NIT No. IITH/CMD/CIV/NIT/2025-26/26

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

Volume -4

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS FOR ELECTRICAL & MECHANICAL (E & M) COMPONENTS

Name of the work: Construction of Additional Building for Campus School (G+1) at IIT Hyderabad Campus, Kandi, Sangareddy.

Executive Engineer (Civil)
IIT Hyderabad

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Technical Specifications of E&M Works and Associated Services

Design, Planning, Supply, Installation, Testing and Commissioning of following E&M Works/Services with ultra-modern and state of the art best industry standards and practices, as per CPWD Specifications, Govt. Building Bylaws, Telangana State Fire Service, NBC 2016, ECBC 2017, CPCB, NABH, relevant IS Codes, Indian Electricity Rules and Acts all amended up to date.

1. CPWD General Specifications for Electrical Works Part I Internal - 2023.
2. CPWD General Specifications for Electrical Works Part II (External) 2023.
3. CPWD General Specifications for Electrical Works (Part-III-Lifts & Escalators) - 2003.
4. CPWD General Specifications for Electrical Works Part IV Sub Station – 2013.
5. CPWD General Specifications for Electrical Works Part V Wet Riser & Sprinkler System– 2020.
6. CPWD General Specifications for Electrical Works Part VI Fire Detection and Alarm System – 2018.
7. CPWD General Specifications for Electrical Works Part VII D.G. Sets – 2013, Amended (05.11.2024).
8. CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) - 2024

Electricity for construction works shall be arranged by the contractor from Local Electricity supplier for which the contractor will pay the connection and electricity bill charges and recovery shall be made in case of any unauthorized usage of electricity at the site on pro-rata basis.

All other items which are essentially required for smooth and seamless functioning of **IIT Hyderabad Campus School Construction under this Project** and to make this building/scheme fully habitable, but not specifically mentioned in the scope of services, the same is deemed to be included within the scope of this tender and nothing extra shall be paid on this account. Complete wiring in all the buildings for light, power, communication etc. shall be done in appropriate size medium class PVC conduits. However, Fire alarm and Firefighting system wiring shall be done in MS (mild steel) conduit.

The responsibility of Investigations, Designing, Detailed Planning, Procurement, Construction, Safety, Quality, and Risk of Engineering lies with the Contractor. Contractor takes the full responsibility for the design and execution.

The Scope, Description of Work, Specifications, approved Conceptual Drawings for Engineering and Architectural Planning as provided in the Contract Documents is kept on record are indicative & minimum requirements, and a No Objection Certificate is recorded by the Engineer in Charge, for the Drawings prepared and submitted by the contractor after Proof Checking by competent Authority. **Payment/Charges of Proof Checking and other incidental charges shall be in the scope of contractor, if any and shall be reimbursed by the department after payment by contractor.**

Complete wiring in all the buildings for light, power, communication etc. shall be done in appropriate size PVC conduits. However, for FFS and FAS wiring shall be one in MS conduit only. During the approval of design and drawings the contractor will submit the data sheets and catalogues of reputed manufacturers of the various equipment in support of their design.

The Contractor gets NOC for the design from NIT approving authority for functional aspects and aesthetics and from the approved proof check agency for engineering and architectural considerations.

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The final clearance shall be obtained by the contractor from the Engineer-In-charge of the respective component.

Quality Assurance Policy shall be adopted as per QAP and Check List for E&M Services enclosed herewith, including Inspection & Testing of Materials & Process at Manufacturer's Works, 3rd Party Lab, etc. No additional payment shall be made to the contractor for initial inspection /testing at the manufacturer 's works by the representative of the Engineer-in- Charge. However, the department will bear the expenses of its representative deputed for carrying out initial inspection/testing, with prior permission of Competent Authority. However, decision of Engineer- in-charge shall be final and binding on contractor/associate agencies for items/products/equipment not listed in this Checklist. The contractor/associate agencies shall have to produce certified copy of proof of procurement of material/service from Manufacturer/OEM/authorized dealer etc. before claiming payment.

Scope of work and Technical Specifications for Internal Electrical wiring, Internal Electrification installations, UPS System, Illuminated Signage's, street lighting, Foot Path Lighting, Lightning Protection System, Earthing System, etc.

The scope of work includes Planning, Design & preparation of Drawings, obtaining approvals from the department, supply, Installation, testing, commissioning and handover of Internal and External Electrical Installations, Building level LT panels, SDBs, Power wiring, telephone/TV conduiting, LED light Fittings, call bell, Exhaust fans, Ceiling/wall fans, Switch boards, switches, sockets, MCBs, MCB DBs, power supply and distribution through cable, lightning protection requirement, earthing, street lights, bollards, associated panels etc for the building as per CPWD specifications as amended up to date as described in the details of specifications of this sub head. Complete wiring in all the buildings for light, power, communication etc. shall be done in appropriate size PVC conduits. However, for FFS and FAS wiring shall be one in MS conduit only.

All the works under this subhead shall be carried out as per following specifications

a) CPWD General Specification for electrical work part I Internal 2023 as amended up to date.
b) CPWD general specification for electrical work part II External 2023 as amended up to date.
c) CPWD general specification for electrical work part IV Sub-Station 2013 as amended up to date.
d) Indian Electricity Act 2003 amended up to date.
e) National Electrical Code 2016 amended up to date.
f) Indian Electricity Rule 1956 amended up to date.
g) National Building Code 2016 as amended up to date

NOTE: These specifications and conditions are applicable for following buildings of this Project:

S.No	Name of Building	Floor level
1	Campus School	G+1

General Conditions

1. The contractor has to submit MOU with associated contractor (in case electrical contractor is associated), engineers name credential email address & mobile no before start of work.
2. The contractor shall therefore employ Supervisory staff as per NIT provision who will be constantly in touch with the department and will sign site order book.
3. All the material to be used on this work by the contractor shall be got approved from the Engineer-in-Charge in advance before installation at the site.
4. Sound Engineering practice as approved by the Engineer – in – charge. Any additional item of work, if taken up subsequently, shall also confirm to the relevant specifications mentioned above.
5. All the equipment shall be delivered with (i) Manufacturer's test certificate,
   (ii) Manufacturer's technical catalogues and Installation / Instruction (O&M) manuals.
6. The work shall be carried out according to approved drawing/details which shall be subsequently issued to the successfully qualified tenderer for execution, in stages as per instruction of the Engineer-in-Charge,

who will have the right to change the layout as per requirement at site and the contractor shall not have any claim due to change in layout.

7. All damages done to the building during the execution of electrical work shall be the responsibility of the contractor and the same will be made good immediately at his own cost to the satisfaction of the Engineer-in-Charge. In case, the repair is not satisfactory, the department will get it rectified &any expenditure incurred by the department in this connection shall be recovered from the contractor and decision of the Engineer-in-charge about recovery shall be final & binding on the contractor.
8. The bad workmanship will not be accepted, and defects shall be rectified at contractor's cost to the satisfaction of the Engineer-in-Charge. The program of electrical works is to be coordinated in accordance with the building work.
9. All the debris of the electrical works should be removed, and the site should be cleared by the contractor immediately after the accruing of debris daily. Similarly rejected material if any should be immediately cleared off from the site by the contractor.
10. Cement/mortar for this benefited work is to be arranged and used by the contractor himself and nothing extra will be paid on this account.
11. The contractor or his engineer is bound to sign the site order book as and when required by the Engineer-in-Charge and to comply with the remarks therein.
12. The size of PVC/ MS conduit and wiring shall be got approved from the Engineer-in- Charge before the execution of work.
13. The contractor shall make his own arrangement at his own cost for Electrical/ General tools and plants required for the work. In case, proper tools are not available, the department will purchase the tools for Bonafide use of work at the risk & cost of the contractor.
14. The contractor must make his own arrangements for stores and watch & ward. No extra claim for this will be entertained.
15. The contractor shall make his own arrangements for electrical power supply for the construction activities. No extra payments for the same will be made.
16. The wiring and conduit route shall be marked by the contractor in the drawing first and shall be got approved from the Engineer-in-charge.
17. Main board and main distribution board: - The work shall be carried out according to the drawing/details as approved by the Engineer-in-Charge. The contractor shall have to get the sample approved before the whole lot is brought to site. The main board, distribution board shall be properly labelled.
18. No tax shall be separately paid by the department separately. The rates tendered should be inclusive all taxes and duties. Statutory deductions at source shall be made while releasing payment through running/final bills as applicable. A certificate specifying the rate and amount of deduction shall however be issued by the department. The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to the department. The watch & ward is the responsibility of the contractor till handing over.
19. All items of interrelated works considered necessary to make the scope complete and operative are deemed to be included, shall be provided by the contractor at no extra cost.
20. The connection inter connection, earthing and inter earthing shall be done by the contractor wherever required and nothing extra shall be paid on this account.
21. Nothing extra shall be paid for inter connections with thimbles/Wires/Tapes strips etc. used on the work.
22. The contractor shall on demand by the Engineer-in-charge, furnish the proof to the satisfaction of Engineer-in-charge regarding purchase of Wires, Modular switches & accessories, MCBs ,DBs, LED lights, fan & fixture and other Electromechanical accessories and other items, from the manufactures authorized outlets.
23. All PVC/ MS conduits accessories shall be of the same make as conduits and shall be ISI marked. The conduits shall be terminated as switch boxes/metallic junction boxes with suitable glands/check nuts.
24. Cutting of brick walls shall be done with due care. All repairs and patch works shall be neatly carried out to match the original finish and to the entire satisfaction of the Engineer in Charge. If the structures are

monolithic, the MS (mild steel)/PVC conduit shall be casted in the walls and ceilings as per approved layout drawings and points shall be provided in accordance of the same. In this Project, precast construction technology will be used so the conduits shall be casted accordingly.

25. All the sub main and circuits wiring includes loose wire for connections inside switch boxes and MCB DBs. No payment for these loose wires shall be made.
26. To facilitate drawing of wires, 18 SWG GI fish wire shall be provided along with laying of recessed conduit for which no extra payment shall be made. Conduits laid for other services, like Fire alarm system, PA, etc., where wiring is not done along with IEI work, fish wire shall be invariably drawn.
27. The connection between incoming switch/isolator and bus bar shall be made with suitable size of thimble and cable at no extra cost.
28. Copper conductor of insulated cables of size 1.5 Sq.mm and above shall be stranded and terminals provided with crimped lugs.
29. All hardware items such as screws, thimbles, GI wire etc. which are essentially required for completing an item as per specification will be deemed to be included in the item even when the same have not been specifically mentioned.
30. All hardware items such as nuts/bolts/screws/washers etc. to be used in work shall be zinc/cadmium plated iron.
31. All Distribution Boards (DB) shall be prewired as per direction of Engineer-in-charge.
32. While laying conduit, suitable size junction boxes shall be provided for pulling the wire as per the decision of the E -in-C of E and M component.
33. Materials to be used in work are to be ISI marked. The makes of the materials have been indicated in the list of preferred makes. No other makes will be acceptable. The materials to be used in the work shall be got approved by the Engineer in Charge/his representative before its use at site. The E-in-C shall reserve the right to instruct the contractor to remove the material which, in his opinion, is not acceptable.
34. The power points 6 Amps and 16 Amps can be looped together as per CPWD specification. In single loop max 3 nos. of 6 Amps power points can be looped and Max two nos. of 16 Amp power points can be looped. AC point/ Geyser Point / Industrial Point shall have separate circuit wiring with 4.0 sq mm wire.
35. All switches shall be modular type with approved Makes and brand.
36. Switch for geyser point shall be provided outside the washroom & socket inside the toilet near geyser location both shall be of minimum 25 Amps rating.
37. 1 nos. call bell point shall be provided in all specially abled toilets.
39. The materials used in the work shall be of make as per List of approved make and shall be approved by Engineer-In-charge before execution.
40. For all Electrical and Mechanical works, the contractor shall have to work as per the instructions of the Engineer-In-charge, Construction and Maintenance Department (CMD), IITH.
41. The firm should submit the warranty against manufacturer defect for a period of 5 years from the date of completion of work for LED fittings and products from the manufacturer.
43. The design, supply, installation, testing and commissioning of lightning protection of each building is in the scope of contractor. The design shall be done as per NBC- 2016, by rolling sphere method and CPWD specifications.
44. LED fittings as a whole including driver shall be guaranteed for 5 years. All the LED fittings shall be suitably engraved/ stickered inside, with for date of handing over.
45. The guarantee for LED fittings shall be submitted from the manufacturer in addition to the guarantee from the contractor. The manufacturer shall give undertaking that in case of discontinuation of model and non-availability of spares, they have to replace the fittings with equivalent/ high end model in case of manufacturing defect during the warranty period of 5 years.
46. The agency shall stand guarantee for at least 5 years of all the LED fittings and provide certificate from the manufacturer to attend the complaints for repairing / replacement directly from IIT Hyderabad of all LED fittings on the basis of complaints of defective LED fittings.

47. Defect Liability Period: All the installations other than LED fittings shall be guaranteed for a period of 36 months from the date of completion. LED fittings shall be guaranteed for at least 5 years. Any defective materials and be replaced free of cost at the direction of the Engineer-in-Charge.
48. Before completion of defect liability period of Three years, the main contractor has to submit security deposit (in addition to 2.5%) of 5% of 80% of the price of LED fittings (based on invoices) for the remaining 2 years' warranty period for LED fittings in acceptable form i.e., FDR/ Bank guarantee, to the Engineer-In-Charge. The Security Deposit deducted from the bills of contractor shall be refunded to the main contractor only after submission of above security deposit for LED fittings by main contractor, failing which this LED security deposit shall be deducted from Security Deposit deducted for total work and balance amount only will be refunded after completion of defect liability period. The LED Security Deposit will be released after completion of warranty period of 5 years to the main contractor.
49. The Contractor shall submit a valid Electrical Contractor Licence for 11 kV or higher voltage levels, issued by the Telangana State Electrical Licensing Board.

Technical specifications

1. The work shall be carried out as per CPWD specifications for Electric work.
2. Wiring for all E & M services shall be done in conduit or done by PVC insulated armoured FRLS cable based on requirement.
3. Minimum size of copper conductor for power wiring/light plug wiring shall be 4 sq.mm multi strand with FRLS copper conductor cable and for light/fan points/exhaust fan/call bell point, wiring shall be done with 1.5 sq mm multi strand FRLS copper conductor cable. The input circuit from the distribution board to any lighting switchboard shall be provided using 4 sq.mm wiring only.
4. Control wiring in all electrical panels shall be done with 2.5 sq mm FRLS copper conductor cables.
5. Wiring for Intercom / Telephone shall be terminated in suitable size of G.I. Junction box and RJ-11 socket (for analogue phone) & RJ45 socket (for IP phone). All the other end of wiring shall be terminated in OFC distribution box/krone box at each floor and in the ELV room. The wiring shall be suitably tagged/marked mentioning the location of each point. Wiring for both analogue & IP phone shall be done with CAT-6A UTP 4 pair cable.
6. All switches, sockets, Telephone socket, Data sockets, stepped type electronic fan regulators, bell push and accessories along with matching mounting boxes shall be of modular type and same shall be of one make.
7. There shall be separate shafts in the building each for Electrical works (LT cables), ELV works (CCTV, LAN, TV, Telephone, Fire alarm, PA etc) and Firefighting works etc.
8. Required illumination level for general lighting shall be achieved as per CPWD General specification for Electrical part-I -2023/NBC-2016/IS guidelines. Wherever range of illumination for space is mentioned, higher side of Lux level shall be taken for design purpose and decision of Engineer-in-Charge is final in that regard
9. Lighting inside the building shall be arranged in such a way that the required average illumination level is available in each of the areas as given in the relevant sections of National Building Code – 2016 (NBC)
10. For all the works mentioned in the chapter, the agency shall also follow the provisions as per NBC 2016 and provisions which are more stringent shall be followed for Design consideration.
11. The minimum scale of amenities/inventory (electrical) to be provided in each of the buildings shall be as given below. These are only indicative, minimum and not exhaustive. It is the responsibility of the Contractor to provide the required number of fixtures, fittings and equipment to cater to the intended requirement/specifications of a particular building and as per direction of Engineer-in-charge.

FOR CAMPUS SCHOOL BUILDING

(For Design consideration only, minimum and Indicative)

Sl. No.	Description	Quantity
1.	Power Plug Points (16 amp 6 pins)	4 in Each Classroom 2 in Electrical Room 4 in ELV Room 2 in Water Pump Room 2 in Common Corridor Water Points 2 in Washrooms 4 in Corridor Area 2 in Each Classroom for Projector 1 in Lift Shaft each floor 16 in Staff Room
2.	Light Plug Points (6 amp)	6 in Each Classroom 2 in Electrical room 2 in ELV Room 6 in Staff Room
3.	Ceiling Fans	6 in Each Classroom 4 in Staff Room 2 in Electrical Room 1 in ELV Room
4.	Call Bell Points	1 no in Staff Room 1 no in PHE Toilet
5.	Exhaust Fans	1 each in toilets
6.	AC Points (with MCB connected socket outlet with wiring) with separate Modular switch	2 in Classroom 2 in Staff Room 1 in Electrical Room 1 in ELV Room
7.	LAN points	2 in Each Classroom 6 in Staff Room 1 in Electrical room 1 in ELV room 1 at LIFT Area
8.	Telephone Point	1 in Staff Room 1 in Each Classroom
9.	LED Batten fittings (Minimum 40W Each)	11 in Each Classroom 4 in Electrical Room 2 in ELV Room
10.	Modular switches and sockets	Yes, to be provided in all areas
11.	LED Mirror light	1 in each Toilet per mirror
12.	PA Speaker	In All rooms, common corridor & Staircase

Note:

(i) In Bathroom / toilet, exhaust fan of suitable size (as approved by Engineer-in-charge) shall be of BLDC type only.

(ii) Above each wash basin LED type mirror light of approved design shall be provided.

(iii) In each room, RJ 45 Data & Telephone socket outlet i/c wiring, socket outlet for TV shall be provided.

(iv) Modular type call bell shall be provided, model as approved by E-in-C.

(v) Lux levels shall be as per NBC 2016

(vi) BLDC Ceiling fans shall be provided and model as approved by the Engineer –in-Charge.

(vii) All the common areas e.g. LIFTS and Staircases, Lobbies, connecting corridors etc. shall have lighting arrangement along with LED light fixtures as per actual design.

(viii) Also, each LIFT lobby on every floor shall be provided with 01Nos. 16A 6 pin plug point for Housekeeping/Cleaning/Service purposes

Note: 1. The above socket outlets/Light points/Light fixtures are indicative only and shall be provided as per approved drawings/plan by Engineer-In-Charge. If required, total no. of power plug shall be varied in whole buildings.

2. Any other area not mentioned above but for functional requirement, any power point, LAN point, telephone point, TV point is required, same shall be provided after approval from Engineer-In-Charge.

3.Sufficient additional LAN points shall be provided as per the requirement of IBMS, access control, CCTV integration and other IP based services.

(i) All internal electrical works shall be carried out with FRLS PVC insulated conductor cables (IS:694) in Opened/recessed conduit except in Fire Alarm work, where M.S conduit shall be used. All switches, sockets, IP Phone socket, Data sockets, stepped type electronic fan regulators, bell push and accessories along with matching mounting boxes shall be of modular type.

(ii) All lighting fixtures should be LED type having efficacy more than 100 Lumen / Watt, CRI >70, THD <10%, LM 79 & LM 80 test report from NABL accredited lab should be submitted by the agency.

(iii) Required illumination level for general lighting shall be achieved on the basis of required lux level in various areas, light power density as per CPWD specification/NBC norms.

(iv) Arrangement of luminaries in various areas of buildings shall be done on the basis of Illumination level & light power density as specified in CPWD specification Internal 2013 and National Building Code 2016 and shall be got approved from Engineer-in-charge.

(v) Ceiling fans will be provided in every building and at each location except toilets / Bathroom. All ceiling fans shall be of 1200 mm sweep and should be of 5 Star rated BLDC type. Optimum size / number of ceiling fans for room of different sizes shall be as per provision laid down in CPWD specifications for internal EI work 2023. Minimum air delivery and service value shall be as per the above specification. BLDC Exhaust fans of suitable capacity and sweep shall be provided in all the toilets as per standard specifications and as per the approval of Engineer-in-Charge.

(vi) T.V outlet wiring shall be terminated in suitable size of G.I. box along with splitter. The interconnections of all splitter boxes fixed at all floors shall be done properly to form proper distribution system with the prior approval of Engineer-in- charge.

(vii) Telephone outlet point wiring shall be terminated in suitable size of G.I. Junction box in DUs direct from ground floor to each DU/ user location. However, conduit for telephone wiring may be provided through branching by providing suitable size of G.I. box along suitable tag block at each floor. The inter connections of all junction boxes fixed at all floors shall be done properly making proper distribution system with the prior approval of Engineer-in-charge.

(viii) Providing incoming television / telephone cables from outside of each building is not covered in the scope of this bid.

The minimum indicative lux levels recommended for different typical areas of buildings under consideration are:

S.No	Area description	Lux level	Recommended light fixture
1	Service/Utility rooms such as Electrical room, UPS room, LT panel room, substation, pump room, Car parking area	250-300 lux	Surface LED batten
2	Fire control room, Common Toilets	300 lux	Surface/ Recessed round LED Downlighters
3	Lift shaft, Terrace, Mumty, OH Tank wall	50 lux	LED Bulk head fitting with IP 65 protection
4	Corridor, lift Lobby, waiting area	150 lux	Surface/ Recessed round LED Downlighters
5	Staircase, basement, ramp area	150 lux	Surface round LED Downlighters
6	Entrance lobby waiting area	200 lux	Cove light/ Strip light/ downlight /Cylindrical surface LED light (Combination of Fittings and layout as per direction of E-in- C)
7	Class rooms & Staff rooms	300-500 lux	LED batten Indoor light
8	Road and Outdoor parking areas	15 lux	LED streetlights

Note: Any other area specifically not mentioned above shall be given with lighting solution after approval from Engineer-in-charge.

(ix) All suspended light fittings shall use suspension GI wire and assembly either supplied by Light fitting manufacturer or by their recommended OEM/OEA.

(x) Heavy duty Metallic exhaust fan of 900 RPM with louvers as per the requirement of ventilation shall be provided in Electrical Panel room, substation, utility rooms etc. The no. of exhaust fan/ventilation fan shall be calculated on the basis of no. of air change required as per NBC 2016 norms.

(xi) 1 no. call bell point along with call bell & switches shall be provided in all specially abled Toilets.

(xii) For LAN Cat-6A UTP, 4 pair cable shall be provided as per the design and to be terminated in G.I. Junction box. & Wiring for cable TV with coaxial cable RG-6 grade, 0.7 mm solid copper conductor PE insulted with fine tinned copper braided & protected with PVC.

(xiii) Bulk-head fitting pressure die cast housing with IP 65 protection surface mounted – In each landing floor level of all the vertical shafts except firefighting shaft and in Terrace area outside mumty, entrance of pump room and as per direction of E-in-C.

(xiv) 1 No 6/16 Amp Socket outlet with switch in lift shaft (As per requirement of lift agency), Electrical and LV(Communication) shaft – in each landing level of every shaft.

(xv) LED Exit signages with 2 hours battery back with bicoloured LED status indicator & should visible from 40 mtrs, at every 6.00 m in corridor and at all conspicuous locations to indicate Exit, staircase location, toilet location, handicapped toilet location, lift location etc. as per NBC norms. All exit signages in staircases, exit path and in critical areas shall be on UPS DB.

(xvi) Fire Staircase lighting shall be provided with LED emergency light with minimum 2 hours battery backup.

(xvii) Lighting automation to be provided by connecting suitable dual mode (sensor should sense movement and occupancy both) occupancy sensor to lighting circuit for entire building excluding complete fire staircase lighting, 20% of corridor lighting on each floor and common area. There shall be arrangement of bypass switch so that in case of failure of sensor, the light can be operated after bypassing the sensor.

(xviii) 20% of corridor lighting on each floor and common area, is to be connected to separate UPS DB for Emergency purpose providing lux level of not less than 10 lux in specified areas, which shall not be connected to lighting automation as per NBC 2016.

(xix) In parking areas, staircase areas, corridors etc. no switch for individual light control is to be provided all such point shall be executed on looping basis and shall be group controlled by MCB/switch from DB. In these areas Light controls shall be provided in such a manner to switch ON/OFF general lighting as per requirement /bay or section wise.

(xx) Inside the lift shaft there shall be arrangement of one light point with LED Bulkhead fittings of suitable rating (minimum 800 lumens) shall be provided at each floor level end. All light points shall be in group controlled and wired with 1.5sq mm FRLS copper conductor cable. 16-amp power plug shall also be provided at all floors with 4 sq mm FRLS copper wiring. In lift shaft, all 16 Amp power point shall be on single loop.

(xxi) All Cables in Parking area, Electrical Room, Panel room, LV rooms, Shafts shall be laid on cable trays and approx. 25% capacity of all such cable trays shall remain unused as future provision. Minimum width of cable try shall not be less than 150 mm.

(xxii) Such cable tray on Parking area, Electrical Room, Panel Rooms, area shall be hot dipped GI as per direction of E-in-C. Proper factory-made TEE, Bend, elbows, cross, joints and other accessories shall be used.

(xxiii) Cable trays shall be Perforated Hot Dipped Galvanised Iron (galvanisation thickness i.e average mass of Zinc coating shall not be less than 65 microns for 2 mm thick & 50 microns for 1.6 mm thick as per IS standard) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required. Suitable size as per site conditions shall be used with thickness 1.6 mm for cable trays with width≤ 300 mm & thickness 2 mm for cable trays with width > 300mm.

(xxiv) GI Metal trunking (Race ways) for drawing LAN cables shall be done for all computer outlets. GI Metal trunking shall have separator in between power cable & LAN cables. and approx. 25% capacity of all such cable trays shall remain unused as future provision.

(xxv) Floor trunking shall be made up of minimum 1.6 mm thick Pre-Galvanised / Hot dipped G.I sheet (minimum 275 GSM) including junction box of suitable size, Couplers, Jointing sleeves, floor fixing supports complete as required. Size of the same shall be as per requirement as per approval of engineer in charge.

(xxvi) AL/ Cu XLPE cable shall be use for power distribution in all buildings.

(xxvii) Cable size shall be decided as per maximum load of the building and 25% future expansion and shall got approved by Engineer – in –Charge.

(xxviii) The rupturing capacity of the MCB's shall not be less than 10KA, higher capacity shall be provided if required in the detailed design. The MCB's shall have ISI mark and rupturing capacity of the MCCB's shall be as per design of fault level, but shall not be less than 36KA. Make of MCB/MCCB shall be the same as the make of MCB DB (in that particular DB).

(xxix) Earthing: All earthing shall be done with copper plate earthing unless otherwise specially mentioned. Copper plate earthing system comprising of earth electrode, earth conductor, earth bus, protective conductor etc for building shall be as per provision laid down in CPWD specifications part – I, 2013. Earthing system should be designed such as to maintain earth resistance as specified in CPWD specifications. Earth resistance shall be checked / tested in harsh climatic conditions.

(xxx) If copper plate earthing is not possible at site due to very hard rock as per direction of E-I-C Copper bounded Rod earthing will shall be executed. It shall consist of Supply, Installation & testing of Earthing Station, consist of 3Mtr Copper Bonded Rod of minimum 17.2mm diameter. with minimum 25Kg Resistance lowering compound Earthing. Copper Bonded Earth Rod made from high tensile low carbon steel and each rod should molecularly bonding 99.9% pure electrolytic copper to the low carbon steel core in accordance with national and international standards such as BS6651, BS7430 and UL467. comprises specifically selected compounds, which possess excellent electrical conductivity. The earth electrode shall be provided in 100 mm dia boaring, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc complete as required.

(xxxi) Lightning Arrestor: -Lightning conductor shall be provided for building & Lightning protection system shall be designed as per rolling sphere method as per NBC 2016 guidelines.

(xxxii) All LT and HT cables laid outside the building portion in open area shall be either laid in RCC HUME pipes or in ground with Sand cushioning and brick protection with route marker or in RCC trench or in DWC pipes or in cable tray as per CPWD Specification and direction of Engineer-in-Charge.

Light Fitting Technical specifications :

S.No	Item description	Specifications
1	LED Batten	Surface mounting type LED fitting with diffuser having a lumen output not less than 2200 lumens, CCT 5700 - 6500K and LED efficacy better than 120 lumen/ watt with opal diffuser in polycarbonate complete with CRCA / Pressure Die Cast Aluminium Housing and life of 50K burning hours (L 70) at 30 deg , THD ≤ 10%, CRI better than 80 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc. as reqd.
2	Mirror light	Surface mounting type LED fitting with diffuser having a lumen output not less than 1100 lumens, CCT 4000K and LED efficacy better than 110 lumen/ watt with opal diffuser in polycarbonate complete with CRCA / Pressure Die Cast Aluminium Housing and life of 50K burning hours (L 70) at 30 deg , THD ≤ 10%, CRI better than 80 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc. as reqd.
3	Recess/ Surface mounted LED Downlight (Type-2)	Luminaire having minimum lumen output of 1800 lumens, CCT 5700 K- 6500K and system efficacy better than 110 lumen/ watt with opal diffuser in polycarbonate complete with Pressure die cast aluminium Housing, THD ≤10%. Service life of 50,000 hrs @ L 70 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc complete as required.
4	Bulkhead Fitting	LED bulkhead fitting light having minimum lumen output of 800 lumens, IP 65, CCT 5700- 6500 K and system efficacy better than 100 lumen/ with opal diffuser in polycarbonate complete with powder coated Pressure die cast aluminium Housing, life of 50K burning hours (L 70), THD ≤ 10%, CRI better than 80 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc. as reqd.
5	Outdoor Wall light	Wall mounted round LED light having minimum lumen output of 1200 lumens, IP 65, CCT 5700-6500 K and system efficacy better than 100 lumen/ with opal diffuser in PMMA complete with polycarbonate/ Pressure die cast aluminium Housing, life of 50K burning hours (L 70), THD ≤ 10%, CRI better than 80 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc. as reqd.
6	Spotlight (Garden lights)	LED light having minimum lumen output of 500 lumens, CCT 4000 K and system efficacy better than 90 lumen/ with anodized aluminium reflector optic, Pressure dies cast aluminium Housing, life of 50K burning hours (L 70), THD ≤ 10%, CRI better than 80 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc. as reqd.

7	Outdoor light (façade light)	Outdoor LED spotlight with 6-10 w warm/neutral white light suitable for wall washing evenly, Service life of 50,000 hrs @ L 70 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc complete as required.
8	Street light	LED Street light having minimum lumen output of 12000 lumens, IP 66, CCT 5700K - 6500 K and system efficacy better than 120 lumen/ watt with injected moulded with aluminium Housing, THD ≤ 10%. Service life of 50,000 hrs @ L 70 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 10 KV including connections etc complete as required.
9	Post Top/ Gate light Fitting	LED Luminaire having minimum lumen output of 4000 lumens, IP 65, CCT 5700-6500 K and system efficacy better than 90 lumen/ watt with symmetric optic diffuser in polycarbonate complete with Pressure die cast aluminium Housing, THD ≤ 10%. Service life of 50,000 hrs @ L 70 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 2 KV including connections etc complete as required.
10	Bollard	Minimum 9 W LED Bollard, maximum 900mm height IP 65, IK10 CCT 6500K diffuser in polycarbonate complete with extruded aluminium Housing, Service life of 50,000 hrs @ L 70 with inbuilt protection against short circuit, over voltage protection and surge protection of up to 4 KV including connections etc complete as required.

Note:

For all LED fittings CCT (5700K - 6500K or 4000K or 3000K) shall be chosen based on final design, aesthetics, functionality and as per directions of Engineer-In-Charge. If any fitting is not available in specific make, Technical and aesthetically Similar shall be installed as per the direction of E-in-C.

General Requirements:

The all buildings will be planned as per a minimum 3 Star GRIHA rating, therefore, the energy consumption of the building should be minimum but without affecting the functional requirements of the building. So, the fittings, fixtures and fans must be energy efficient. To minimize the energy consumption of the building, maximum sun light can be utilized while designing. Wiring for internal and external electric installation, copper wiring in PVC/ conduit i.e. light & fan point, call bell point, light & power plug with modular switch, socket and accessories, LED Fittings, Exhaust/Fresh air fan, Ceiling fan, switch board, DB, MCB, MCCB, RCCB, main panel Ceiling Fans.

1.0. Lighting

Lighting shall be based on average lighting level considerations, which are as per NBC- 2016 except otherwise specified in inventory.

Contractor shall submit the Dialux analysis of lighting for internal & external usage. All light fixtures shall be LED having LM79 and LM80 certification from NABL accredited laboratory and relevant approved IES files for Dialux. LM79 & LM80 reports to be furnished by contractor for each type of LED fittings.

Nos. of fittings shall be provided to have required LUX level as well as maintaining aesthetic look.

The fixtures shall be of surface/ recessed type as per site requirement and drawing. Number of fittings shall be provided on the basis of average illumination range for different areas subject to maximum LPD specified in CPWD internal specification 2023 (Section 2.10 and Table 2.5) & ECBC+ Building 2017 Table 6.4,6.5 & 6.6 & NBC 2016.

Only 5 Star rating BLDC ceiling & Exhaust fans should be provided in the various part of building as per healthy engineering practice and as per prescribed norms/architectural drawings approved by Engineer-In-Charge.

