up of high quality micro-fine glass fiber media. Filter frames shall be made up of Galvanized steel. Hepa filter shall ensure low pressure drop even at high airflows & with Antimicrobial protection.

All filters shall be made in accordance and tested to EN 1822 / ASHRAE 52.2 standards. These

filters shall be tested at factory and test certificates from OEM's shall be produced. The Hepa filter shall be fixed in a plenum constructed at the AHU mouth.

2.8.4 Humidity Controller

Humidity controller shall be strip heaters in order to achieve dehumidification by heating the supply air. The heater shall be placed inside the duct/plenum and humidistat shall be provided to measure the humidity level on all occasions.

2.9 PAINTING WORK

2.9.1 All equipment shall be painted as specified under respective headings. Grilles/ diffusers shall be powder coated as per approved colour matching with interiors. The contractor has to get approval of the quality and colour of paints for all types of painting work.

2.9.2 Colour scheme for the plant and equipment

i)	Compressor	.. Battle ship grey
ii)	Condenser	.. Battle ship grey
iii)	Refrigerant discharge line	.. Red
iv)	Refrigerant liquid line	.. Yellow
v)	Steel supports	.. Black
vi)	Direction of flow of water	.. White arrows
vii)	Electrical panels/sub-panel/remote control console	.. Light grey or any approved
viii)	Cable trays	.. Black
xi)	Supports for ducts/open ducts	.. Black.

2.10 GENERAL CONDITIONS

Unless otherwise specified the following shall be included in the scope of works of HVAC contractor

- a) The HVAC contractor shall make own arrangements for the safe storage of all the equipment's and items during the progress of work till handing over.
- b) The HVAC contractor shall make necessary cutting of walls, ducts, shafts etc for routing of pipes, ducts, equipment's etc as per shop drawing and shall ensure the proper closing of the openings made after erection of ducts/pipes/equipment's.

- c) The contractor shall arrange necessary power and water for the erection, installation and testing of all the HVAC equipment's till handing over of the system.
- d) The contractor shall obtain prior approval from the engineer in charge before supply of any items and necessary test certificates shall be submitted for major items as instructed by the engineer in charge.
- e) PCC/RCC pedestals, channels etc for supporting the equipment's, pipes, ducts shall be provided by the contractor as per direction of engineer in charge.
- f) Any change in the design, drawings, positions, routing shall be approved by engineer in charge before execution.

SECTION- III

MODE OF MEASUREMENT

THE FOLLOWING MEASUREMENT CODE SHALL APPLY TO THIS CONTRACT:-

3.1 MECHANICAL ITEMS

3.1.1 Ducting

- i) All sheet metal ducting work shall be measured in terms of final sheet area installed in Sq. m.
Eg:- Measurement of 600 mm x 300 mm duct of 1 m length = $[(600+300) \times 2 \times 1] = 1.80$ Sq.m/1000.
- ii) Duct fittings such as bends, elbows, tap-offs, collars, transformation pieces etc. shall be treated as ordinary duct pieces with their length measured along their centre line as mentioned in point (i).
- iii) Vanes, splitters, duct dampers, deflectors, access doors, etc. which are required to be installed in the duct work shall not be measured separately as it shall form part of the duct work.
- iv) Duct supports, channels, stiffening members, etc. shall not be measured separately. All such supports/hangers shall form part of duct work.
- v) Equipment connections such as canvas/asbestos/rexine shall be deemed to be part of the duct work, and no separate measurement shall be allowed.
- vi) No separate special measurement shall be made for bends, transformation pieces, tap offset, elbows, etc.

3.1.2 Grilles:

All grills will be measured in terms of effective area in Sq.m.

3.1.3 Diffusers:

Diffusers will be measured in terms of effective area in Sq.m.

3.1.4 Ducting Insulation

d) Ducting insulation will be measured on the basis of centerline of insulation and not the outer line of insulation.

Eg:- Measurement of 25mm thick insulation on 600 mmx300mm duct of 1m length =

$[(600+25)+(300+25)] \times 2 \times 1$ Sq.m

1000

- ii) No separate special measurement shall be made for insulation of bends, transformation pieces, tap offs, elbows, etc. All such insulation shall be treated as standard duct insulation.
- iii) Insulation item shall include all accessories and finishes as specified. No separate measurement will be made for such items.

3.2 Electrical items

Mode of Measurement of Electrical Items

The Works shall be measured, as prescribed in the specification of work, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. Wherever not specifically mentioned in the Contract, the mode of measurement as prescribed in the relevant IS codes shall be applicable and binding to the Contract. Only the latest editions of all the codes of practices including all latest official amendments and revisions shall be applicable.

SECTION-IV

TESTING OF AIR-CONDITIONING SYSTEM

- 4.1 Routine and type tests for the various items of equipment of the system shall be performed at the Contractor's own cost and test certificates are to be submitted.
- 4.2 The performance tests to determine whether or not the full intent of the specification is met shall be conducted by the contractor. After notification to Purchaser that the installation has been completed and the system has run continuously for a period of at least one week, the contractor shall conduct under the direction and the presence of Purchaser such tests as specified to establish the capacity of various equipment supplied and installed by the contractor.
- 4.3 The contractor shall operate, test and adjust the air-conditioning system units, fan, motors, all air handling appliances including adjustment of regulators, dampers, etc. Pressure differential shall be checked and positive/negative pressure area shall be maintained. All testing equipments, labour, operating personnel, oil, refrigerant or any other item required for these tests shall be provided by the contractor to enable the plant to be put in a continuous running test. Particle count shall be carried out for all clean room areas to achieve the specified class.
- 4.4 DOP (Dispersed Oil Particulate) test shall be carried out for hepa filter installation using aerosol& photo meter.

4.4 **TEST PROCEDURE:**

4.4.1 Design Conditions:

The inside and outside conditions shall be recorded on hourly basis. The outside and inside dry bulb and wet bulb temperatures shall be recorded by means of a sling psychrometer with mercury thermometers. The relative humidity shall be computed from the psychrometric chart. The inside dry bulb temperature and relative humidity shall fall within the specified limits.

The contractor should conduct performance such tests as indicated in the rated Technical Part and produce sufficient documentary proof that the plant is operating at the rated capacity.

- 4.5 The following readings shall be recorded hourly during the tests and capacity of the plant shall be computed.

1. Compressor

- a. Suction pressure - Kg/cm² (psi)
- b. Suction temperature - °C (°F)
- c. Discharge pressure - Kg/cm² (psi)
- d. Condensing Tempr. - °C (°F)

- e. Oil pressure - Kg/cm^2 (psi)
 - f. Compressor Speed - RPM
- 2. Compressor motor**
- a. Rated capacity - HP
 - b. Rated volts - Volts
 - c. Rated current - Amps
 - d. Starting current - Amps
- 3. Inside unit**
- a. Air velocity - M/Hr. (FPM)
 - b. Face area - M^2 (SFT)
 - c. Air quantity - $\text{M}^3/\text{Hr.}$ (CFM)
 - d. Entering air temp. DB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
 - e. Entering air temp. WB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
 - f. Leaving air temp. DB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
 - g. Leaving air temp. WB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
- 4. Air Grilles**
- a. Area of Grilles - M^2 (Sft)
 - b. Velocity - M/Hr (FPM)
 - c. Air flow rate - M^3 (FPM)
 - d. Temperature DB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
 - e. Temperature WB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
- 5. Air Diffusers**
- a. Area - M^2 (Sft)
 - b. Velocity - M/Hr (FPM)
 - c. Air flow rate - M^3 (FPM)
 - d. Temperature DB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)
 - e. Temperature WB - $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

6. Filters

- | | |
|--|---------------|
| a. Total area | - M^2 (Sft) |
| b. Effective area | - M^2 (Sft) |
| c. Velocity of air upstream/downstream | - M/Hr (FPM) |
| d. Quantity of air upstream/downstream | - M^3 (CFM) |

SECTION-V

TECHNICAL DATA

(To be submitted along with the tender)

5.0 The following data shall be furnished along with the offer: (REFER LIST OF APPROVED MAKES)

(Attach catalogues, brochures, etc.)

1. Ductable Split unit

Manufacturer

Model

Actual capacity TR

Overall dimensions

Over all weight

Operating weight

Refrigerant

Compressor

Manufacturer

Model

Type

Capacity at the specified water temp. and flow rates - in TR

Type of capacity control provided

Type of lubrication

KW / TR

Motor

Model

Manufacturer

Number of motors

Capacity HP

Whether provided with part winding

Type

Class of insulation

Speed RPM

Characteristics

Type of starter

Rating

Whether the following protections are provided.

i) Overload Yes/No

ii) Under voltage Yes/No

i) Single phase protection
(for three phase motor starters) Yes/No

2. Inside units (AHU/Indoor unit)

Manufacturer

Model

Type of fan

Fan speed (R.P.M.)

No. of fans.

Fan wheel diameter (mm)

Drive arrangement

Material and thickness of fan wheel and blades.

Materials and thickness of housing.

Fan outlet area

Outlet velocity.

Total air quantity

Static pressure at outlet. (mm. of water)

Whether statically and dynamically balanced.