All the modular switch, sockets, Fan regulators etc. shall be of equivalent specifications of Legrand Arteor series or similar specification series of other approved makes in the tender. The contractor shall submit the data sheets for the modular switches, sockets, fan regulators etc. along with sample to the Engineer-In-Charge for prior approval before procurement of the same at site.

EXTERNAL LIGHTING

The scope of this work consists of planning, designing and SITC of LED street lighting with poles and at least 1 meter of arm, Bollards, post top light etc. as mentioned below along roads, pathways, gardens etc. around the building as per following details. Exact quantity shall be determined as per the requirement of NBC 2016, as per the approved external lighting layout and as per directions of E-in-C.

Also disconnecting and dismantling existing street lights in the new building construction premises and shifting the poles as per the directions of Engineer-In-Charge.

S. No.	Item
1.	9-meter height hot dip galvanized pole along 7-meter road
2	6-meter Height hot dipped galvanized pole along 6-meter Road
3	5-meter Height hot dipped galvanized pole along 4-meter road
4	LED streetlight fitting of minimum 90W
5	1200 mm long Single arm 60 mm dia bracket
6	Feeder Pillar for streetlight (minimum 03Nos.)
7	Garden Bollard light
8	4-meter height Smart Post-top light

Note : The street light poles shall be installed at average distance of 18-20 meter. However, contractor shall design the system to avoid any black spot on the road. All road inside the campus, residential block surrounding area and all hostel block surrounding area will be illuminated by lights.

Appropriate size of copper/ aluminium armoured cables shall be as per CPWD specifications and shall be laid with appropriate size GI wire required for earthing of every streetlight and bollard fitting. Cable laying shall be done in appropriate size NP2/DWG pipes of strength not less than SN8, which is laid inside ground at required depth below finished floor level including trenching, refilling of earth, compaction etc.

Weatherproof & flameproof SMC (Sheet Moulding Compound)/FRP (Fibre-reinforced Plastic) loop in/loop out boxes to be considered for all external lighting poles for cables terminations as required and as per the directions of Engineer-In-Charge. However inbuilt cable termination box/system within the pole and completely flushed with the pole is also acceptable as per the approval of Engineer-In-charge.

The scope of work is inclusive of RCC foundation of appropriate size with J bolts. The drawings of each and every item, layout drawings, foundations, poles shall be submittedfor approval from Engineer-In-charge. The detailed specifications of items are as follows:

Street / compound lighting:

9.00 mtr long surface mounting type hot dipped galvanized octagonal pole with at least 1.2 mtr long single arm GI bracket in approved design capable of holding the luminaire. The pole structural design shall be as per ILE TR7 considering the wind speed as per IS:875, the HT steel for construction should be as per BSEN10025 grade S355Jo, hot dipgalvanizing on both internal and external surfaces as per IS: 2629/IS: 2633/IS: 4759 withaverage coating thickness of 65/70 microns through a single dipping process. The pole shall also be provided with hinged / chained flush door with rubber gasket of length not less than 300mm at an elevation of 1.0 m (approx.) from the base plate with proper strengthening to the cut-out of the door opening having locking arrangement, earthing arrangement (at least 0.5 m height). Each pole shall be complete with a Bakelite sheet complete with DIN rail, 6 amps, 10 kA SP MCB, screw less DIN mountingConnectors suitable for 16 sq.mm. terminations complete with DIN bar, shorting links, end locks etc as required.

The pole shall continuously tapered (bolt fixing type) tubular Pole with top 70 mm dia. (minimum) and bottom 130 mm dia. (minimum) made of 3 mm (minimum) thick H T sheet Steel conforming to grade S 355 complete with G I base plate of size not less than 220 mm (L) X 220 mm (B) X 16 mm thickness welded at bottom of pole complete with 4 Nos 20 mm dia 600 mm long foundation bolts conforming to EN 8 grade, inbuilt / Vandal resistance, weather proof electrical junction box having terminal block, MCB etc mounted on bakelite sheet for looping in /looping out of cables, with flush door having locking arrangement, earthing arrangement (at atleast 0.5 m height) GI foundation bolts (EN 8 grade) of min. 20 mm dia each with three GI nuts and two GI washers etc complete as per drawing.. The pole shall have a section thickness of not less than 3 mm. The pole shall be fabricated in a single section.
The pole shall have a single /double side GI bracket as per the design approved by the engineer- in-charge. (For Street Lights)

The cable entering and exiting provision using appropriate size of DWC pipe compatible with IS 16205, Part 24:2017 in the foundation of poles. RCC foundation (1:2:4 with 12mm reinforcement) size not less than 500 mm x 500 mm x 1200 mm in ground and 200 mm above ground level with foundation bolt duly embedded before casting as per manufactures designs and recommendations. (Design & drawing must be got approved from Engineer-in-Charge).

1) The cable entering and exiting provision using appropriate size of NP2 RCC/DWC pipe compatible with IS 16205, Part 24:2017 in the foundation of poles. RCC foundation (1:2:4 with 12mm reinforcement) size not less than 500 mm x 500 mm x 1200 mm in ground and 200 mm above ground level with foundation bolt duly embedded before casting as per manufactures designs and recommendations. (Design & drawing must be got approved from Engineer-in-Charge).

2.0. For surface car parking, landscape, service area:

2.1. 4 meter long street light pole made of 65 mm dia (nominal size) medium class G.I. pipe welded with M.S. base plate of size 300 mm x 300 mm x 6 mm thick I/c drilling of holes for cable entry, earth stud and painting pole with one coat of anti-corrosive paint and two coats of approved quality of Aluminium paint, Erection of the same in cement concrete 1:2:4 (1 cement: 2 coarse sand : 4 graded stone

aggregate of 20 mm nominal size) foundation with cement concrete collar of minimum size 0.5m dia X1.0 m depth X 0.4m height above ground level including excavation and refilling etc as required. LED street light luminaire with 2500 lumens, suitable for 230V, single phase, 50 Hz,AC supply complete with all accessories and connections, earthing the body etc. complete as reqd. SMC cable looping box 230mm X 170mm X 105mm deep, having hinged cover plates including providing and fixing one No. 6 amps SP MCB "C" series, and 4 way 32A brass connector terminals on 6 mm thick phenolic laminated sheet for looping of 2 x 10 / 16 Sq.mm cable and suitable size detachable gland plate inside with necessary hole at the bottom for cable entry pipe etc.as required. Cable entry pipe with 50 mm dia 1.5 mtr long medium class GI pipe suitably bent at the bottom end for cable entry to street light looping box including threading the pipe and fixing the same with MS clamp to the pole including painting etc. complete as required. – Not less than 4 Nos.

4 meters pipe pole post top lights shall be installed in parking and around School Building every Entry / Exit of every blocks as per the approved drawing and directions of Engineer-In-Charge.

2.2. Bollards in the landscape

Minimum 9 W LED, LED bollard, 900mm height, CCT 4000 K and IP 65 and IK10 protection with appropriate size RCC foundation as approved by officer in charge complete etc. as required.

The bollards shall be installed along the road inside green area and on periphery of green area in front of New School building at distance of 3-4 meter.

3.0. Streetlight control panels :

3.0. The panel shall be of cubicle compartmentalized wall/floor mountable outdoor type (IP 54) fabricated out of minimum 2.00 mm thick CRCA sheet, duly powder coated,manufactured by CPRI approved panel builders having in-house facilities for 7 tank process treatment and powder coating. The panel shall have incoming MCCB, Busbar section with insulated tinned copper bus bars cu (size 20% extra over calculated current), metering section with ammeter, voltmeter, LED indicating lamps, cable alley etc. Street/compound/ parking/ garden bollard lighting control section shall be provided with individual astronomical timer in outgoings required to feed street lighting for automatic operation, wireless RF controller gateway which can communicate with the sensors located at fittings, 3 pole contractor, suitable size TPN incoming MCB , outgoing SP MCBs as per the number of circuits, multi way connectors for terminating the UG cable,Auto ON /OFF with Astronomical switch, contactor(s) , timer toggle switch(s), interconnecting copper wiring not less than 2.5 sq mm, etc as required suitable for operation on 415 V, 3 phase, 50 Hz, AC power supply . There should be separate controls for Street/compound light/ Bollard light. Earthing/loop earthing etc shall be done as per CPWD specifications.

3.1. Distribution of electric power to street / compound lighting etc. and gate lights shallbe with FRLS XLPE insulated and PVC sheathed aluminium conductor armored UG cable of 1100 (ISI marked). 6 SGW GI wire shall be used for street light earthing. Minimum 1-1.5 RM cable shall be kept extra at each street light pole for loop and maintenance purpose.

3.2. The cables shall be laid directly in ground, NP2 pipe, closed or open duct, cable trays or on surface of wall etc. depending upon the site conditions and as per direction of Engineer-In-charge. Tagging of cables on both ends of each circuit of street, compound lighting and gate lights shall be done. Before lay of cable work, trench/ cable try/ pipe work shall be inspected by E-I-C

3.3. Lighting luminaries for street / compound/ garden bollard and gate lighting shall be of LED type as specified in bid documents.

3.4. All lights of street, compound/ Garden bollard and gate shall be controlled by astronomical time switch. There shall be arrangement of bypass switch so that in caseof failure of time switch, the lights can be operated after bypassing the same.

3.5. Earthling of Street / compound lighting shall be carried out as per CPWD General Specifications Part-I (Internal)-2023 and CPWD General Specifications Part-II (External)-2023.

3.6. RCC pipe of suitable size (as mentioned below) for protection of UG cables shall be used for road crossing, entry in to buildings and paved areas.

3.7. Underground cables of size up to size of 35 sq.mm (up to 2 run of cables)- 150 mm dia.

3.8. Underground cables of size exceeding 35 sq.mm but not exceeding 120 sq.mm (up to 2 run of cables) - 200 mm dia.

3.9. Underground cables of size exceeding 120 sq.mm but not exceeding 300 sq.mm (up to 2run of cables) - 300 mm dia.

3.10. After completing the work, necessary test results as envisaged in CPWD GeneralSpecifications Part-I (Internal)-2023 and CPWD General Specifications Part-II (External)- 2023 shall be recorded and submitted to the department. The results shall be within permissible limits.

3.11. Street light panel / feeder pillar panel shall be installed on brick / RCC foundation at minimum height of 500 mm above ground level as per approved diagram.

3.12. After 12.00 night 50 % of all outdoor lights (every alternate fitting) shall be off. circuit layout and outdoor loop wiring shall be provided accordingly

3.13. Each panel will have surge protection Device of suitable capacity

FEEDER PILLAR

Outdoor type Feeder Pillars shall be suitable for 3 phase, 50Hz, 415 volts, A.C. system and shall generally conform to IS 5039. Feeder Pillar shall be fabricated as per CPWD specification and sound engineering practice. Fabrication shall be started only after approval of drawing by Engineer-in-charge. All components of feeder pillars like MCCBs, Bus bar, MCBs, astronomical timer etc. shall fulfill all requirement of relevant IS codes. MCCBs upto 250 amp capacity should have breaking capacity not less than 36 KA and that of more than 250 Amp shall have breaking capacity 50 KA. All MCBs to be used shall have breaking capacity not less than 10KA Bus bar shall be of tinned copper electrolytic grade. For all MCCBs and MCBs ICs = ICu. Enclosures of feeder pillars shall be painted with 7 tank process.
The street light feeders should have controlled by the Manual/ Auto mode (Digital timers).

MOULDED CASE CIRCUIT BREAKERS

Moulded Case Circuit Breaker shall be incorporated in the Feeder Pillars wherever specified. MCCBs shall conform to IS: 13947 (Part-II) IEC-947(2) in all respects. MCCB"s shall be suitable either for single phase AC 230 volts or three phase 415volts. The MCCB shall of thermal magnetic type upto 200A rating and MCCB above 250A rating shall be of microprocessor based having overload and short circuit protection. The incomer MCCB shall also have earth fault protection and time delay. The main incoming MCCB/ACB provided in the main panel of each building shall be microprocessor based and shall be suitable for BMS operation.

Signages / Sign boards:

The scope of works consists of

(i) **Signages:** Designing , manufacturing, providing and fixing of self-glowing photo luminescent safety signages on 1.2 mm thick aluminium sheet of various matter as briefed by the Engineer-in- charge such as electrical safety precaution, instructions for lift passengers, fire safety measures, indication of various shafts, entrance , exit, stairs, toilets, fire exit etc. having single side printing / computerized setting of letters on the photo luminescent as base chemical covered with stabilizer coating complete as required for various buildings under construction . Wherever required light illuminated signages shall be used.

(ii) **Sign Boards (For various buildings):** The scope of work also consists of design, supply, fabrication and fixing of sign board using word made of acrylic cut out letter with LED and reflecting vinyl sheet as per design approved by Engineer-in-charge. The board shall be fabricated with 3mm thick ACP sheet. Powder coated aluminum sheet shall be fixed from therear side of the entire board to make box section. Powder coated aluminum cuts and bracket shall be used of minimum 3 mm thickness.

UPS Scope:

The scope covers supply, installation, testing & commissioning of 15 KVA & 5 KVA UPS system complete with batteries & all accessories.

The UPS shall be provided in the following buildings:

S.No.	Name of Building	UPS qty.	UPS rating
1	Campus School – Network	1	5 kVA
2	Campus School – Classrooms, Emergency Lighting & FAS	1	15 KVA

UPS:

"True Online-Double conversion type single/multi module UPS. Input 240/415V Nominal; 50Hz; 3Phase 4wire system".

Output 240/415V Nominal; 50Hz; 3Phase 4 Wire system with Battery each UPS comprising of the following Major components.
IGBT based Rectifier cum charger.
IGBT based Inverter.
Sealed maintenance free battery with 30min back up time, Inter connecting cables; Links; Racks and standard accessories (Battery Sizing calculation for back up to be provided by vendor along with GA drawing)Built in SNMP card.
All other equipment necessary to operate the UPS is in the scope of the contractor.

GENERAL SUMMARY
This specification describes the operation and functionality of a continuous duty, dual input feed with configurable single-phase or three-phase output power (3:1 or 3:3), solid-state, static Uninterruptible Power System (UPS) hereafter referred to as the UPS.

The UPS shall utilize double conversion online topology designed to protect electronic equipment by supplying reliable, network-grade power with extremely tight voltage and frequency regulation. The UPS shall feature an internal static bypass and input power factor correction.

Configuration Specifics:

1. The system power train shall comprise of, input disconnect and filter stage, input PFC power stage, energy storage stage (DC bus capacitor bank), output power stage (inverters), static bypass switchfor connecting bypass line to the output, and battery charger.

2. The system shall also include, field-replaceable fan module, removable input/output wiring trays, battery disconnects, an LCD interface display, EPO, and an integrated UPS network management card with temperature monitoring.

   The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power for mission critical, electronic equipmentload.

   All programming and miscellaneous components for a fully operational system as described in this specification shall be available as part of the UPS.

   STANDARDS
   EN50091-1/ EN/IEC62040-1-1, EN50091-2 / IEC62040-2, EN55022 Class A, EN55024, EN61000-4-2, 4-3,4-4, 4-5, 4-6, 4-11, EN60950, IEC 60950, CE, VDE, C-tick, ISO 9001, ISO 14001

   MODES OF OPERATION

   Normal: The input Power Factor Corrector (PFC) stage and output inverter stage shall operate in an on-linemanner to continuously regulate power to the critical load. The input and output converters shall be capableof full battery recharge while simultaneously providing regulated power to the load for all line and load conditions within the range of the UPS specifications.

   Battery: Upon failure of the AC input source, the critical load shall continue being supplied by the output inverters, which shall derive their power from the battery system. There shall be no interruption in power tothe critical load during either transfer to or from battery operation back to normal operation.

   During the re transfer from battery to on-line operation, the load shall be softly transferred from battery backon-line within 10 seconds, to avoid step load changes on the mains supply.

   Recharge: Upon restoration of the AC input source, the input converters and output inverters shall simultaneously provide regulated power to the critical load and recharge the battery.

   Bypass operation: Bypass mode shall be reached either as a user selection/maintance and automaticallywith indication.

3. Bypass mode can be selected through the Control menu screen on the Powerview display

4. The UPS will automatically switch into bypass mode if:

   a. Both normal and battery operation modes are unavailable
   b. An output overload condition occurs
   c. The UPS has an internal fault

   During bypass operation the utility power is connected to the load, bypassing the internal converters. If

thebypass mode becomes unavailable, the UPS will automatically switch to mains power. In the event that mains power is unavailable the system will switch to battery power.

With the UPS supplied from dual feeds and operating on battery, due to a mains failure, it shall be possibleto request the unit to go to bypass, in addition to automatically transfer to bypass when the batteries are depleted. In this bypass mode the inverter shall become a PFC and back-feed the DC busses. This allows the charger to continue charging the batteries.

SUBMITTALS

General arrangement drawing and details:

5. Bill of materials.
6. Product catalog sheets or equipment brochures.
7. Product guide specifications.
8. System single-line operation power and control diagram.
9. Installation information, including weights and dimensions.
10. Information about terminal locations for power and control connections.
11. Battery Sizing calculation includes weight & dimension.
12. Any other information/clarification asked by Engineer/consultant/Employer related to design and product specification.

Delivery Submittals:

13. Installation manual, which includes instructions for storage, handling, examination, preparation, installation, and start-up of UPS.
14. User manual, which includes operating instructions.

PRODUCT

MECHANICAL DESIGN

Generally, The UPS shall be contained in two rugged steel cabinets, one containing the power electronicsand the other containing the batteries and single-phase distribution outlets; The UPS and battery cabinets shall be capable of conversion between Tower / Stack and Rack-Mount configurations;

SYSTEM CHARACTERISTICS

System Capacity:

15. The system capacity as specified in BOQ shall be rated for 0.8 Pf output:Input:

16. AC input nominal voltage:As specified in BOQ
17. AC input voltage window:

a. Full Load, 160 -275V (Line-Neutral) for single phase input or 277 -476V (Line-Line) for threephase input;
b. Half Load, 100 -275V (Line-Neutral) for single phase input or 173 -476V (Line-Line) for threephase input;

18. Input frequency range: 40-70Hz;

19. Input Power Factor; > 0.98 at 100% load

20. Input Current Distortion: < 4% at 100% load, 230VAC (<7% for 3 phase output)

21. Crest factor: 3:1.

UPS Output:

22. AC Output Nominal Output: (Customer configurable)As specified in BOQ

23. AC output voltage distortion: Max. 2% @ 100% linear load; Max. 5% @ 100% non-linear Load;

24. AC output voltage regulation (Static): +/-1%;

25. Voltage Transient Response: +/- 8% maximum for 100% load step

26. Voltage Transient Recovery within < 10ms recovery time;

27. Output Voltage Harmonic Distortion:
a. <2% THD maximum for a 100% linear load
b. <5% THD maximum for a 100% non-linear load

28. Overload Rating:

a. Online: 105% - infinite; 125% - 1 minute; 150% - 30 seconds;
b. In bypass: Overload is limited by the external input circuit breaker feeding the UPS. System AC-AC Efficiency: >95%
29. Output Power Factor Rating: 0.2 –1.0 lagging, nominal: 0.8 lagging.

30. Output frequency: 50 +/- 0.7Hz tracking

31. Output connectors:

a. Single phase: Hardwire 3-wire (Phase + N + G),
b. Three phase: Hardwire 5-wire (3 Phase + N + G)

32. Output frequency Slew rate: 1.0Hz/Sec, 0.5Hz/Sec 0.25Hz/Sec

ENVIRONMENTAL

33. Storage Ambient Temperature:

a. -15° to +55° C

34. Operating Ambient Temperature: 0°C to +40°C (+32°F to +104°F).

35. Relative Humidity: 0 to 95% non-condensing

36. Audible noise:

a. <50dBA at <70 % load at 1m,
b. <60dBA at >75 % load at 1mc.

INPUT PFC POWER STAGE

The input PFC power stage of the UPS shall constantly rectify the power imported from the mains input ofthe system, converting the input mains AC power to DC power for precise regulation of the DC bus voltage, battery charging, and output power stage (inverter) regulated output power.

Input Current Total Harmonic Distortion: The input current THD_I shall be held to 6% or less at full system load, while providing conditioned power to the critical load bus, and charging the batteries under steady-state operating conditions. This shall be true while supporting loads of both a linear or non-linear type. Thisshall be accomplished with no additional filters, magnetic devices, or other components.

Input Current Limit:

The input converter shall control and limit the input current drawn from the utility supply

Overloads at low line input voltages shall draw power from the battery, (battery assist mode) in order to support the load and maintain the input current below the set current limit points.

Charging:
The battery charging shall maintain the DC bus float voltage of +/-219V, +/-1% at the nominal temperatureof 20°C (68°F)

The battery charging circuit shall contain a temperature monitoring circuit, which will regulate the battery charging current to optimize battery life.

The battery charging circuit shall remain active when in automatic Bypass and in Normal Operation.

The battery charging system shall adjust the charging current by automatically sensing the number of battery modules and by monitoring the individual battery current. Maximum charger power shall be 3kW.

OUTPUT POWER STAGE (INVERTER)

The UPS output power stage (inverter) shall constantly recreate the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT switches. In both online operation and battery operation, the output power stage (inverter) shall create an output voltage waveform independent of the mains input voltage waveform. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave ofthe output power stage (inverter).

Overload Capability: The output power stage (inverter) shall be capable of withstanding 150% overload for30 seconds or 125% overload for 1 minute or 105% overload for an indefinite length of time. The system shall transfer to bypass if the overload persist and then return back on-line when the overload is removed.

Battery Protection: The UPS shall have monitoring and control circuits to limit the level of discharge on thebattery system.

AUTOMATIC BYPASS

As part of the UPS, a system automatic bypass switch shall be provided. The system automatic bypass shall provide a transfer of the critical load from the Inverter output to the automatic bypass input source during times when the inverter cannot support the load. Such times may be due to prolonged orsevere overloads, or UPS failure. The UPS shall constantly monitor the output current, as well as the bypass source voltage, and inhibit potentially unsuccessful transfers to automatic bypass from taking place.

The design of the automatic bypass switch power path shall consist of an electromechanical bypass contactor and series SCR's.

Automatic Transfers: An automatic transfer of load to bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from bypass back to normal operation takes place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to bypass shall also take place if for any reason the UPS cannotsupport the critical bus.
Manual Transfers: Manually initiated transfers to and from bypass shall be initiated through the UPS interface display or via the serial communications port.

DISPLAY AND CONTROLS

Control Logic: The UPS shall be controlled by an embedded microcontroller which performs the followingfunctions:

- Monitoring quality of input, bypass and output voltages;
- Monitoring vital parameters of the UPS;
- Executing the state machine;
- Remaining runtime calculation;
- Self-diagnostics, self-test and proactive fault detection;
- Communication to the Network Interface Card or another SmartSlot accessory card if equipped.

Display Unit: A microprocessor controlled display unit shall be located at the front of the system. The display shall consist of an alphanumeric display with backlight, providing system status, LED alarm indicators and a keypad consisting of pushbutton switches for control and status reading selection.

Metered Data: The following metered data, shall be available on the alphanumeric display:

- Year, Month, Day, Hour, Minute of occurring events
- Source and Bypass Input Voltages
- Output AC voltage
- Input, Bypass and Output AC currents
- Input, Bypass and Output Frequency
- Battery voltages and currents
- Internal and battery pack temperature

Event log: The display unit shall allow the user to display a time and date stamped log of the 10 most recent status and alarm events.

Alarms: The display unit shall allow the user to display a log of all active alarms. The following minimumset of alarm conditions shall be available:

1. Low/No AC input, startup on battery
2. UPS Fault
3. On Battery
4. Shutdown or unable to transfer to battery due to overload
5. Load Shutdown from Bypass. Input Frequency Volts outside limits
6. Fault, Internal Temp exceeded system normal limits
7. UPS in Bypass due to Internal Fault
8. UPS in Bypass due to overload
9. Low Battery

Controls: The following controls or programming functions shall be accomplished by use of the displayunit. Pushbutton switches shall facilitate these operations.

1. Silence audible Alarm
2. Display or set the date and time
3. Transfer critical load to and from bypass

4. Test battery condition on demand

5. Adjust set points for different alarms

Communication Interface Board: A communication interface shall provide the following communicationports which can be used simultaneously:

1. RS232 Serial Port #1

2. RJ-45 Interface port for Power View Display

3. RJ-45 Ethernet connection, on installed Network Management Card

UPS should have the RS-485 MODBUS compatability for IBMS integration.

BATTERY

External SMF Battery

4. The complete set of batteries consists of multiple units so as to obtain an overall nominal voltage (direct voltage). A battery rack comprises 12 Volt batteries connected in series. The battery rack must comply with standards governing electrical safety, which requires the use of adequate protections and particular care when higher voltages are present and direct contacts are possible. Battery calculation sizing to be provided by contractor for approval.
5. The UPS battery system shall comprise of user replaceable external batteries providing nominal voltage for the positive DC bus rail and nominal voltage for the negative DC bus rail.
6. The battery blocks shall be of the type sealed maintenance free.
7. The UPS shall incorporate an Intelligent Battery Management system to continuously monitor the health of the battery system and notify the user if that system is weak or needs replacing.

General description for Batteries

8. Batteries shall be of the SMF type.
9. Each battery system shall have identical Amp-hrs capacity.
10. Ground wires shall be supplied for connection from the UPS to each battery enclosure grounding point.

Charging:

- The battery charging circuit shall remain active when in bypass or on-line.

- Charging system shall automatically adjust the maximum charger power based on the installed proprietary battery capacity and current through each battery string to avoid excessive charging that could result in bloated batteries. Each proprietary battery pack shall report its battery currents and temperature to UPS through communication

- The Battery Charger must be equipped with control and regulation circuit both for charging voltage and current to batteries, in order to have a controller battery charge and optimize the battery life. The UPS must charge batteries with and early boost charge followed by a constant charge and, at the

end, with a floating charge. During normal run the UPS will execute periodically a battery equalizing in order to recover natural charge leakages and keep al batteries at the same capacity. Battery charger calculation sizing to be provided by contractor for approval.

ACCESSORIES

REMOVABLE INPUT/OUPUT ELECTRICAL TERMINAL

The input and output terminal connections shall be designed to be removable trays for easy electricalconnection and unit removal.

The removable input and output trays shall contain a means of configuring the system for 1 or 3 phaseinput and output as well as for single or dual feed input.

SOFTWARE AND CONNECTIVITY

Network Adaptor: Built in Smart Slot Network Management Card shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments.
Unattended Shutdown

The UPS, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems when the UPS is operating in the battery mode. Network Shutdownsoftware shall be available with the UPS.

The UPS shall also be capable of using an RS232 port to communicate with the host computer by means of serial communications so as to gracefully shut down one or more operating systems during an on battery situation.

REMOTE UPS MONITORING, CONFIGURATION AND CONTROL

The following three methods of remote UPS control, configuration and monitoring are available:

Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.

RS232 Monitoring: Remote UPS monitoring shall be possible via either RS232 or contact closure signals from the UPS.

Simple Network Management Protocol (SNMP): Remote UPS Monitoring shall be possible througha standard MIB II compliant platform.

SOFTWARE COMPATIBILITY

The UPS manufacturer shall have available software to support graceful shutdown and remote monitoringfor the systems detailed on the following web link:

EXECUTION

START-UP

Start-up is requested, factory trained service personnel shall perform the following inspections, test procedures, and on-site training:

Visual Inspection:

- Inspect equipment for signs of damage.
- Verify installation per manufacturer's instructions.
- Inspect cabinets for foreign objects.
- Inspect battery chassis and modules.
- Inspect power chassisMechanical Inspection
- Check all UPS and internal power wiring connections.
- Check all UPS and nuts, and/or spade lugs for tightness.

Electrical Inspection:

- Verify correct input and bypass voltage.
- Verify correct UPS control wiring and terminations.

- Verify voltage of all battery modules.
- Verify neutral and ground conductors are properly landed.
- Inspect external service bypass panel for proper terminations.

Site Testing:

- Ensure proper system start-up.
- Verify proper control functions.
- Verify proper bypass operation.
- Verify system set points.
- Verify proper inverter operation and regulation circuits.
- Simulate utility power failure.
- Verify proper charger operation.
- Document, sign, and date all test results.
- Load test (for 40KVA and Above rating)
- Battery test

On-Site Operational Training: During the factory assisted start-up, operational training for site personnel shall include key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

MANUFACTURER FIELD SERVICE

Worldwide service: The UPS manufacturer shall have a worldwide service organization available, consisting of factory trained field service personnel to perform start-up, preventative maintenance, and service of the UPS system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support.

Replacement parts: Parts shall be available through the worldwide service organization 24 hours a day, 7 days a week, 365 days a year. The worldwide service organization shall be capable of shipping parts within 4 working hours or on the next available flight, so that the parts may be shipped to the customer sitewithin 24 hours.

MAINTENANCE CONTRACTS

A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available from the vendor. All contract work shall be performed by the vendor's factory trained service personnel.

WORKMANSHIP

As instruction by Engineer-in-charge.

	DATA SHEET FOR UPS SYTEM	
SL. No.	DESCRIPTION	TENDER REQUIREMENT
	RATING OF UPS	15 KVA/5KVA
1.0	Environmental Characteristics	
1.1	Working temperature	Up to 40 Deg. C (no de rating)
1.2	Storage temperature	0 to 70 Deg C
1.3	Humidity	Up to 95% non-condensing
1.4	Interference	AS PER IEC 62040-2 /EN50091A
1.5	Operating altitude.	Sea level to 1000 meters.
2.0	General Characteristics	
2.1	Efficiency	
2.1a	AC/AC total efficiency @ 25% load	>88%
2.2b	AC/AC total efficiency @ 50% load	>88%
2.3c	AC/AC total efficiency @ 75% load	>90%
2.3d	AC/AC total efficiency @ 100% load	>94%
2.4	Noise level @ 1Mt distance	<65 dBA
2.5	Conversion technology	True online & Double conversion
2.6	Configuration	Parallel mode/Standalone
2.7	Maximum No. of systems can be paralleled	3
2.8	Dimensions in mm (LxBxH)	BY VENDOR
2.9	Weight in Kgs	BY VENDOR
2.10	Cooling	Forced cooling using fans
2.11	Cable entry-Top/bottom	BY VENDOR
2.12	Degree of Protection	IP23
3.0	Input Electrical Characteristics	
3.1	Type of rectifier	IGBT
3.2	Input Voltage(3Phase)	415 V
3.3	Input Frequency	50 Hz

3.4	Input Power factor @ 50 to 100% load	>0.99 lag
3.5	System power walk-in	10 msec
3.6	Input current harmonic distortion(THD)	
3.6a	THD @ 25% load	<5%
3.6b	THD @ 50% load	<5%
3.6c	THD @ 75% load	<5%
3.6d	THD @ 100% load	<5%
3.7	Maximum current drawn during battery charging &	BY VENDOR
3.8	Recommended Cu. cable size in Sq.mm	BY VENDOR
3.9	Recommended breaker rating in amps	BY VENDOR
3.10	Rectifier DC voltage ripples	<1%
3.11	Rectifier DC Current ripples	<1%
3.12	Charging time	<10 Hrs
4.0	Output Electrical Characteristics	
4.1	Output Voltage(3Phase)	415V
4.2	Static output Voltage variation	+/-1%
4.3	Output wave form	True
4.4	Dynamic output Voltage variation when load varies from 0-100% & vice versa.	AS PER IEC/EN 62040-3CLASS-1
4.5	Dynamic output Voltage variation at 100% load step.	AS PER IEC/EN 62040-3CLASS-1
4.6	Output Voltage variation at balance load	AS PER IEC/EN62040-3CLASS-1
4.7	Output Voltage variation at unbalance load	AS PER IEC/EN62040-3 CLASS-1
4.8	Phase displacement-100% Unbalance load	+/-2 deg
4.9	Voltage adjustment – Manual	REQURIED
4.10	Output frequency	50 Hz
4.11	frequency regulation	+/-1 Hz / Sec
4.12	Phase displacement-in balance load	AS PER
4.13	Output Power factor @ rated capacity	0.8 LAG TO
4.14	Overload capacity	
	For 30 minutes	110%
	For 10 minutes	125%
	For 1 minute	150%
4.15	Short circuit capability	BY VENDOR
4.16	Crest Factor	>3:1 LN
4.17	Recovery time	+/-1 %
4.18	Galvanic Isolation Transformer	External
5.0	Static bypass arrangement	
5.1	Rated Voltage(3Phase with neutral)	415 V

5.2	Voltage variation	+/-10%
5.3	Nominal Frequency	50 Hz
5.4	Maintenance bypass switch	Yes
6.0	Battery details	
6.1	Type of batteries	SMF LEAD ACID
6.2	Back-up	30 Min.
6.3	AH of the battery	BY VENDOR
6.4	Battery Charging Time from fully discharge	<6HRS
6.5	Life of Battery	>5YRS
6.6	Battery temperature sensor	REQUIRED
6.7	No of Batteries provided.	BY VENDOR
6.8	Battery Monitoring in UPS	Yes
6.9	Battery Mounting	MS Cabinet
6.10	Dimensions of battery cabinet (LxBxH)	BY VENDOR
6.11	Weight of battery cabinet	BY VENDOR
7.0	Communication	
7.1	Battery temperature sensor	REQUIRED
7.2	Programmable inputs/outputs	REQUIRED
7.3	BMS compatibility(Hardware & software items for third	REQUIRED
7.4	Telenet service- communication with LAN for sending	REQUIRED
8.0	Losses in KW	BY VENDOR

INTERNAL BUILDING POWER DISTRIBUTION SCHEME FOR NEW CAMPUS SCHOOL BUILDING:

A. For New Campus School Building

1) In this Project, there are 01Nos. New Campus School Building proposed for construction. The incoming power to this building will be given from nearby existing New Precast Staff Tower Building.
2) There shall be two LT panels named as Main Normal Power Panel-1 and Main Emergency Power panel–1 to be installed in New Campus School Building.
3) The incoming power supply to Main Normal Power Panel-1 shall be given from Main Normal Panel at Precast Staff Tower Building and incoming power supply to Main Emergency Power panel -1 shall be given from Main Emergency panel at Precast Staff Tower Building. The incoming power supply cables shall be multiple runs of suitable size XLPE insulated LT cables as per approved Electrical SLD by the Engineer-in-charge.
4) These Main Normal Power Panel-1 and Main Emergency Power panel-1 at New Campus School will be given power supply from Main Normal Panel and Main Emergency panel of Precast Staff Towers respectively.
5) Equivalent Spare feeder for source from new School Building Main LT Panel both Normal & Emergency should be provided suitable size of cables for Old School Building.
6) Power distribution for all essential loads like UPS, Lifts, Washrooms, classrooms lighting, Firefighting pumps, water supply pumps, etc. should be distributed from main Emergency Power Panel and rest of the loads from Normal Power Panel, floor wise.

NOTE: (i) All the MCCBs in all the LT panels shall have microprocessor based communicable safety release with over current, short circuit and earth fault protection with RS-485 port.

(ii) All the incomers and outgoings in all the LT panels shall be provided with MFMs (showing minimum parameters as I, V, PF, KVA, KVAh, KWh, KVARh etc.) having RS-485 communication port.

Other General Specifications to be complied by the contractor:

Distribution Boards:

a) Distribution boards along with the controlling MCB's/Fuse or Isolator as shown shall be fixed in an M.S. Box with hinged door suitable for recessed mounting in wall. Distribution boards shall be made of minimum 16 SWG steel sheet duly rust inhibited through a process of de-greasing, acid pickling, phosphating and powder coated to an approved colour of adequate micron rating duly approved by Engineer/Employer/architect/consultant.

Three phase boards shall have phase barriers and a wire channel on three sides. Neutral bars shall be solid tinned copper bars with tapped holes and chase headed screws. For 3 phase DB's, 3. independent neutral bars shall be provided for per phase isolation in addition to main neutral links.

b) Conduit knockouts shall be provided as required/shown on drawings and the entire board shall be rendered dust and vermin proof with necessary sealing gaskets. The top and bottom side of DB should be detachable.

c) All DB's shall be internally pre-wired using copper insulated Busbars of appropriate rating. Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° Cover the ambient. Each board shall have two separate earthing terminals. Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. Two earthing terminal for single phase and two terminals for 3 phase DB's shall be provided with one earth strip connecting the studs and the other earth link should be provided with base insulator in such a way that link should in contact with body of distribution board. Door earthing for DBs to be provided. (If it is 2 leaf door, then 1 no earthing per door).

RCCB/RCBO:

a) The RCCB should suffices all the requirements of BIS as per code BIS - 12640 (Part I) - 2000. The RCA should be current operated and not on line voltage.

b) The RCCB/RCBO should ensure mainly the following functions.
   1) Measurement of the leakage & fault current value.
   2) Comparison of the Leakage & fault current with a reference value.

c) The RCCB/RCBO should have a toroidal transformer which has the main conductors of primary (P - N) which check the sum of the current close to zero. All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant. It should be truly current operated. It should operate on core balance torroidal transformer. Its accuracy should be ± 5 %. It should operate even in case of neutral failure. It should trip at a present leakage current within 30 M.S. It's enclosure should be as per IP 30. It's mechanical operation life should be more than 20,000 operations. It should conform

to all national and international standards like BIS, BS 4293 - 1983, CEE 27 (International commission Rules for the approved of electrical equipment).

MCB/ Isolators:

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS : 3871 (Part-I) 1965, IEC 898-1995 and BIS :8828 (1996). The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a faulty current. Tightening torque at terminals shall be not less than 2.5 Nm. Power losses should not be more than as specified in IEC 898-1995.

The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay 3 as for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCB's shall be tested and certified as per Indian Standard, prior to Installation.

For protection of electric circuits with equipment that does not cause surge current (i.e. lighting and socket outlet circuits)'B' curve MCB to be used in which magnetic releases operates between 3 and 5 In.

For protection of electric circuits with equipment that cause surge current (i.e. inductive and motor circuits) 'C' curve MCB to be used in which magnetic releases operates between 5 and 10 In.

For protection of electric circuits with equipment that cause surge current (i.e. transformer, heavy start motors circuits) 'D' curve MCB to be used in which magnetic releases operates between 10 and 15 In.

Isolators shall confirm to BIS 13947-3 and IEC 60947-3.

Flame Proof DB

Flameproof Distribution boards should be suitable for Gas Groups Class II. It should be made of cast Aluminum Alloy LM6. And also required to have necessary provisions as per relevant standards. All the hardware should be made out of stain steel.

Miniature Circuit Breakers (MCB), MCCB and Distribution Boards shall be custom designed and supplied to house various capacities and combination of MCB, MCCB, Switches, Fuses, Indicating Lamps, Busbar Panels as specified.

The enclosure shall be flame proof and suitable for indoor / outdoor installation as per requirement. A canopy shall also be supplied, if it is located in outdoor area. Panel board shall have external fixing lugs, and shall be suitable for mounting on vertical face such as wall / column, or steel pedestal.

Panel shall comprise of one four-pole incoming isolating device, bus bars and required number of outgoing feeder-isolating devices equally distributed over the phases. Each outgoing shall have 2 pole isolation viz. Phase and neutral. The number of outgoing feeders, and rating of both incomer and outgoing shall be as

required/as mentioned in BOQ. Incomer, busbars, and outgoing feeder elements shall be housed in separate compartments. The separation between the compartments should be such that no flame propagation is allowed.

Incomer shall have mechanical On and Off indication and facility for pad locking the operating handle in off position. An explosion proof cable gland for incoming cable shall be provided, suitable for cable size required. Crimping type lugs shall be provided for incoming cable. Bus bars shall be made of high conductivity copper and supported by non-hydroscopic insulators. Individual compartments shall have separate inspection covers secured by screws / bolts requiring special tools for opening.

A separate internal and external earthing link to be provided with required no's of ways. Terminals shall be provided in an independent compartment for connection of outgoing cables. Terminals should be anti-loosening type and suitable for required sq. mm-copper/aluminium.

Caution plates shall be provided on the inspection covers to avoid opening without isolation. Nameplates shall be provided for each outgoing circuit, and for the complete panel indicating panel number.

All internal and external surfaces shall be powder coated with two coats of epoxy-based paint. Colour shade of final paint shall be as per relevant standards. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc. All unpainted steel parts shall be cadmium plated /stain less steel or suitably treated to prevent rust formation. All moving elements shall be properly greased.

LIGHTNING PROTECTION:

General :

Lightning Protection System shall be in accordance with IEC 62305-3, and NBC -2016. Zone of Protection The zone of protection of a lightning conductor defines the space within which a lightning conductor provides protection against a direct lightning stroke by diverting the stroke to itself. For a single vertical conductor, this zone is described as a cone with its apex at the highest point of the conductor and with an angle called as protective angle. For the purpose of providing an acceptable degree of protection the protective angle of termination network shall be considered as 4°. Between two or more vertical conductors of equal height spaced at a distance not exceeding twice their height, the protective angle within the space bounded the air termination shall be taken as 60° to the vertical, while the protective angle away from the conductor will be taken as 45° to the verticals.

Selection and execution of lighting protection system as per the approved design and drawings and instructions of Engineer-In-Charge.

Material and Dimensions:

The materials of lightning conductor, down conductors, earth termination etc. shall be copper / GI as per schedule of quantities and shall be protected against corrosion. All air terminations and down conductors shall be of copper / GI as per schedule of quantities and shall conform to BIS/IEC: 62305-2010.

Joints and Bonds

The lightning protective system shall have as few joints as far as possible. Wherever joints in the conductor are necessary they shall be mechanically and electrically effective, and shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner. Earth

Terminations Each down conductor shall have an independent earth termination. All the earth termination shall be interconnected and shall be capable of isolation for testing.

Earth Electrode

Earth pits shall be as specified. The resistance of earthing system shall not exceed 1 ohm

Air Terminations Mesh (On the Terrace)

As an alternative to vertical air termination, grid of horizontal air termination may also be provided as per BIS2309/IEC:62305-2010. Often combination of both may be provided when structure to be protected for high ratio of length to height. Air termination mesh shall be provided not greater than 10mx20m. Down conductor shall be not more than 10 m apart where the building height in more than 20 m.

The design shall be made according to BIS:2309/IEC 62305-3 using any or combination of three method - Rolling sphere, Angle of protection and Mesh method as per defined lightning protection level.

✓ Rolling sphere method

✓ Mesh method

✓ Protective angle method

The designing is based on level of protection of individual building / structure determined by Risk assessment. It differentiates between four classes of lightning protection system. A Class I lightning protection system provides the maximum protection and a Class IV, by comparison, the least.

Lightning protection level LPL	Probabilities for the limit values of the lightning current parameters		Radius of the rolling sphere (final striking distance h_B) r in m	Min. peak value of current I in kA
	< Max. values acc. to Table 5 IEC 62305-1 (EN 62305-1)	> Min. values acc. to Table 6 IEC 62305-1 (EN 62305-1)		
IV	0.84	0.97	60	16
III	0.91	0.97	45	10
II	0.97	0.98	30	5
I	0.99	0.99	20	3

Relations between lightning protection levels.
The rolling sphere method is the universal method of design particularly recommended for all types of buildings / structure especially to geometrically complicated applications.

Separation distance shall be considered while designing the ELP as per IEC 62305-3which is essential to avoid creepage flashover. It can be achieved either by maintaining physical separation distance or by use of High voltage insulated (HVI) cable, as a down conductor to compensate the need of the separation distance.

Lightning Protection components shall be tested for natural weathering and exposure to corrosion i.e. Salt Mist Treatment test according to EN 60068-2-52 and Humid Sulphurous atmosphere treatment test according to BS EN ISO 6988.

Metal compatibility shall be ensured to avoid corrosion and contact resistance at connection point.

External Lightning Protection comprises of below listed items: All components shall meet the requirement

of IEC 62305. standard.

Down conductor

In order to reduce probability of damage it is often necessary to have several parallel current paths. As recommended by BIS/IEC:62305-2010 equal spacing of down conductors, 8 mm Copper \ AL \ GI external strip, around the building perimeter.

The down conductor must be kept in constant physical contact with the structure via conductive mounting clamps.

Each down conductor shall be directly connected at the dedicated earthing pit and the dedicated earth pit shall be connected to the other earth pits in the earthing grid.

Alternatively, steel reinforcement can be used as down conductor in line with BIS/IEC:62305-2010. Steelwork within reinforced concrete structures is considered to be electrically continuous, provided that major part of interconnections of vertical & horizontal bars are welded, clamped or overlapped a minimum of 20 times their diameter and bound or otherwise securely connected.

While using structural reinforcement as down conductor,
- Preferably outer columns which are straight from terrace up to the ground floor shall be used as down conductor. Steel bars in this column should be welded \ bolted with proper overlapping at every floor to ensure, proper continuity throughout.
- At ground level steel bars shall be taken out & welded \ bolted to the GI tape, and the tape will be carried out till the earthing pit at ground
- Also at terrace level steel bars will be taken out & to the connected to the Air terminal

This method is allowed by BIS \ IEC , however requires close coordination with structural agency & monitoring during construction work to ensure proper bonding of steel bars at every level.

For buildings utilizing steel reinforcement as down conductor, the electrical continuity if reinforcing bars shall be determined by electrical testing between uppermost part &ground level. The overall electrical resistance should be as per IEC measured using test equipment suitable for this purpose.

Fasteners

Conductors shall be securely fixed to the building to be protected by fasteners which shall be not more than 1.20 meter apart for horizontal run and 1.0 meters for vertical run.

1	Air terminal	It shall be made of Aluminum/ GI or it's alloy, as far as possible drilling shall be avoided on roof top, The terminal shall withstand wind velocity of 145 KM/hour.
2	Down conductor	Preferably round conductor (long length, minimum joints) shall be made of Aluminum / GI or it's alloy, min dia 8 mm.
3	Clamp for support to conductor	The conductor shall be supported with the structure at every 1 mtr, as far as drilling shall be avoided on roof top.

4	Expansion piece	It shall be used at every 20 -25 mtr to compensate the expansion and contraction of metal due temperature variation.
5	Cross connectors	In case of conductors are crossing one over another/ T joints "cross connector clamp" (universal clamps) shall be used.
6	Test clamps	It shall be used for every down conductor at 1(approx.) meter above to ground level (connection /disconnection purpose).
7	Equi-potential bond	All metal (natural conductor) components shall be bonded together with roof/down conductor for equi-potential bonding

Workmanship

As per IS & instruction of Engineer In charge.

NOTE: All Lightning protection works shall be carried out as per CPWD General Specifications for Electrical works with latest amendments up to date.

EARTHING:

Scope

This chapter covers the essential requirements of earthing system components and their installation. This shall be read with Appendix F, which lays down criteria for their design. For details not covered in these specifications IS code of Practice on Earthing (IS 3043 : 1987) shall be referred to. All the earthing works to be executed as per the approved design & drawings by Engineer-In-Charge.

Application

(i) The electrical distribution system in the Department is with earthed neutral (i.e. neutral earthed at the transformer / generator end). In addition to the neutral earthing, provision is made for earthing the metallic body of equipment and non- current carrying metallic components in the sub-station, as well as in the internal/ external electrical installations.

(ii) Earthing system is also required for lightning protection, computer installations and hospital operation theaters, etc. for functional reasons.

(iii) Earthing requirements are laid down in Indian Electricity Rules, 1956, as amended from time to time, and in the Regulations of the Electricity Supply Authority concerned. These shall be complied with.

(iv) **Application for Internal E.I.**

(a) Every sub-main will have earth continuity conductor to run along with sub-main wiring. In case of 3-phase sub-main wiring two earth continuity conductors shall be provided.

(b) Every circuit will have its earth continuity conductor to run along with circuit wiring. In case of 3-phase circuit two earth continuity conductors shall be provided.

(c) Looping of earth is allowed only in case of point wiring.

(d) When 2/3 power outlets are looped to one circuit, earth looping of these outlets is permissible.

Types of Electrodes & Material

Installation

Electrodes

Various Types of Electrodes

(i) (a) Pipe electrode shall be buried in the ground vertically with its top at not less than 20 cm below the ground level. The installation shall be carried out as shown in Fig. 11 (revised) (CPWD Spec Internal Electrical works 2023).

(b) In locations where the full length of pipe electrode is not possible to be installed due to meeting a water table, hard soil or rock, the electrode may be of reduced length, provided the required earth resistance result is achieved with or without additional electrodes, or any alternative method of earthing may be adopted, with the prior approval of the Engineer-in-charge. Pipe electrodes may also be installed in horizontal formation in such exceptional cases.

(ii) Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3.0 m below the ground level. The installation shall be carried out as shown in Fig. 12 (revised) (CPWD Spec Internal Electrical works 2023).

(iii) When more than one electrode (plate/pipe) is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

(iv) (a) The strip or conductor electrode shall be buried in trench not less than 0.5 m deep.

(b) If conditions necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straighttrench where feasible, or preferably in a number of trenches radiating from one point.

(c) If the electrode cannot be laid in a straight length, it may be laid in a zigzag manner with a deviation upto 45 degrees from the axis of the strip. It can also be laid in the form of an arc with curvature more than 1 m or a polygon.

Artificial Treatment of Soil

When artificial treatment of soil is to be resorted to, the same shall be specified in the schedule of work. The electrode shall be surrounded by charcoal / coke and salt as indicated in Fig. 11 and 12 (CPWD Spec Internal Electrical works 2023). In such cases, excavation for earth electrode shall be increased as per the dimensions indicated in these figures.

Watering Arrangement

(v) In the case of plate earth electrodes, a watering pipe of min. 20 mm dia. Medium class pipe shall be provided and attached to the electrodes as shown in Fig. 11.and 12(CPWD Spec Internal Electrical works 2023). A funnel with mesh shall be provided on the top of this pipe for watering the earth.

In the case of pipe electrodes, a 40 mm x 20 mm reducer shall be used for fixing the funnel with mesh.

(vi) The watering funnel attachment shall be housed in a masonry enclosure of size not less than 30 cm x 30 cm x 30 cm.

(vii) A cast iron / MS frame with MS cover, 6 mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

Earthing Conductor (Main Earthing Lead)

(i) In the case of plate earth electrode, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.

(ii) In the case of pipe earth electrode, wire type earthing conductor shall be secured as indicated in Fig. 11 (CPWD Spec Internal Electrical works 2023) using a through bolt, nuts and washers and terminating socket.

(iii) A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth electrode. Galvanized "C" shaped strips, bolts, washers, nuts and check nuts of adequate size shall be used for the purpose.

(iv) The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class, 15 mm dia. GI pipe in the case of wire, and by 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

(v) The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by:

(a) Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and
(b) Bolt, nut and washer in case of strip conductor.

In the case of sub-stations or alternators, the termination shall be made on the earthing terminal of the neutral point on the equipment and/or the earth bus, as the case may be.

Loop Earthing/ Earth Continuity Conductor

(i) Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/ terminal of the upstream switch board by protective conductor(s).

(ii) Two protective conductors shall be provided for a switchboard carrying a 3-phase switchgear thereon.

(iii) Loop earthing of individual units will not be however necessary in the case of cubicle type switchboards.

(iv) The earth connector in every distribution board (DB) shall be securely connected to the earth stud/ earth bar of the corresponding switchboard by a protective conductor.

(v) The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the

earth stud in switch boxes by protective conductor. Where the switch boxes are of non-metallic type, these shall be looped at the socket earth terminals, or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.

(vi) Earth Resistance

(vii) The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be up to 8 ohms.

(v) Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-in-charge.

Marking

(vi) Earth bars/terminals at all switch boards shall be marked permanently, either as "E" or as

(vii) Main earthing terminal shall be marked "SAFETY EARTH – DO NOT DISCONNECT".

Use of Residual Current Devices (RCDs)

An extract on selection and application of RCDs (also known as RCCBs) from IS 12640: 1988 is given at Appendix G. Provision of RCD shall be specified in individual cases keeping in view the type, use, importance, system of earthing and nature of electrical installations to be protected by the RCCBs, requirements of the local electric supply company, etc. The sensitivity shall be 30 mA, 100 mA, 300 mA, or 500 mA, as specified.

TABLE IX (Revised)
Materials and Sizes of Earth Electrodes
[Clause 8.2.1.2(i)]

Type of Electrodes	***Material***	***Size***
Pipe	GI medium class	40 mm dia 4.50 m long (without any joint)
Plate	GI Copper	60 cm x 60 cm x 6 mm thick 60 cm x 60 cm x 3 mm thick
Strip	GI Copper	100 sq. mm section 40 sq. mm section
Conductor	Copper	4 mm dia (8 SWG)

Note : Galvanization of GI items shall conform to Class IV of IS 4736 : 1986.

NOTE: All Earthing works shall be carried out as per CPWD General Specifications for Electrical works with latest amendments up to date.

MV CABLES AND LAYING for EXTERNAL SERVICE CONNECTION:

MEDIUM VOLTAGE CABLES AND LAYING SCOPE :

The scope consists of Supply, laying, testing and commissioning of L.T. XLPE Cable.

Standards :

AS PER SCHEDULE OF INDIAN STANDARDS; ATTACHED IN THE DOCUMENT

Cables :

All cables shall be 1100 Volt grade XLPE insulated PVC sheathed with or without steel/GI wire or flat armoring as specified s. The cable shall conform to BIS-7098, Part I. The conductors shall be composed of annealed Bare or tinned of high conductivity copper or Aluminium complying to BIS and cores colour coded to the Indian Standards. All cables laid up to load should be without any joint.

All cables shall be new without any kind or visible damage. The manufacturers name, insulating material, conductor size and voltage class shall be marked on the surface of the cable at every 600 mm centers.

Insulation:

The core insulation shall be with PVC compound applied over the conductor by extrusion and shall confirm to the requirement of BIS-5831.

Core identification shall be provided with prominent and indelible Arabic numerals on the outer surfaceof the insulation colour as under.

Single core	-	Red, Black, Yellow or blue.
Two core	-	Red and Black.
Three core	-	Red, Yellow, and blue.
Four core	-	Red, Yellow, Blue and Black.
3.5 core	-	Red, yellow, Blue and Black.(Reduced neutral)
Five core	-	Red, Yellow, Blue, Black and Light Grey.

In case of cables having more than 5 cores two adjacent (counting and directional) in each layer shall be colored Blue and yellow respectively and the remaining cores shall be light grey.

Inner Sheath:

The inner sheath shall be applied over the laid up cores by extrusion and shall be of extruded XLPE compound.

Armouring:

Armouring shall be applied over the inner sheath. Armour shall be of galvanized round steel wires up to the cable diameter of 13 mm and above 13 mm galvanized flat steel wires shall be provided. Requirement and methods of tests for armoured material and uniformity of galvanism shall be as per BIS-3975 and BIS -2633.

The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound confirmingto the requirement of compound of BIS-5831 for protection of the cable against atmospheric effect. Pollution rodent and termite attack suitable chemicals shall be added in PVC compound. Colour shall be black.

Testing and Inspection:

All the cables shall be tested and examined at the manufacturer work as per BIS code. All the materials employed in the manufacturing of cable shall be subject to examination and testing after manufacture of cable.

All routine and acceptance tests in accordance with the relevant standard shall be conducted on each size of cables and shall be submitted to Employer at the time of hand over.
Packing and Marking:

Cables shall be dispatched in wooden drums of suitable barrel diameter, securely battened with the take off end fully protected against mechanical damage. The wood used for construction of the drum shall be properly seasoned. Sound and free from defect. Wood preventative shall be applied to the entire drum. On flange of the drum, necessary information such as manufacturers name, type, size, voltage grade of cable, length of cable in meters, drum no., cable code, ISI certification mark gross weight etc. shall be printed. An arrow shall be printed on the drum with suitable instructions to show direction of rotation of

the drum. Cable shall be supplied in drum length as follows.

Workmanship for cable

Installation

a) Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the contractor shall mark it out on the drawings and also on the site and obtain the approval of the Engineer before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.

b) Cables, running indoors shall be laid on walls, ceiling, inside shafts or trenches. Single cables laid shallbe laid in GI/PVC pipe and not to fix on wall slab directly or drawn through GI / PVC pipes fixed on wallor ceiling and supported at not more than 500 mm. Where number of cables is run, necessary laddertype cable trays shall be provided wherever shown. laid in built-up trenches shall be on steel supports.Plastic / Aluminum identification tags shall be provided at every 30 m. All cables laid shall be properlydressed and at least 50 mm space shall be kept between the cables.

c) Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or inaccordance with the manufacturer's recommendations whichever is higher.

d) In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with brick or cement tiles onall the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Backfill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall beprovided with cables markers at every 20 meters and at all loop points.

e) The general arrangement of cable laying is shown on drawings. All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. cable termination for conductors upto 4 sq.mm. may be insertion type and all higher sizes shall have tinned copper compression lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armoring shall be earthed at both ends.

f) In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall belaid in slant position. So, that no rain water may enter the building. After the cables are tested. The pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making theentry of water light.

g) All cables shall be provided with stainless steel/Aluminum cable identification tags at a maximum distance of 30m.

h) All cables to be laid should be properly dress and at least 50 mm space should be kept between thecables.

Testing:

MV cables shall be tested upon installation with a 1000V/500 V Meggar and the following readings established:

1) Continuity on all phases.
2) Insulation Resistance.
(a) between conductors.
(b) all conductors and ground.

All test readings shall be recorded and shall form part of the completion documentation

MV CABLE JOINTING & END TERMINATIONS SCOPE :

The scope consists of Supply, testing and commissioning of L.T. XLPE Cable terminations.

Cable joints and termination:

Connectors:

Cable terminations shall be made with copper/Aluminium Heavy duty long nack copper crimping lugs only crimped type solderless lugs for all aluminium cables and stud type terminals. For copper cables copper crimped solderless lugs shall be used.

Crimping shall be done with the help of hydraulically operated crimping tool. All cable lugs should be long necktype only.

Cable Glands:

Cable glands shall be of heavy duty brass single compression type as specified. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations. Glands for classified hazardous areas shall be CMRS approved.

Ferrules:

Ferrules shall be of self-sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.

Cable joints:

Kit type joint shall be done and filled with insulating compound. The joint should be for 1.1 KV grade insulation.

Workmanship for cable termination

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool.

Additional points to be noted and complied:

Meter Boards: Meter boards shall be fabricated 14 SWG CRMS sheet. It should be of cubical construction, powder coated. Number of Energy meters to be accommodated in each meter board shall

be equal to no. of quarters at each building. Each meter board shall be equipped with 4P MCB/SPNMCB of suitable rating as incomer and as decided by Engineer-in-charge and MCB of suitable rating for each compartment, digital type MFM, selector switches, LED type indication lamps etc. All energy meter should be with RS – 485 port/MODBUS and should be CT operated. Meter board shall be fabricated from a CPRI approved fabricator after approval of drawing from Engineer-in-charge.

1. The breaking capacity of MCCB for all types of panel boards except DBs shall be minimum 35KA for ratings upto 200A and 50KA for 250A ratings & above. The rated service breaking capacity should be equal to rated ultimate breaking capacities (Ics=Icu). Where Ics is service breaking capacity and Icu is ultimate breaking capacity and they should be of approved make. The MCB/MCCB shall be same make ofapproved company.

2. LT Distribution Panels: In all buildings, the panel boards shall be of modular type and fabricated as per CPWD Specifications. The incomers, outgoings, bus bar, indicating instruments etc. shall be designed as per connected load and shall be got approved from Engineer-in-charge.

3. All types of panel shall be fabricated from CPRI approved firms and strictly as per CPWD specifications. The drawing of panel boards must be got approved from Engineer – in – charge before fabrication work. The panel board shall consist of MCCB/ACB as incomer and outgoing, Aluminium bus bar, digital type ammeter, voltmeter OR multifunction meter, selector switches, LED type indication lamps etc as per standard sound engineering practice. Every multi-function meter should have RS 485 port/MODBUS.

4. Staircase lighting shall be group controlled. Lobby and Toilet lights shall be controlled by occupancy sensors. Configuration tool for sensor programming shall also be provided. There shall be arrangement of Bye pass switch so that in case of failure of sensor, the light can be operated after bypassing the sensor. Therefore, one control switch for common light shall be provided at each floor.

5. Minimum size of copper conductor for power wiring shall not be less than 4 Sq mm and that for light and fan points wiring shall be 1.5 sq mm.

6. The wiring and conduit route plan/drawings shall be submitted by the contractor and shall be got approved from the Engineer-in-charge.

7. To facilitate drawing of wires, 18 SWG GI fish wire shall be provided along laying of recessed conduit. Conduits laid for other services, like fire alarm etc., where wiring is not done along IEI works, fish wire shall be invariably drawn.

8. The connection between incoming switch / isolator and bus bar shall be made of suitable size of thimble and cable.

9. While laying conduits for fire alarm system, sufficient junction outlets are to be provided as per the direction of the Engineer-in-Charge for detectors as required.

10. After completing the work, necessary test results as envisaged in CPWD General Specifications Part-I (Internal)-2023 & Indian Electricity Rules 1956, shall be recorded and submitted to the department. The results shall be in the permissible limits. Test report forms duly signed by authorized person for obtaining electric connections (energy meters) by the agency shall be given to the allottees.

11. Lightning arresters shall be provided for all buildings irrespective of height as per IS 2309-1989 as

amended up to date and CPWD specifications for internal work – 2023.

12. Isolator and RCCB of 30 ma sensitivity of suitable rating shall be provided as Incomer of each Distribution boards.

13. Lighting luminaries (LED type) in all buildings shall be decided as per functional requirement, design anddrawing approved.

14. In each building, wherever lift is provided, power supply to DBs located in Lift shaft at suitable locationas approved by Engineer-in-charge shall be done using suitable XLPE insulated armored cable. Supply of cable shall be in the scope of work.

15. Inside the lift shaft there shall be arrangement of one light point at each floor level and one light point at overhead, one light point in lift pit. All light points shall be in group controlled and wired with 2.5 sq mm FRLS copper conductor cable. 15-amp power plug and 5-amp power plug shall be provided at alternate floor. Wiring of these power plugs shall be done with 4 sq mm FRLS copper wires. LED Bulk head fittings of suitable rating to provide minimum lux of 100 shall be connected with each point of lift shaft.

16. For accommodating various size of cable incoming to the building, NP2 class light duty complete with RCC Collar jointing with cement mortar 1:2 pipes of suitable size shall be provided.

17. The scope of work includes 1.1 KV XLPE LT UG Armoured Alluminium cables (Confirming to IS 7098 Part-1) from main substation to all individual buildings for service connection as per the approved load details and drawings.

18. Size of distribution board shall be as per number of light / power circuits. All distribution boards shall bedouble door type RCBO of suitable rating shall be provided as main incomer in all DBs.

19. In vertical DBs used for power distribution main incomer shall be MCCB of suitable rating breaking capacity not less than 16KA, Ics=Icu.

20. LT panel shall be cubicle type with IP 54 protection class and fabricated from CPRI approved fabricator and shall be equipped with digital type measuring instruments like ammeter, voltmeter, frequency meter, watt meter, multi- function meter etc. as per drawing approved by Engineer – in – charge.
21. Each LT Panel shall be fabricated from1.6 mm thick M.S. sheet powder coated 7 tank process and shall be equipped 4 pole MCCBs, MCBs, Bus bar, digital voltmeter, ammeter, KWH meter, LED indicating lamp extended rotary handle and all accessories as required.

22. If used as incomer then it should have earth fault protection and time delay in addition to above protection.Earth leakage modules are not acceptable.

23. Earthing: Earthing system comprising of earth electrode, earth conductor, earth bus, protective conductor etc. for each building shall be as per provision laid down in CPWD Specifications Part – I 2023.Earthing system should be designed such as to maintain earth resistance as specified in CPWD specifications. Earth resistance shall be checked / tested in harsh climatic conditions.

Cable laying and Jointing

(i) All Cables for external lights shall be laid through DWC pipes of required size with 50% space capacity. Pipe shall be buried under ground at required depth as per direction of E-I-C. There shall be separate pipes for electrical cable and Data/signalling cable. Same pipe shall not be used to carry data and Electrical power cable

(ii) Cable shall have GI wire earthing not less than 6 SWG. Earthing can be looped for common run of wires.

(iii) The cable joint shall be weather and water proof connectors only. Twisted cable joint with electric tap will not be accepted.

(iv) At each pole about 1.5 R meter cable shall be kept extra for future maintenance.

(v) Before laying of cable, it will test for its continuity and physical damage.

(vi) Cable shall be laid with minimum joints. If joint is unavoidable, it shall be planned in chamber. RCC / brick work chambers shall be provided at every 50 meters to facilitate cable drawings and maintenance.

Form of Completion Certificate

I/We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief it complies with Indian Electricity Rules, 1956, as well as the C.P.W.D. General Specifications of Electrical Works 2013.

Electrical installation at .....
Voltage and system of supply .....

I. Particulars of work:
(a) Internal Electrical Installation No. Total Type or system Load of wiring
(i) Light point
(ii) Fan point
(iii) Plug Point
(a) 3 pin 5 Amp.
(b) 3 pin 15 Amp.
(b) Others Description HP/KW Type of Starting (a)Motors:
(i)
(ii)
(iii)
(b) Other plants:

(c) If the work involves installation of overhead line and/or underground cable.
(d) (i) Type & description of overhead line.
(ii) Total length and no. of spans.
(iii) No. of street lights and its description.
(e) (i) Total length of underground cable & its size.
(ii) No. of joints: End joint : Tee joint: St. through joint:

II. Earthing

(i) Description of earthing electrode.

(ii) No. of earth electrodes.
(iii) Size of main earth lead.

III. Test results:

(a) Insulation resistance
(i) Insulation resistance of the whole system of Conductors to earth –Mega ohms
(ii) Insulation between the phase conductor and neutral Between Phase R and neutral – Mega ohms Between Phase Y and neutral –Mega ohms Between Phase B and neutral – Mega ohms
(iii) Insulation resistance between the phase conductors in case of poly phase supply.
Between Phase R and Phase Y – Mega ohms Between Phase Y and Phase B –Mega ohms Between Phase B and Phase R – Mega ohms
(b) Polarity test
Polarity of linked single pole branch switches.
(c) Earth continuity test
Maximum resistance between any point in the earth continuity conductor including metal conduits and main earthing lead Ohms
(d) Earth electrode resistance of each earth electrode
(i) Ohms
(ii) Ohms
(iii) Ohms
(iv) Ohms
(e) Lighting protective system
Resistance of the whole of lightning protective system to earth before any bonding is effected with earth electrode and metal in/on the structure ..... Ohms.