B.H.P. Consumed

Total weight of all items

Cooling Coil

Material of Tubes

Material of fins

Tube diameter

Tube thickness

Fin thickness

Method of bonding of fins

No. of fins/cm.

Total tube surface outside

Test pressure

Coil face area

Filter

Manufacturer

Type of filters

Filter medium

Material of frame work and its thickness

Face area

Face velocity across filters

Pressure drop across filters (mm of water)

Motor

Manufacturer

Model

Number of motors

Capacity HP

Type

Class of insulation

Speed RPM

Characteristics

Type of starter

Rating

Whether the following protections are provided.

- | | | |
|-----|--|--------|
| i) | Overload | Yes/No |
| ii) | Under voltage | Yes/No |
| | iii) Single phase protection
(for three phase motor starters) | Yes/No |

3. Ducting

Material

Manufacturer

4. Insulation (for ducting)

Manufacturer

Material

'k' Value at 10 (°C) mean temperature

Thickness.

Density

Fire Retardant property

Note : Any other data relevant to each equipment shall also be furnished.

Approved make of items –HVAC

1.	AC Condensing Outdoor Units/Ductable Units /Split AC	-	Blue star/ Voltas/ Carrier /Hitachi/ ETA/Daikin/Samsung/General
2.	AC Compressor	-	Danfoss/Koplan/Emerson
3.	AHU's&TFEA Units	-	Carrier/ Edgetech/VTS/ETA
4.	Heat Pipe	-	SPC
5.	Air- curtain		VTS/Systemair
6.	Copper Pipes	-	Totaline/Mandev/Piyush
7.	Three phase motors	-	Siemens/Kirloskar/Crompton/Bharath Bijlee /ABB /Alsthom
8.	Aluminium Conductor Cables	-	Finolex/NICCO/Havells//Gloster
9.	Stabilizer	-	V Guard/VOLTAS/Everest
10	GI/Al Sheets	-	SAIL/TATA/JINDAL/HINDALCO/NACL
11	Resin bonded Glass wool	-	UPTWIGA /Owens Coning/KIMMCO
12	Nitrile Rubber Insulation	-	Armaflex/K Flex
13	Grilles/Diffusers	-	Airmaster/Carryaire/ACRP/ Air Flow/Systemair
14	Pressure gauges	-	Feibig/H-Guru/Jaspin
15	Industrial type thermometers	-	Feibig/H-Guru/Jaspin
16	Fire/Volume Control Dampers	-	Carryaire/Airmaster/Air Flow/ Systemair
17	Exhaust/ Fresh air/ Duct Fans	-	System Air/Kruger/Nicotra
18	Paints	-	ICI/Asian/Berger
19	PVC pipe	-	Any ISI marked
20	Hepa Filter	-	Aerosol/Pyramid/AAF/Thermodyne
21	Valves	-	Audco, Leader, Kirloskar, Advance,
22	Factory Fabricated Ducts	-	ZECO, Western Air Ducts,Rolastar,Camduct
23	Double Skin Aluminum Panel	-	Lloyd, Rinac, Beardshell

24	Digital sensors (temp-humidity- pressure)	-	Honeywell, Siemens, Anergy
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TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING SYSTEM

1.0 TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING SYSTEM

1.1 General

Work under this subhead is time-bound and has to be completed within the time limit set in the tender. Work shall be executed in accordance with an agreed schedule which shall be submitted by the tenderers along with offer and agreed to by owners.

1.2 Scope of Work

The scope of work in this subhead shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely do all work relating to the supply, installation, testing & commissioning of Fire Detection & Fighting System Works of new CDIO Palode as described herein after and shown on the drawings. The scope of work in general shall include the following.

- i) Fire Fighting Pumps & Accessories and related electrical works
- ii) External & Internal Fire Hydrant System.
- iii) Sprinkler system.
- iv) Fire Detection System.
- v) Hand Held appliances.

Without restricting to the generality of the foregoing, the work shall include the following:

- A. Pumps - One number Terrace Pump of 450 LPM at 35 M head.
- B. Other piping system ancillaries such as Suction and Delivery Headers, Air Vessel, Pressure Gauges, Pressure Switches, Pump Panel etc. as required.
- C. External Hydrant Ring Main with single headed Yard Hydrants, RRL Hose, Branch Pipes, etc. all housed in a Hose Box.
- D. Internal Hydrant system where required with single headed landing valves accompanied by 1 number swinging type Hose Reel, 2 numbers RRL Hoses,

Branch Pipe etc. all housed in the niche. Bidder shall provide front frame with shutter for niche.

- E. Sprinkler system as indicated in the drawing.
- F Hand appliance as per Bill of Quantities.
- G. To obtain the approval of the relevant drawings before actual installation at site and to get the complete installation inspected and passed by the concerned authorities, as may be necessary as per local bye laws. (Any fee payable to the local bodies for such activities shall be reimbursed by the CLIENT/CONSULTANT on production of receipt).

1.3 Contractor's Experience

- 1.3.1 Contractors shall engaged specialist agency only for this work of Fire Fighting systems.
- 1.3.2 The selected specialist agency must have sufficient experience in the execution of turn-key projects as specified.
- 1.3.3 Contractor must submit with the tender a list of similar jobs carried out by him as required along with the name of works, name and address of clients, year of execution, capacity of plant and value of work.

1.4 Technical Information

- 1.4.1 Contractor shall submit along with the tender copies of detailed specifications, cuts, leaflets, and other technical literature of equipment and accessories offered by him.
- 1.4.2 Contractor's attention is specially invited to the special conditions and other clauses in the agreement which required the contractor to :-
 - a. Submit detailed shop drawings.
 - b. Use material of specific makes and brands.
 - c. Obtain all approvals from Fire Fighting authorities.
 - d. Execute the entire work on a turn-key basis so as to provide a totally operating plant.

1.5 Exclusions

- 1.5.1 Work under this contract does not include the following work:-
- 1.5.2 Electrical cables upto incoming motor control centre.

1.6 Site Accessibility

- 1.6.1 The equipments are to be located in pump house located within the Service block.

- 1.6.2 The equipment must be carried from the goods receiving station to the site in an extremely careful manner to prevent damage to the equipment building or existing services.
- 1.6.3 Contractor must visit the site and familiarize himself with above problems to ensure that the equipment offered by him are of dimensions that they can be carried and placed in position without any difficulty.

1.7 **Approvals**

The contractor shall prepare all submission drawings and obtain all approvals of fire fighting works from fire fighting authorities.

1.8 **System Description**

- 1.8.1 The Hydrant System shall comprise of AC motor driven pump set, standby diesel pump set, jockey pump set for pressurization with all required accessories including valves, special fittings, instrumentation, control panels and any other components required to complete the system in all respects.
- 1.8.2 The Hydrant System shall be semi automatic in action and shall be laid covering the entire area externally and all the floors internally with independent piping system. For the Sprinkler System, a separate piping system shall be installed as per codes if required.
- 1.8.3 The Hydrant System shall be kept pressurized at all times. The proposed Jockey Pump shall take care of the leakages in the system, pipe lines and valve glands.
- 1.8.4 The pressure in the hydrant pipe work shall be kept constant at 7 Kg/cm². In the event of fire when any of the hydrant valve in the network is opened, the resultant fall in header pressure shall start the AC motor driven fire pump through pressure switches automatically. There shall be one Diesel Engine Driven pump as standby for hydrant system. In case of failure of electricity or failure of Electric Pump to start on demand, the standby Diesel Pump shall automatically take over.
- 1.8.5 However, shutting down of the pump set shall be manual except for the Jockey Pump which shall start and stop automatically through pressure switches. In addition to auto start arrangements, the main pump shall also have an over-riding manual starting facility by push button arrangement.
- 1.8.6 The piping for the hydrant system in the yard shall be laid in soil 1 Metre deep or in rectangular Trench. The pipe laid in soil shall be protected as specified in para 1.9.3 below. The scope of work includes necessary excavation of trench and back filling the same. The scope of work also includes necessary watering, ramming, removing the surplus earth from the site and construction of brick pedestal at 3 Mtrs intervals of size as indicated in the Bill of Quantities. Pipes shall be cleaned before wrapping and coating.
- 1.8.7 The yard hydrants shall be placed at a regular spacing of 30m - 45m centre to centre. The following accessories are proposed near each yard hydrant.

- i) One no. gunmetal single headed hydrant valves.
- ii) Two nos. RRL Hoses of size 63mm dia x 15m long.
- iii) One nos. gunmetal Branch pipe.

Gun metal hydrant valve, RRL hose and gunmetal branch pipe will be accommodated in an aluminium hose box mounted on brick pedestals.

1.8.8 The Internal Hydrant System shall be provided at points as indicated on the drawing on each floor.

1.8.9 The hydrant point shall be directly tapped from the Riser pipes, and shall be furnished with required accessories such as

- i) One no. gunmetal single headed hydrant valves.
- ii) Two nos. RRL Hoses of size 63mm dia x 15m long.
- iii) One no. first aid Dunlop hose reel full swinging type 20mm dia x 30m long.
- iv) One no. gunmetal Branch pipe.

The hydrant risers shall be terminated with air release valve at the highest points to release the trapped air in the pipe work. At each tapping from the Riser an Orifice Plate shall be located in the lower floors to reduce the pressure at no extra cost.