Signature and name of Contractor

Signature and Name of the Junior Engineer (E) / AE (E)

UNDERTAKING LETTER FROM MANUFACTURERS OF LED FITTINGS
(ON THEIR LETTER HEAD)

We hereby agree that:

1. All the LED fittings supplied by us are guaranteed for five years including drivers from the date of handing over.

2. In case of discontinuation of model and non-availability of spares, we will replace the fittings with equivalent/high end model in case of manufacturing defect during the warranty period of 5years.

For M/S……..……..

Authorized signatory of manufacturer of LED luminaries)

Counter Signature,

Major contractor

LOWEST BIDDER TO SUBMIT THIS MAC
Manufactures' Authorization Certificate (MAC) (to be filled by OEMs)

To
The Engineer-in-Charge,
Construction and Maintenance Division
IIT Hyderabad

Subject: Manufactures' Authorization Certificate for Bid Number:

Sir,
We……..**OEM Name** ..... having our registered office ..... who are established and reputed original equipment manufacturers (OEMs) having factories at {addresses of manufacturing location} do hereby authorize ..... **Bidder name and address .....** who is our {distributor / Channel Partner /retailer /other <please specify>} to bid, negotiate and conclude the contract with you against and aforementioned reference for the following Hardware / Software manufactured by us.

We also hereby declare that we will support fully for supply of all genuine spares components and software up gradation for the installed system for five years from the date of commissioning of system and also attend any manufacturing defect for five years on behalf of the bidder.

Yours faithfully,

For and on behalf of M/s (Authorized signatory)
Name, designation & contact no. Email Id:
Address:

Seal

Scope of work and Technical specifications for Split AC Installation

A. GENERAL:

These Specifications shall be read in conjunction with the General Conditions of Contract, special condition of contracts, schedule of work, drawings and other documents connected with the work.

The proposed Split ACs Supply, Installation, Testing and Commissioning in IIT Hyderabad campus is for the following buildings:

- **Campus School Building -01 No.**

SCOPE OF WORK AND BASIS OF DESIGN

The scope consists of design, supply, installation, testing and commissioning of Split ACs not less than 1.5 TR in Hall & ELV room. Work execution as per the approved design, drawings and directions of Engineer-In-Charge.

All the HVAC works to be executed as per the CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC)-2024 amended up to date.

The Split ACs should be installed in the UPS room and ELV rooms.

PIPING WORKS:

- **Scope**
  The scope of this section comprises the supply and installing of Design, Supply and Installation of Split AC with refrigerant piping required for the complete installation as shown on the Drawings. All piping inclusive of fittings and valves shall follow the applicable Indian Standards.
- **Pipe Sizes**
  Pipe sizes shall be as required for the individual fluid flows. Various pipe sizes have been indicated on the Drawings, these are for Contractor's guidance only and shall not relieve contractor of responsibility for providing smooth noiseless balanced circulation of fluids.

  - **The Inverter type units having one indoor unit and one outdoor unit comprising of INVERTER rotary compressor functioning with environment friendly refrigerant like R32 or equivalent. The refrigerator used should be ozone non-depleting.**
  - **The unit should have full function battery operated cordless remote control.**
  - **The drain pipe should be as per schedule with suitable length and well insulated to avoid condensation. The refrigerant pipe should be well insulated to avoid condensation. The unit shall be suitable to operate on 230 +/- 10%, 50Hz AC Supply for 1.5/2.0 TR units.**
  - **The Unit shall be of min. BEE-5 star rating.**
  - **Only copper material condenser units and cooling unit will be accepted.**
  - **The Split ACs should be designed to operate at high ambient conditions, cools even at 55°C. Backed by the efficient compressor, High-resistance components and intelligent controller.**
  - **The indoor Fan motor should be of BLDC.**

DOCUMENTS TO BE FURNISHED ON COMPLETION OF INSTALLATION

Three sets of the following documents shall be furnished to the department by the contractor on completion of work:

a. Completion drawings as per "TENDER DRAWINGS FOR APPROVAL & COMPLETION DRAWINGS"

b. sets of manufacturer's technical catalogues of all equipment and accessories.

c. Operation and maintenance manual of all major equipment, detailing all Adjustments, operation and maintenance procedure, Mandatory & Recommended spares list for each equipment.

d. A detailed list of inventory of HVAC system shall be compiled and submitted to the Engineer-In-Charge for his approval as per approved format

Scope of work and Technical specifications for External Service Connections from nearby Precast staff Housing and Earthing System for the following sub heads mentioned in the payment schedule.

SCOPE AND SPECIFICATIONS FOR L.T. POWER DISTRIBUTION SCHEME FOR NEW CAMPUS SCHOOL BUILDING

Scope:

1. **For Campus School Building.**

The scope of work includes Design, supply, installation, testing & commissioning and handover of Power distribution system to supply electricity through LT cables to make New Campus School building E&M services functional complete as per approved design and drawings and instructions of E-I-C.

A) **Main Power Distribution (From Precast Staff Tower):**

1. The Power supply to Campus School building will be given from the existing Main Normal power supply LT Panel and existing Main Emergency power supply LT panel at nearby Precast Staff Tower building from the existing panels.

2. Sufficient length, multiple runs of suitable size LT cable shall lay from the Precast Staff Tower to the proposed LT Panels located at the Proposed Campus School building, in surface, cable tray, RCC Humes/DWC pipes wherever required. The cables shall be with multiple runs.

3. The contractor has to provide separate set of multiple runs LT cables for normal power and separate set of multiple runs for Emergency Power from the nearby Precast Staff Tower till the New Campus School Building main LT Panels (Normal & Emergency).

4. The necessary switchgears i.e., MCCBs, ACBs, relays etc. shall be provided as per the approved drawings by the Engineer-In-charge. All the MCCBs, ACBs shall be provided with microprocessor based release having overcurrent, short circuit and earth fault protection.

5. Decision of laying LT cable in RCC cable trench, DWC, surface, cable tray, RCC Humepipe etc shall be on complete discretion of Engineer-In-charge and same shall be binding, hence bidders are requested to quote accordingly.

6. Also, the contractor shall measure the actual required length of cables on site and quote the rates accordingly. However, the tentative routing plan along with the approximate span distance from nearby precast tower to the new campus building is given in the Tender drawings.

7. As per the above proposed power distribution scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including load sheets cable schedule, voltage drop calculations and electrical SLD in accordance with the relevant electricity/IS Codes.

B) LT Distribution:

S.No.	Name of Building	Type of Building	Quantit	Scope of Work
1	New Campus School Building	G+1	1	a) Design, supply, installation, testing and commissioning of LT Panels which shall be feeding the Campus School Building (1 nos.) which is having 4P, 415V, microprocessor based MCCB/ACB incomer and MCCB/ACB outgoings of suitable rating for feeding E&M service requirements of respective block.

This Section covers the detailed requirements of medium voltage switch panel for 433 V, 3 phase 50 Hz 4 wire system. These shall be branded and/or assembled/ fabricated from a factory of repute. All switchgears shall be fully rated at an ambient of 40°C.

2. TYPE OF PANEL

The medium voltage switch board panel shall comprise of any one of the following types of switchgears or combination thereof as specified.

(a) Air Circuit breakers draw out or fixed type.

(b) MCCBs of suitable ICS ratings. MCCBs shall invariably be Current Limiting type. Features like Double Break, Positive Isolation functions shall be preferred.

The Panel shall be indoor type having incoming sectionalization and outgoing switchgears as specified. The design shall be cubical type. The degree of enclosure protection shall be IP 42 as per IS 13947 (Part-I).

Main L.T. Panels (both Normal Power Panel and Emergency Power panel)	Main Panels for Emergency supply, Normal supply, Utility supply (Lifts, corridor lights, stair case lights, common area lights) Type: Extensible type Bus bars : Aluminium bus bar Incomer : Air circuit breaker of designed capacity No. of ACBs : As per design No. of Bus coupler : As per design Outgoings: ACBs &MCCBs as per load requirement with spare ACBs/MCCBs provision All MCCBs protection release should be Microprocessor based having inbuilt adjustable protections against Over Load (L), Short Circuit (S) and Earth fault with communication port. The breaking capacity of MCCB shall be minimum 36KA for ratings upto 200A and 50KA for 250A ratings & above. The rated service breaking capacity should be equal to rated ultimate breakingcapacities (Ics=Icu). 2 amp MCB shall be used for protection of indication lamps / Meters etc. All incoming outgoing ACBs/MCCBs shall be provided with communicable Multi-function meter with RS-484 port showing parameters such as V,I, F, PF, kWH, kVAh, kVA, KW etc. No. of outgoing ACBs and MCCBs shall be as per design and requirements. For future use, number of MCCBs kept in spare shall be equal to 25% of connected MCCBs (Rating wise). Other criteria like protection, interlocking, cable termination, internal wiring, selector switches, multifunction meters etc., shall be as per CPWD specifications and sound engineering practice.

Outdoor Feeder Pillars	(i) Protection Class : IP 65 (ii) Type : Free standing, double door type (iii) Material of enclosure : 2 mm MS sheet (iv) Incomer : MCCBs of designed rating (v) Bus Bar : Aluminium conductor (vi) Outgoing : MCCBs/MCB's (vii) Other accessories like Digital timers for auto operation of street lights, voltmeter, voltmeter selector switch, indicating lamps, selector switch etc., shall be as per CPWD specification, IS code and approved make list.
L.T. cables	Various sizes of L.T. cables for feeding power to various buildings / services shall be designed and laid between L.T. panel and various buildings / services. Cable route indicators to be provided wherever it is necessary.
Earthing	Earthing work for Body and Neutral earthing of LT Panels shall be donein accordance of provision laid down in CPWD specification for internal EI and substation buildings.

COMMERCIAL AND ADDITIONAL CONDITIONS

1.0 GENERAL

1.1 This specification covers Design, manufacture, testing as may be necessary before dispatch, delivery at site, all preparatory work, assembly and installation, commissioning putting into operation of sub-station equipment consisting of LT panels, LT cabling etc. and final testing of equipment at IIT Hyderabad, kandi, sangareddy.

1.2 The work shall be executed as per CPWD General Specifications for Electrical Works Part-I Internal-2023, Part II External-2023 and Part IV substation-2013, as amended up to date, relevant I.E. Rules, BIS/IEC and as per directions of Engineer-in-charge. These additional specifications/conditions are to be read in conjunction above and in case of variations; specifications given in these additional conditions shall apply. However, nothing extra shall be paid on account of these additional specifications and conditions.

1.3 GUARANTEE

All equipment shall be guaranteed for a period of 36 months, from the date of taking over the installation by the department, against unsatisfactory performance and/or break down due to defective design, workmanship or material. The equipment or components, or any part thereof, so found defective during guarantee period shall be forth repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case of replacement or repair requiring more than 7 days, the agency shall temporarily install the equipment so that the system becomes operational. In case itis felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor. The decision of the Engineer-in-Charge in this regard shall be final & binding on the contractor.

1.4 The contractor shall guarantee, among other things, the following:

(a) Quality, strength and performance of the material used as per manufacturers standards.

(b) Safe mechanical and electrical stress on all parts under all specified conditions of operation.

(c) Satisfactory operation during the maintenance period.

1.5 ACCEPTABLE MAKES OF VARIOUS EQUIPMENT

The acceptable makes of various equipment's/components/accessories have been indicated in "Acceptable Makes"

1.6 DATA MANUAL AND DRAWINGS TO BE FURNISHED BY THE CONTRACTOR

a) The contractor shall furnish detailed technical literature, pamphlets and performance data after award of work for approval of the Department.

b) The successful contractor would be required to submit the following drawings before first milestone for approval.

(i) General arrangement drawing of the equipment like LT panels in the buildings with complete dimensions for approvals by the Engineer in charge.

(ii) Any other drawings are necessary for the job.

1.7 The successful tenderer should furnish well in advance three copies of detailed instructions and manuals of manufacturers for all items of equipment's regarding installation, adjustments operation and maintenance including preventive maintenance & trouble shooting together with all the relevantdata sheets, spare parts, catalogue etc. all in triplicate.

2.0 EXTENT OF WORK

2.1 The work shall comprise of SITC of all Equipment complete with entire labour including supervision and all materials necessary to make a complete installation and such tests and adjustments and commissioning, as may be required by the department. The term complete installation shall not only mean major items of the plant and Equipment covered by specifications but all incidental sundry components necessary for complete execution and satisfactory performanceof installation all layout charts whether or not those have been mentioned in details in the tender document in connection this contract as this is a turnkey job.

2.2 The LT cables shall be brought at site after taking correct measurements since no joint shall be permissible.

2.3 In addition to supply, installation, testing and commissioning of Equipment, following works shall be deemed to be included in the scope of work to be executed by the tenderer as this is a turnkey job-

(a) Minor building works necessary for installation of Equipment, foundation, making of opening in walls or in floors and restoring them to their original condition/finish and necessary grouting etc. as required. The opening in the RCC floor/Slab shall have to be carried diamond core cutting machine and resealing shall have to be done by the tenderer.

(b) All support for overhead bus ducts, cables and MS channels for erection of panels &transformers

etc. as are necessary.

(c) Testing of PTs/CTs for metering and protection purpose and relay calibration and setting.

(d) Getting CEA/Electrical inspector's inspection done and obtaining approval for energizing the installation. However, necessary fees for inspection shall be borne by the Department.

3.0 INSPECTION AND TESTING

a) All major Equipment i.e. LT panel and feeder pillar boxes etc. shall be offered for initial inspection at manufacturers works. The contractor will intimate the date of testing of Equipment at the manufacturer's works before dispatch. The successful tenderer shall give advance notice of minimum two weeks regarding the dates proposed for such tests to the department's representative to facilitate his presence during testing. Equipment will be inspected at the manufacturer/Authorized Dealers premises, before dispatch to the site by the contractor if so desired by the Engineer-in-Charge.

b) Copies of all documents of **routine and type** test certificates of the equipment, carried out at the manufacturer's premises shall be furnished to the Engineer-in-Charge and consignee.

c) After completion of the work in all respects the contractor shall offer the installation for testing and operation.

4.0 COMPLIANCE REGULATIONS AND INDIAN STANDARDS

4.1 All works shall be carried out in accordance relevant regulation, both statutory and those specified bythe Indian Standards related to the works covered by this specification at his own expenses by the tenderer. In particular, the equipment and installation will comply the following:

(i) Factories Act.
(ii) Indian Electricity Rules and Indian Electricity Act.
(iii) B.I.S. & other standards as applicable.
(iv) Workmen's compensation Act.
(v) Statutory norms prescribed by local bodies like CEA, Power Supply Co., etc.

4.2 After completion of the installation, the same shall be offered for inspection by the representatives of the Central Electricity Authority/Local Government Electrical Inspector. The contractor will extend all help including test facilities to the representatives of CEA/Local Government Electrical Inspector. The observations of CEA/Local Government Electrical Inspector will be attended by the contractor. The installation will be commissioned only after getting clearance from CEA/Local Government Electrical Inspector.

4.3 Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment, all accessories in accordance currently applicable statutory regulations and safety codes.

4.4 Successful tenderer shall at his own expenses, arrange for compliance statutory provisions of safety regulations and departmental requirements of safety codes in respect of labour employed directly or indirectly on the work by the tenderer. Failure to provide such safety requirement would make the tenderer liable for penalty of Rs. 2000/- for each default. In addition, the department will be at libertyto make arrangement for the safety requirements at the cost of tenderer and recover the cost thereof from him.

5.0 TRAINING

The contractor shall arrange for at site training by the supplying company of Equipment to thestaff deployed by him for proper and effective maintenance of the Equipment.

6.0 Sufficient trained and experienced staff shall be made available to meet any exigency of work during the guarantee period of one year from the handing over of the installation.

7.0 INTERPRETING SPECIFICATIONS

In interpreting the specifications, the following order of decreasing importance shall be followed in case of contradictions:

(a) Technical specifications
(b) General specifications.
(c) Relevant BIS or other international code in case BIS code is not available.
(d) Drawing (if any)

8. SAFETY PROCEDURE

1. The Indian Electricity Rules 1956, as amended upto date, are to be followed in their entirety. Any installation or portion of installation which does not comply with these rules should be got rectified immediately.

2. The detailed instructions on safety procedures given in B.I.S. Code No. 5216-1969-"Code of Safety Procedures and Practices in Electrical Works" shall be strictly followed.

3. No inflammable materials shall be stored in places other than the rooms specially constructed for this purpose in accordance with the provisions of Indian Explosives Act. If such storage is unavoidable, it should be allowed only for a short period and in addition, special precautions, such as cutting off the supply to such places at normal times, storing materials away from wiring and switch boards, giving electric supply for a temporary period with the permission of Engineer-In-Charge shall be taken.

4. The electrical switchgears and distribution boards should be clearly marked to indicate the areas being controlled by them.

5. Before energizing an installation after the work is completed, it should be ensured that all tools have been removed and accounted, no person is present inside any enclosure of the switchboard etc., any earthing connection made for doing the work has been removed.

9.0. LT Distribution – GENERAL

9.1. For feeder pillars for street light, ancillary blocks, security blocks and terrace LT panels, shall be PTTA (partially type tested panels), enclosures shall be of non-corrosive materials and shall be made up of at least 2 mm CRCA sheet manufactured by reputed firm and should not be less than IP-42 for indoor applications and IP-54 for outdoor applications with canopy.

9.2. The connection between incoming switch / isolator and bus bar shall be made with suitable size of thimble and cable.

9.3. RCBO of 30 mA/100mA/300mA sensitivity of suitable rating shall be provided as Incomer of each Distribution boards.

9.4. **All the switchgears (ACBs) must have Motorized operation and shall be electrical draw out type. In order to ensure the same, required number of potential free NO/NC contacts for both input and output shall be provided with each switchgear.**

9.5. For accommodating various size of Power cable/Telephone cable /Data cable incoming to the building/out going from the building sufficient number of GI/ NP2 pipes of suitable size shall be provided.

9.6. Size of distribution board shall be as per number of light / power circuits coming on each floor as per the occupancy. All distribution boards shall be double door type made of minimum 1.6 mm thick sheet and RCBO of suitable rating shall be provided as main incomer in all DBs.

9.7. In MCB DBs used for power distribution, main incomer and outgoings shall be of suitable rating breaking capacity not less than 16KA, Ics=Icu.

9.8. If MCCB used as incomer then it should have earth fault protection and time delay in addition to above protection. Earth leakage modules are not acceptable.

9.9. Earthing: Earthing system comprising of earth electrode, earth conductor, earth bus, protective conductor etc. for the building shall be as per provision laid down in NBC 2016 / BIS Standards IS 3043:2018 and IS 732:2019 and CPWD specifications. Earthing system should be designed such as to maintain required earth resistance as specified in the above standards.

9.10. The laying of LT power cables and control cables shall be done in RCC cable trenches or/and in DWC pipes wherever required shall be laid underground at depth not less than 120 cm from finished level or as recommended by OEM of DWC pipes whichever is more. The DWC pipes shall be at least 50% vacant for future provision, hence the number of runs shall be appropriate to accommodate the same. The excavation, refilling, compaction and restoring the site to its original condition for trenching and laying of DWC pipe is included in the scope of contractor. The pipes shall be compatible with IS 16205 part 24, 2017 and wherever required 1 Nos additional DWC pipe shall be laid in the same route to accommodate communication cables. The DWC pipes used shall not be less than SN-8. The DWC pipes shall be confirming to IS 16205 part 24, 2017.

9.11. Decision of laying LT cable in RCC cable trench, DWC, surface, cable tray, RCC hume pipe etc shall be on complete discretion of Engineer-In-charge and same shall be binding, hence bidders are requested to quote accordingly.

9.12. For routes carrying both power and communication cables, it is required to lay both the pipes using spacers of not less than 600mm at spacing of 6 meters to ensure the separation in both lines and disturbance shall not be there in communication cables.

9.13. The energy meters for monitoring as per GRIHA norms are required to be with IBMS compatibility and shall be having provision of meter reading by RS485/Ethernet/TCP/IP communication port which shall be communicating required parameters to a required DCU or gateway feeding the IBMS software.

The energy meters of each panel shall be looped with RS 485 ports, and the communication shall be done by laying CAT 6A cables which will be terminating to the GATEWAY required for wireless/wired communication. Near every panel where communication via RS 485 is required, a LAN port shall be provided for ethernet connectivity to gateways.

9.14. The LT Panels as described in substation chapter shall be designed verified/ Totally Type Tested (TTA) as per the standards IEC 61439-1 & 2. The drawing of panel boards must be got approved from Engineer-in-charge before fabrication work. The panel board shall consist of ACB/MCCB as incomer and outgoings, copper bus bars, digital type ammeter, voltmeter OR multifunction meter, selector switches, LED type indication lamps etc as per standard sound engineering practice. As part of GRIHA 3-star requirement for calculating energy consumption of every service, all the outgoings shall be provided with Energy Meter with a communication port.

9.15. All MCCBs and ACBs coming at the level of LT panels, Distribution boards, end feed units, feeder pillars etc **shall be controlled and monitored from IBMS software** of the building for ensuring the

same, the switchgears shall be electrically operated with either soft points communication through RS 485 ports or using field devices (if controlling is not inbuilt in required current rating).

Scope of work and Technical specification for Lifts

SCOPE OF WORK and SPECIFICATIONS FOR LIFTS

The requirement of lift shall be worked out as per the traffic analysis and as per the requirement of local bye laws and NBC – 2016. However, following minimum number of lifts shall be provided by the contractor in buildings as detailed below:

Sl. No.	Name of the Building	No. of Floors	No. of Blocks/ Buildings	Capacity of Lifts.	No. of Lifts.
1	Construction of Campus School Building	G + 1 (up to 4 floors)	1	8 passengers	1

GENERAL

1. STANDARDS

The following Indian Standard Specifications and Codes of Practice, currently applicable and updated as of date irrespective of dates given below, shall apply to the Equipment and the work covered by this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable

1.	Code of Practice for installation, operation and maintenance of electric passenger & goods lifts.	IS-14665 (Part 2) Sec-1 : 2000
2.	Code of practice for installation, operation and maintenance of electric service lift.	IS-14665 (Part 2) Sec-2 : 2000
3.	Safety Rules Section-1 Passenger and Good lifts	IS-14665 (Part 3) Sec-1 : 2000
4.	Safety Rules Section-2 – Service Lifts	IS-14665 (Part 3) Sec-2 : 2000
5.	Outline dimension for electric lifts.	IS-14665 (Part-1) : 2000
6.	Inspection Manual for Electric Lifts	IS-14665 (Part 5) : 1999
7.	Electric Traction Lifts – Components	IS-14665 (Part 4) Sec-1 to 9: 2001 IS 15330 :2003
8.	Installation And Maintenance of Lifts For Handicapped Persons (Code of Practice)	
9.	Specification for lifts cables.	IS-4289 (Par-1) : 1984 Reaffirmed 1991
10.	Specification for hot rolled and slit steel tee bars.	IS-1173-1978 Reaffirmed 1987
11.	Method of loading rating of worm gear.	IS-7443-1974 Reaffirmed 1991
12.	Code of practice for selection of standard worn and helical gear box.	IS-7403-1974 Reaffirmed 1991
13.	Isometrics screw threads.	IS-4218-(Part-II)1976 Reaffirmed 1996
14.	Degree of protection provided by enclosure for low voltage switchgear and control gear.	IS-2147-1962
15.	Classification of insulating materials for electrical	IS-1271-1985 Reaffirmed 1990

	machinery and apparatus in relation to their thermal stability in service.	
16.	Code of practice for earthing.	IS-3043-1987
17.	Electrical installation Fire Safety of Building.	IS-1646-1997
18.	PVC insulated electric cable for working voltage upto and including 1100 volts.	IS-694-1990
19.	Code of practice for electrical wiring and installation	IS-732-1989
20.	PVC insulated (Heavy Duty) electric cables for working voltage upto and including 1100 volts.	IS-1554-1988 (Part-1)
21.	Flexible steel conduits	IS-3480-1966
22.	Accessories for rigid steel conduit for electrical wiring	IS-3837-1976
23.	Boxes for the enclosure of electrical accessories	IS-5133-1969 (Part 1)
24	Guide for safety procedures and practices in electrical work.	IS-5216-1982 (Part-1)
25.	Conductors for insulated electric cables and flexible cordes	IS-8130-1984
26.	Miniature Circuit Breakers	IS-8828-1996
27.	Rigid steel conduits for electrical wiring (Second revisions)	IS-9537-1981
28	Methods of test for cables	IS-10810-1998
29.	Earth Leakage Circuit Breakers.	IS-12640-1988
30.	Moulded Case Circuit Breakers	IS-13947-1993
31.	General requirement for switchgear and control gear for voltage not exceeding 1000 volts.	IS-13947-1993
32.	1100 volt grade XLPE insulated armoured cables	IS 7098
33.	Specifications for hoistway door-locks	IS 7754-1975
34.	Rules for design, installation, testing and operation of lifts, escalators and moving parts.	IS 1735-1975

In addition the relevant clauses of the following, as amended upto date shall apply.

- The Indian Electricity Rules 1956
- The Indian Electricity Act 1910
- Bombay Lift Act 1939
- Delhi Lift Rules
- Fire safety regulations pertaining to lifts

The tenderers shall also take into account local and State regulations as in vogue for the design and installation of lifts.

Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable. BIS certified equipment shall be used as a part of the Contract.

2. ELECTRIC SUPPLY

The available system of electric supply is 415 volts +10% -20%, -3 phase 4 wire AC 50 Hz system and

240 volts between phase and neutral. Any equipment /component operating at other than the above mentioned power supply shall be provided with necessary transformers/voltage stabilizers. The amount of power required for lifts shall be indicated in the tender. Power shall be provided at one point to be indicated by the tenderer. All subsequent electrical systems shall be deemed to be included in the scope of this contract.

3. TECHNICAL PARAMETERS

Technical parameters given in Appendix-I give requirement of passenger, Service & Goods lifts. Tenderers shall fill in their item wise confirmation/comments in the column provided for the purpose in this annexure. Deviations, if any, from tender requirements shall be clearly brought out in this annexure, failing which it shall be presumed that the offer conforms to the tender requirements fully. Tenders in which Appendix-I is not duly filled in by the tenderers are liable to be summarily rejected.

4. BMS COMPATIBILITY

All the elevators shall be communicable to third party BMS. All the necessary hardware/SNMP cards/communication ports, cards, software etc.for establishing BMS communication shall be provided by the LIFT contractor Necessary potential free contacts to be provided in the electrical system control panels. Elevator supplier shall be required to coordinate with BMS vendor for software compatibility between BMS & elevator system.

1	INSIDE SIZE OF LIFT WELL	As per the CPWD specification/NBC or manufacturer requirement whichever is maximum.
2	POSITION OF MACHINE	Inside the lift shaft. (Machine Room Less)
3	(a)TYPE OF CONTROL/DRIVE	A.C. Drive variable voltage variable frequency (ACVVVF WITHREGEN DRIVE) control with microprocessor based group control system.
	(b)TYPE OF OPERATION	Automatic group supervisory control with/without attendant.
4	SPEED GOVERNOR	The car safety shall be operated by a mechanical centrifugal speed governor located in the overhead & at the top of the hoist way. The governor shall actuate a switch when excessive descending speed occurs, disconnecting power to the hoist motor and applying the brake prior to deployment of the safeties. Governor sheave in elevator pit shall be enclosed in a wire cage to a height of 2.40 m.
5	VOLTAGE FLUCTUATIONS	All electrical equipment supplied by the lift contractor shall withstand an incoming supply voltage fluctuations of +10% - 20%
6	PIT SWITCH	An emergency stop switch shall be located in the pit which when operated shall stop the car regardless of position in the hoist way.

7	BUFFERS	Buffers shall be provided in the pit in compliance with ANSI/ASME/CENEN-81 or local code if more stringent. Clearance from underside of car resting on a fully compressed buffer shall be not less than 1.20m. Buffer shall be designed for design speed + 15%. Oil buffers shall be provided for the passenger elevators for speeds of more than 1.7 mps and spring buffers for lower speeds or in case of specifically asked for in technical data. The oil buffers shall be self-resetting type and shall be provided with means for determining the oil level.
8	GUIDE RAILS	Steel guide rails shall be installed to guide the car and counterweight, erected plumb and securely fastened to the building structure, fitted to ensure smooth joints. The guide rail shall be minimum 16 mm, tongued and grooved type.
9	GUIDES	Rubber encased coil spring tension adjusted roller guides shall be provided for passenger elevators with speed of 1.7 mps or greater, mounted on top and bottom of the car frame, and on top and bottom of the counterweight frame to engage their respective guide rails. Service elevators and low speed elevators can have sliding guides on car and counterweights
10	CABLE ANCHOR	Cable shall conform to ANSI/ASME/CENEN-81 and shall anchor to the frame by means of an equalizing device to insure uniform cable loading. Cable safety shall conform to ANSI/ASME/CENEN-81 or governing code if available.
11	TRAVELLING CABLE	Travelling cable shall be secured to the cars underside. Cable shall be clear of all obstructions while car is in motion. Cable jacket shall be suitable for immersion in water, salt water and oil. Jacket shall minimize strain on conductor
12	INTERLOCKS	Hoist way openings shall be provided with electro-mechanical locks
13	COMPENSATING ROPE	Compensating ropes shall be furnished and installed for all elevators with speed over 2.0 m/sec, and travel in excess of 30 m, to compensate for the shifting weight of the hoist ropes. A device shall be provided to tie the car and counterweight together to limit the jump of the car or counterweight. Compensating chain where provided shall be enclosed in a plastic flame resistant jacket to minimize noise.
14	COUNTER WEIGHT	A structural steel frame with cast iron or steel plate filler weights shall be furnished to provide proper counterbalance for smooth operation.
15	COUNTERWEIGHT GUARD	A metal counterweight guard shall be furnished and installed at the bottom of the hoist way, and shall wrap around counterweight rails for a height of no less than 1.80 m in order to protect accidental contact.

16	ROPES	Hoist ropes shall be traction steel of size, construction and number to insure proper operation of the elevator and give satisfactory and safety assurance. Governor ropes shall be steel. All ropes shall consist of at least eight strands wound about a hemp core centre. All ropes shall conform to ANSI/ASME/CENEN-81 or more governing codes or regulations. The minimum factor of safety for ropes shall be 10.
17	PLATFORM	The car platform shall be of Aluminium/ Stainless steel plate as asked for in the BOQ. The entire platform shall rest on rubber pads, so designed to form an isolating cushion between the car and car frame. Platform deflection shall be limited to maximum 3 mm under maximum normal operating conditions. Platform shall confirm to ANSI/ASME/CENEN-81 or more stringent local codes.
18	OVER-LOAD FEATURE	Elevators shall be fitted with the load weighing feature to illuminate "Over-Load" and defeat the car's operating circuits when car load reaches 110% or more of rated load. Car platform may require stiffening to minimize margin of error resulting from excessive deflection. Overload feature and / or circuit defeat for elevators shall conform to governing code.
19	CAR SPEED	Car speed shall be based on the travel distance and number of floors. This has been specified in Schedule of Quantities.
20	NOISE LEVELS (PASSENGER ELEVATOR)	Noise from moving equipment including door operation, car motion, fan, etc. shall not intrude into adjoining spaces by more than 20 dB and adjoining occupied areas by not more than 10 db. (All octave bands). Noise level inside the car shall not exceed 50 db. without car cabin fan running. Noise level inside the car shall not exceed 55 db. in case of door opening / closing. The noise level shall be measured at 'Zero Activity'.
21	EMERGENCY CAR LIGHTING & INTERCOM	Provision shall be made in the car for emergency lighting, low speed and low noise fan, status indication and communication. Wiring cabling for the above facilities shall be provided along with travelling cable. Elevator contractor shall provide and install hand free communication unit above the car operation panel. Fan shall be four speed and low noise and shall be approved by the Engineer-In-Charge. Speaker shall be provided for emergency announcement and background music.
22	CAR POSITION INDICATOR (PASSENGER CARS)	Scrolling alpha numeric car position indicator shall be installed above each operating panel. The position of the car in the hoist way shall be shown by illuminating the corresponding landing at which the car is stopped or passing.
23	Car Entrance door	
	(a) Number	Center opening stainless steel sliding door in the Dama/ Scratch proof/Matt Finish.

	(b) Type of door	Horizontal Sliding - Centre opening.
	Car open in front only or open through	Open in front only
	Power or manual operation	Automatic door operation both infrared screen based and pressureswitch shall be provided for door opening.
24	Construction Design & finish of Car body work	Car body shall be fabricated from stainless steel with scratch proof, Matt Finish as per approved drawings. Car shall be complete with anti skid flooring and toe guard of adequate depth. The car shall be with false ceiling, LED fittings, stainless steel hand rail on three sides. For handicapped person, the liftshall be disabled friendly and shall have railing and controlling switch etc. at the appropriate height.
25	Type of signal system	Digital floor position indicator, Digital display in the car andat all landings Travel direction indicator, Dot matrix type, in the car and at all landings.
		Gongs / Car chime & visual indication through directional arrows on all landings for pre arrival of the car at all floors. Overload warning Audio & Visual indicator, inside the car (liftshould not start on overload). Battery operated alarm bell and emergency light duly fed by suitable inverter SMF batteries for 30 minutes backup. Car operating panel luminous buttons in car and intercom (3ways – at car, lobby, controller). Luminous hall buttons at all landings. Landing call registered indicator at all floors. Voice annunciation system. This will announce the position ofthe car landing. Protection against over-voltage, under-voltage and single phasing should be provided
26	Landing Entrance	
	Location of Landing entrance on different floors	All doors on the same side
	(b) Number	In each landing / floor
	(c) Size	As per drawings approved by Engineer-in-charge
	(d) Type of Doors	Horizontal Sliding - Centre Opening.
	Lift in Use/ Lift outof Order Sign	A suitable box on the landings LED illuminated sign of "LIFT OUT OF ORDER" coming up simultaneously on all floors.