1.8.10 Sprinkler system shall be distributed so as to cover 10–12 sq. m area with one sprinkler.

Sprinkler risers shall be provided with instantaneous control valve with alarm gang. The alarm valve assembly shall be complete with all accessories as required for the performance.

A suitable drainage arrangement with bye pass valves shall be provided to facilitate maintenance of sprinkler pipe work.

1.8.11 To compensate for slight losses of pressure in the system and to provide an air cushion for counteracting pressure surges/water hammer in the underground pipe work Air Vessels shall be furnished in the pump room near fire pumps. The air vessel shall be normally partly full of water and the remaining being filled with air which shall be under compression when the system is in normal operation.

1.9 GENERAL SPECIFICATIONS

1.9.1 Pipes and Fittings

Pipes upto 150mm dia shall conform to IS-1239. Pipes with dia 200mm and above (6mm thick) shall confirm to IS-3589. All pipes shall be I.S.I. marked. Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

1.9.2 Jointing

Joint for black steel pipes and fittings shall be metal-to-metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between C.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with C.I. or M.S. flanges with appropriate number of bolts. Flanged joints shall be made with 3mm thick insertion rubber gasket.

Note: Joints for pipes and fittings upto 50mm diameter shall be threaded joints using Teflon Tape or equivalent bonding tape on the threads. Joints for pipe and fittings above 50mm diameter shall be welded joints.

1.9.3 Pipe Protection

- a) All pipes in under ground masonry trenches/service tunnels, above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.
- b) Pipes in wall chases shall be protected from corrosion by 2 coats of bituminous paints.
- c) Protection of Underground Pipes:

The underground steel pipes shall be protected by coating and wrapping. The coating and wrapping shall be done, in general, as per IS:10221-1982.

It specified in Bill of Quantities, the proprietary pipe protection system shall be provided as per the Manufacturers recommendation. The proprietary system shall be of approved make.

1.9.4 Installation of Pipes

All pipes shall be adequately supported from ceiling or walls by structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time of slab casting or provide suitable anchor fasteners.

The pipe supports or hangers shall be designed to withstand combined weight of pipe, pipes fittings, fluid in pipe and insulation. Pipe supports shall be of steel and coated with rust preventing paint and finished with two coats black enamel paint. The maximum spacing for pipes supports shall be as below:

Pipe (MM)	Spacing (MTR)	Size of support
Up to 25	2.0	6mm
32 to 65	2.4	8mm
75 to 125	2.7	10mm

150 & above

3.0

12mm

Pipes supports shall be spaced at maximum interval of 1.5 mtrs. on either side of heavy fitting and valves. Wherever piping passes through walls, pipes sleeves of diameter larger than that of piping shall be provided. Pipe sleeves shall be of steel or cast iron pipe.

The underground piping shall be supported with cement concrete blocks of suitable size and strength provided at an interval of 2.5 mtrs. The pipes shall be laid at 1 mtr depth (top of the pipe) and trench excavated for sufficient width. The rate for pipe shall include the scope of excavation/refilling the trench. 1:2:4 concrete thrust blocks are also to be provided at turning of pipe. The cost of installation includes concrete pedestals etc. as required and to be included in the item rate.

1.9.5 Orifice Flanges

Contractor shall provide orifice flanges fabricated from 6mm thick stainless steel plates on the branch lines feeding different zones/floors so as to allow required flow of water at a pressure of 3.5 kg/sq.cm. for each hydrants and 2 bar at installation valve for sprinkler system. The contractor shall design the orifices to ensure the required pressure. No extra cost shall be paid for the orifice plate.

1.9.6 Valves & Other Accessories

1.9.6.1 General

Each valve body shall be marked with cast or stamped lettering giving the following information's:

- a) The manufacturer's name or trade mark
- b) The size of the valve
- c) The guaranteed working pressure

Isolating valves on the water supply lines shall be full bore ball valve type for pipe diameters upto 50mm. For 65mm dia and above these shall be butterfly valves.

1.9.7 Full Way Ball Valve

The valves shall be of full bore type and of quality approved by the Consultant/Owner. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

1.9.8 Sluice Valve (SV)

1.9.9

It shall be of IS 780 standards. Construction shall be of inside screw, non-rising stem for water purpose and flanged type. Pressure class shall be of PN 1.0 and tested to 15 kG/Sq.cm pressure. Seat ring shall be of gun metal as per IS 318. Gasket packing shall be of CAF / Graphited asbestos

1.9.9 Non-Return Valves

Non-return valves are to be IS:778-1984 manufactured from gun-metal or dezincification resistant brass.

1.9.10 Drain Valve

Drain Valves are to be provided at all low points in the system for draining the water. These shall be 40mm dia full way ball valve fixed on 40mm dia black steel pipe.

1.9.11 Inspection & Testing Assembly

Inspection and testing of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve.

1.9.12 Flow Switch

Flow switch shall be provided on sectional mains and branch lines as indicated on drawings, or necessary and required and directed by the Engineer-in-charge.

Flow switch should be suitable to actuate at a minimum of flow and shall be suitable for connection to a central annunciation panel.

1.9.13 Pressure Switches

Pressure switches shall be differential type for operation of all pumps and for the various duties and settings required. Pressure switches shall be for heavy duty operation and of approved make. All pressure switches shall be factory calibrated.

1.10 External Fire Hydrants

Yard Hydrant valves shall be single headed as per IS : 5290. The valve shall be complete with hand wheel, quick coupling connection spring loaded type and gun metal blank cap. The Yard Hydrant shall be laid on 125 and 100mm dia pipe as per standards. Hydrant Ring Main, branched off to 80 mm dia and Stand Post of 80mm dia.

1.11 Internal Landing Valves

The internal landing valves shall be single-headed made of gun metal and conforming to IS:5290. It shall be complete with hand -wheel, quick coupling connection spring loaded type and blank cap.

1.12 Hose pipes, Branch Pipes and Nozzles

Hose Pipe: Hose pipe shall be rubber lined woven jacketed and 63mm in diameter. They shall conform to type-2 (Reinforced rubber lined) of IS:639-1979. The hose shall be sufficiently flexible and capable of being rolled.

Each run of hose pipe shall be complete with necessary coupling at the ends to match with the landing valve or with another run hose pipe or with Branch pipe. The couplings shall be of instantaneous spring lock type.

Branch Pipe: Branch pipe shall be of gunmetal 63mm dia and be complete with male instantaneous spring lock type coupling for connection to the hose pipe. The branch pipe shall be externally threaded to receive the nozzle.

Nozzle : The nozzle shall be of copper or gunmetal, 20mm in internal diameter. The screw threads at the inlet connection shall match with the threading on the branch pipe, the inlet end shall have a hexagonal head to facilitate screwing of the nozzle on to the branch pipe with nozzle spanner.

End couplings, branch pipes, and nozzles shall conform to IS:903-1985. two hoses of 15 mtr. Lengths with couplings shall be provided with each external (yard) hydrant. One nozzle and one branch pipe with coupling shall be provided with each yard hydrant.

1.13 External Fire Hose Cabinet

The external fire hose cabinet to accommodate the hose pipes, branch pipe nozzle and the hydrant outlets shall be fabricated from 1.5m thick sheet steel. This shall be lockable and provided with center opening glazed doors.

The support for hose cabinet shall be of brick work up to a height of 0.5m above ground level. The depth of footing for this support shall be minimum 50cm below ground level, resting on leveling course of minimum 10cm of PCC (1:5:6). The brickwork shall be plastered in cement mortar (1:6). The hose cabinet shall be painted red and stove enameled.

1.14 Internal Fire Hose Cabinet

Each internal fire hydrant valve shall be housed in a niche of size indicated on drawings. Each internal fire hose Cabinet shall hold single headed hydrant, 2 Hoses, 2 Branch pipes and 1 no. Dunlop hose reel mounted on a drum.

- A) The cabinet shutters & frames shall be fabricated from boxed steel sections and MS plate 2mm thick.
- B) The front glass of shutters shall be 5.0 mm thick clear glass and shall be held by means of rubber. Locking arrangement shall also be made with one number of mortice lock of approved make. A separate Key Box of 2 mm thick MS sheet with glass facing shall be provided.
- C) The Shutter shall be given a powder coat finish in post office red colour.

1.15 Hose Reel

The hose reel shall be directly tapped from the riser through a 25 mm dia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The Hose Reel shall be swinging type (180 degrees) and the entire Drum, Reel etc shall be as per IS:884. The rubber tubing shall be of approved quality and the nozzle shall be 6 mm dia shut off type.

1.16 Brigade inlet Connections

Two sets of 4 ways collecting head Fire Brigade connection shall be provided at the location indicated in the drawing.

The inlet to the riser shall be with 150mm dia sluice valve and non-return valve. The scope shall include providing necessary reducers, tees bends and special fittings as required. Necessary enclosure made of 2mm thick sheet metal with support shall be provided, as in the case of hose cabinets.

1.16 AUXILIARY PUMPING EQUIPMENT (Jockey Pump)

1.16.1 Scope

This section covers the details of requirements of the auxiliary equipment necessary for the operation of the fire pumps and the wet-riser system.

1.16.2 Drive

The pump shall be directly driven from the electric motor. Flexible coupling and coupling guard shall be provided.

1.16.3 Capacity

The discharge and head of the jockey pump shall be as mentioned in Bill of Quantities.

Jockey pump shall be Horizontal type. The pump casing shall be of cast iron and parts like impeller, sleeve, wearing ring etc. shall be of non-corrosive metal like bronze, brass or gunmetal. The shaft shall be of stainless steel.

Bearings of the pump shall be effectively sealed to prevent loss of lubricant or entry of the dust or water. The pump casing shall be designed to withstand 1.5 times the working pressure.

1.16.4 Motor

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz, system. The motor shall be totally enclosed fan cooled type confirming to protection clause IP 21 of IS 4691. The class of insulation shall be B, synchronous speed shall be 3000 RPM/1500 RPM. The motor shall conform IS 325-1978 and rated for continuous duty.

1.16.5 Motor Starter

The motor starter shall be automatic star delta type with overload trip, but without under voltage/no volt trip. Starter shall conform to IS 1822-1967.

2.0 MAIN ELECTRIC FIRE PUMP

2.1 Scope

This section covers the details of requirements of the motor, starter and pump for the electrically operated fire pump.

2.2 General

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz. AC system. Both the motor and the pump shall be assembled on a common base plate of fabricated MS channel type or cast iron type.

2.3 Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided.

2.4 Fire Pump

The fire pump shall be horizontal split casing centrifugal type. It shall have a capacity as specified in BOQ, developing adequate head so as to ensure a minimum pressure of 3 Kg per sq.cm at the highest and the farthest outlet. The delivery pressure at pump outlet shall be not less than 7 Kg. Per sq.cm. in any case.

The pump shall be capable of giving a discharge of not less than 150 percent of the rated discharge, at a head of not less than 65 percent of the rated head. The shut off head shall be within 120 percent of rate head.

The pump casing shall be of cast iron to grade FG 200 to IS:210 and parts like impeller, shaft sleeve, wearing ring etc., shall be of non-corrosive metal like bronze/brass/gunmetal. The shaft shall be of stainless steel.

Bearing of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plate indicating the suction lift delivery head, discharge speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

2.5 Motor

The motor shall be squirrel cage A/C induction type suitable for operation on 415 volts 3 phase 50 Hz system. The motor shall be totally enclosed fan cooled type conforming to protection clause IP 21 vide I.S. 4691. The class of insulation shall be B. The motor shall be rated for continuous duty as per relevant IS and shall have a horsepower rating necessary to drive the pump at 150 percent of its rated discharge.

2.6 Motor Starter

The motor starter shall be automatic star Delta type conforming to IS:1822-1967. The starter shall not incorporate under voltage or overload trip or single-phase preventer. The starter assembly shall be suitably integrated in the power control panel for the wet riser system.

Each pump shall be provided with vibration isolating pads of appropriate size.

3.0 DIESEL FIRE PUMP

3.1 Scope

This section covers the details or requirements of the stand by fire pump operated by a diesel engine.

3.2 General

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bed plate, fabricated with mild steel channel.

3.3 Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided.

3.4 Fire Pump

The fire pump shall be horizontal split casing centrifugal type. It shall have the capacity to deliver as specified in BOQ, developing adequate head so as to ensure a minimum pressure of 3 kg. Per sq.cm. at the highest and the farthest outlet. The delivery pressure at the pump outlet shall be not less than 7 kg. Per sq.cm. in any case. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head. The shaft shall be of stainless steel. The pump shall be provided with mechanical seal. The pump casing shall be designed to withstand 1.5 times the working pressure.

Bearings of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

3.5 Diesel Engine

Engine Rating:-

The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater plugs etc.). The engine shall be multi cylinder/vertical, 4-stroke cycle, water-cooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and after correction for altitude, ambient, temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of the rated head. The engine shall be capable of continuous non-stop operation for 8 hours. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run.

The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to B.S. 649/IS 1601/IS 10002, all amended up to date.

3.6 Cooling System

The engine cooling system shall be radiator water cooled system. The radiator assembly shall be mounted on the common baseplate. The radiator fan shall be driven by the engine as its auxiliary with a multiple fan belt. When half the belts brake remaining belts must be capable of driving the fan. Cooling water shall be circulated by means of an auxiliary pump of suitable capacity driven by the engine in a closed circuit.

3.7 Fuel System

The fuel shall be gravity fed from the engine fuel tank to the engine driven pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself suitably wall mounted on brackets. The fuel filter shall be suitably located to permit easy servicing.

The engine fuel tank shall be welded steel construction (3mm thick) and of capacity sufficient to make the engine to run on full load for at least 8 hours. The tank shall be complete with necessary supports, level indicator (protected against mechanical injury), inlet, outlet, over flow connections drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediment into the fuel line of the engine. A semi rotary hand pump filling the engine fuel tank together with hose pipe 5 mtr. Long with a foot-valve etc. shall also form part of the scope of work.

3.8 Lubricating Oil System

Forced feed Lubricating Oil system shall be employed for positive lubrication. Necessary Lubricating Oil filters shall be provided and located suitably for convenient servicing.

3.9 Starting System

The starting system shall comprise of necessary battery/batteries, starter motor of adequate capacity and axle type gear to match with the toothed ring fly wheel. Suitable metallic relay to protect starting motor from excessively long cranking runs shall be included within the scope of the work. The metallic relay protection shall be integrated with engine protection system.

The capacity of the battery shall be suitable for meeting the needs of the starting system but not less than 180 AH.

The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

The scope shall cover all cabling, terminals, initial charging etc.

3.10 Exhaust System

The exhaust system shall be complete with silencer suitable for indoor installation, and silencer piping including bends and accessories needed. The exhaust pipe shall

protrude outside the pump room. The total backpressure shall not exceed the engine manufacturer's recommendations. The exhaust piping shall be suitably supported and the pipe used shall be of medium class MS pipe.

3.11 Engine Shut Down Mechanism

This shall be manually operated and shall return automatically to the starting position after use.

3.12 Governing System

The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

3.13 Engine Instrumentation

Engine instrumentation shall include the following :-

- a. Lubricating Oil Pressure Gauge
- b. Lubricating Oil temperature gauge
- c. Water temperature gauge
- d. Water pressure gauge
- e. Tachometer
- f. Hour meter
- g. Starting key

The instrument panel shall be suitably mounted on the engine.

3.14 Pipe Work

The piping for exhaust outlet as well as fuel piping between fuel tank and the engine shall be with Medium class M.S.

3.15 Anti Vibration Mounting

Suitable vibration mounting duly approved by engineer-in-charge shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated in the report, which will be submitted to engineer-in-charge before installation.

3.16 Battery Charger

Necessary float and boost charger shall be incorporated in the control section of the power and control panel to keep the battery under trickle condition. Ammeter to indicate the state of charge of the batteries shall be provided.

4.0 POWER AND CONTROL PANEL AND OTHER CONTROL COMPONENTS

4.1 Scope

This section covers the detailed requirements of the power and the control panel for the wet riser system, and also for the various control components in the system.

4.2 Power and Control Panel

4.2.1 Constructional Requirements

General Features

The power and control panel shall be totally enclosed, free standing floor mounted cubicle type, fabricated out of sheet steel not less than 2mm thick. Where ever necessary, additional stiffening shall be provided by angle iron framework. General construction shall be of compartmentalization and sectionalisation such as mains incomes, electric fire pump, diesel fire pump, pressurization pump, and control, so that there is no mix up of power and control wiring and connections in the same sections as far as possible. The panel shall also have the space for cable allays. The space for cable alleys shall be at least 200mm wide to the entire depth of panel. The panel shall be front operated type with all connections accessible from the front. Front doors shall be hinged type. Back doors shall be hinged type or removable type for inspection. The door hinges shall be of concealed type. The doors for busbar chamber shall be of removable type with the help of bolts. The doors shall be provided with quick fixing doors knobs with indication. The general arrangement of the panel shall be got approved before fabrication the cubicle construction shall be to IP 21 as per IS:2147.

4.2.2 Cable entries and gland plates

All cable entries shall be through gland plates which are removable and sectionalized. Where heavy cables are brought in and terminated, suitable clamps shall be incorporated to relieve the stress on the glands due to the weight of the cable. Cable entries may be from top or bottom depending on the equipment layout and cable scheme as approved.

4.2.3 Busbar and Connections

The busbars shall be air insulated, and of aluminium of high conductivity electrolytic quality (grade E 91 E to IS: 5082) and of adequate cross section. Current density shall not exceed 1.3 amps. Per sq.cm. All connections to individual circuits from the busbars shall preferably be with solid connections. The busbars and the connections shall be suitable covered with PVC sleeves or in an approved manner. Busbars shall be suitably supported using non-hygroscopic insulated supports. High tensile bolts and spring washers shall be provided at busbar joints.

4.2.4 Earthing Arrangement

GI strip 25mm x 5mm shall be run at the rear of the board. 2 nos. earth terminals shall be provided at the ends of the GI strip for connection to earth system.