27	Electric supply		Power: 415 V, A.C., 50 Hz, 3 phase, 4 wire system. Lighting: 230 V, A.C., 50Hz, 1 phase.
28	Is neutral wire available forcontrol circuits		Yes.
29	Period of completion		As per tender document.
30	Storage space provided		Yes.
31	Additional items-		
	(a)	Location of main switch	Top floor
32	Dimensions of car platform		Conforming to IS:14665
	Ventilation opening in the Car Body		Required fans. The fan should be auto switch off when there is nopassenger inside the lift car
	Operating panel inside Car		Automatic cum manual flush mounted luminous brail button suitable for barrier free environment for physically challenged persons
	(e) Fireman's Switch		Required for all lifts at ground floor.
	Emergency power supply		Available
	(g) Miscellaneous		The firm's offer should include beam and all structural steelrequired for the work.
	Automatic Rescue Device (ARD)		Provisions of Automatic Rescue Device for the purpose of bringing the lift car to the nearest floor should be provided, one foreach individual lift. This shall consist of: Control panel necessary interface/ integration of device with the main controller, Inverter of required capacity, Maintenance free batteries of required Ampere-hours capacity, Battery charging unit, "Rescue Operation on" indicator in the lift car. Free maintenance for a period of one year from the date of commissioning after completion of work.
	(i) Fire resistance		Landing doors in lift enclosures shall have a fire resistance of not less than one hour.

	(j) Manual Switch	Manual switch shall be provided in controller located on top floornearer to landing door to operate the lift manually
	(k) Features for physically challenged persons	The lift shall be equipped brail system, stainless steel mirror finishhand rail on 3 sides inside the car and other additional special features for use by physically challenged persons.
33	Car Fittings	Overload Device, Emergency Car Light Unit, Emergency Alarm Button, Door Open/Close Button, Manual Rescue Operation, BeltInspection Drive.
34	Intercom system	In each lift for communication between the passengers in the elevator & fire control room & machine room (press & speak type)with rechargeable maintenance free battery backup.

COMMERCIAL AND ADDITIONAL CONDITIONS

a) The work shall be executed as per CPWD General Specifications for Electrical Works Part-III, Lifts & Escalators-2003 as amended upto date and as per relevant IS and as per direction of Engineer-in-charge. These additional specifications are to be read in conjunction above and in case of variations; specifications given in this additional condition shall apply. However, nothing extra shall be paid on account of these additional specification & conditions as the same are to be read along schedule of quantities for the work.

b) The tenderer should in his interest visit the site and get familiarize the site conditions before tendering.

c) No T &P shall be issued by the Department and nothing extra shall be paid onaccount of this.

d) Technical particulars, Annexure I as appended with the tender documents has to bedully filled & uploaded by the tenderer failing which tender is liable to be rejected.

(2) STORAGE AND CUSTODY OF MATERIALS

The room, if available, may be used for storage of sundry materials and erection Equipmentor else the agency has to make his own arrangements. No separate storage accommodation shall be provided by the department. Watch and ward of the stores and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by thedepartment.

(3) CARE OF THE BUILDING:

Care shall be taken by the contractor while handling and installing the various Equipment and components of the work to avoid damage to the building. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost failing which the same shall be got rectified/made good at the risk and cost of the contractor by the department and will be recovered in the bill. He shall also remove every day at his cost all unwanted and waste materials arising out time to time of the installation from the site of work.

(4) GUARANTEE

a) All equipment shall be guaranteed for a period of 36 months, from the date of taking over the installation by the department, against unsatisfactory performance and/or break down due to defective

design, workmanship or material. The equipment or components, or any part thereof, so found defective during guarantee period shall be forth repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the departmentat the risk and cost of the contractor. The decision of the Engineer-in-charge in this regard shall be final & binding on the contractor.

b) The tenderer shall guarantee among other things, the following:

i) Quality, strength and performance of the materials used as per manufacturer's standards.

ii) Safe mechanical and electrical stress on all parts under all specifiedconditions of operation.

iii) Satisfactory operation during the maintenance period.

(5) DATA MANUAL AND DRAWINGS TO BE FURNISHED BY THE TENDER:

a) Tender: After the award of work, the successful bidder shall furnish along the tender, detailed technical literature, pamphlets and performance data for appraisal, evaluation and approval by the Engineer-In-charge.

b) After award of work:
The successful tenderer would be required to submit the following drawings in 15 days ofaward of work for approval before commencement of installation.

- General arrangement drawing of the equipment like lift car, rail, controls, doors, supporting arrangements,
- Details of fixing arrangements for the equipment and the weights of assembled equipment.
- Cable/ layout between each equipment etc.
- Any other drawings necessary for the job.

(6) The successful tenderer should furnish well in advance three copies of detailed instructions and manuals of manufacturers for all items of equipment regarding installation, adjustments operation and maintenance including preventive maintenance & trouble shooting together all the relevant data sheets, spare parts catalogue etc. all in triplicate.

(7) INSPECTION AND TESTING

a) All major equipment i.e. lift shall be offered for initial inspection at manufacturers works. The contractor will intimate the date of testing of equipment at the manufacturer's works before dispatch. The successful tenderer shall give advance notice of minimum two weeks regarding the dates proposed for such tests to the department's representative to facilitate his presence during testing. The Engineer-in-charge may witness such testing. The cost of the Engineer's visit to the factory will be borne by the Department. Equipment will be inspected at the manufacturer/ Authorized Dealers premises, before dispatch to the site by the contractor if so desired by the Engineer-in-charge.

b) Copies of all documents of routine type test certificates of the equipment, carried out at the manufacturer's premises shall be furnished to the Engineer-in-charge andconsignee.

c) After completion of the work in all respects the contractor shall offer the manual fortesting and operation.

8. The following tests, in addition to those mentioned in the CPWD specifications, shall be carried out to the satisfaction of the Engineer-In-Charge.

(i) The car shall be loaded until the weight on the rope is twice the combined weight of the car and the specified load. The load must be carried on for about 30 minutes, without any sign of weakness, temporary set or permanent elongation of the suspension rope strands.

(ii) The following items shall be tested.
(a) No load current and voltage readings both on 'Up' and 'Down' Circuit
(b) Full load current and voltage readings both on 'Up' and 'Down' Circuit
(c) One and quarter load current and voltage readings both on 'Up and 'Down' Circuit Stalling current and voltage and time taken to operate overload.
(e) Overload protection.
(f) Car and counterweight buffers with contract load and contract Speed.
(g) Manual operation of elevator at mid-way travel
(h) Emergency operation
(i) Tests on completion shall also be performed to the satisfaction of Inspector of Lifts.

(8) COMPLIANCE REGULATIONS AND INDIAN STANDARDS:

a) All works shall be carried out in accordance relevant regulation, both statutory and those specified by the Indian Standards related to the works covered by this specification. In particular, the equipment and installation will comply the following:

i) User technical specifications of contract documents
ii) Factories Act.
iii) Indian Electricity Rules.
iv) B.I.S. & other standards as applicable.
v) Workmen's compensation Act.
vi) Statutory norms prescribed by local bodies like CEA, Power Supply Co., etc.

b) After completion of the installation, the same shall be offered for inspection by the representatives of the Lift Inspector of State/ Centre Govt., client Authority and security authority. The contractor will extend all help including test facilities to the representatives. The observations of theirs if any will be attended by the contractor. The installation will be commissioned only after getting clearance from clients that the system is perfectly working.

c) Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment all accessories in accordance currently applicable statutory regulations and safety codes.

(9) ERECTION TOOLS:

No tools and tackles either for unloading or for shifting/erection of the Equipment and for execution purposes would be made available by the department. The successful tenderer shall make his own arrangement for all these facilities. No T&P shall be issued by the Department and nothing extra shall be paid.

(10) VERIFICATION OF CORRECTNESS OF EQUIPMENT AT DESTINATION:

The contractor shall have to produce all the relevant records to certify that the genuine equipment from

the manufacturers has been supplied and erected.

(11) PAINTING:

This shall include cost of painting of the entire installation where ever required. The car body, doors, panels etc shall be factory final finish painted. The agency shall be required to do only touching to the damages caused to the painting during transportation, handling & installation at site, if there is no major damage to the painting. However, hangers, supports etc. shall be painted required shade including painting two coats of anticorrosive primer paint at site.

All exposed metal work furnished in these specification, except as otherwise specified shall be given one shop coat of anti-corrosive primer after approved surface treatment of metal surfaces and two coats of approved enamel paint of approved shade.

(12) TRAINING:

The scope of works includes the on job technical training of two persons of The Client Department at site. Nothing extra shall be payable on this account.

1.0. GENERAL

The equipment and installation covered by specifications and drawings shall conform to codes of practice and highest standards of workmanship and materials. This work shall be done in accordance with the provisions of the Lifts Act, and subsequent provisions, as also any state or local Act in force and latest Indian Standard 14665, 15330.

The Electrical wiring shall strictly comply with IS:732 and the entire installation shall be in accordance with the Indian Electricity Act 2003 and Indian Electricity Rules 1956 as amended to-date. The electrical works shall also conform to CPWD General Specifications for Electrical works Part - I (Internal) 2023 , Part – II (External) 2023 and Part -III (Lifts and Escalators) 2003 as amended up to date wherever relevant. **All Lifts shall have a minimum warranty of 3 years (in DLP). Bidders are requested to quote accordingly.**

The Contractor shall follow all statutory requirements as well as best trade practices in the manufacture & installation of elevators. The Contractor shall arrange to obtain the approval of the Inspectorate of Lifts for commissioning of the Lifts and getting RR number and handover for operation after satisfactory tests.

2.0. TRACTION MACHINE AND DRIVE

The motor shall be controlled by a variable voltage variable frequency (V.V.V.F.) micro- processor control system which shall control and monitor every aspect of elevator operation at all stages of the car motion cycle on real time basis.
The A.C. V.V.V.F. drive system shall control A.C. voltage and frequency concurrently with the hoist motor to regulate the elevator's actual performance to match closely the ideal speed pattern to obtain maximum efficiency of operation and provide a very smooth ride. Frequency shall range fully between zero and rated value.
The Controller shall be provided with a self-diagnostic programme to keep downtime to a minimum possible.
The controller shall intelligently adjust door times in response to car calls, hall calls and "Door Open" button operation.

An Inspector's changeover switch and set of test buttons shall be provided in the controller. Operation of the Inspector's changeover switch shall make both the car and landing buttons inoperative and permit the elevator to be operated in either direction from machine room for test purposes by pressing corresponding test buttons in the controller. It shall not however interfere with the emergency stop switches inside the car or on the top of the car.
The braking of machine shall be of regenerative type.

3.0. SAFETY

In the addition to other specifications the Lifts shall be provided with safety devices as follows:
(i) Safety gear on car so that in the event of rope breaking or loosening the car will be brought to rest immediately by means of grips on the guides.
(ii) The over speeding car shall be automatically brought to a gradual stop on guide rails and power supply to the hoist motor shall be switched off.
(iii) Car gate lock so that in the event of car gate gets opened when passengers are in the car, the elevator shall be brought to rest.

4.0. CAR

4.1. **Cabin Size**
The internal **clear** dimensions of the cabin shall not be less than those specified in IS 14665-Part I and as per CPWD specifications.

4.2. **Car Display Panel**
The Car Display panel shall be of LCD. This shall indicate the Car capacity, floor indication, direction of travel, current time and date at the minimum.

4.3. **Frame and Safety Device**
The car frame shall consist of steel channel top and bottom securely riveted or bolted and substantially reinforced and braced so as to relieve the car enclosure of all strains when the safety device comes into action due to over speed or when the capacity loaded car is run on the buffer springs at normal speed.
The safety device mounted on the bottom members of the frame operated by a centrifugal speed governor shall be arranged to bring the car to a gradual stop on the guide rails in the event of excessive descending speed; and provision shall be made to shut off the power supply to the motor.

4.4. **Doors**
Provision shall be made of SS and central opening

4.5. **Door Operators**
The door operators shall be VVVF inverter controlled heavy duty A. C. motor, allowing variable opening and closing speeds, and with full synchronization of car and landing doors.

4.6. **Emergency Lighting**
Emergency lighting with battery backup shall be provided.

4.7. **Evacuation**
An emergency key shall be provided on each landing to unlock the doors for evacuation and maintenance.
The doors shall be capable of being opened manually during power failure from inside the car when the car is within a landing zone.

4.8. **Intercom**

The intercom system in the lifts shall be capable of two way communication.
Necessary arrangements shall be provided for communication between the lift cars, Fire Control Room, Reception and the room of other security as per direction of Engineer-in-charge.
The main control for the Intercom shall be placed at Fire control room. The intercom system shall be provided with a power backup of at least 30 minutes.

4.9. **Manual Cranking Facility**

Manual cranking facility shall be provided in the machine to facilitate evacuation of passengers in case of power failure. The manual mode shall be in addition to automatic car failure operation specified elsewhere.

4.10. **Emergency Stop Switch**

A stop switch in the top of car shall be provided for use by maintenance crew to cancel all car and landing calls for a particular lift.

4.11. **Maintenance Switch**

On operation of the maintenance switch located on top of the car by the maintenance crew, the car shall travel at slow speed not exceeding 0.85 m / sec by continuous operation of a button

4.12. **Overload Indicator**

An overload indicator with buzzer shall be provided in the cabin to indicate to the passengers that the car will not start as it is overloaded.

4.13. **Operating Panels, Buttons & Switches**

All buttons and switches shall be clearly legible with fade-proof text and figures, and shall be easily accessible, especially for disabled persons.

5.0. STATUTORY APPROVALS

All statutory approvals from concept to commissioning of lifts shall be obtained by the Contractor from the Inspector of Lifts, Chief Fire Officer and other authorities as applicable. However the Department shall provide all necessary assistance for providing documents, drawings and certificates pertaining to other contractors, as may be required. The Department shall reimburse the statutory fees paid in connection with the approval of installation of elevators.

6.0. ADDITIONAL FEATURES REQUIRED

6.1. **Fireman's Switch**

A fireman's toggle switch shall be provided in a break glass for the specified elevator at ground floor to enable firemen to bring the elevator non-stop to ground floor from any location and to cancel hall calls until the car is operated on attendant control.

6.2. **Anti – Nuisance**

If number of calls registered is in excess of corresponding car load, all car calls shall be cancelled.

6.3. **Home Landing Facility**

A car shall return to a pre-determined landing after the last call is answered

6.4. **Load Non stop**

When the car load exceeds a predetermined limit the lift shall not respond to hall calls.

6.5. **Separate door times**
When a car responds only to hall calls or only to car calls, the door shall open for a shorter time than when responding to both car and hall calls.

6.6. **Door Failure Operation**
When an obstruction prevents a door from opening, the controller shall attempt its removal by repeated opening and closing, failing which the car shall travel to the next floor.

6.7. **Nudging Door Operation**
When the doors remain open for more than a predetermined period a buzzer shall sound and the door shall close automatically. The door sensing device shall be rendered in operative but the Door Open button and the safety shoe shall remain operative

6.8. **Self - Diagnostic Facility**
The Controller shall perform self - diagnostic tests and report the health of the system. The system shall take care of minor faults like door operation and motor overheating.

6.9. **Car Failure Operation**
In case of car mal-function, the system shall make a self - diagnostic check and then allow the car to travel to the nearest floor at slow speed, if safe.

6.10. **Selective floor Service**
Programming for selective floors services shall be software driven.

6.11. **Auto Fan Off**
In case no calls are registered for pre-set time, the cabin fan shall be automatically switched off.

6.12. **Automatic Rescue Device**
In case of mains power failure and elevator control system failure, the elevator's own rechargeable and maintenance free battery power shall move the car to the nearest floor and the door shall open automatically for automatic rescue of passengers. A battery run- down indicator shall be provided.
Automatic Rescue Device shall be provided for all the Lifts.

NOTE:

1. The lifts shall be design for clear entry and movement of wheelchair and suitable for Especially abled people in accordance with the provisions of NBC-2016.
2. Quality of Service for all Lifts should be Good.
3. The number, capacity and speed of Lifts mentioned in scope of work are minimum however contractor/ consultant will design capacity, speed, quality of service, handling capacity etc. based on detailed traffic analysis.
4. The specifications are indicative and better specifications shall be installed as per the direction of Engineer in charge.
5. The scope of work includes SITC, handing over to client dept. and liasoning with local bodies, nothing extra will be paid in that regards. Bidders are requested to quote accordingly. Bidder are also requested to read the architectural drawings and verify the site conditions before quoting.
6. Scope of work also include Lift panel / DB required for distribution of power among the lifts and installation of lighting and power point sockets inside lift shaft.
7. The minimum operating speed of each LIFT shall be 1 m/sec.

Scope of work and Technical Specifications for Fire Fighting System, Automatic Fire Alarm System, Fire Extinguishers, Public Address System, Stairways, Lift shaft Pressurization System.

CONDTIONS AND SPECIFICATIONS FOR FIRE DETECTION, ALARM AND CONTROL SYSTEM (FAS)

SCOPE AND GENERAL SYSTEM DESCRIPTION

This section of the specification includes the Supply, Installation, Testing and Commissioning of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

Scope of ELV Sub-Contractor shall also include the integration of Fire alarm system with Fire Dampers, Smoke Exhaust Fans, Access control doors, Elevators, PA equipment, etc. for necessary activation/deactivation of systems during fire. Interfacing of Fire alarm panel with BMS (Building Management System) for alarms monitoring is also included in the scope of Contractor.

An intelligent reporting, Intelligent addressable microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings.

The fire alarm system shall comply with requirements of NFPA Standard 72 (2013), IS 2189 (2008) and NBC 2016 for Protected Premises Signalling Systems. The system shall be electrically supervised and monitor the integrity of all conductors.

The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

The system and its components shall be UL/FM/EN/VdS listed/approved and CE Certified standard certified for fire alarm applications.

The panel shall be supplied with all accessories, control modules and power supplies in the required quantities as per site requirements for all types of field devices to make the system fully operational.

The FAS shall be supplied with necessary hardware and software so as to ensure networking of all panels. This shall include all devices such as modules and interfaces for providing fiber-optics based connectivity between panels and any licences, as applicable.

The detectors and devices connected to the fire alarm panel's loop(s) shall be auto-addressable via panel or software or manually addressable via a rotary switch or DIP switch.

The detectors shall provide dual alarm and power LED's. Both LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

The FAS system shall be supplied with all functionality including hardware, software and licences for integration with a third party IBMS system for real-time monitoring, supervision and control. The necessary interfaces and functionality for such networking protocols as BaCNet/IP shall be provided.

The FAS system shall be provided in the entire New Campus School Building.

SCOPE OF WORK:

The scope of work inclusive of supply, Installation, Testing, Commissioning of addressable Fire Detection/Alarm system with suitable panel, detectors, hooters, strobe, MCP & sub control panel (Mimic) with all cable and required accessories as per the approved design and directions of Engineer-In-charge in following buildings:

- **New Campus School Building - 01No.**

EQUIPMENT AND MATERIAL, GENERAL:

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protective signalling system, meeting the National Fire Alarm Code.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable detectors of various types, addressable modules, printer, annunciators, and other system-controlled devices.

CENTRAL MICROPROCESSOR

The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

A special program check function shall be provided to detect common operator errors.

An auto-program (self-learn) or a pre-configuration from software function shall be provided to quickly install initial functions and make the system operational.

For flexibility and to ensure program validity, an optional Windows (TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete

testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

OPERATOR CONTROL

1. Acknowledge Switch:

Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.

Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:

Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silence-able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch:

The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:

Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:

The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

Basic Performance:
- Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class A Signalling Line Circuits (SLC).
- Initiation Device Circuits (IDC) shall be wired Class A as part of an addressable device connected by the SLC Circuit.
- Notification Appliance Circuits (NAC) shall be wired Class A as part of an addressable device connected by the SLC Circuit.
- On Class A configurations a single ground fault or open circuit on the system Signalling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

SYSTEM CAPACITY AND GENERAL OPERATION SIGNALING LINE CIRCUITS (SLC)

Each loop of the fire alarm panel shall provide power to and communicate with up to a minimum of 127 intelligent addressable detectors and 127 intelligent addressable modules (monitor or control) or a mix of up to 250 detectors and devices in any combination.

Type 1: The control panel or each network node shall be equipped with 4 installed loops with each loop having a capacity of a minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. It shall

be modularly expandable up to minimum 12 loop capacity with each loop having a capacity of minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. However, the number of loop cards can be done as per the OEM configuration.

Type 2: The control panel or each network node shall be equipped with 5 installed loops with each loop having a capacity of a minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. It shall be modularly expandable up to minimum 12 loop capacity with each loop having a capacity of minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. However, the number of loop cards can be done as per the OEM configuration.

Type 3: The control panel or each network node shall be equipped with 7 installed loops with each loop having a capacity of a minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. It shall be modularly expandable up to minimum 12 loop capacity with each loop having a capacity of minimum 127 addressable detectors and 127 addressable modules or a mix of up to
250 detectors and devices in any combination with max. 80% of loop loading in a single loop. However, the number of loop cards can be done as per the OEM configuration.

Type 4: The control panel(s) or each network node shall be equipped with minimum 14 installed loops either in same panel or combined, each loop having a capacity of a minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. It shall be modularly expandable by minimum additional 4 loops with each loop having a capacity of minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop. However, the number of loop cards can be done as per the OEM configuration.

Type 5: The control panel or each network node shall be equipped with 1 installed loop with each loop having a capacity of a minimum 127 addressable detectors and 127 addressable modules or a mix of up to 250 detectors and devices in any combination with max. 80% of loop loading in a single loop.

Class A (NFPA Style 6/7) type cabling structure.

The FACP or each network node shall provide the following features:

- Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.

- Detector sensitivity test, meeting requirements of NFPA 72

- Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

- Detectors shall be programmable as application specific, selected in software for a minimum of eleven environmental fire profiles unique to the installed location. These fire profiles shall eliminate the possibility of false indications caused by dust,
moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition
report.

- The ability to display or print system reports.

- Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

- Positive Alarm Sequence - PAS pre signal, meeting NFPA 72 3-8.3 requirements.

- Rapid manual station reporting (less than 3 seconds) and shall meet NFPA 72 requirements for activation of notification circuits within 12 seconds of initiating device activation.

- Periodic detector test, conducted automatically by the software.

- Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.

- Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.

- Walk test, with a check for two detectors set to same address.

- Control-by-time for non-fire operations, with holiday schedules.

- Day/night automatic adjustment of detector sensitivity.

- Device blink control for sleeping areas.

SYSTEM DISPLAY

The system shall be supplied with a LCD display or a VGA colour LCD display with touch screen.

The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD) or a VGA colour LCD display with touch screen, individual colour coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

The display shall provide all the controls and indicators used by the system operator such as ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.

The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

The LCD display or VGA colour LCD display with touch screen shall provide Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY EVENT, SYSTEM TROUBLE, ALARM SILENCED, DISABLED POINTS, OTHER EVENTS, CPU FAILURE and Controls Active.

The LCD display or VGA colour LCD display with touch screen shall provide a set of "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility.

NETWORKCOMMUNICATION AND INTERFACES

The FACP shall be capable of communicating with each other on a Local Area Network (LAN) over UTP CAT6A cabling or RS485 or fiber optic cable connectivity, utilizing a peer-to-peer protocol.

The system shall include min. two serial EIA-232 interfaces. Each interface shall be a means of connecting respected certifications or standards (UL/CE/FM/EN/VdS).

Besides, the system shall include interfaces for connecting devices such as printers, LAN interface, RS485, Fiber Optics based connectivity interface, BacNet/IP for 3rd party communication.

The system shall be capable to integrate with ELV and other 3rd party services like Access Control system, Public Address system, Lifts, Fire dampers, AC Electric panel etc.

ENCLOSURES:

The control panel shall be housed in a standardized cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

POWER SUPPLY:

An off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.

Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall have an integral battery charger for use along with batteries. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

- Ground Fault LED
- AC Power Fail LED

The main power supply shall operate on 230 VAC, 50Hz and shall provide all necessary power for the FACP.

The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 120 AH.

System shall be proposed with backup power from UPS and also independent power backup through Sealed Maintenance Free (SMF) Lead acid Batteries with backup of 24 hours under Normal working condition & 30 minutes under emergency condition of operation under alarm condition with adequate spare capacity overhead.

The system shall be provided with requisite power supplies, including additional power supplies for the operation of devices such as sounders.

SYSTEM COMPONENTS - ADDRESSABLE DEVICES ADDRESSABLE DEVICES - GENERAL

- Addressable devices shall use simple to install and maintain decade, decimal address switches.
- Detectors shall connect with two wires to the fire alarm control panel signalling Line Circuits.
- The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
- Detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.

- The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Bases shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 6/7 applications.

- Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.

- Addressable modules shall mount in a 4-inch square (121.6 mm square), 2-1/8 inch (54 mm) deep electrical box.

INTELLIGENT MULTI SENSING DETECTOR

- The intelligent multi-sensing detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smouldering fires and thermal properties all within a single sensing device.

- The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

- The addressable multi-sensing detector shall be capable to configure and to be addressed manually or from software or remote locations also.

INTELLIGENT THERMAL OR HEAT DETECTORS

Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signalling line circuit.

The detector shall be capable to configure and to be addressed manually or from software or remote locations also.

BEAM SMOKE DETECTORS

Sensing Range: 5 to 50 meters

Adjustment Angle: ±12° horizontal and vertical.

Typical sensitivity levels:
Level 1 — 25%.
Level 2 — 30%.
Level 3 — 40%.
Level 4 — 50%.

Fault Condition (trouble):
96% or more obscuration blockage.
In alignment mode.
Improper initial alignment.
Self-compensation limit reached.

Alignment Aid using optical gun sight or integral signal strength indication or Two-digit display.

HYDROGEN DETECTOR

The Hydrogen detector shall have high sensitivity and selectivity to hydrogen.

Shall have fast response and recovery time

Shall have minimum spans of 0.25 to 4.0 % to detect H2 in Air.

Input Voltages: 12 to 24 VDC

Output sensing Range: 1 to 4.5 VDC

Power Consumption: minimum 0-12 A

Minimum Response Time: < 5 seconds

The detector shall have hazardous location approvals and certifications

ADDRESSABLE MANUAL CALL BOX

- Addressable manual fire alarm boxes shall on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
- All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
- All entrances and stair levels shall be equipped with a pull type manual call point to activate an alarm. Manual call points shall be located in a manner so as to give an easy access to occupants in emergency; these shall be at entry/exits and within 30meters distance.
- Manual Call Points shall be provided with Weatherproof IP rating with minimum IP 52 for indoor applications.

SOUNDER AND STROBE:

- Shall follow NFPA 72 2013.
- Electronic sounders shall operate on 24 VDC nominal.
- Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 3 meters from the device. It shall be capable to produce different signals/tones.
- Sounders and strobes shall be provided with Weatherproof IP rating with minimum IP 52 for indoor applications.
- Shall be capable to broadcast pre-programmed Voice Message also Shall be flush or surface mounted as shown on plans.
- Shall produce broad band directional sound with 20 Hz to 20 Khz frequency band to guide occupants to safe exists even in complete darkness.

- Strobe lights shall meet the requirements of the Americans with disabilities Act (ADA), be fully synchronized, and shall meet the following criteria:

- The maximum pulse duration shall be 2/12 of one second.

- The flash rate shall be minimum 1 flash per second.

- Field Wiring Terminal Blocks

- For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

ADDRESSABLE RELAY MODULE

- Addressable Relay Module shall provide a dry potential contact o/p for activating a variety of auxiliary devices and other services equipment (i.e. Smoke Exhaust Fans, Fire Dampers, Access control doors, elevators, PA equipment and HVAC electrical panel such as for AHUs).

- It shall have a various current handling capability of 1A/2A/3A (as required) @ 30 VDC to integrate with third party system.

ADDRESSABLE CONTROL MODULE (WHETHER APPLICABLE SEPERATELY)

- Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered polarized audio/visual notification appliances.

- Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised remote power supply from the same OEM.

- The control module shall be suitable for pilot duty applications and rated for a minimum of 2.0 amps at 24 VDC.

ISOLATOR MODULE (WHETHER APPLICABLE SEPERATELY)

- Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. In case of UL/FM listed panel shall have isolator module after every 20 detectors to protected zone of the building. In case VdS/EN every detector or device shall be equipped with inbuilt isolator module.

- If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

- The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

- The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

MONITOR MODULE

Nominal operating voltage: 15 to 32 VDC.

Maximum current draw: 5.0 mA (LED on).
Average operating current: 350 mA (LED flashing, once every 5 seconds)

Maximum IDC wiring resistance: 40 ohms.

EOL resistance: 47K ohms.

RESPONSE INDICATOR

- Remote Response Indicator shall be provided for detectors above false ceiling and shall be installed outside the areas normally kept closed to identify the detectors response even if the room is locked. These indicators shall be able to indicate the status of the corresponding detectors in these areas.

FIREFIGHTER TELEPHONE JACK AND HANDSET

Fire-fighter telephone jack is semi-flush mounted receiving plate with a single-gang box. The plate has a single phone jack mounted on an attractive, single-gang, stainless steel plate. Colour coded wires, approx. 6 inches long, are prewired to the jack to enable fast and accurate wiring to the system

Fire-fighter telephone handset comes with a coiled cord. The attached plug fits Fireman's Phone Jack and it is allowing fire-fighters to make direct communication with a central control area

SYSTEM OPERATIONS

BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- The system alarm LED on the system display shall flash.
- A local piezo electric signal in the control panel shall sound.
- A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
- All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

SPECIFIC SYSTEM OPERATIONS

- Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed standard window and have a minimum of 11 application specific sensitivity levels.

- Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

- Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

- Point Read: The system shall be able to display or print the following point status diagnostic functions:
  a. Device status
  b. Device type
  c. Custom device label
  d. View analog detector values
  e. Device zone assignments
  f. All program parameters

- System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.

- System History Recording and Reporting: The fire alarm control panel shall contain an events buffer that will be capable of storing a minimum of 5000 events. Up-to 1200 events shall be dedicated to alarm and the remaining events are general purpose. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

- Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyse the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciate on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

- Pre-Alarm Function: The system shall provide pre-alarm levels of warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully fielded adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

- Software Zones: The FACP shall provide minimum 70 software zones, minimum 5 additional special function zones, minimum 5 releasing zones, and minimum 12 logic zones.

- The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
  - Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
  - Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
  - All devices tested in walk test shall be recorded in the history buffer.

SUPERVISORY OPERATION

An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

SIGNAL SILENCE OPERATION

The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

NON-ALARM INPUT OPERATION

Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

CODES AND STANDARDS:

All the following codes & standards shall follow and conform to the latest editions, amended to date.

- National Building Code of India – 2016
- Bureau of Indian Standards (BIS) Codes: IS 2189 (2008)
- NFPA-72 (2013)
- Local Fire Code, Comply with Local Fire Authorities requirements.
- Listing and/or Approvals:
  UL (Underwriters Laboratories Inc.)
  FM (Factory Manual)
  CE (European Conformity)
  EN (European Norms)
  VdS

As per the above proposed scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including related calculations, supporting documents and SLD in accordance with the relevant electricity/IS Codes.

INSTALLATION

All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

TEST

The service of a competent, factory-trained engineer or technician authorized by the OEM of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72/ IS 2189/Local Fire Code

- Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- Open initiating device circuits and verify that the trouble signal actuates.
- Open and short signalling line circuits and verify that the trouble signal actuates.
- Open and short notification appliance circuits and verify that trouble signal actuates.
- Ground all circuits and verify response of trouble signals.
- Check presence and audibility of tone at all alarm notification devices.
- Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

FINAL INSPECTION

At the final inspection, a factory-trained representative of the OEM of the major equipment shall demonstrate that the system functions properly in every respect.

2-CORE 1.5 SQ MM (15AWG) FRLS FLEXIBLE CABLE OR ARMOURED CABLE (Fire Alarm Cable)

All Cables shall follow the general IS Cable Standard IS 1554.

Conductor:

Nos. of cores x size in sq. mm:	2 X 1.5
Material:	Plain annealed copper (Cu)
Type of pair:	Shielded twisted pair
Copper as per Class 2 of IS:	8130/84
Max. d.c. resistance of conductor at 20° C:	12.12 (ohm/km)
Shape of the conductor: Stranded Circular	
Outer Sheath colour:	RED

Insulation:

Material:	XLPE as per IS 7098(Pt-1)/88, Latest
Nominal thickness (mm):	0.7
Minimum thickness (mm):	0.53
Core Identification:	Red, Black

Armouring:

Material:	Galvanised Steel
Type of armouring:	Round Wire
Nominal size of armour (mm):	1.40

Electrical Parameters:

Approx. overall diameter of the cable (mm):	12
Minimum bending radius:	12 times Overall diameter

PUBLIC ADDRESS SYSTEM (PAS) – DIGITAL

SCOPE & SYSTEM DESCRIPTION

- The suggested Public Address System (PAS) and Emergency Evacuation System (EVAC) must meet and comply with all the requirements of IEC60849 standards for emergency sound systems, EN-60849/54, BS5839 and IS 1881 & IS 1882 standards. The public address and emergency system shall be using digital audio transportation and processing. The system shall provide a very user-friendly user interface and the system design shall be based on a network-based concept.