4.2.5 Terminal Blocks and Small Wiring

Terminal blocks shall be of heavy duty type and generally not less than 15 amps 250V grade upto 100V, and 600V grade for the rest of the functions. They shall be easily accessible for maintenance. All control wiring inside the panel shall be with PVC insulated copper conductor of 2.5 sq.mm. size and 600V grade conforming to IS:694-1977. Suitable colour-coding may be adopted. Wiring harness shall be neatly formed and run preferably function wise, and as far as possible segregated voltage wise. Identification ferrules shall be used at both ends of the wires.

4.2.6 Instruments and Lamps

All indication lamps and instruments shall be flush mounted type in front of the panel. The voltmeter and ammeter shall be of size 100mm nominal (dial size) conforming to clause 1.5 of IS 1248 for accuracy.

Current transformers shall be provided with ammeters.

Indicating lamps to indicate the availability of electric supply shall be provided at the incoming section. Necessary indicating lamps for alarm indications and battery charging shall be provided in the respective sections.

All indicating lamps and meter shall be protected with HRC cartridge type fuses.

4.2.7 Labels

All internal components shall be provided with suitable identification labels. Suitably engraved labels shall be fixed at the panel for all switches, instrument push buttons, indicating lamps etc.

4.2.8 Painting

The entire panel shall be given a primer coat of red lead after degreasing and phosphating treatment and 2 coat of final paint of approved shade before assembly of various items.

4.3 Equipment Requirements

4.3.1 General

The power and control panel shall comprise individual section for the various equipments of the system and controls, in a combined cubicle type design. All switches, MCCBS, MCBS and fuse/fuse switch units shall be conforming to relevant IS.

4.3.2 Incomer Section & outgoing section

(A) Incomer section:

1 no. 630 amps TP MCCB unit complete. One set of 96 mm square digital Ammeter (0-400 Amps) complete with selector switch and CTS. One set of 96 mm square digital Voltmeter (0 - 500 V) complete with control fuses and selector switch. One set of phase LED indicating lights with control fuses. One set of 4 strips of 800 Amps aluminium busbars.

(B) **Outgoing feeder**

(i) Three numbers of 300 Amps TP MCCB (35 KA, Ics = Icu) unit complete, S P Preventer, ML 4 type Contactor for star delta starting, start and stop push buttons, auto-manual switch, digital Ammeter with CTS, ASS, LED phase indicating lights, Auxillary Contactors for interlocking/sequence of operation, control terminals complete in all respect with interconnections for Hydrant Pump and sprinkler pump.

(ii) Two numbers of 63 Amps rated TP MCCB (25 KA, Ics = Icu) unit- complete, ML 1.5 type Contactor for D O L starting with overload relay, start and stop button, digital Ammeter, CTS and selector switch, phase indicating lights, Auxillary contacts for interlocking/sequence of operation, control terminals complete in all respect for Jockey Pump.

C Control Wiring from Pressure Switches of different settings in Hydrant and Jockey Pumps, for sequence of operation shall be included to complete the system.

D Colour code with ferrule marking shall also be made.

E The cabling shall be XLPE insulated and aluminium / copper conductor cable of 1100 volts grade conforming to IS as required from Fire Pump Board to motor and cable of suitable size as per BOQ.

4.3.3 Electric Fire Pump Section

This section shall incorporate the following facilities.

- a. Suitable capacity MCCBS
- b. Control system components and equipment such as relays, contractors, timers etc. for automatic operation.
- c. Starter Unit, Current Transformer and digital ammeter.
- d. LED Indication lamps, their fuses, terminal block, push buttons, control and selector switches etc. are as required.
- e. Pump lock out devices due to faults or abnormalities as specified in operating sequence.
- f. Visual/audio alarms, indications and communications facility as specified in operating sequence.

- g. Necessary inter-connection and control wiring etc.

4.3.4 Engine Section

The engine section shall incorporate the following facilities:

- i. Control system components and equipment such as relays, contractors, timers etc. for automatic operation.
- ii. Instruments, indicator lamps, fuses terminal blocks, push buttons, control and selector switches etc. as are required.
- iii. Engine shut down and block out devices due to faults or abnormalities as specified.
- iv. Visual/audio alarms and indications as specified.
- v. Inter-connection and control wiring etc.

4.3.5 Auxiliary Pump Section

The auxiliary pump section for jockey pump shall incorporate the following:

- a. TP&N MCBS.
- b. Control system components such as relays, times, contractors, etc. as are necessary for functional requirements.
- c. Starter unit, current transformer and ammeter.
- d. Indication lamps, fuses, terminal blocks, push buttons selector, switch etc. as required.
- e. Inter-connections and control wirings etc.

4.3.6 Control Section

This section shall incorporate the following:-

- a. Control components integrating the various sections, so as to satisfy the functional requirements.
- b. Battery charger unit with boost/float charge facility with voltmeter, capable of independently charging 2 sets of batteries at a time.
- c. Visual/audio alarms, not covered in individual sections.
- d. Lamps healthy test facility.
- e. Instruments, indicating lamps, push buttons, fuse terminal blocks etc. as are required.
- f. Test facility to simulate operation of hydrants.

4.4 Other Control Components

4.4.1 Pressure Switches

Pressure switches shall be provided for switching on and off the pressurization pump at preset pressures and also for switching off the fire pump at preset pressure. Being the main component for initiating the signal for the operation of the pumps, the pressure settings shall be totally reliable, sturdy in construction and of long life. The pressure settings shall be adjustable.

4.4.2 Power Supply for Controls

In order to ensure that the control systems remains co-operational at all times the control system shall be designed for 24 VDC operation fed from the battery. This shall be independent of the starting battery for the engine i.e. battery shall remain trickle charged at all times from the separate battery charger at the control section.

5.0 Electrical Work and Earthing

Scope

This section covers the detailed requirements of electrical works including earthing, for the materials installation.

Electric power supply shall be terminated in the incoming switch gear of the power and control panel by the Department. All further connections to the various components of the system shall be the responsibility of the contractor, for a complete and working system, satisfying all the functional requirements.

The scope shall particularly include the following :

Power and Control Panel(s) as given in relevant section.

All inter-connections with multi-core armoured copper cables of size suitable between various control units and control panel(s).

All power cable connections with multi-core armoured aluminium cables of size as specified in BOQ, between panels, motors etc.

Necessary earthing with 2 Nos. G.I. plate electrodes and loop earthing.

The work shall be carried out conforming to CPWD General Specifications for electrical works part-I (Internal) amended up to date and part-II (External) amended upto date.

6.0 Sprinkler System

6.1 Sprinkler Heads

Sprinkler heads shall be of quartzoid bulb type with bulb, valve assembly yoke and the deflector. The sprinklers shall be approved make and type.

6.2 Types

6.2.1 Conventional Pattern

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown upwards to the ceiling side of wall extras. The sprinklers shall be suitable for erection in upright position or pendant position.

A. Spray Pattern

The spray type sprinkler shall produce a hemispherical discharge below the plane of the deflector.

B. Ceiling (flush) Pattern

These shall be designed for use with concealed pipe work, these shall be installed pendant with plate or base flush to the ceiling with spray head below the ceiling.

C. Side Wall Sprinklers

These shall be designed for installation along with the walls of room close to the ceiling. The discharge pattern shall be similar to one quarter of sphere with a small proportion discharging on the wall behind the sprinklers.

6.2.2 Construction

- i) **Bulb:-** Bulb shall be made of corrosion-free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.
- ii) **Valve assembly:-** Water passage of the sprinkler shall be controlling assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly shall be stable and shall withstand pressure surges or external vibration without displacement.
- iii) **Yoke:-** The yoke shall be made of high quality gun metal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti corrosive treatment if the same is to be used in corrosive conditions.
- iv) **Deflector:-** The deflector shall be suitable for either upright or pendant erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

D) Colour Code

The following colour code shall be adopted for classification of sprinkler according to nomination temperature ratings.

Sprinkler Temperature Rating

Colour of the Bulb

E. Size of Sprinklers Orifices

The sprinklers shall be of 15mm nominal bore size.

6.2.3 Pipes and Fittings

Pipes for sprinkler system shall be of black steel conforming to I.S. 1239 (medium class).

Fittings for black steel pipes shall be malleable iron suitable for welding or approved type cast iron fittings with tapered screwed threads.

6.2.4 Jointing

Joint for black steel pipes and fittings shall be metal to metal tapered thread or welded joints. A small amount of red lead may be used for lubrication and rust prevention in threaded joints.

Joints between G.I. or black steel pipes, valves and other apparatus, pumps etc. shall be made with G.I. or M.S. flanges with appropriate number of bolts. Flanged joint shall be made with 3mm thick insertion rubber gasket.

6.2.5 Pipes Protection

All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade.

Pipes in chase or buried underground shall be painted with two coats of hot bitumen.

6.2.6 Pipe Supports

All pipes shall be adequately supported from ceiling or walls from structural clamps fabricated from M.S. structural e.g. rods, channels, angles and flats. All clamps shall be painted with one coat of primer and two coats of black enamel paint. The contractor shall provide inserts at the time of slab casting or anchor fastner later.

6.2.7 Valves

Sluice valves of sizes 80mm and above shall be double flanged cast iron conforming to I.S. 780. Check valve shall be of cast iron double flanged conforming to I.S. 5312.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20 kg/sqcm. pressure. Valves shall conform to I.S. 778.

1. Air Valves

25mm dia screwed inlet cast iron single acting air valves on all high points in the system or as shown on drawings.

2. Drain Valves

50mm dia black steel pipe conforming to I.S. 1239 medium class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

6.2.8 Installation Control Valve

Installation control valves shall comprise of the followings:

- a) One-man stop valve of full way pattern with gunmetal pointer to indicate where open/shut.
- b) One automatic alarm valve fitted with handle & cover.
- c) One hydraulic alarm motor and gong for sounding a continuous alarm upon out-break of fire. One combined waste and testing valve including 5mtr of tubing and fittings.
- d) Alarm stops valve.
- e) Strainer
- f) Drain plug
- g) Padlock and strap
- h) Wall box for installation of valve.
- l) All other accessories as required.

6.3 Pressure Gauges

Burden type pressure gauges conforming to IS/BS specifications shall be provided at the following locations:

- a. Just above alarm valve.
- b. Just below alarm valve, on the installation stop valve.
- c. One pressure gauge on delivery side of each pump.
- d. Required number of pressure gauges on pressure tank.

6.4 Installation of Piping

- a. All above ground piping shall be installed on suitable to pipe hangers/supports as required. The hangers shall be made of MS angles, channels etc. and painted to the required finish with suitable synthetic enamel paint. The maximum spacing of piping supports shall be as follows:

- | | | |
|------|------------------|----------|
| i) | 20mm to 32mm dia | 2.5 mtr. |
| ii) | 40mm to 65mm dia | 3.0 mtr. |
| iii) | 65mm & above | 3.0 mtr. |

Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve. In case of basement and other areas where the pipe work is below the installation drain valve/auxiliary valves of the following sizes shall be provided.

20mm dia valve for pipes up to 50mm dia

25mm dia valves for 65mm dia pipe

32mm dia valves for pipes larger than 65mm dia

Piping shall be of screwed type upto 50mm diameter. Welding of joints will be allowed for pipes of above 50mm dia.

The entire piping shall be pressure tested by hydrostatic method upto a pressure of 1.5 times the working pressure. The piping shall be slowly charged with water so that all the air is expelled from the piping by providing a 25mm inlet with a stop cock. The piping shall be allowed to stand full of water for a period of 2 hours and then the piping shall be put under pressure by means of manually operated test pump or by a power driven test pump. The pressure gauges used for testing shall be accurate and shall preferably be calibrated before the testing is carried out. All the leakage's and defects in joints revealed during the testing shall be rectified to the entire satisfaction of the Engineer-in-charge. The system may be tested in sections/parts as the work of erection of piping proceeds. The piping shall stand 1.5 times the working pressure for at least 2 hours.

7.0 Operating Sequence for the Fire Fighting System

- 7.1 The operating pressure in the mains is to be maintained at 7.0 kg/cm².
- 7.2 The jockey pump shall start automatically the moment pressure drops to 6.5 kg/cm² because any leakage or minor draw-off from the system and stop when the pressure reaches 6.5 kg/cm² again.
- 7.3 In case, after the start of jockey pump, the pressure still keeps on falling, the main fire pump shall start at 6.0 kg/cm² by triggering of the pressure switch. Jockey pump shall stop when main pump starts.
- 7.4 In the event of electrical or mechanical failure of main fire pump to start, the diesel engine driven pump shall cut in when the pressure in the mains fall down to 5.5 kg/cm². The main electric pump shall then be locked out.
- 7.5 If within a preset period the standby pump fails to start or fails to develop adequate pressure, the control system shall shut down the standby pump and lock it out and given an audiovisual indication to that effect at the control panel.
- 7.6 Jockey pump shall be shut down automatically when the fire pump electric or diesel, is operating. Necessary integration of pipe work and controls shall be provided for the purpose. A timer may be employed where necessary to distinguish between slow fall of pressure due to system leaks and sudden fall of pressure due to fire duty by opening of valves and thus prevent parallel start up of both pressurization and fire pumps.

- 7.7 The control panel shall have status selection for each of the pumps for “automatic” as well as “manual” operation.
- 7.8 Pumps when under “manual” status shall be operated manually through relevant push buttons.
- 7.9 The fire pumps once started shall not be stopped automatically.
- 7.10 The fire pumps shall be locked out for operation both for “manual” and “automatic” operations, once the low water controls operates and furnish an audio and visual alarm on the panel the audio alarm can be silenced by accepting the alarm. The visual alarm shall be individual for each equipment. It shall be flashing type and on acceptance remain steady. A reset button shall be provided for each pump for returning the pump for fire duty.
- 7.11 Over load or under voltage/no volt trip devices for electric fire pump shall not be provided in the starter. LED type indication lamps to indicate the availability of power shall be provided.
- 7.12 Once tripped the electric fire pump shall remain locked out for operation irrespective of the position of its operational status selection switch. Lock out indication shall be available on the panel.
- 7.13 Return to normal operational availability shall be feasible only by manual re-set of locked out units by operation of appropriate push buttons.
- 7.14 When fire pumps are brought into operation an audible tone from turbine type alarm operated by water flow in the mains shall be provided to indicate the healthiness of the system. The healthy running alarm shall not be silenced till the fire pump is shut down, but the tone may be mellowed by the operation, if required.
- 7.15 Alarm for failure and lock out of any pump shall distinct from “healthy” alarm. Failure alarms shall be loud and can be silenced on acceptance.
- 7.16 Repeat indication of various audio and visual indications on a slave remote panel in fire control room in terminal building shall be available. The slave Remote panel shall have indication lamps to show the status of :
- a) Power healthy in fire pump room.
 - b) Jockey pump ‘ON’
 - c) Main pump ‘ON’

The slave Remote panel shall also have a hooter, which shall sound in case, any pump is ‘ON’. The slave Remote panel shall have a provision to reset the hooter with the help of a push button.

8.0 Testing

8.1 Testing on Completion of Installation

The entire system shall be tested after completion of installation as per the operating sequence specified.

8.2 Schedule of Inspection

Testing of fittings/equipments shall be carried out either at site or at works in the presence of a CLIENT/CONSULTANT's representative given below:

- | | | | |
|----|---------------------------------------|---|---|
| 1. | Pumps, motors and engine | - | Inspection by Client/Consultant at Manufacturers works before dispatch. |
| 2. | Electrical panel | - | Inspection by Client/Consultant at Manufacturers works before dispatch. |
| 3. | Pipes | - | Visual inspection at site for ISI mark. |
| 4. | Various valves | - | Visual inspection at site for ISI mark. |
| 5. | SFUs, MCBs etc. | - | Type test certificates. |
| 6. | Sprinklers | - | Test certificate from independent test laboratories. |
| 7. | Fire hose, hydrant, extinguisher etc. | - | Visual inspection at site for ISI mark. |

Approvals It shall be the responsibility of the contractor to obtain the approval of drawings and to get the installation inspected and passed by any concerned authorities, as may be necessary as per local by laws, any fee payable to the local bodies for such activities shall be reimburse by the Client/Consultant on production of receipt.

9.0 Standards and Codes

- | | | |
|----|------------------|---|
| 1. | IS – 1648 – 1961 | Code of Practice for fire safety of building (general) fire fighting equipment and maintenance. |
| 2. | IS – 3844 – 1966 | Code of practice for installation of internal fire hydrant. |
| 3. | IS – 2217 – 1963 | Recommendation for providing first aid and fire fighting arrangement in public buildings. |

4.	IS – 2190 – 971	Code of practice for selection, installation and maintenance of portable first fire appliance.
5.	IS – 3589	Electrically Welded Steel pipes (Medium class)
6.	IS – 1239	Mild steel tubes, Tubulers and other wrought steel fittings (Medium class)
7.	IS – 780	C.I. Double flanges sluice valve.
8.	IS – 778	Gun Metal Valves
9.	IS – 909 – 1965	External fire hydrant (underground)
10.	IS – 5290 – 1969	Internal Landing Valve
11.	IS – 884 – 1969	First and hose reel
12.	IS – 934 – 1976	Specification for portable chemical fire extinguisher soda acid type.
13.	IS – 2873 – 1969	Specification for fire extinguisher for carbon dioxide
14.	IS – 2189 & 2109	Automatic fire alarm system or BSS 3116.
15.		National building code

10. FIRE DETECTION AND ALARM SYSTEM

10.1 STANDARDS

The manufacture, identification of material and testing of equipment covered in this specification shall comply with the latest editions as on date of opening of tenders of the appropriate standards of the following. Unless otherwise specified, Indian Standards are preferred. All the appliances and accessories shall carry IS or International certification and shall be of approved make.

NFPA 72E Standards on automatic fire detection.

IS:2189 Code of practice for selection, installation and maintenance of automatic fire detection and alarm system.

IS: 823 Welding procedure

IS: 1652 Batteries

IS: 694 PVC insulated cables (light duty) for working voltage upto 1100 volts.

IS: 1554 PVC insulated cables (heavy duty) for voltage upto 1100 volts.

IS: 5959 Specification for polythelene insulated PVC sheathed heavy duty electric cables, voltage not exceeding 1100 V

IS: 5578 Guide for marking of insulated conductors

IS: 3043 Code of practice for earthing.

IS: 5216 Guide for safety procedures and practices in electrical work.