- The Digital PA system shall also provide extensive audio processing facilities. The equipment shall be provided with digital audio processing facilities for all audio inputs and outputs. The call stations shall also be provided with audio processing facilities. The audio transport from the call stations to the power amplifier shall be achieved by using digital audio technology right up to the amplifying circuits, before which the digital audio is converted to analog audio.

Web-based technology

- The Public Address system network controller shall be a web server, which can be accessed by any properly authorized workstation connected to the network.

The functional combination

- Various functions shall be combined and incorporated in each system unit, such as audio processing and speaker line monitoring in the power amplifier. Delay function amplifier channel which shall be incorporated in the power amplifiers.

Software

- The system shall be provided with configuration and diagnostic & logging software as standard which shall be used to configure all system parameters.

- The diagnostic &logging software shall provide extensive diagnostic and logging functions. This software shall enable the user to find details of any status changes in the system. The same software shall also be used to display call status in either text or graphic form.

Display on Equipment

- The system units shall have a minimum 2 x 16-character display for user interaction. The navigation control shall enable the user to view any change in status of that particular equipment on the display. The user shall be able to carry out enquiries on the status of all units for faults and calls from the network controller.

External Interfaces

- The network shall have three types of interfaces; namely RS232, Ethernet and control inputs/outputs for interfacing with other systems. In the public address and emergency systems, the fault status and other status changes have to be reported to a central building management system.

- PA Controller shall have provision to interface with Fire alarm system and EPABX Exchange through open protocols.

- The system shall be able to accept large numbers of control inputs, which can be used to initiate actions in the system. The system shall be provided with control outputs, which can be used to interface with external systems.

MAIN UNIT / NETWORK CONTROLLER

- The unit shall be capable of routing minimum 20 audio channels, delivering power to the system, fault reporting and controlling of the system and such that a variety of audio inputs shall be supported such as - calls from call stations, background music or local audio inputs.

- The controller shall have an in-built web-server for configuration and management and not require a client program for installation.

- The unit shall be capable of working either in stand-alone mode or with a PC connected to it and be configured for any complex public address configuration via the PC. The PC connected to the network controller unit shall be able to show all status changes in the system with the configuration and diagnostic & logging software. The unit must be supplied with user-friendly configuration and diagnostic & logging software. The unit shall be certified to be compliant to IEC60849.

- The unit shall support either freestanding or a 19" rack mounting installation. It should have the following functions:

- The network controller shall have minimum 4 analogue audio inputs. Two of these inputs shall be selectable between microphone and line. The other 2 inputs shall be fixed as line inputs.

- There shall be minimum 8 control inputs, which are freely programmable. These can be programmed for actions to be done in the system and assigned priorities.

- Minimum 5 x control outputs (of which two dedicated fault contacts)
- Minimum 1 x internal speaker
- Minimum 1 x headphone output
- The network controller shall have minimum 4 analogue audio line outputs.
- The audio line outputs shall have a selectable 20 KHz monitoring signal.
- The control output shall be freely programmable for faults and calls.
- The network controller shall be supplied with a switch mode power supply.
- The network controller shall have a redundant network wiring capability.
- The network controller shall have the capability to handle up to 256 priorities and minimum 120zones. The priorities shall be classified based on the nature of call, i.e., type of calls, such as:
    - Emergency Calls, such as during event of fire or other such trigger, which shall take the highest priority
    - Normal Calls such as announcements
    - BGM Routing, which shall take the lowest priority
- It shall be possible to assign different priority levels to different paging microphones/call stations
- The front panel shall have a minimum 2 x 16-character LCD display and a rotary control for selection of system enquiry mode, change in volume for the headphone or internal speaker and to navigate through the menu.
- The network controller shall be provided with a storage facility for the last 200 fault messages in the system.
- The network controller shall have a socket for the flash memory card, which is available commercially as the storage device for the pre-recorded audio messages. The user shall be able to select the memory size of the compact flash memory card according to his storage requirements for the audio messages. The network controller shall be capable of playing four messages simultaneously. The status of the digital audio storage and the messages shall be monitored. The audio messages (stored as a set of wav files) can be downloaded from a computer via the Ethernet link.
- The network controller shall monitor the status of all equipment in the system and report status changes.
- The network controller shall monitor the microphone capsule of a call station microphone and report any fault.
- The external cables connected to the control inputs shall be monitored for short and open circuits.
- Attention and alarm tone definitions shall be stored in the network controller. These tones can be accessed by any call stations or control inputs for announcement broadcast or alarm broadcast
- The network controller shall have an internal real time clock.
- The network control unit shall have extensive audio processing possibilities for audio inputs and audio outputs. Parametric equalization, limiter, and gain can be adjusted with the configuration software.

POWER AMPLIFIERS

- The Digital PA System amplifiers shall be Class D amplifiers. It shall be possible to select the output voltage between 120V, 70V or 50V by changing jumpers. The power amplifiers shall be provided with a minimum 2 x 16-character display for status display.
- The Class D amplifiers shall be available for various capacities, such as:
    - 1x500W: Single zone for up to 500 watts.
    - 2x250W: Two zones for up to 250 watts per zone.
    - 4x125W: Four zone for up to 125 watts per zone.
- The power amplifiers shall be equipped with amplifier monitoring and change-over relays. The amplifier shall provide short-to-ground and short-circuit detection functions.
- The power amplifiers shall have 2 auxiliary audio inputs with microphone/line level selection.
- The audio input of the power amplifier can be selected as automatic volume control input.
- Minimum 8 freely programmable control inputs shall be available for actions that can be initiated in the system and these shall have priorities.
- Minimum 4 freely programmable control outputs shall be available that can be programmed for faults and calls.
- Minimum 2 x 16-character display and rotary control on the front panel for status enquiries and monitoring functions. The display shall show the VU meter reading when the audio monitoring mode is selected. The audio output can be monitored by connecting a headphone to the headphone socket. Status changes of the unit shall be monitored continuously and reported to the network controller for fault/status reporting.
- The control input can be programmed for momentary or toggle operation. This selection can be made in the configuration software.
- The control input shall have the ability to monitor the cable between the control input and the external switch against open and short circuits.
- The power amplifier shall be designed for redundant network wiring.
- The amplifier monitoring and changeover facility shall be incorporated in the power amplifier. The changeover relays shall be included in the unit.
- The unit shall incorporate digital audio processing possibilities for 3 sections of parametric equalization and 2 sections of shelving equalization and audio delay.

Interfaces

- Minimum 2 x system network connection

Indications and controls

- Minimum 2 x 16-character LCD display for status display
- Rotary control for selection of system enquiry mode and headphone volume
- Power supply ON/OFF switch on the back

Inputs

- Minimum 8 x control inputs
- Minimum 2 x audio inputs

Outputs

- Selectable 120V, 70V or 50V outputs for each amplifier channel. An additional fixed 50V output shall be provided for each amplifier channel
- Minimum 4 x control outputs
- Minimum 4 x amplifier channel outputs
- Minimum 1 x headphone output

PA MICROPHONE

- The call station shall be used for making a manual or pre-recorded call to any pre-assigned zones or executing a predefined action. The call station shall have one key. The call station shall have a fixed microphone to transmit speech over the network and a press-to-talk key. The call station shall also have a headset socket. Once the headset is connected the microphone will be muted.
- The call station shall have minimum six zone capacity.
- The call station shall have a speech filter with a cut-off frequency at 340Hz to improve intelligibility and prevent clipping of the audio input on low-frequency signals.
- It should be possible to connect the unit with minimum 12call station keypad units via serial data communication links.
- The power supply to the call station keypad units shall be provided from the call station.
- The call station shall have a volume control for the monitoring loudspeaker at the call station. The volume control shall also control the volume of the headset.
- The call station shall be programmable for momentary actions on make contact and toggle actions without repeat on make contact.
- It shall be possible to assign minimum 200 priorities.
- Analogue-to-digital audio conversion shall be performed at the call station.
- The call station shall also have a digital signal processor, which can be used for audio processing. It can be used to adjust sensitivity, limiter and parametric equalizer.
- The monitoring loudspeaker shall be on when that particular call station activates a chime or pre-recorded message and will be switched off when its own live audio channel is open.

Interfaces

- system network connection
- Serial data and power supply interfaces for call station keypad units
- Headset socket

- Number of connectors: 1
- Position: Front
- Type: 3.5 mm jack
- Maximum cable length: 1.5m
- Audio: Mono microphone signal, mono earphone signal

Indications and controls

- The call station shall have three 2-color LEDs for indications such as:
  - Power on and no system/call station fault
  - Power not available
  - Fault in the system and power on
  - Call station fault and power on
  - Chime on or pre-recorded message playing
  - Ready to talk/live speech
  - No call status to display
  - Emergency announcement being ON in the system. Possible to make normal calls to the zones which are not involved (emergency) indication has priority over other indications)
- Lower-priority calls are ON or RESERVED (to all or some of the pre-assigned zones of the PTT key of the call station and selected zones of the call station keypad unit if installed)
- Calls with higher or the same priority (not emergency) are ON or RESERVED (to all or some of the pre-assigned zones of the PTT key of the call station and selected zones of the call station keypad unit if installed)
- No predefined or selected zones are in use or reserved by the system, nor is an emergency announcement being made.
- Volume control for loudspeaker/headset.

PA MICROPHONE KEYPAD – ADDITIONAL 6 ZONES

- The call station keypad shall have 8 keys.
- The call station keypad keys can be programmed for various actions such as:
  - Control system functions: recall of selection, live speech call, cancel selection, BGM off, BGM volume control, programmable key for any action.
  - Select resources: BGM selection, pre-recorded message selection, attention and alarm tone selection.
  - Zone selection, system control output selection.
- Each key at the call station keypad shall have 2 color LEDs.
- The call station keypad shall be provided with in and out connections for serial data and power supply.

- The keys shall be provided with a label slot for indicating the name of the action assigned to that particular key.
- The power supply for the call station keypad shall be provided from the call station basic unit.
- The call station keypad key can be programmed for momentary or toggle operation.

Interfaces

- Serial data and power supply interfaces for call station keypad units/call station basic.

Indications and controls

- The call station keypad shall have a 2-color LED per key for various functions.

CEILING LOUDSPEAKER (6-WATT)

- The Ceiling Loudspeaker shall be an ergonomic, flush-mounting ceiling loudspeaker for general-purpose applications. It shall be a full range loudspeaker for speech and music reproduction.
- The Ceiling Loudspeaker shall be a single-piece, 6W, dual-cone loudspeaker with a120 V matching transformer mounted on the back of the frame. It shall have a circular metal grille as an integral part of the front. The loudspeaker shall have built-in protection to ensure that, in the event of a fire, damage to the loudspeaker shall not result in failure of the circuit to which it is connected.
- The loudspeaker will have ceramic terminal blocks, thermal fuse and heat-resistant, high temperature wiring. It can also be fitted with an optional fire-dome to increase protection of the cable termination.
- Max. Power – 9 W
- Rated Power – 6 Watts
- SPL at 1 KHz, 1m, 1w: 94dB/86 (SPL)
- Rated Voltage: 120 volts
- Rated impedance: 1667 ohms
- Effective frequency range (-12dB) :(80 Hz to 16000 Hz)
- IEC 60849 compliant
- Mode of Measurement - "Each".

WALL MOUNTED BOX SPEAKER (6- WATT)

- The loudspeaker will have ceramic terminal blocks, thermal fuse and heat-resistant, high temperature wiring. It can also be fitted with an optional fire-dome to increase protection of the cable termination.
- Max. Power – 9 Watts
- Rated Power – 6 Watts,
- Rated Voltage: 120 volts, 70 volts, 50 volts

- Effective frequency range :(80 Hz to 16000 Hz).
- Minimum SPL @ 1Khz(1W/1m) : 96dB / 90dB
- Mode of Measurement - "Each".

WALL MOUNTED BOX SPEAKER (15- WATT)

- The loudspeaker will have ceramic terminal blocks, thermal fuse and heat-resistant, high temperature wiring. It can also be fitted with an optional fire-dome to increase protection of the cable termination.
- Max. Power – 25 Watts
- Rated Power – 15 Watts,
- Rated Voltage: 120 volts, 70 volts, 50 volts
- Effective frequency range :(80 Hz to 16000 Hz).
- Minimum SPL @ 1Khz(1W/1m) : 96dB / 90 dB
- Mode of Measurement - "Each".

NETWORK CABLE ASSEMBLIES / FIBER INTERFACE

The system shall be supplied inclusive of Network cables assembly and OEM's fiber optics interfaces, any other applicable adaptors / interfaces / cards / supervision modules for main controller, amplifier & paging microphone and any other devices as applicable.

CODES AND STANDARDS:

All the following codes & standards shall follow and conform to the latest editions, amended to date.

- EN60849/54
- IS 1881 & IS 1882
- IEC60849
- BS5839

Software

- Web based Software Application for System Configuration, Management & Diagnostics. It shall not be necessary to install any software client application on computer for configuration, management and operation of the system.

TESTING AND INSTALLATION:

- System installation, commissioning and testing shall be carried out as per the OEM's guidelines.

2-CORE 1.5 SQ MM (15AWG) FRLS FLEXIBLE CABLE OR ARMOURED CABLE (Public Address System)

All Cables shall follow the general IS Cable Standard IS 1554.

Conductor:

Nos. of cores x size in sq. mm:	2 X 1.5
Material:	Plain annealed copper (Cu)
Type of pair:	Shielded twisted pair
Copper as per Class 2 of IS:	8130/84
Max. d.c. resistance of conductor at 20° C:	12.12 (ohm/km)
Shape of the conductor:	Stranded Circular
Outer Sheath color:	Black

Insulation:

Material:	XLPE as per IS 7098(Pt-1)/88, Latest
Nominal thickness (mm):	0.7
Minimum thickness (mm):	0.53
Core Identification:	Red, Black

Armoring:

Material:	Galvanised Steel
Type of armouring:	Round Wire
Nominal size of armour (mm):	1.40

Electrical Parameters:

Approx. overall diameter of the cable (mm):	12
Minimum bending radius:	12 times Overall diameter

As per the above proposed scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including related calculations, supporting documents and SLD in accordance with the relevant electricity/IS Codes.

UNDERTAKING FROM THE OEM OF FIRE ALARM SYSTEM

We, as manufacturer of.....fire alarm system & accessories, do hereby confirm that all the products supplied under this tender will be UL listed. Moreover, we will provide all technical support & backup to M/s..... during the execution of fire alarm work. In addition to it, we will provide all technical support to the department/agency approved by department in maintaining the fire alarm system on payment basis in future.

Signature & Stamp of contractor Signature & Stamp of Manufacturer (F/A System)

GENERAL

The work shall be executed as per CPWD General Specifications for Electrical Works Part-I (Int.) 2023, Part-II (Ext.) 2023, CPWD General Specifications for Electrical Works Part VI Fire Detection and Alarm System – 2018, relevant I.E Rules, BIS/IEC and as per directions of Engineer-in-Charge. These additional specifications/ conditions are to be read in conjunction with above in case of variations; Specifications given in these additional conditions shall apply. However, nothing extra shall be paid on account of these additionalspecifications and conditions, as the same are to be read along with schedule of quantities for the work.

This specification covers manufacture, testing as may be necessary before dispatch, delivery at site, all preparatory work, assembly and installation, commissioning putting into operation of Fire Alarm system and allied works.

- Location: The equipment will be installed **at IIT Hyderabad, Kandi, Sangareddy**
- The tenderer should in his own interest visit the site and get familiarize with the site conditions before tendering.
- No T&P shall be issued by the Department and nothing extra shall be paid on account of this.

All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation bolts, terminationlugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespective of the fact whether such items are specially mentioned in the tender documents or not.

- **Guarantee**

All equipment shall be guaranteed for a period of 36 months, from the date of taking over the installation by the department, against unsatisfactory performance and/or break down due to defective design, workmanship or material. The equipment or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused bythe contractor in doing this, the same will be got done by department at the risk and cost of contractor. The decision of the Engineer-in-Charge in this regard shall be final & binding on the contractor.

- **The tender shall guarantee among other things, the following:**

(a) Quality, strength and performance of the materials used as per manufacturer's standards.

(b) Safe mechanical and electrical stress on all part under all specified conditions of operation.

(c) Satisfactory operation during the maintenance period.

- **ACCEPTABLE MAKES OF VARIOUS EQUIPMANTS:**

The acceptable makes of various equipment / components/ accessories have been indicated in "Acceptable Makes" indicated in the list attached. The tenderer shall work out the cost of the offer on this basis. Alternatemakes are not acceptable.

- **After award of work:**

The successful tenderer would be required to submit the following drawings within 15 days of award of workfor approval before commencement of installation.

(a) General arrangement drawing of the equipment like detectors, R.I., LT Panel etc. in the building withcomplete dimensions.

(b) Any other drawings necessary for the job.

- The successful tenderer should furnish well an advance three copies of detailed instructions and manuals of manufacturers for all items of equipment regarding installation, adjustments operation and maintenance including preventive maintenance & trouble shooting together with all the relevant data sheets,spare parts catalogue etc. all in triplicate.

- **EXTENT OF WORK**

The work shall comprise of entire labour including supervision and all materials necessary to make a complete installation and such tests and adjustments and commissioning as may be required by the department. The term complete installation shall not only mean major items of the plant and equipment covered by specifications but all incidental sundry components necessary for complete

execution and satisfactory performance of installation with all layout charts whether or not those have been mentioned in details in the tender document in connection with this contract as this is a turnkey job.

- In addition to supply, installation, testing and commissioning of FAS/AFAS including intelligent addressable FAS equipment, following works shall be deemed to be included within the scope of to be executed by the tenderer as this is a turnkey job –

(a) Minor building works necessary for installation of equipment, foundation making of opening in walls orin floors and restoring them to their original condition/ finish and necessary grouting etc. as required.

(b) All supports for cables and MS Channels for erection as are necessary.

(c) Getting CFO inspection done & obtaining approval for energizing the installation. However, necessaryfees for inspection shall be borne by the Department.

INSPECTION AND TESTING

Copies of all documents of panels, detectors and other components shall be furnished to the Engineer-in-Change and consignee.

COMPLIANCE WITH REGULATIONS AND INDIAN STANDARDS:

All works shall be carried out in accordance with relevant regulation both statutory and those specified by theIndian Standards related to the works covered by this specification. In particular, the equipment and installation will comply with the following:

(i) Factories Act.
(ii) Indian Electricity Rules.
(iii) B.I.S. & other standards as applicable.
(iv) Workmen's compensation Act.
(v) Statutory norms prescribed by local bodies like CEA, Power Supply Co.etc.

Nothing in this specification shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes.

- Successful tenderer shall arrange for compliance with statutory provisions of safety regulations and departmental requirements of safety codes in respect of labour employed on the work by the tenderer. Failure to provide such safety requirements would make the tenderer liable for penalty of **Rs. 2000/- for each default**. In addition, the department will be at liberty to make arrangement for safety requirements at the cost of tenderer and recover the cost thereof from him.

- **COMERCIAL CONDITIONS**

The tenderers are advised not to deviate from the technical specifications / items, commercial terms and

conditions of NIT like terms of payment, guarantee, arbitration clause, escalation etc.

- **TECHNICAL SPECIFICATIONS**

The work shall be carried out as per CPWD General Specifications for Electrical works Part VI- Fire Alarm system as amended upto date and CPWD General Specifications for Part I and Part II, as amended upto date, relevant IE rules, and as per directions of Engineer-in- charge.

FIRE FIGHTING SYSTEM:

TECHNICAL SPECIFICATIONS

SCOPE OF WORK:
Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install Wet riser, Sprinkler, First Aid Fire Protection system as required for all floor as per the drawings and specified here in after or given in the Bill of Quantities.

System designed shall be in accordance with NBC-2016 & state fire act & rule.

CAMPUS SCHOOL BUILDING:

For this building below mentioned Firefighting system has been considered:

- Fire Extinguishers
- Hose Reel
- Down Comer
- Over Head Fire Water tank
- Terrace pump

Fire Fighting works
Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install Wet riser, Down comer, fire hydrant system/fire extinguishing as required as per CPWD specifications and requirement of Local body Fire & Emergency Service by the drawings and specified hereinafter or given in the Bill of Quantities.

Fire Pumps, Motor, Engine and Accessories:
1. Electrically operated firefighting pumps with motors, base plate and accessories.
2. Pressure gauge with isolation valves.
3. M.S./Galvanized Pipes, fittings, valves, suction strainers, suction & delivery headers & accessories.
4. Foundations, vibration eliminator pads and foundation bolts.
5. Pressure vessel, pressure switches etc.

ii. Fire Hydrant System:
1. Piping for Down comer /hydrant systems.
2. Fire Hydrant valves, canvas hose pipes, hose reels, hose cabinets, connections to fire mains.

iii. Inspection & Testing assemblies.
iv. Hand Appliances /Fire Extinguishers:
v. Supply and installation of fully charged and tested fire extinguishers hand appliances water CO2, foam, dry chemical powder type, ABC stored pressure type, CO2 gas cartridge type as required as per by these specification and drawings.

Pump
i) The pump shall be horizontal /vertical type, as per design described in the Schedule of Quantities.
ii) The impeller shall be secured to the shaft and shall be retained against circumferential movement by keying, piping or lock rings.
iii) All screwed fasteners shall tighten in the direction of normal rotation.
iv) Pump shall be provided with approved type of mechanical seals.

Pumps Casing
(i) The casing of horizontally /vertically pumps shall be hydrostatically tested to 1.5 times the maximum working pressure but in no case less than 250 PSI.
(ii) Pressure classification of flange connections shall correspond to casing working pressures.
(iii) Casing material shall be close grained, accurately machined, cast-iron, and precision manufactured for best performance and long-term duty and fitted with gunmetal wearing ring.
(iv) Water discharge diffusers shall be included to reduce radial torque to impellers.

Wearing Ring:
Wearing rings shall be suitable for an individual application. Rings shall be replaceable, and positively keyed to prevent rotation.

Bearing:
Bearings shall be heavy-duty ball bearings with a minimum average life of 120,000 hours. The bearings shall be self-sealed, and housed in malleable-iron housing aligned to bearing bracket by means of large precision registers. Bearings shall be removable without dismantling any rotating element or pumps.

Impeller:
(i) Impeller shall be one-piece, phosphor bronze, and the bush of gun metal. The impeller shall be hydraulically and dynamically balanced.
(ii) Impellers of pumps shall be fully enclosed suction type and hydraulically balanced.
(iii) Impellers shall be accurately keyed to the shaft and positioned axially by shaft sleeves and separate snap rings.
(iv) Impellers shall be fully protected against damage from reverse rotation.

Pump Shaft-Motor Shaft Coupling:
All shafts shall be connected with adequately sized flexible couplings of suitable approved design. Necessary guards shall be provided for the couplings.

Base Plate:
(i) A common base plate mounting both for the pump and drive shall be provided. The base plate shall be rigid construction, suitably ribbed and reinforced.
(ii) Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc.

Vibration & balancing:
The rotating elements shall be so designed to ensure least vibration during start and throughout the operation of the equipment. All rotating components shall be statically and dynamically balanced at workshop.

Installation:
Installation of the Fire Fighting Pump set shall be carried out exactly as per manufacturer recommendation.

Foundation:
The foundation of Fire Fighting Pumps & Electrical motor shall be constructed as per the requirement/recommendation of manufacturer of Fire Fighting Pumps / motor /Diesel Engine.

Anti-vortex Plates:
Anti-vortex plates shall be installed at the end of the Fire Pump suctions inside tanks.

Instruction Manual & Tools/Spares:
A comprehensive instruction manual shall be provided by the contractor indicating detailed requirements for operation, dismantling and periodic operation and maintenance procedures.

Electric Motors

i) Electrically driven pumps shall be provided with totally enclosed fan cooled induction motor. The motor shall be full load duty & shall be capable of handling the required starting torque of the pumps. Speed of motor shall be compatible with the speed of the pump. All electrical motors for pumps inside Fire Pump Room shall be IP
54 rating enclosure.
ii) Motors shall have a dust tight construction with suitable means of breathing.
iii) All Components shall be of adequate mechanical strength and robustness and shall be constructed of metal unless otherwise approved.
iv) The rating and design shall conform to (IS : 325) specification.
v) The motors shall be wound for Class-F insulation and the winding shall be vacuum impregnated with head and moisture resisting varnish and glass wool insulated to withstand tropical conditions.
vi) Two independent earthing points shall be provided on opposite sides of the motor for bolted connections.
vii) Volt power terminals shall be suitable for receiving 1.1 KV grade armoured power cables.
viii) The cable boxes and terminations shall be designed to enable easy disconnection and replacement of cables.
ix) Provide other specific requirements required by governing energy conservation codes.

Motors shall comply with the following:

(i) **Three** phase induction motors shall conform to Indian Standard (IS) 12615 and shall fulfil the following efficiency requirements:
• ECBC+ Buildings shall have IE 3 (premium efficiency) class motors or higher class
(ii) All permanently wired polyphase motors of 0.375 kW or more serving the building and expected to operate more than 1,500 hours per year and all permanently wired polyphase motors of 50kW or more serving the building and expected to operate more than 500 hour per year, shall have a minimum acceptable nominal full load motor efficiency not less than levels specified in the latest version of IS 12615.
(iii) Motors of horsepower differing from those listed in the table shall have efficiency greater than that of the next listed kW motor.
(iv) Motor horsepower ratings shall not exceed 20% of the calculated maximum load being served.
(v) Motor nameplates shall list the nominal full-load motor efficiencies and the full-load power factor.

Codes And Standards For Pumps, Motors And Diesel Engine

PUMPS:

The pumps shall conform to the standards and codes as given below:
i) IS: 1520 Horizontal centrifugal pumps for clear, cold and fresh water.
ii) BS: 599 methods of testing pumps.
iii) PTC: 8 ASME Power test Codes – Centrifugal Pumps.

MOTOR

The following codes shall be applicable for the motor :-
i) IS: 325 Induction motor, three – phase.
ii) IS: 900 code of practice for induction motors, installation and maintenance.
iii) IS: 7816 guide for testing insulation resistance of rotating machines.
iv) IS: 4029 guide for testing three phase induction motor.
v) IS: 3043 code of practice for earthing.
vi) Further to those stated above, the design, manufacture, installation and performance of motors shall conform to the latest Indian Electricity Act and Indian Electricity Rules.

The following scheme shall be followed for FTs, STs and Hostel blocks

Building	Jockey Pump	Sprinkler Pump	Hydrant Pump	Terrace Pump	Fire DG
New Campus School Building	---------	---------	---------	Required	---------

General

Electrical characteristics of Factory Built Assemblies:
When the components are mounted in the enclosures, appropriate de-rating factors shall be allowed for the effect of other components and interconnections.

i. Enclosures of factory Built Assemblies:
ii. Unless otherwise indicated, enclosures shall provide a minimum degree of protection of IP 42 when located within buildings and IP54 when located outside building.
iii. Door shall have adequate fastenings with provision for locking in the closed position.
iv. Fixing holes for equipment may be inside or outside the enclosure.
v. Earthing terminals shall be fitted to each enclosure, suitable for internal and external connection to enable the exposed conductive parts of the protective conductor.
vi. Where the enclosure has a painted finish, provision shall be made for earthing terminal to be electrically connected to the enclosure without need to remove any paint from ferrous metal.
vii. Cable terminals shall be suitable for the number, size and type of cables as indicated. Adequate spacing shall be allowed for spreading of cable tails to avoid stress on the insulation or terminals; if necessary, extension boxes shall be fitted to standard enclosures. Terminals for neutral conductors for three phase and neutral circuits shall be the same size as for phase conductor, except where reduced section neutral cable cores are indicated.
viii. Nos. of Gland Plates for cable entry made of 3 mm thick CRCA sheet (each cable gland plate in two halves), complete with required Knock Outs shall be provided at top or bottom with number and size of knock outs to be sufficient for the incoming and outgoing as specified in the panel details as per site conditions.
ix. Metallic enclosures for location within buildings shall have a stove dried painted finish of the manufacturer's standard colour, unless otherwise indicated. Ferrous parts shall be degreased and adequately rust protected immediately prior to painting.
x. The compartment door shall be interlocked mechanically with the switch so that the door cannot be opened unless the switch is in OFF position. Means shall be provided for releasing this interlock at any time.
xi. All MCCBs shall be provided with Rotary handle on the front door unless specifically mentioned otherwise.

Construction:

Basic Structure:
i. All electrical panels will be fabricated from 2mm thick CRCA sheet steel for robust construction properly supported with angles and channels.
ii. The covers and doors shall be very well gasketed with neoprene rubber gaskets so as to obtain dust proof enclosure.
iii. The cubicle will be floor-mounted type unless specified otherwise.
iv. The cabinet will be welded construction and not of jointing construction.

Doors:
1) Door shall be made of 2mm sheet steel, with foamed seal polyurethane gasket, square section under tabular frame with punching in DIN pitch pattern.
2) The door will be provided with concealed hinges and panel locks of superior quality. The hinges will be union joint type to facilitate easy removal of the doors when necessary. Neoprene gaskets shall be provided beneath all doors and corners and also between adjacent sections, and on gland plates.
3) The doors will be provided in a similar fashion as generally provided for the outdoor cabinet, where water cannot enter in the cabinet from the door.
4) The door will be provided with strengthening arrangement to avoid wobbling and distortion. Doors shall have provision for earthing.
5) Wherever the doors are opened on horizontal hinges, an arrangement will be provided to latch the doors in an open condition for inspection of the wiring.
6) Generally, meter, relays push buttons, signal lamps and control components will be provided on a separate compartment for in-comer feeders only.

7) The circuit components will be mounted on sectionalized 3 mm thick CRCA sheet with suitable threading in the sheets to facilitate easy maintenance, future addition etc.
8) The panels shall be manufactured with separate busbar chamber isolated from unit feeder chambers and cable alleys, to provide extra safety for working personnel.

Dimensions:
Based on the SDL approved by E-I-C, Contractor shall prepare panel diagram. The height of the panel will be as per the drawing but not be more than 2120 mm. Depth of the panel will not be less than 300 mm and width of the panel will be given in the particulars of panel specifications or as per actual site conditions. Shop drawings
shall have to be approved by the Engineer-in-charge before fabrication is taken up by hand.

Adaptor Chambers for all cable entries:
Wherever necessary, sheet metal adaptor chambers with angle frame and minimum depth of 300 mm will be supplied with panel. All the covers of adaptor box will be removable type. The box can be mounted horizontally or vertically. The pattern of cable entry, wherever not specified will have to be confirmed by the manufacturer/
Supplier/ Contractor in writing after placement of order. The cable entry shall be as per actual site conditions and approved.

Powder Coating Treatment:
1) The cubicle will undergo the process of Powder Coating treatment to the satisfaction of the Engineer-in-Charge.
2) The panels shall be treated for degreasing, de-rusting, phosphatizing and passivizing by adopting seven/nine tank process. As per the Indian Standard Specification. Powder coating process with a final coating shall be of 80-120 microns.
3) The painting of panel shall be carried out in a dust free atmosphere then baked in oven.

Busbars:
1) The bus bars will be of copper with a current density of 1.0 Amp per Sq. mm. The bus bars will be insulated with heat shrinkable sleeves and properly supported. All live parts shall be shrouded by means of acrylic / steel /FRP sheets to ensure no accidental contact with live parts during maintenance and provide simultaneous inspection. The busbar supports will be designed to withstand short circuit current equivalent to 35 MVA at 415 volts. The bus bars will be adequately insulated and protected to prevent accidental contact during operation and maintenance.
2) Non-hygroscopic SMC supports shall be used for busbar to give better mechanical and electrical strength and to ensure capability to withstand specified fault current.

Insulation:
The insulation between phases and between phases and ground of the power conductors will be made of synthetic resin board/molding, resistant to dust and dampness. All insulating material will be non-hygroscopic, fungus-proof and treated with suitable synthetic varnishes. All live exposed busbar inside the panel shall be guarded with insulating sheet like hylum sheet to protect direct contact of any person after opening of panel door.

Terminals:
Upto 35 sq. mm cables, the terminal will be provided of clip-on type and above 35 sq. mm, cable end terminals will provide of brass stud type designed of rugged construction.

Wire ways:
PVC extruded wire ways of required size will be provided for wiring in the control panel.

Ferruling and colour code:
Cabling for power circuit should be red, Yellow and blue or otherwise proper coloured sleeving will be provided at both ends of cables. For control cables every conductor will be provided with the identification ferrule matching with the one in the drawing.

All power and control wiring shall be done by using thimbles ferrules of proper size and quality at both ends for identification. The wiring shall be neatly bunched for easy identification.

Cable Termination:
Every cable, either for control or power duty will be provided with crimped type of lugs of suitable size as specified.
All power and control wiring terminals shall be brought out in the cable Alley for easy Cable Termination.

Cables (Internal Wiring)
All the cables will be PVC insulated FRLS of ISI approved and reputed make. The cables will be copper conductor as specified in the drawings and will be stranded and minimum number of strands will be three. The ratings will conform to IEE regulations.
All internal wiring inside the cubicle shall be carried out with 1120V grade, PVC insulated copper wires duly ferruled at either end. The power wiring above 120A shall be carried out through the PVC insulated aluminium links.