In case where the offer deviates from the specified standards, the tenderer shall indicate clearly in the offer the alternative standards proposed and details thereof.

Unless otherwise mentioned, all applicable codes and standards shall be of the latest editions as published by the Indian Standards and all other such as may be published by them during the tenure of the contract, and shall govern in respect of workmanship, properties of materials, installation and methods of testing. In case where suitable Indian Standards are not available, generally accepted codes and practices as approved by CLIENT/CONSULTANT shall be adopted. Any changes or modifications directed by CLIENT/CONSULTANT shall also be incorporated by the contractor during execution of the work.

Automatic fire detection and alarm system consists of fire control panel, detectors, manual call points, hooters, isolators, response indicators, etc. The equipment and cables of the system shall be independent of any other system in the premises and shall not be shared with any other system. The fire detection and alarm system shall be installed as per NFPA 72E / IS-2189 code.

DETECTORS AND ACCESSORIES

Detectors

The fire detectors shall be of analogue addressable type to detect one or more characteristic of fire like smoke, heat or flame. It shall be sleek, suitable communication technique with noise immunity, built-in functional test switch, microprocessor based technology, mechanically integrated photoelectric and ionization shared volume smoke chamber, etc. All types of detectors shall be of both electronically and manually programmable type using dip-switches or handheld programmer or from fire control panel. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts or components subject to wear. It shall be possible to test the detector in the field. The response of a detector shall always be clearly visible from outside by a flashing light on the base. The detector shall connect to the control unit via a fully supervised two-wire circuit. A built barrier shall prevent entry of insects into the sensor. The detector shall be designed for fast and simple cleaning.

All electronic circuits must be solid state devices and virtually hermetically sealed to prevent their operation from being impaired by dust dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. All radioactive parts of the source, if any, shall be fully gold plated. The detector shall be inserted into or removed from the base by a simple push-twist mechanism to facilitate easy exchange for cleaning and maintenance.

The smoke & heat detectors shall fit into a common type standard base. The standard base shall be supplied with a seal plate, preventing dirt, dust, condensation or water reaching the wire terminals or the detector points. Detectors shall be provided with a MS box for entry and termination of armoured cable and to protect detectors terminals.

At the time of installation and prior to commissioning, every detector shall be allotted an identification number. All detectors shall have LED blink when it is addressed. Detectors shall not be either partially or totally recessed in ceiling or wall. Detectors shall be suitably protected where they are liable to be subjected to mechanical damage. Detectors should not be painted or coated or covered in any manner after installation as this will adversely affect the sensitive of operation.

10.2.2 Beam detectors

It shall be addressable type linear optical beam smoke detector type. It shall be of a combined transmitter/receiver unit. The minimum range of the detector shall be 50 m. The detector shall operate in the infra – red light spectrum. Numerical indicators shall be provided to aid beam alignment. The indicators shall comply to EN 54- 12 standards. The detector shall operate on the principle of light obstruction utilizing infra-red beam. The detector shall have standby automatic fault and alarm LED indicators visible from the front and bottom. Alignment shall be accomplished via an optical sight and it shall be listed for operation from - 22° F to 131° F. Smooth four square grid reflector shall also be provided reflect the transmitted beam shall also be provided for the satisfactory performance of the system.

10.2.3 Smoke detectors

It shall be of optical-cum-thermal type. Smoke detectors shall quickly respond to smoke containing small particles normally produced and heat likely to be generated and automatically adjusts sensitivity without needing operator intervention.

10.2.4 Heat detector

It shall be of fixed-cum-rate of rise temperature type. Heat detectors shall be suitable for use in situation where sufficient heat is likely to be generated and damage caused by heat generated.

10.2.5. Loop Hooters

The loop hooters shall be so arranged that when any alarm operates all the hooters through out the premises shall be activated. The hooters at the fire alarm shall be electronic type having frequency of suitable frequency range. The hooters shall be capable to produce a sound output of 90 db at 1 m. Hooters shall be of loop powered and no separate power is provided.

- (a) 'Fault' alarm and 'Fire' alarm in a panel sounder shall be distinctly different. Fire alarm sounders shall not be used for any purpose other than for fire operations. When installed flush with a false ceiling these shall match the ceiling surface. Necessary provisions such as wooden boxing or frame work, if required, to accommodate the sounders shall be made in the ceiling in advance.
- (b) These shall be installed at a height not lower than 2.4 m, except when recessed in a false ceiling of lower height. In such cases the sounders shall be recessed at false ceiling level.
- (c) The panel sounders in the respective panels shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device connected to them. These shall also be sounded when there is a fault alarm signal within their areas of control. The sound shall be continuous and of the same characteristics from all fire alarm sounders in a building.
- (d) 10.2.6. Loop Isolators
- (e) Loop isolators shall be designed to protect one area or a number of devices which are consecutively wired in a loop. Its function is to isolate a section of the loop if a problem develops within that section, allowing the remainder of devices connected on the loop to function correctly. Loop isolators shall be provided after every 20-30 devices in each loop.
- (f) 10.2.7. Manual Call Points (MCPs)
- (g) It shall be of 'break glass' type, and 1.5mm thick welded sheet steel or 3 mm thick cast aluminium. The front glass shall be breakable. The MCPs shall be recess mounted suitable to support the intelligent addressable panel. It shall form an integral part of the fire detector system. The housing shall be dust/vermin proof properly sealed with rubber lining. The glass frangible element shall keep a push button pressed inside such that in the event of breaking the glass, the push button is released to actuate an alarm in the control panel. MCPs shall be easily resettable with key.
- (h) Where sheet steel is used for, this shall be thoroughly cleaned off dust, dirt, grease and rust if any and two coats of anti rust primer shall be given both inside and outside. This shall be followed by two coats of synthetic enamel paint in fire red colour on the external surface that will be visible on installation. In the case of cast aluminium body for a call box, the surface shall be neatly finished with red colour paint. The following words shall be painted on the front of the call box in contrasting colour with a letter size of not less than 5mm.
- (i) "BREAK GLASS IN CASE OF FIRE"
- (j) Installation requirements:-

(k) Manual call points shall be located at exit space and shall be installed at a height of 1.4 m above the floor at an easily accessible position. They shall be installed at easily accessible, well illuminated positions, preferably in a contrasting background so that they are easily noticeable from either direction. They may be semi-recessed so as to project by 10mm. They shall be installed free from obstructions.

(l) 10.2.8. Fire Control Panel

(m) The fire alarm control panel shall be of micro processor controlled and of modular hardware design of intelligent addressable type. It shall be housed in a steel enclosure. It shall also be finished with hard wear textured epoxy paint/ powder coated. Cable entries shall be provided on the top and bottom of the panel.

(n) The system capacity shall be based on the number of devices and control modules. Each devices in the system shall be identified by its unique address position on the two wire loop. The panel retains command over the alarm process, LED indicators, automatic test feature and loop hooters. The panel shall be of software programmable. The panel shall be capable of:-

- (o) programmable at site.
- (p) automatic system test activates
- (q) detector sensitivity adjustments
- (r) alarm verification
- (s) Alpha/numerical display
- (t) Relay control module
- (u) Support for bacnet and modbus protocol.
- (v) maintenance alert facilities
- (w) provision to connect to PCs

The panel shall have facility to shut off individual AHUs in case of fire through relay arrangements. The relay shall be suitable to withstand AHU contactor coil current.

The manufacturer of fire control panel, detectors and other detection devices shall have own or authorized service centre in India with spares for carrying out maintenance service during the guarantee and maintenance periods. The tenderer shall submit a brief write-up of the service centre facilities available in India along with the tender.

10.2.9 Power Supply of panel

The power supply shall drive the system from either the main electrical supply single phase supply or the standby power supply. The standby power supply shall be derived from exclusive SMF back-up batteries of reputed make. Standby power supply shall be capable of maintaining the system in normal operation having a period of not less than 24 hrs. after the failure of normal main supply.

10.2.10. Control Cable

The control cable for wiring fire alarm system shall be of 650 Volt grade. Cables shall be laid as per relevant installation standards. The size of these cables are specified in schedule of requirements.

10.2.11 Cable Glands

Cable glands shall be of heavy duty single compression type of brass, chrome plated. These shall have a screwed nipple with conduit electrical thread and checknut. These shall be suitable for armoured/unarmoured cables, which is being used.

10.2.12 Cable Connectors

Cable connectors, lugs/sockets, shall be of copper/aluminium alloy, suitably tinned, solderless, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.)

11. **INSPECTION AND TESTING**

(Fire detection and alarm system)

11.1 *INSPECTION*

All materials shall be offered for inspection in cleaned condition, prior to erection. At no event, site fabricated work /material shall be installed in position without inspection and approval by CLIENT/CONSULTANT. The Contractor shall ensure that each stage of fabrication is carried out in compliance with the procedures specified in the IS standards as applicable and/or specified in this document.

The contractor shall conduct sample tests of all the materials supplied at reputed laboratories/agencies as directed by CLIENT/CONSULTANT at his own cost and test reports are to be submitted. Inspecting officials like CLIENT/CONSULTANT, TAC / Local Authorities shall have the right to access the premises of the work at any time with or without giving prior notice. All the formalities or procedures for conducting the inspections by the authorities as required by them shall be arranged by the contractor free of cost.