Earthing:
The earth busbars should be GI/AI unless otherwise specified. Bolts to be of cadmium plated with washers. Earth busbars will be provided all around the cubicle at the bottom with duplex external earth connection arrangement.

Cable Glands and Lugs:
The cable glands will be of brass cone grip type. These glands will be provided for all the outgoing connections at both the ends for power as well as control circuits provided in the panel and also for the incoming cable or cables. Lugs will be crimped for termination of outgoing cable at both ends (i.e., load end and panel end) with each outgoing feeder.

Feeder Units:
1) The feeder units shall be of compartmental design comprising of cubicles assembled together and shall incorporate cubicle MCCB and MCB having rupturing capacity of minimum 35 KA and 12 KA at 440 volts respectively unless specifically mentioned.
2) The MCCB shall be quick break and trip free type with magnetic thermal release or as specified in the Tender. Protection Devices shall be as specified in Tender.
3) Individual MCCB (with ammeter, selector switch, CTs) small wiring where provided should be easily removable from the front of the switchboard for servicing and maintenance. The connections to MCCBs from the busbars and cables should be terminated in pressure bolted joints inside the switch contacts.
4) The MCCB on main LT Panel shall have ratings: 63A, 120A, 125 A, 160 A, 200 A, 250A, 320A, 400A / 630A with 36 KA (minimum) rupturing capacity unless specifically mentioned in the Tender.
5) Bus bar should have sufficient mechanical strength to with stand the effects of short circuit until it can be cleared by appropriate protecting device. All bus bars should be clearly marked with appropriate colour code to enable immediate identification of the phase and neutral. (Mechanical strength upto 70KA/1 Sec).
6) The vertical bus bar should have a number of laminations to give appropriate current rating and can be graded to suit the current rating required at each point by omitting laminations at the points of current decrease.
7) Arrangements should be provided to receive PVC cables either from the topside or from the bottom (as specified). End plates should be mounted inside the busbar at unit level for cables from above or below
8) All sheet-steel parts used in the construction of a cubicle board should have undergone rigorous rust proofing process which must comprise of alkaline degreasing descaling in dilute sulphuric acid and a recognized phosphatizing process. The steel work shall be finished with powder coating paint.
9) The equipment when assembled shall form a neat and compact unit and shall be complete with supporting framework, mounting channels, and foundation bolts etc. and shall be designed so as to ensure complete interchangeability of component.

Pipe, Fittings, Valves, Supports and Other Accessories:

Pipes, Fittings & Supports:

i. General:

a. All materials shall be new of the best quality conforming to the specifications and subject to the approval of the Engineer-in-Charge.

b. Pipes and fittings shall be fixed truly vertical, horizontal as required in a neat workman like manner.

c. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

d. Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.

e. Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

iii. For MS/Galvanised pipes upto and including 50 mm dia screwed jointing shall be adopted, while for pipes 65 mm and above welded connections shall be used for MS and screwed connection for Galvanised. Only Electro Galvanised nuts /bolts shall be used.

iv. The piping system and components shall be capable of withstanding 150% of the working pressure including water hammer effects and test pressure upto 16 kg/cm2.

v. Flanged joints shall be used for connections to vessels, equipment, flanged valves and also, on suitable straight lengths of pipeline of strategic points to facilitate erection and subsequent maintenance work.

vi. Flange thickness shall be as per table below IS: 6392 – 1971. Table – 17/18.

250 mm dia : 26 mm
200 mm dia : 24 mm;
150 mm dia : 22 mm;
125 mm dia : 22 mm;
120 mm dia : 20 mm;
80 mm dia : 20 mm;
65 mm dia : 18 mm.

vii. M.S./GI Fittings for pipes above 65 mm or and upto 150 mm dia shall be fabricated from seamless pipe pieces of minimum 5 mm wall thickness. For tees and other fittings where seamless sections are not available, the fittings shall be fabricated from Electric resistant welded pipes as given in the Preffered Makes. However Galvanised
fitting will be screwed. The fittings shall have a minimum 5 mm wall thickness. The fittings shall with stand pressure of upto 21 kg/cm2.

viii. Fittings below 50 mm or shall be M.S./ Galvanised Forged Screwed ends. The fittings shall be threaded at both ends. The fittings shall withstand pressure of upto 21kg/cm2.

ix. For tapings of 50 mm/40mm/32mm/25mm from headers, half socket connections with one side threading shall be employed. The half socket shall be welded at the centre of the header, either on the side or on the top.

x. Wherever two horizontal headers are to run side by side, the two headers shall be located at different levels, if possible, so as to avoid unnecessary bends at tapping off from the headers. Accordingly, the supports shall also be staggered to support pipes at two levels.

Pipe Support:

i. All pipe clamps and support shall be mild steel.

ii. Pipe shall be hung by means of expandable anchor fastener of approved make and design (Dash Fasteners or equivalent). The hangers and clamps shall be fastened by means of galvanized nut and bolts. The size/diameter of the anchor fastener and the clamp shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

iii. Hangers and supports shall be capable of carrying the sum total of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipelines movements as necessary. All guides, anchor, braces, dampeners, expansion joints and structural steel to be attached to the building/structure, trenches etc shall be provided by the contractor. Hangers and components for all piping shall be approved by the Client/engineer. Anchoring fasteners shall be rated to take minimum tons load and shall be of approved make.

iv. While all piping shall have clevis type hanger supports from the ceiling with fasteners, for pipe headers of 120 mm dia and above, additional wall/column mounted supports shall be taken. Clevis type hanger supports shall be at 3.0 m intervals and at every turn, at both ends. MS angle supports at wall and columns shall be at 18 m intervals. The angles shall be cut by gas cutter and evened out by grinder. All welding to angles shall also be cleaned by grinder. Angles shall not be less than 40 x 40 x 6 mm size.
v. For fixing clevis hanger and angle support, only dash fasteners shall be used. Exposing of steel reinforcement and welding to them shall not be permitted except in exceptionable circumstances.
vi. Pipes in vertical shafts shall have MS angle brackets at alternate floor level. The bracket shall be mounted behind the pipe. A base plate of 50 wide x 6 mm thick shall be welded to the bracket. The base plate shall be fixed to the wall by means of fasteners GI U clamps shall be used to fix the pipe to the bracket.
vii. Each riser shall also be anchored to the floor slab with MS angles mounted on the slab. The angles shall be 40 x 40 x 5 size, one mounted before the pipes and the other after the pipes. Extra cleat pipe pieces shall be welded to the pipes at this point which shall be welded to the angle iron support.
viii. Wherever angle type supports are being used, profiled packing materials or wood or materials as approved by the Engineer shall be used. The packing materials shall be at least 25 mm thick and tight fitted with the pipe.

Hose Reel:
i. Wall mounting the swinging type first aid hose reel with drum shall conform to IS: 884-1985.
ii. The rubber tubing shall be 20 mm dia high pressure rubber hose 36.0 m long as per IS : 444 with gunmetal shut off nozzle having 6.5 mm dia orifice and control valve, shut off valve of approved make. The wall mounted bracket shall be fixed by means of fasteners. The hose reel shall have a gun metal nozzle.
iii. The hose reel shall be connected directly to the riser by means of 25 mm dia MS pipe with threaded bends, union & one no. ball valve.
iv. The drum can swing up to 180 degrees.

Hose Cabinets:
i. Hose cabinet shall be fabricated from 16-gauge MS powder coated sheet of fully welded construction with hinged single/double door partially glazed door with suitable locking arrangement, stove enameled fire red paint with 'Fire Hose' written on it prominently. Glass panes shall be 4 mm thick.
ii. The hydrant cabinet shall hold double headed hydrant, 2 nos. Hoses and 1 no. branch pipe.
iii. The cabinet shall have two pipe studs of 200 mm dia in MS with base which shall be fixed to the back of the cabinet and shall be used to hold the RRL hose.

RRL Hoses:
i. The hoses for the internal and external hydrant system should be rubber impregnated woven jacketed type conforming to IS:636 Type-A. Each fire hose shall be provided with quick coupling, branch pipes, nozzles, spanners etc.
ii. Hose pipes of all types shall be capable of withstanding an internal water pressure of not less than 35 Kg/Sq.cm without bursting. It must also withstand a pressure of 21 Kg/Sq.cm without undue leakage or sweating.
iii. Each hose shall be fitted with instantaneous spring lock type couplings at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanized mild steel wires and leather bands.

Branch Pipes and Nozzle:
Stainless steel Standard Branch Pipe shall be used conforming to IS : 903 with Stainless steel nozzle of 20 mm (nominal internal dia) to fit standard instantaneous type 63mm dia hose coupling. Suitable spanners of approved design shall be provided in adequate numbers for easy assembly and dismantling of various components like branch pipes, nozzles, quick coupling ends.

Hydrant Valve:
i. Stainless steel Hydrant valve shall be of oblique pattern provided as per IS: 5290 complete with hand wheel, quick coupling connection, spring and blank cap and chain.

ii. The hydrant shall have flanged inlet of 120 mm dia and 63 mm female instantaneous type outlet. The hydrant shall have a rubber plug with chain fixed to the main body of the Hydrant.

Pressure Switch:

i. The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by lines pressure. The Pressure switch shall be diaphragm type, it shall be suitable for line pressures up to 15 kg/cm2.

ii. The switch shall be suitable for consistent and repeated operations without change in values.

iii. The enclosure shall be of aluminium and pressure element and wetted parts shall be of stainless steel. The switch shall be snap acting type with 1 no. N O/NC contact.

Valves:

i. Sluice Valves: Sluice valve of 65 NB and above shall be flanged valve with cast iron body. The spindle, wall seat and wedge nuts shall be of bronze. They shall generally have nonrising spindle and shall be of the particular duty and design called for. All sluice valves will be provided with supervisory switch.

The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fiber gasket. Sluice valves shall conform to Indian Standard IS:14846: 2000 and IS: 2906. Sluice valves for water works purposes suitable for seat test pressure of 16 Kg/Sq.cm.

ii. Butterfly Valve:

a. The butterfly valve shall be suitable for water works and tested to minimum of 15 Kg/Sq.cm pressure.

b. The body shall be of cast iron to IS : 212 in circular shape and of high strength to take the water pressure of 12 Kg/Sq.cm. The disc shall be heavy duty cast iron with anti-corrosive epoxy or nickel coating.

c. The valve seat shall be of high-grade elastomer or nitrile rubber. The valve in its closed position shall have complete contact between the seat and disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be EN 8 grade carbon steel.

d. Butterfly valve shall be of best quality conforming to IS : 13095 of class specified.

e. The valves shall be supplied with manual gear operated opening/closing by lever.

f. The valves shall be supplied with supervisory switch.

iii. Gun Metal Valves:

a. Gun metal valves shall be used for smaller dia pipes, and for threaded connection. The valves shall bear certification as per IS: 778-1984 and shall be rated to 15 Kg/Sq.cm pressure.

b. The body and bonnet shall be of gun metal to IS: 318. The steam gland and gland nut shall be forged brass to IS: 319. The hand wheel shall be of cast iron to IS: 212.

c. The hand wheel shall be of high-quality finish to avoid hand abrasions. Movement shall also be easy. The spindle shall non rising type.

d. All valves shall be approved by the Authority Representative before they are allowed to be used on the work.

iv. Non-Return Valve:

a. Non-return valves shall be cast iron dual plate type. An arrow mark in the direction of flow shall be marked on the body of the valve. The valve shall bear IS: 5312 certifications.

b. The valve shall be of cast iron body and cover. The internal flap in the direction of water shall be of cast iron and hinged by a hinge pin of high tensile brass of stainless steel. Cast iron part shall be as per IS: 212.

c. The gasket shall be of high-quality rubber and flap seat ring of leaded gunmetal. At high pressure of water flow the flapper shall sit tightly to the seat. The valve shall be capable of handling pressure up to 15 Kg/Sq.cm.

v. Air Valves:

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

vi. Drain Valve:

a. Provide 50 mm dia between steel pipe to IS : 1239 (heavy duty) with 50 mm gunmetal full way valve for draining any water in the system in low pockets.
b. Drain valves shall be provided at low points of all water riser and mains to ensure that all sections of pipe works and plant can be drained.
vii. Foot Valve:
a. Foot valves of water supply system shall be heavy duty construction with integrated flanges connection and have cast iron body, all bronze trims with stainless steel spring and stainless-steel strainer.
b. The flow area on strainer shall be at least three times of Pipe size.

Gate Valve Chamber:
A masonry chamber of internal dimension 1.20m x 1.20m x 1.5m depth shall be built to accommodate sluice valves placed in external ring main, 230mm thick walls shall be of 75 class designation brick work in cement mortar 1:5 (1 cement : 5 fine sand) with CI medium duty manhole cover. The top slab RCC shall be of 1:2:4 mix (1 cement: 2 coarse sand : 4 graded same aggregate 20 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement all complete.

Pressure Gauge:
Pressure gauge shall be provided near all connections to hydrant system and isolation valves of sprinkler system and where required. Pressure gauge shall be stainless steel 120 mm dia gunmetal Burden type with a scale range from 0 to 15 Kg/cm2 and shall be constructed as per IS 3624. Each pressure gauge shall have a siphon tube connection with ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate level and height for easy readability.

Branch Pipe:
Gun Metal Standard Branch Pipe shall be used conforming to IS : 903 with gun metal nozzle of 20 mm (nominal internal dia) to fit standard instantaneous type 63mm dia hose coupling. Fire man's axe for firefighting purpose shell be used conforming to IS:926 – 1985

Painting:
All hydrant pipes shall be finished with post office red colour paint. All M.S. pipes shall first be cleaned thoroughly before application of primer coat. After application of 2 coats of Red oxide primer, two coats of enamel paint shall be applied. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO 1" etc.

Testing:
i. All piping in the system shall be tested to hydrostatic pressure of 13.5 Kg/Sq.cm without drop in pressure for at least 2 hours.
ii. Rectify all leakages, make adjustments and retest as required and directed.

IS Codes For Design, Manufacture, Erection, Testing and Trail Operation of Piping Valves etc.:
The following codes and standards and their subsequent modifications shall apply for the design, manufacture, shop testing, erection, fabrication at site, resting and trial operation of piping, valves and specialties requirements:
- IS: 554: Dimensions for pipe threads where pressure tight joints are required on the threads.
- IS: 638 : Sheet rubber jointing and rubber insertion jointing.
- IS: 778: Copper alloy gate, globe and check valve for water work purposes.
- IS: 14846 : Sluice valves for water –works purposes (50 mm to 1200 mm).
- IS: 901 : Couplings, double male and double female, instantaneous pattern for fire fighting.
- IS: 1239 : Mild steel tubes, tubular and other wrought (Part I & II) steel fittings.
- IS: 884 : Swinging type wall mounted hose reel with drum.
- IS: 388 : Hose tubing.
- IS: 4038 : Foot valves for water-works purposes.
- IS: 5290 : landing Valves.
- IS: 12221 : Anti-corrosion treatment for underground MS pipes.
- IS: 5312 : Swing check type reflux (non-return) valves.

Fire Extinguishers:
Without restricting to the generality of the foregoing the work shall inter-alia consist of the following:
Installation of fully charged and tested fire extinguishing hand appliances CO2 and dry chemical powder type as required by these specifications and drawings.
Portable Fire Appliances Requirement, Type and Location as per Fire Authority:

Portable Fire appliances as mentioned below :-
(i) ABC Dry Powder fire extinguisher IS : 15683 – 2006 -6 Kg & 9 kg capacity .
(ii) CO2 Gas Fire extinguisher IS 15683 – 2006 – 4.5 Kg capacity.
(iii) CO2 Water type Fire extinguisher IS 2878 – 9 litre capacity and
(iv) K type Fire extinguisher – for Canteen
(v) Fire bucket IS : 2546 4 Nos. shall be installed at following places :-

(a) Electrical Rooms.
(b) Pump Rooms.

Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners or by means of floor mounted supports.

Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

All appliances shall be fixed in a true workman like manner truly vertical and at correct locations. Identical type of extinguishers shall be of same make and shall have similar method of operation.

As per the above proposed scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including related calculations, supporting documents and SLD in accordance with the relevant electricity/IS Codes.

COMMISSIONING & TESTING:
Down comer System
i. Switch on the terrace pump and test check. The diesel engine driven pump in the same **manner** as the electrically driven pump.
ii. Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

Handing Over:
All commissioning and testing shall be done by the contractor to the complete satisfaction of the Engineer-in-Charge, and the job handed over to the Engineer-in-Charge, or his authorized representative.
Contractor shall also handover, to the Engineer-in-Charge, all maintenance & operation manuals and all other items as per the terms of the contract.

Guarantee:
- The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.
- The form of warranty shall be as approved by the Engineer-in-Charge.
- The warranty of all the components shall be valid for a period **of Three year (in DLP**) from the date of handing over.
- The warranty shall expressly include replacement of all defective or under capacity equipment. Engineer-in-Charge may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.
- The warranty shall include replacement of any equipment found to have capacity lesser than the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Engineer-in-Charge.

LIST OF IS CODES (Relating to Fire Fighting works)

The following codes and Indian Standards shall be applicable with amendments up to date.

CODE OF PRACTICE

Code of practice for fire safety of building (general) fire-fighting equipment and maintenance.	IS : 1648
Code of practice for installation of internal fire hydrant in multistoreyed buildings	IS : 3844
Recommendations for providing first aid and firefighting arrangements in public buildings	IS : 2217
Code of practice for the selection, installation and maintenance of portable first aid and fire appliances	IS : 2190
National building code. **FIRE FIGHTING APPLIANCES**	
External fire hydrants	IS : 5290
Internal landing valves.	IS : 5290
2 & 3 way suction collecting heads	IS : 904
First aid hose reels	IS : 884
Dunlop high pressure rubber pipe	IS : 5132
Centrifugal pump	IS:1520
Electrical motors	IS:7538
Specification for horizontal centrifugal pumps for clear cold fresh water	IS : 1520
Specification for submersible pump sets for clear, cold, fresh water	IS : 8034
Specification for horizontal centrifugal self priming pumps	IS:8418

Scope of work:

The scope of firefighting system in various building to be constructed work shall be as follow:

Fire Protection System including downcomer system and yard hydrant if required, pre-wired control panel etc., complete as required. wherever required shall be designed and provided as per NBC 2016, IS standard & Fire Bye Laws. NOC for the scheme from Telangana Fire Service shall be obtained by the agency.

Scope of work shall be as under:

I. To get the firefighting scheme approved first from Telangana Fire service before taking up execution

of work.

II. To execute the work as per approval of Telangana service.

III. Agency shall obtain clearance certificate from Telangana fire service, Telangana Govt. for installations of Fire Fighting system.

IV. All the buildings to be constructed and to be connected with Heavy duty (C–Class) M.S. pipe of sutable diameter, necessary NRV / sluice valve / butter fly valve as per drawing approved by Engineer – in – charge as FIRE FIGHTING RING MAIN WATER LINE. The fire pump house and fire pumping sets shall be Supplied, Installed, tested and commissioned by the contractor as per the approved drawing and design.

V. One number 4.5 kg Co2 type fire extinguishers and/or one number 9.00 ltr water type extinguisher (gas pressure type) shall be installed at each floor near each staircase in all buildings (are as per NBC/Fire Services of TS Govt. norms). In addition to this Co2 type fire extinguishers and ABC type fire extinguishers of not less than 4.5 kg capacity shall also be installed in sub-station building, Electrical rooms, fire pump house, LT rooms. (are as per NBC/Fire Services of TS Govt. norms).

VI. The agency must study specifications, provision for fire-fighting system for various buildings, NBC code – 2016, local byelaws and additional conditions carefully. The work shall be executed in close co-ordination with the progress of building work.

VII. Contractor shall provide all tools, equipment, metering and testing devices required for the purpose. On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract

VIII. All tests shall be made in the presence of the Engineer-in-charge or his representative or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

IX. Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

X. Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rotameters. Contractor shall also supply all required pressure gauge, temperature gauge & rota meter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.

XI. Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper intwo weeks after completion of the tests.

SPECIFICATION:

The works shall be executed as per CPWD"s General specification for Electrical Works, Part-I (Internal-2023); Part-II (External)-2023; Part-V (Wet Riser and Sprinkler System for Fire FightingInstallation)-2020, Part-VI (Fire Alarm System)-2018, IE Rules, provision laid down in NBC – 2016,and latest building byelaws of local body / Local Municipal Corporation and various Indian Standards amended up to date, and as per direction of Engineer-in-Charge. The additionalspecifications are to be read above and in case of any variations; specifications given along the tender shall apply.

Indian standards:

IS-8757 Glossary of terms associates Fire safety.

IS-884 Specification for first-aid hose reel for the fighting.IS-884 Specification for first-aid hose reel for the fighting.

IS-902 Specification for suction hose couplings for fire fighting purpose.

IS-903 Specification for fire hose delivery couplings, branch pipe, nozzles andnozzle spanner

IS-904 Specification for two-way and three – way suction collection heads for firefighting purposes.

IS-908 Specification for fire hydrant, stand post type

IS-636 Non percolating flexible firefighting equipment.

IS-1646 Code of practice for fire safety of buildings (general): Electrical installations. IS-5290 Specification for landing valves.

IS-8090 Specification for couplings, branch pipe, nozzle, used inhose reel tubing for fire fighting.

Completeness of the work - All sundry equipment, fittings, assemblies, accessories, hardware items, bolts, supports, termination lugs for electrical connection, cable glands, junction box and allother sundry items for proper assembly and efficient working of the various equipment and components of the work shall be deemed to have been included in the scope of work, irrespective of the fact whether such items are specifically mentioned in the tender document or not.

Dispatch of Materials to Site and Safe Custody thereof:

The contractor shall dispatch materials to site in consultation h the Engineer-in- Charge. Programme of dispatch of material shall be framed keeping in view the building progress. Safe custody of all machinery and equipment supplied by the contractor shall be the responsibility of the contractor till final taking over by the department Piping, cabling or any other work, which directly affect the progress of building work, shall begiven priority.

Quality of Materials and Workmanship:

(i) The components of the installation shall be of such design so as to satisfactorily functionunder all conditions of operation.

(ii)The entire work of manufacture/ fabrication, assembly and installation shall conform to sound engineering practice.

(iii) All equipment and materials to be used in work shall be manufactured in factories of good repute having excellent track record of quality manufacturing, performance and proper aftersales service.

Care of the Building:

Care shall be taken by the contractor during execution of the work to avoid damage to thebuilding. They shall also be responsible for repairing all such damage and restoring the same to theoriginal finish at their cost.

They shall also remove all unwanted and waste materials arising out of the installation from thesite of work from time to time.

GUARANTEE:

All equipment shall be guaranteed for a period of 36 months from the date of handing over ofthe installation by the Department against unsatisfactory performance and/or breakdown due to defective design, material, manufacture, workmanship or installation. The equipment or component or any part thereof so found defective during the guarantee period shall be repaired or replaced free of cost to the satisfaction of the Engineer-in-charge. In case of replacement or repair requiring more than 7 days, the agency shall temporarily install the equipment so that the system become operational. If it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk & cost of the contractor and the warrantee period will be extended for the equipment for the time period equal to interval of defect and replacement. The decision ofEngineer-in-charge in this regard shall be final & binding on the contractor.

The tender shall guarantee among other things, the following:-

Quality, strength and performance of the materials used as per manufacturers standards. Safe mechanical & electrical stress on all parts under all specified conditions ofoperation.

TENDER DRAWINGS, DRAWINGS FOR APPROVAL AND COMPLETION DRAWINGS

- Drawings for approval on award of the work -The contractor shall prepare & submit three sets of following drawings and get them approved from the Engineer-in-charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment/materials as per agreement, if there is any contradiction between the approved drawings and agreement. The decision of the Engineer-in-Charge shall be final & binding on the contractor.
- Lay out drawings of the equipment to be installed in pump from and terrace.
- Drawings showing the details of erection of entire equipment including their foundations.
- Plumbing drawings showing the layout of entire piping, dia. and length of pipes, hydrant, air vessel and isometric drawings showing connections to various equipment.
- Lay out and isometric drawings of the equipment and pipe work, valves, nozzles to be installedin various rooms.
- Drawings including section, showing the details of erection of entire equipment including their supports/ mountings etc.
- Electrical wiring diagrams for all electrical equipment and controls including the sizes and capacities of the various cables and equipment.
- Any other drawings relevant to the work.
- Completion Drawings: Three sets of the following laminated drawings shall be submitted bythe contractor while handing over the installation to the Department. Out of this one of the sets shall be laminated on a hard base for display in the Control room. In addition, one soft copywill be given on compact disc/pen drive
- Installation drawings giving complete details of all the equipment, including their mountings/

supports.

- Plumbing layout drawings giving sizes and lengths of all the pipes and the sizes and locations of valves, nozzles and including isometric drawings for the entire piping including the pipes connections to the various equipment.
- Electrical wiring diagrams for all electrical equipment and controls including the sizes and capacities of the various cables and equipment.

Final Inspection and Testing

Final Inspection and testing will be done by the Engineer-in-Charge or his representative as per details indicated in Chapter -11 of Specification.

The installation will be offered for inspection by local bodies (Chief Fire Officer). The contractor or his representative shall attend such inspection of the Chief Fire Officer, extend all rest facilities as are considered necessary, recently and comply all observations of the Chief Fire Officer which are part of the agreement and arrange for obtaining necessary clearance certificate in favour of the department. In case the contractor fails to attend the inspection and made desired facilities available during inspection, the department reserves the right to provide the same at the risk and cost of the contractor and impose penalty for the same. The installation will be accepted by the department only after receiving clearance from Chief Fire Officer for the work executed by the contractor under the agreement.

WORKS TO BE DONE BY THE CONTRACTOR:

- Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall be deemed to be included in their tendered cost- whether specifically indicated in the schedule of work or not.
- Foundations for equipment including foundation bolts and vibration isolation spring/pads Suspenders, brackets and floor/ wall supports for suspending/supporting pipes.
- Suspenders and/or cable trays for laying the cables.
- Excavation and refilling of trenches in soil wherever the pipes are to be laid directly inground, including necessary base treatment and supports.
- Sealing of all floor slab/ wall openings provided by the Department or contractor for pipesand cables, from fire safety point of view, after laying of the same.
- Painting of all exposed metal surfaces of equipment and components h appropriate colour.
- Making openings in the walls/ floors/ slabs or modification in the existing openingswherever provided for carrying pipe line, cables etc.
- All electrical works including cable/wires earthing etc. beyond power supply.
- Making good all damages caused to the structure during installation and restoring the sameto their original finish.
- Approval from local fire authority/NOC from TS Govt. Fire Service as may be required asper local bye-laws.

Verification of correctness of equipment at destination

The contractor shall have to produce all relevant records to certify that the genuine equipment for the manufacturers

After Sales Service:

The contractor shall ensure adequate and prompt after sales service in the form of maintenance, spares and personnel as and when required and shall minimize the breakdown period. In case of equipment

supplied by other manufacturers the firm shall furnish a guarantee from the manufacturerfor the same before the installation is taken over.

Documents to be provided on Completion of Work:

Three sets of following documents shall be furnished to the department by the contractor oncompletion of work.

Completion drawings (As built drawings)

3sets of manufacturer's technical catalogues of all equipment and accessories.

Operation and maintenance manual of all major equipment, detailing all adjustments, operation and maintenance procedure

Maintenance:

Maintenance including free defects liabilities period, of one year from date of record of completion by Engineer-in-Charge and handing over of the installation.

One number trained operator for firefighting system and one helper shall be made available to meet anyexigency of work during the guarantee period of one year from the handing over of the installation.

The maintenance, routine as well as preventive, for one year from the date of taking over the installation asper manufactures recommendation shall be carried out.

PRE-COMMISSIONING:

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

- Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- All strainers shall be inspected and cleaned out or replaced.
- When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:

Remove oil, grease and foreign residue from the pipe work and fittings;
Pre-condition the metal surfaces to resist reaction water or air.
Establish an initial protective film;

- After pre-treatment, the system shall be drained and refilled fresh water and leftuntil the system is put into operation.
- Details and procedures of the pre-treatment shall be submitted to the Architect forapproval.
- Check all clamps, supports and hangers provided for the pipes.
- Fill up pipes water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

Fire Protection System

- Check all hydrant valves by opening and closing: any valve found to be open shall be closed.
- Check all the piping under hydro test.
- Check that all suction and delivery connections are properly made for all pump sets.
- Check rotation of each motor after decoupling and correct the same if required.
- Test run each pump set.
- All pump sets shall run continuously for 8 hours (if required, temporary piping back to thetank to be made).

Commissioning and Testing

- When the fire pumps have been checked for satisfactory working on automatic controls, openfire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.
- Check each landing valve, male and female couplings and branch pipes, for compatibility h each other. Any fitting which is found to be incompatible and do not fit into the otherproperly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- Check all annunciations by simulating the alarm conditions at site.

STATUTORY AUTHORITIES' TESTS AND INSPECTIONS

- As and when notified in writing or instructed by the Engineer-in-charge, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authoritiesand other Statutory Authorities, and shall forth execute free of charge any rectification work ordered by the Engineer-in- charge as a result of such tests and inspections where these indicate non-compliance Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make allallowances in this respect.
- The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.
- The submission shall comply the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.
- The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities. The Engineer-in-charge may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.
- The Contractor shall notify the Engineer-in-charge at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Engineer-in-charge out delay.

FINAL ACCEPTANCE TESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance to a programme to be agreed with the Engineer-in-charge.

If the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary, replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shallbe carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

REJECTION OF INSTALLATION / PLANT

Any item of plant or system or component which fails to comply the requirements of this specification in any respect whatsoever at any stage of manufacture, test, erection or on completion atsite may be rejected either in whole or in part as considered necessary/appropriate. Adjustment and/or modification work as required by the Engineer-in-charge so as to comply the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Engineer-in-charge.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Engineer-in-charge /Employer.

HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Engineer-in-Charge and all testing and commissioning documents shall be handed over to him. The Contractor shall also hand over all maintenance and operation manuals, all certificates and all otherdocumentation as per the terms of the contract to the Engineer-in-Charge.

PRESSURIZATION SYSTEM:

- No pressurization required for all the staircases which are naturally ventilated.
- All the lift well for the buildings higher than 15 m in height shall be pressurized at 50 pa +ve pressure.
- Dedicated pressurization system to be installed for Individual Lift as per the Fire safety norms and should be integrated with Fire Alarm system installed in the building.
- Dedicated pressurization system to be installed for each Emergency Stairs inside the building as per the Fire safety norms and should be integrated with Fire Alarm system installed in the building if required.

Scope of work and Technical specification for LAN and Networking system, Telephone wiring:

CONDITIONS AND SPECIFICATIONS FOR Networking (LAN) SYSTEM

GENERAL - SCOPE OF WORKS

The general character and the Scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Engineer-In-Charge. The Contractor shall furnish all labour, materials and devices and specified otherwise, transportation and incidental necessary for Supply, Installation, Testing, Commissioning, final testing, putting into operation and handing over of the complete Extra Low Voltage (ELV) system as described in the Specifications and as shown in the drawings. This also includes any material, devices, appliances and incidental work not specifically mentioned herein or noted on the Drawings / Documents as being furnished or installed, but which are necessary and customary to be performed under this contract.

All the specifications for the Conduits, Cable trays and Raceway items to be considered from the Electrical part of the tender documents.

1. The ELV system works shall comprise of but not limited to the following:
2. Information & Communication Technology (ICT) Infrastructure – (Data/LAN & Telecom) – Passive Components
3. Fire Detection, Alarm and Control System (FAS) – Complete System Works
4. IP Television & Audio-Visual (AV) System – Only Enabling works with Conduit Provision.

1. INFORMATION & COMMUNICATION TECHNOLOGY (ICT) INFRASTRUCTURE –(DATA/LAN & TELECOM) - PASSIVE COMPONENTS

SCOPE OF WORK

- Complete Design, Supply, Installation, Testing and Commissioning (SITC) shall be done in accordance with installation practices for a well-structured cabling system, using components from a single OEM (Original Equipment Manufacturer) to ensure consistent and assured performance. The structured cabling distribution network shall serve as a vehicle for transport of data, video and voice telephony signals over a common network throughout the network.
- The scope consists of both Active and Passive system, the system should be designed for suitable no of LAN, WIFI & Telephone points for each floor with UTP cable for horizontal distribution from Manageable switch/Distribution Switch/POE Switch per floor and vertical connectivity with UTP/OFC as per the approved design in individual buildings listed below.
    - **New Campus School Building-01No.**
- Supplying, Installation, Testing & commissioning of suitable Active Components (Manageable switches/ Distribution Switches/ POE Switches) are included in scope of work.
- Supply, laying of Main OFC cable(input) from existing nearest Precast Staff Tower building to New Campus School Building with required civil works(excavation for burying cable/laying through existing RCC Hume pipe /laying new RCC Hume pipe for OFC routing) is included in the scope as per the approved design and directions of Engineer-In-Charge.