All testing shall be carried out in the presence of CLIENT/CONSULTANT/ statutory authorities and test registers shall be maintained by the contractor. The contractor shall provide all material, tools, equipment, instruments, services and personnel required to perform the tests and remove debris resulting from cleaning and after testing free of cost.

The original test certificates of all tests conducted are to be forwarded to CLIENT/CONSULTANT. After conducting the tests, any defects found on materials, equipment, piping, etc. shall be got rectified/repared / replaced by the Contractor without any extra cost.

11.2 TESTING

11.2.1 Fire Detection and Alarm System

The entire fire detection and alarm system shall be tested for continuity and performance as per IS-2189 code. After installation, the visual inspection of all the detectors shall be made to make sure that they are properly installed. Each detector shall be inspected to ensure that it is properly mounted and connected. Heat detectors shall be tested to initiate an alarm by a heat source such as hair drier or a shielded heat lamp. After each heat test, the detectors shall be reset. Smoke detectors shall be tested to initiate an alarm at its installed location with smoke or other aerosol. All detectors found to have the sensibility outside the approved range shall not be used.

Detectors, control and indicating panels, sounders shall be tested at the manufacturer's factory and test certificate be furnished with the supply. Type test certificate to prove conformity to the relevant contract specifications shall be furnished with the supply, from recognised testing institutions or Govt. test bodies in India or abroad.

Following tests shall be conducted in the presence of CLIENT/CONSULTANT and the test certificate shall be furnished with the record of tests.

11.2.2 Continuity test

Test for insulation resistance of the wiring work and the control and indicating panels.

Test for system operation.

Tests for detectors shall be conducted using a test fire at normal floor level. The system operation for fault conditions shall be conducted by introducing faults such as open circuit, short circuit, removal of detector, open/short circuit in a sounder circuit etc. Tests relevant to loop isolators shall also be conducted to confirm that it functions as required.

12. TECHNICAL DATA

(Fire detection and alarm system)

(To be submitted along with the tender)

Note: Refer list of preferred makes of items in Section IV. (Please attach catalogue, etc. of items from the original supplier)

Beam Detectors

Make

Model No.

Size:

Beam range:

Alignments : Horizontal & Vertical :

Reflector size:

Operating temp range:

Voltage range:

LED display status:

Air velocity:

Protocol used

IP rating

Smoke Detectors

Make

Model No.

Size:

Operating temp range:

Voltage range:

LED display status:

Air velocity:

Protocol used

IP rating

Heat Detectors

Make

Model No.

Size:

Operating temp range:

Voltage range:

LED display status:

Air velocity:

Fixed temp. set point:

Rate of rise temp:

Sensor:

Protocol used:

IP rating

Loop isolators

Make

Model No.
Spacing of isolators
Operating voltage
Temp. range
Size:
IP rating

Loop hooters

Make
Model No.
No. of tones
Sound output
IP rating
Size

MCPs

Make
Model No.
Size:
IP rating

Fire control panel

Make
Model No.
Maximum No. of programmable loops
Maximum No. of devices per panel
Maximum devices per loop
Maximum control cable length
Maximum resistance per loop
Length per loop
No. of slots for additional cards
Networking facilities
No. of auxiliary output for AHU shut off.
No. of repeater output
No. of hooters per loop
No. of isolators per loop

Operating voltage
Operating current
No. of display characters
Support for bacnet and modbus protocol.
Size
Weight

Makes of following items

PVC insulated FRLS

armoured Cu. Cable :

PVC insulated armoured Cu. Cable :

PVC insulated FRLS cu. wire :

PVC conduits :

MS conduits :

TECHNICAL DATA

(Hydrant System)

(To be submitted along with the tender)

Note: Refer list of preferred makes of items in Section IV. (Please attach catalogue, etc. of items from the original supplier).

1 Diesel engine driven pump

1.a Pump details

Make

Type

Model

Overall dimensions

Weight (Kgs)

Material

Pump casing

Impeller

Shaft sleeve

Base plate

Type and material of steel

Operating speed (R.P.M.)

Head (Mtr)

Efficiency

Performance curves (whether enclosed with the tender).

Yes/No

1.b Engine details

a) Make

b) Model

c) HP

d) RPM

e) SFC

Oil consumption

Weight

Overall dimension

Exhaust pipe dia

2 Battery & Battery Charger

Make of battery charger

Make of batteries

Model No. of batteries

Voltage

AH

No. of batteries

Model No. of battery charger

3 Electric motor driven pump

1.a Pump details

Make

Type

Model

Overall dimensions

Weight (Kgs)

Material
Pump casing
Impeller
Shaft sleeve
Base plate
Type and material of steel
Operating speed (R.P.M.)
Head (Mtr)
Efficiency
Performance curves (whether enclosed with the tender).
Yes/No

1.b Motor details

- a) Make
- b) Model
- c) HP

RPM

Weight

Overall dimension

Class of insulation

4 Jockey pump

1.a Pump details

Make

Type

Model

Overall dimensions

Weight (Kgs)

Material

Pump casing

Impeller

Shaft sleeve

Base plate

Type and material of steel

Operating speed (R.P.M.)

Head (Mtr)

Efficiency

Performance curves (whether enclosed with the tender).

Yes/No

1.b Motor details

- a) Make
- b) Model
- c) HP
- d) RPM
- g) Weight
- h) Overall dimension
- i) Class of insulation

5 Makes and model numbers of following items

MS Pipe :
GI & MS fittings :

Valves	:
Strainer	:
Instrumentation	:
Pressure guage	:
Pressure switch	:
Hardware	:
Paint	:
Polymeric mix	:
Hydrant valve	:
CP hose	:
Branch pipe	:
Hose Reel	:

TECHNICAL DATA
(Sprinkler system)

(To be submitted along with the tender)

Note: Refer list of preferred makes of items in Section IV. (Please attach catalogue, etc. of items from the original supplier).

Alarm valve

Make

Model No.

Size

Sprinklers

Make

Model No.

Size

‘Y’ strainer

Make

Model No.

Size

MS pipes

Make

Model No.

APPROVED MAKES OF ITEMS

HYDRANT/SPRINKLER/DETECTION/SYSTEMS

Motor	: Kirloskar/Siemens/ABB/Crompton Greaves
Pump	: Kirloskar/Mather & Platt/KSB/Beacon
Diesel Engine	: Kirloskar/Cummins/Greaves
MS Pipe	: Tata/Jindal/SAIL/GST/Zenith
GI & MS fittings	: Tube weld/Tube products/Punjab steel/TNT
Butterfly, Sluice, Check Valves:	Kirloskar / Kalpana / Updhaya / Leader / Advance
Foot Valve	: Kirloskar/Sant/Zoloto
Ball Valves	: Sant/Zoloto/ Kirloskar
Strainer	: Sant/Emerlad/Teleflo/Jaypee/ Grandpix
Pressure guage	: Fiebig/H.Guru
Pressure switch	: Indfoss/Switzer/Schneider
Hydrant valve &	: Newage/Steelage/ Arihant/Shah Bhogilal
Fire brigade point	
Branch pipe	: Newage/ Arihant/Shah Bhogilal
CP hose	: Newage/Shah Bhogilal/Pyroline
Hose Reel	: Newage/Chathariya/Shah Bhogilal
Hose cabinet	: Newage/ Zenith/Shah Bhogilal
Hardware	: TATA/Sundaram fasteners/GKW
Paint	: Asian/ICI/Nerolac/Berger
Polymeric mix	: STP/IWL
Fire extinguisher	: Ceasefire/ Minimax / Safex / Bharat / Safeguard.
Alarm valve	: HD / Tyco (UL listed)
Sprinkler	: HD/ Tyco (UL listed)
Smoke/heat detectors	: Edwards/Morely/Essar/Siemens/Notifier
Fire alarm panel	: Edwards/Morely/Essar/Siemens/Notifier
Manual call points	: Edwards/Morely/Essar/Siemens/Notifier etc. (UL approved)
FRLS Cable	: Havells/Finolex/Polycab/RR Kabel

LIST OF APPROVED MAKES FOR ELECTRICAL WORKS

S.No.	MATERIALS	PREFERED MAKE
1	Light fitting	Philips/ Wipro / GE
2	Ceiling, wall fans	Crompton / Usha / Almonard
3	MCBs, DBs, Industrial plugs	Legrand / Schneider / Siemens
4	PVC wires (Copper)	RR Kables/ Finolex / Panasonic / Lapp Kabel
5	Cat 6 UTP, telephone, co-axial cable	Finolex / RRRKabel / Panasonic / Lapp Kabel / Amp
6	Modular Switches	Legrand-Arteor / MK-Aspect / Panasonic-Vision
7	PVC Conduit & accessories, Casing & capping	Precision / Avon Plast / /Konseal / Balco
8	CCTV Cmera	Capture / Hikvision / CP Plus
9	DVR	Capture / Hikvision / CP Plus
10	Hard disk	WDI / Hitachi
11	LCD Monitor	LG / Panasonic / Samsung
12	Network rack	Netrack / Legrand / D link
13	Access Control System	Siemens / Schneider / Honeywell
14	Projector	Sony / Hitachi / Panasonic
15	Lamps	Philips / Wipro / GE / Osram