- Devices and services that shall run on the passive network shall include, but not limited to, the following:

    a) Wired LAN access
    b) WiFi
    c) Voice communications servers and IP/SIP end-points
    d) IP-based CCTV/Surveillance Cameras
    e) Various devices and controllers for AV system
    f) Fire Detection System
    g) Public Address System

- Cabling installation for data and voice communications shall originate at networking racks and terminate at IOs terminated at wall or furniture.
- Installation, termination and identification of wiring between station outlets and networking distribution rack(s) and networking distribution rack(s) and main rack (s), shall be considered part of the ELV Sub-Contractor's work.
- All cables and terminations shall be tested @500 MHz identified, labelled and documented at all locations.
- The ELV Sub-Contractor carrying out the SITC shall make the system entirely operational for its intended use, by addition of components specific to its make/model even if not specifically mentioned in the BoQ at no additional Cost.

Supported Applications, but not limited to:

- Ethernet Applications – wired Ethernet and wireless as per IEEE 802.11a/b/g/n/ac
- IEEE 802.3af Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI)
- Telecom – BRI, PRI and Digital Subscriber Loop (DSL) Applications
- Voice, Video and ISDN Applications

It shall be the responsibility of the ELV Sub-Contractor and OEM manufacturer to ensure that:

The Passive Components of structured cabling distribution network will be free from manufacturing defects in material and workmanship under normal and proper use.

All Passive Components in the structured cabling distribution network shall meet or exceed the relevant component specification of the EIA/TIA 568-B and EIA/TIA 568-C.2 series, EIA/TIA 569-A, EIA/TIA 606, EIA/TIA 607 and ISO/IEC 11801-1: 2017 standards or latest version, amended to date.

As per TIA/EIA standards requirement, the horizontal cabling system shall run from each workstation outlet to the patch panel installed at networking rack. The maximum horizontal distance from the workstation outlet to the patch panel shall not exceed 90 meters. An additional length shall be permissible for patching cables between patch panels and networking switch at one end and between workstation outlet and workstation and the combined length shall not exceed 12 meters. The patching cables shall be from cabling system OEM in various lengths, i.e., 1mtr, 2mtrs or 3 mtrs as per requirement. The complete cabling system shall be from a single OEM.

As per TIA/EIA standards requirement, the backbone cabling that shall run between the floors of the building (risers) or across a campus for providing the interconnection for equipment installed inside

racks/enclosures shall be either UTP/STP/FUTP CATx based or Single mode or Multi mode fiber optic cables. The permissible distances of this cabling shall depend on the type of cable and shall be as follows:

- UTP/STP/FUTP: up to 90 meters
- Multimode fiber optic cable: 200 meters
- Single mode fiber optic cable: 3000 meters

As per TIA/EIA standard for grounding guideline, the shield of FUTP cables shall be bonded through a conducting path to the telecommunications grounding busbar (TGB) in the network room(s) or server room(s). Grounding at the work area is usually accomplished through the equipment power connection. Shield connections at the work area are accomplished through an FUTP patch cord. At the work area end of the horizontal cabling, the voltage measured between the shield and the ground wire of the electrical outlet used to supply power to the work station shall not exceed 1.0 V rms. The cause of any higher voltage shall be removed before using the cable.
The structured cabling distribution network compliant channels will meet or exceed the Guaranteed Channel Performance as per relevant standards in the structured cabling distribution network Performance Specifications in effect at the time of installation.

The site will be duly certified by OEM for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier, for which they shall submit detailed performance test reports for every IO installed.

The specifications for items in this section, applies to the following:

a) F/UTP CAT6A cable and associated components such as Patch Panels, IOs/RJ45 Jacks, Patch Cords
b) UTP CAT6 cable and associated components such as Patch Panels, IOs/RJ45 Jacks, Patch Cords
c) Single-Mode fibre optic cable and associated components such as distribution shelves, LIUs, pigtails and patch cords
d) Networking Racks – for termination of networking cables

Installation:

The final branch connections with single pair cables in conduits and the maximum number of cables in each conduit shall be as follows:

Conduit Diameter	**Inch/mm.**	**Max. No. of cables**
1"	25	2 Nos. of F/UTPCAT6A cables
1 ½"	40	4 Nos. of F/UTPCAT6A cables

Codes & Standards, but not limited to the following:

All the following codes & standards shall follow and conform to the latest editions, amended to date.

- TIA/EIA568-C.1–Commercial Building Telecommunications Cabling Standard – General requirements

- TIA/EIA 568-C.2 – Commercial Building Telecommunications Cabling Standard - Balanced Twisted
- Pair Cabling Components
- TIA /EIA 568-C.3 – Optical Fiber Cabling Components Standard
- TIA /EIA 569-A – Commercial Building Standard for Telecommunications Pathways and Spaces
- TIA /EIA 606 – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- TIA/EIA 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications
- TIA/EIA-862 - Building Automation Systems Cabling Standard For Commercial Buildings
- ISO/IEC 11801-1: Information technology - Generic cabling for customer premises – Part-1 General Requirements
- EN
- ETL
- ITU for Voice
- ISO/OSI models
- International Electro technical Commission (IEC)
- European Committee for Electro technical Standardization (CENELEC)
- American National Standards Institute (ANSI)
- Institution of Electrical and Electronics Engineers (IEEE)

Wherever there is reference to multiple standards and/codes, the ones most recent as amended to date and most stringent shall apply.

F/UTP CAT6A CABLING SYSTEM

No.	Description	Specification
	Following common specifications shall apply to all F/UTP CAT6A standards based structured cabling components, i.e., Cable, Patch Panel, IOs& Patch Cords. All components of the structured cabling system shall be from the same OEM manufacturer. As per structure cabling, ELV Sub-Contractor should have to consider maximum 90 meter CAT 6A cable length from rack side patch panel to LAN I/O.	
i.	Standards Compliance	F/UTP cabling system, conforming to ANSI/TIA/EIA 568-C.2 CAT6A Cabling system, ISO/IEC 11801-13rd edition, EN-50173-1as amended to date. The cabling system components must be UL listed
ii.	OEM Performance Certification	Performance characteristics shall be provided after installation at site and actual tests conducted at site after installation and commissioning for the following parameters: Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR for 4-connector channel. The site will be duly certified by OEM for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier, for which they shall submit detailed performance test reports for every IO installed.

		The cable shall be tested for minimum guaranteed performance as per standards at 500MHzoperation minimum.
iii.	OEM Requirement	All passive cabling must be from same OEM (UTP, F/UTP and Fibre)
	F/UTPCAT6A	
	Standards Compliance	As per i) above under F/UTP CAT6A Cabling System
	Conductors	23 AWG solid bare copper
	Construction and mechanical details	Polyethylene insulation, LSZH jacket, each pair to be individually foiled.
	Operating temperature	-20 Deg. C to +60 Deg. C
	Delay Skew	Not exceeding 45 ns / 120m
	Performance Characteristics	Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR for 4-connector channel, to be submitted with bid
	F/UTPCAT6A I/O Jack	
	Standards Compliance	As per 1.i) above, UL Listed
	Performance Characteristics	ETL Verified 4-Connector Channel to ISO/IEC 11801 AMD 1 Class EA, along with channel illustration, and parts numbers to be submitted along with the bid, options in different colours
	F/UTPCAT6A PATCH PANEL	
	Standards Compliance	As per 1.i) above
	Ports	12/24/48 Ports Angular/Straight (as per BOQ) pre-loaded with shutter for keystone Jacks
	Port arrangement	Individually replaceable jacks or keystone
	Height	1 U (1.75 inches)
	Panel	Fully powder coated
	Approvals	UL listed
	Termination Pattern	TIA / EIA 568 A, B and C;
	Performance Characteristics	ETL Verified 4-Connector Channel to ISO/IEC 11801 AMD 1 Class EA, along with channel illustration, and parts numbers to be submitted along with the bid
	F/UTPCAT6A PATCH CORDS	
	Standards Compliance	As per 1.i) above
	Conductor	24-26 AWG, multi-stranded copper, UL Listed
	Length	1 Meter, 2 Meter, 3 Meter options in different colours
	FACEPLATES	
	Type	1-port, 2 -port or 4-port, White Face plate
	Material	ABS / UL 94 V-0
	No. of ports	One/ Two / Four

FIBER OPTIC CABLE AND COMPONENTS

SPECIFICATIONS OF SINGLE MODE FIBER OPTIC CABLING SYSTEM:		
	Type	Single mode OS2 fiber cabling system and all its components; must be from a single OEM (Cables + Components)
	Networks Speeds Supported	1Gbps, 10Gbps and 40Gbps
	Standard Compliance	ITU-T G.652A, B, C & D, IEC - 60793-2-50, TIA/EIA 568-C.3
	Performance Testing	Fiber channel compliance to ANSI/TIA568 -C.0 forOS2
	OEM Performance Certification	The site will be duly certified by OEM for a period of 20 years from the date of issuance of the registration certificate or installation, whichever is earlier, for which they shall submit detailed performance test reports for every IO installed and OTDR test report

SPECIFICATIONS FOR SINGLE MODE OPTICAL FIBER CABLE:		
	Cable Type	12 core/ 6 core as applicable as per BoQ, Single Mode, OS2 Type, Armored, Loose- unitube for 6 and 12 core
	Fiber Type	Single Mode, 9 / 125
	Fiber core must be	As per Telecordia GR20, ITU-T G652D, IEC-60793-2-50, TIA/EIA 492-CAAB
	No of cores	12 core / 6 core as applicable as per BoQ-ISO 11801 -OS2
	Armor	Corrugated steel tape armour
	Cable Construction Type	Loose tube corrugated steel tape armored cable, provided with FRP non-metallic central strength member
	Outer Jacket Construction	High density polyethylene, anti - termite, anti - rodent suitable for direct burial application. Jacket must be UV stabilized
	Losses @ 1312nm frequency	< = 0.4 dB/Km
	Losses @1550nm frequency	< = 0.3 dB/Km
	Operating Temperature	-20 deg C to + 60 deg C
	Cable / Component	All fiber cables and components must be from a single OEM (Including F/UTP CAT6A Cabling System)
	Testing Parameters	Must pass the following: -IEC794-1-E1, IEC794-1-E2, IEC794-1-E3, IEC794-1-E4, EIA-455-124, IEC794-1-E7, IEC794-1-E12, IEC794-1-E11, IEC794-1-F5
	Multi-channel capability	The fiber cable must have been designed to provide optimum performance from 1265nm to 1625nm making it suitable for 16 –channel Course Wavelength Division Multiplexing (CWDM) Applications.

SPECIFICATIONS FOR CONNECTORS:		
	Connector Type	LC-Style, Duplex
	Operating temperature	-20 deg C to + 50 deg C
	Durability	(500 Matting's): < 0.2 dB Max
	Ferrules	Pre-radius Ceramic Zirconia Ferrule. Bayonet Coupling: 2.5 mm

		Zirconia Ferrule
	Attenuation	Not more than 0.75 dB per mated pair
	Parameters / standard	Meets or exceeds ITU specifications

SPECIFICATIONS FOR PIGTAILS:		
	Type	LC style, SM OS2as required. Simplex, lengths of 1,2 & 3meters, compliant to ITU-G657.B - Bend Insensitive Fiber
	Operating temperature	-20 deg C to + 50 deg C
	Durability	(500 Matting's): < 0.2 dB Max
	Ferrules	Pre-radius ceramic Zirconia ferrule. Bayonet coupling: 2.5 mm Zirconia ferrule
	Attenuation	Not more than 0.75 dB per mated pair
	Parameters / standard	Meets or exceeds ITU specifications UL Listed

SPECIFICATIONS FOR FIBER OPTIC CABLE PATCHCORDS:		
	Cable type	LC-LC style, SM OS2 as required. -Simplex or duplex patch cord with lengths of 1, 2 & 3 meters. Compliance to ITU-G657.B - Bend Insensitive Fiber
	Fiber type	Single mode 9/125-micron primary coated buffers
	No of cores	2 cable construction type PVC outer jacket
	Outside Diameter	1.6mm x 3.0mm (Simplex) or 1.6mm x 3.3mm(Duplex)
	Operating Temperature	-20 deg C to + 60 deg C

SPECIFICATIONS FOR 19" RACK MOUNTED FIBER OPTIC PATCH PANELS		
	Fiber optic patch panel	19-inch, rack mounted fiber optic patch panel
	Height	1U
	Number of fiber cores	12 core configurations
	Number of OSP (outdoor) cables for termination	Minimum 2
	Grounding	2 Nos. of earthing lugs
	Cable Management rings	Front and rear cable management rings
	Adapter plates	12 Port adapter plates with each plate loaded with single-mode couplers, as applicable
	Construction	Complete Aluminum alloy housing, fully powder coated
	Splice tray	Shall be included in LIU

SPECIFICATIONS FOR ADAPTOR PLATES & ADAPTORS:		
	Fiber Optic adapter plate	12 port/6-port, SC or LC style
	Attenuation	Max of 0.75 dB per mated pair
	Adapters	Available in Simplex and Duplex types
	Durability	< 0.2 dB max (Min 500 and upto 1200 Matting cycles)
	Standard	Compliant as per EIA/TIA 568-B and ISO/IES 11280

SPECIFICATIONS FOR EXTERNAL FIBER OPTIC ENCLOSURE:		
	No of fiber core terminations	12 ports/6-port
	Features	Easy and fast-to-fix for fiber cable termination, IP-68 Rated
		Easy to re-enter, it should not require re-entry kits
		Fiber optic splice tray must be designed in snap in lock & easily fixable way.
		Must meets fire codes and industry standards
		Should prevent cable sheath movement with temperature changes

Fiber Joint Enclosure (IP 68 Rated)

Enclosure	It Shall be a butt type enclosure with a dome and base (IP 68 Rated)
Cable Entry	The Cable entries shall be through the cable ports located in the base.
Dome & Base	The dome and base shall be sealed using a clamp with O-ring system. The cable entry ports should be sealed mechanically and no need of added tools for cable Installation.
General Specifications	a) IP68 Rated b) No. of Splice trays: 6 nos. c) Splice Tray Capacity: 24 Fibers d) No. of cable entry ports: 4 round ports and 1 oval port.
Closure	a) The closure should have the capability to accommodate loop cables (un cut loose tube cables) b) The cables should be secured to the closure using hose clamps and a cable attachment device. c) The closure should have a basket for storing loose tubes.

48/24/12 Sliding Fiber Shelf

Specifications & Standard Compliance	
Type of Fiber Shelf	Shall accommodate 4 coupler plates or 4 pigtail cassettes for a total of 48 fiber terminations.
Width	The width shall be 19 inches and height of 1U (1.75 inches), with a maximum of 18 inch depth.
Sliding type	The shelf/LIU shall be sliding.
Intelligent Upgradable	The Fiber shelf must be intelligent ready and must support field upgrade to intelligent fiber panels without removal of existing patch cords and without disruption of network services.
Splice trays	Shall have splice trays to splice minimum 32 fibers.

12 Fiber Single mode Fiber Pigtail Cassettes

Specifications & Standard Compliance	
Type	Shall be Single mode OS2, zero water peak fiber.
Standards Compliance	G.652.D, G.657.A1 and OS2
Regulatory Compliance	RoHS 2011/65/EU

Safety Standard	UL
Number of Fibers	12
Interface, Front	LC
Adapter Color:	Blue
Optical Performance	a) Insertion Loss Change, mating: 0.30 dB b) Insertion Loss Change, temperature: 0.30 dB c) Insertion Loss, Typical: 0.30 dB d) Return Loss, Min: 55.0 dB
Pigtail Environmental Specifications	Environmental Space: Plenum Operating Temperature: -12 degree Celsius to +60 degree Celsius Cable Retention Strength, Max: 1.00 lb @ 0 degree, 1.00 lb @ 90 degree Ferrule Geometry: Pre-radiused Ferrule Material: Zirconia
Optical Components Standard:	ANSI/TIA-568-C.3

LC – LC Single mode LSZH Patch Cords

Specifications & Standard Compliance	
Type	Shall be Singlemode (OS2), zero water peak, LC to LC, Fiber patch cords.
Standards Compliance	G.652.D, G.657.A1 and OS2
Regulatory Compliance	RoHS 2011/65/EU
Jacket	Low Smoke Zero Halogen (LSZH) compliant to IEC 60332-3, IEC 60754-2, IEC 61234-2, IEEE 383, UL 1666, UL 1685
Flame Test Listing	NEC OFNR-LS (ETL) and c(ETL)
Cable Qualification Standards	ANSI/ICEA S-83-596 and Telcordia GR-409
Optical Components Standard	ANSI/TIA-568-C.3
General Specifications	Connector Color: Blue Connector Interface: LC Operating Temperature: -12 degree Celsius to +60 degree Celsius
Connector Optical Performance	Insertion Loss, Typical: 0.20 dB Return Loss, minimum: 55.0 dB Insertion Loss Change, mating: 0.30 dB Insertion Loss Change, temperature: 0.30 dB

19"WALL MOUNTED NETWORKING ENCLOSURES (9U TO 15U USABLE HEIGHTS)

- Construction shall be single section welded robust with ventilation holes on the sides and top & bottom covers with provision to mount 2 fans
- Top/ Bottom covers and side panels shall be of sheet steel, powder coated
- Vertical 19" metric panel mounts and door trims shall be of sheet steel and powder coated

- The top and bottom covers shall be provided with four cut outs on top and bottom cover for cable entry and round cuts shall be edge protected with rubber grommets
- Two pairs of 19" equipment mounting angles with mounting holes conforming to IEC 297-3
- Toughened glass front lockable door
- Wall mounted 19" Networking rack shall be available in various heights
- Cooling shall be achieved with the help of two fans, 90 CFM capacity each, mounted on top
- Power shall be provided in form 19" rack mountable power strip which shall consist of minimum four 5/15A power sockets. Power strip shall be provided with 20A MCB
- Cantilever shelf – at least one front mounting 1U cantilever shelf shall be provided with depth of 250 mm or more
- 1U vertical cable managers on as required for dressing of cables for 12/24/48 ports patch panel and switch Hardware Pack / Rack mounting accessories and hardware – as required
- Horizontal managers on as required basis for ensuring neat and aesthetically clean installation
- Cabinet material – cabinet shall be made of 16 Gauge (1.5mm) thick cold rolled steel sheets or thicker
- Finish – cabinet shall be black or grey epoxy powder-coated of durable quality
- Load carrying capacity – min. 25 kg load of equipment should be mountable
- Product must be UL listed and certified for use in Information Technology or Communication Equipment
- EIA standard pattern design with 12-24 tapped holes (EIA-312-E compliant)

19" FLOOR STANDING NETWORKING ENCLOSURES (22U TO 42U USABLE HEIGHTS)

- Frame of sturdy frame section construction, consisting of 9 x folded rolled hollow frame section punched in 25mm DIN pitch pattern. All profile edges are radiuses. The corners are stiffened with welded zinc die-cast corner connectors, Front and rear perforated door. Top cover with cable entry and Bottom open. 42 U 19" L type angle Front & Rear on 6 x punched section. Cabinet color should be Black and light grey
- The Thickness of the CRCA sheets used for Doors is 1.5mm and for Side Panels is 1.5mm
- Fully adjustable 19" equipment mounting angles
- The cabinet design confirming to DIN 41494 or EIA 312D standards
- Top and Bottom Covers and Side panels shall be of sheet steel and Primary Dip Coat = 20-30 Microns Power Coat = 80-120 Microns

- Vertical 19" metric panel mounts and door trims shall be of sheet steel and powder coated
- The Top cover with min. 4 cut out of diameter 120mm or more for cable entry. Bottom cover with 4 cut out of diameter 120mm or more for cable entry. All cut outs blanked with plastic caps
- Perforation - for full / split perforated doors the style should be" Honeycomb" type of perforation for maximum air circulation and stiffness. Doors should have min. 75% perforation for better air Circulation
- Cabinet shall be capable of dismantling and reassemble at the site
- Locks options – options shall be available such as slam lock - common key or unique key, Swing
- handle lock, Digital Keypad operated locks, Biometric locks
- Side panels – must contain slam latches for locking purpose and option of providing slam locks, or screw fitted for removal, if required
- Two pairs of 19" Equipment mounting angles with mounting holes conforming to IEC 2973
- Front glass door made of toughened glass, tinted with easily detachable hinges, lockable type.
- Two pairs of slotted vertical cable channel shall be provided at front and back for managing cables
- Lockable industrial grade castors with foot brakes
- Rack shall be supplied with 4 x 90 CFM fans at top
- Rack shall be supplied with equipment mounting hardware in pack of 20s such as mounting nuts and screws either 12-24 or M6 type as applicable
-
- Minimum 2 nos. of 8 x 5/15 Amps power supply sockets, 2 nos. of vertical cable managers and 2 no. of 19" 1U size horizontal cable managers
- Finish – cabinet shall be black or grey epoxy powder-coated of durable quality. The Powder coating of the racks is as per Nano coated, electro-dip coat primed to 20 microns, and power coated with texture polyester with 80 to 120 microns for long lasting paint against corrosion
- Product must be UL listed and certified for use in Information Technology or Communication Equipment
- EIA standard pattern design with 12-24 tapped holes (EIA-312-E compliant) or EIA standard pattern design with 3/8" (9.5mm) square punches for Cage Nuts for mounting.

SPECIFIC REQUIREMENT TO THE SOLUTION

a. Supply, installation, testing and commissioning of networking components for
b. providing LAN in new Upcoming buildings of IIT Hyderabad.
c. The solution includes
    i. Supply, installation, including necessary cabling, testing, commissioning, and documentation.

ii. Integration with the existing environment and
iii. Three years warranty.

d. Network operational centre (NOC) is in Academic block A. OFC connectivity from NOC to these building should be in star topology.
e. Solution should include a distribution switch
f. Connectivity between distribution switch to access switches should be in star topology for all buildings.
g. All access switches Non-PoE should support stacking.
h. Building to Building connectivity should be with single mode (SM) OFC
i. Switch to switch connectivity within the building should be with Multimode (MM) OFC

SCOPE OF WORK

Supply, installation, testing and commissioning of Active and passive components for establishing Network Infrastructure in IIT Hyderabad campus.

- The bidder should submit and follow the Detailed Project report (DPR) for the cabling routing plan, labeling of the cabling infrastructure and the documentation of the cabling infrastructure for maintenance & handing over to the IIT Hyderabad.
- The bidder should submit a separate HLD / LLD document which is validated by the OEM.
- Performance testing of laid Fiber Optic cable by OTDR for continuity, length & db loss.
- The LAN IP addressing, creation of in building VLAN for segregation between users, configuration for all the LAN security issues will be carried out by the successful bidder (wherever required).
- All the switch & IP addressing scheme need to be documented for maintenance purposes.
- The scope of work also includes supply and services that are necessary to lay & terminate OFC cable.
- Preparation of cable route survey drawings.
- Labeling of Cables, I/Os, Patch Panel, Switches
- Repair/Refurnishing work owing to damage caused due to cabling or any other work related to this Project. There should not be any hanging or uncovered wire.
- Patch cords should be branded, and factory crimped.
- Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment's and/or needed for erection, completion and safe operation of the equipment's as required by applicable codes though they may not have been specifically detailed in the tender document, unless included in the list of exclusions. All similar standard components/parts of similar standard equipment's provided, shall be interchangeable with one another.
- The successful Bidder shall be responsible for providing all materials, equipment's, necessary software, licenses, drivers and services, specified or otherwise, which are required to fulfill the intent of ensuring operability, maintainability, and reliability of the complete equipment covered under this specification within the quoted price. This work shall be in compliance with all applicable standards, statutory regulations and safety requirements in force on the date of award of this contract. All the safety measures should be taken for the protection of cables and devices from LI and other such sources.
- The scope covers design/development of a suitable architecture/layout of the proposed networking system, preparation of bill of materials, pre-dispatch/ inspection / testing, packing and forwarding, transportation, insurance and carrying out further activities at viz. unloading, storage, (space to be

provided by IITH) further handling, erection, testing and commissioning including successful completion of acceptance tests and any other services specified.

- Testing of LAN Cables and Fiber Optic after laying, terminations and ferruling at both the ends. All testing tools and instruments shall be brought by the contractor and taken back after the testing.
- Integration with existing setup.
- Entire networking infrastructure must be IPV6 & IPV4 Compliant
- The installation of equipment's shall be accepted only after successful commissioning and testing are over and certified by the designated team of IITH
- The successful bidder should ensure that during installation of LAN, day-to-day functioning of official work should not get disrupted.
- The bidder's proposal shall include the list of tools (such as crimping tool, Krone punch tool, standard fiber optic installer tools etc.) and other accessories, which are required for installation of the Project. No separate charges for fixing/crimping/terminating/other connection charges would be paid by IITH.
- The Contractor shall be responsible for obtaining necessary clearances for excavation work from the respective buildings and provide requisite copies of information, maps, survey report etc to the authorities. The IITH shall assist the Contractor in obtaining such clearances.
- Bidders are required to submit the make and model of proposed equipment with detail data sheets.
- All equipment should be latest models with no End of Life for at least five years from date of commissioning.
- Successful bidder is required to submit the drawing of installed network.
- Distribution Switches on each site should have redundant power supply.
- Acceptance Parameters
- Site acceptance tests to establish satisfactory performance of the equipment's as per specifications.
- The successful bidder must implement the solution at the site and complete the necessary integration of the solution with the core network infrastructure deployed at IIT Hyderabad and demonstrate the performance of the deployed infrastructure to the technical committee.
- The warranty services will start only after installation and commissioning of the complete solution.

TECHNICAL SPECIFICATIONS

Notes:

- All proposed distribution switches, Access switches, must be manageable and of enterprise class.
- Cisco/HPE(Aruba) or equivalent makes are preferred.
- Cisco SMB switches and HP office connects are not admissible.
- The equipment supplied must support the below specifications.

Distribution Switch:

	Specifications
	Architecture
	Should have min 16 autosensing 1200/12000 SFP+ ports.
	Shall be 19" Rack Mountable
	Switch should have support for 25/40/50 G uplink for future upgrade without changing hardware.
	The switch should have one Rj-45/USB-micro-B console port and RJ45 management port
	8GB SDRAM, 16 GB of Flash Memory and 8 MB Packet buffer size
	Shall have switching capacity up to 480 Gbps

	Shall have up to 360 million pps switching throughput or higher
	The Switch should support min 32000 MAC address
	Should support stacking or equivalent Virtual chassis technology to group min 2 switches. Stacking modules and cables to be provided from day 1"
	Features
	The switch should support HTTP redirect function
	Should Support Network Visibility and Analytical Capability
	Quality of Service (QoS)
	The switch should support Traffic prioritization (IEEE 802.1p) to allows real-time traffic classification into eight priority levels mapped to eight queues
	The switch should support Layer 4 prioritization to enable prioritization based on TCP/UDP port numbers
	The switch should support Class of Service (CoS) to sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ
	The switch should support Rate limiting to sets per-port ingress enforced maximums and per-port, per-queue minimums
	The switch should have Modular operating system
	IPv6 Feature
	The switch should support IPV6 host to enable switches to be managed in an IPv6 network
	The switch should support Dual stack (IPV4 and IPV6) to transition from IPv4 to IPv6, supporting connectivity for both protocols
	The switch should support MLD snooping to forward IPv6 multicast traffic to the appropriate interface
	The switch should support ACL with min 1200 access control entries (Ingress) and QoS for IPv6 network traffic.
	Security
	The switch should support RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping
	The switch should have Energy-efficient design
	The switch should support Energy-efficient Ethernet (EEE) to reduce power consumption in accordance with IEEE 802.3az
	The switch should support very low latency, increased packet buffering, and Optimum power consumption
	Selectable queue configurations
	The switch should have facility to allow for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network applications
	Convergence
	The switch should support IP multicast routing and PIM Sparse and Dense modes to route IP multicast traffic
	The switch should support IP multicast snooping and data-driven IGMP.
	The switch should support LLDP-MED (Media Endpoint Discovery)
	The switch should support IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
	The switch should support Local MAC Authentication
	Resiliency and high availability

	Switch should have Hot Swappable redundant Power Supply from day 1 Include Power supply units and Power cords Indian Standard
	The Switch should create one virtual resilient switch from two or more switches and attached the network devices using standard LACP for automatic load balancing and high availability to simplify network operation by reduce the need for complex protocols like Spanning Tree Protocol (STP), Equal-Cost Multipath (ECMP), and VRRP
	The switch should support IEEE 802.1s Multiple Spanning Tree
	The switch should support IEEE 802.3ad link-aggregation-control protocol (LACP) and port trunking
	The switch should provide easy-to-configure link redundancy of active and standby links
	Management
	Should support Configuration validation and config check capability as part of a solution.
	The switch should support SNMPv1, v2, and v3
	Layer 2 switching
	The switch should support IEEE 802.1Q (4094 VLAN IDs) and 1200 VLANs simultaneously
	The switch should support Jumbo packet support
	The switch should support IEEE 802.1v/802.1Q protocol VLANs
	The switch should support Rapid Per-VLAN Spanning Tree (RPVST+)
	The switch should support GVRP and MVRP
	The switch should support encapsulation (tunneling) protocol for overlay network that enables a more scalable virtual network deployment
	Layer 3 services
	The switch should support DHCP server
	The switch should support DHCP relay agent
	Layer 3 routing
	The switch should support minimum 16000 unicast routes
	The Switch should support VXLAN
	The switch should support OSPFv2, OSPFv3 and BGP4 protocols for routing between access and the next layer on the LAN.
	Switch should have Hot Swappable redundant Power Supply from day 1 and should have hot swappable fan tray
	The switch should support Policy-based routing
	Security
	The switch should support IEEE 802.1X
	The switch should support Web-based authentication
	The switch should support MAC-based authentication
	The switch should support Multiple IEEE 802.1X users per port
	The switch should support Concurrent IEEE 802.1X, Web, and MAC authentication schemes per port and accept up to 32 sessions of IEEE 802.1X, Web, and MAC authentications. The switch also should support Sflow/Jflow/ Net flow or equivalent.
	The switch should provide IP Layer 3 filtering based on source/destination IP address/subnet and source/destination TCP/UDP port number
	The switch should support Source-port filtering
	The switch should support RADIUS/TACACS+
	The switch should support Secure shell.
	The switch should support Secure Sockets Layer (SSL)

	The switch should support Port security
	The switch should support MAC address lockout
	The switch should support Secure FTP
	The switch should support Switch management logon security
	The switch should support STP BPDU port protection
	The switch should support DHCP protection
	The switch should support Dynamic ARP protection
	The switch should support STP root guard
	The switch should support Identity-driven ACL
	The switch should support Per-port broadcast throttling
	The switch should support Private VLAN or equivalent
	Environmental Features
	Operating temperature of 0°C to 40°C
	Safety and Emission standards including EN 60950; IEC 60950; VCCI Class A; FCC Class A
	Warranty and Support
	The below Warranty shall be offered directly from the switch OEM.
	Vendor should provide 3 years warranty which will provide NBD advance hardware replacement and24x7x365 days a year online TAC support. A proof of this offering to be submitted
	Software upgrades/updates shall be included as part of the warranty
	All above mentioned features should be available from day 1. Any license required to be factored from day 1
	The Proposed Switches, transceivers, wireless, equipment's and NMS shall be from the same OEM.
	OEM Criteria
	The OEM shall be consistently present in Leaders or Challengers quadrant in Gartner's Magic Quadrant for Wired and Wireless LAN Access Infrastructure for last three years
	Switch / Switch's Operating System should be tested for EAL2/NDPP or above under Common Criteria Certification.

48 Port Access Switch

	Specifications
	Architecture
	48 x ports 12/120/1200 Base T ports and minimum 4 SFP+1/12GbE or more
	Shall be 19" Rack Mountable
	The switch should have RJ45 management port / USB-micro-B console port
	Min of 2 GB SDRAM, 4GB of Flash Memory and min 6 MB Packet buffer size or more or sufficient DRAM, Flash & Buffer to be provided from Day1
	Shall have switching capacity of minimum 176 Gbps or more
	Shall have up to 130 million pps switching throughput or More
	The Switch should support min 16000 MAC address
	Quoted 24 port POE / 24 port non-POE / 48 port non-POE switches should support stacking with one other from day 1 with minimum of 4 Switches in a stack and stacking modules and cables to be provided from day one for POE switches only.
	The Switch should support VXLAN
	Features

	The switch should support HTTP redirect function
	Solution should Support Network Visibility and Analytical Capability
	Quality of Service (QoS)
	The switch should support Traffic prioritization (IEEE 802.1p) to allows real-time traffic classification into eight priority levels mapped to eight queues
	The switch should support Layer 4 prioritization to enable prioritization based on TCP/UDP port numbers
	The switch should support Class of Service (CoS) to sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ
	The switch should support Rate limiting to sets per-port ingress enforced maximums and per-port, per-queue minimums
	IPv6 Feature
	The switch should support IPV6 host to enable switches to be managed in an IPv6 network
	The switch should support Dual stack (IPV4 and IPV6) to transition from IPv4 to IPv6, supporting connectivity for both protocols
	The switch should support MLD snooping to forward IPv6 multicast traffic to the appropriate interface
	The switch should support ACL with 1200 access control entries (Ingress) and QoS for IPv6 network traffic
	Security
	The switch should support RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping
	The switch should have Energy-efficient design
	The switch should support Energy-efficient Ethernet (EEE) to reduce power consumption in accordance with IEEE 802.3az
	The switch should support very low latency, increased packet buffering, and Optimum power consumption
	Selectable queue configurations
	The switch should have facility to allow for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network applications
	Convergence
	The switch should support IP multicast routing and PIM sparse and dense modes to route IP multicast traffic
	The switch should support IP multicast snooping and data-driven IGMP
	The switch should support LLDP-MED (Media Endpoint Discovery)
	The switch should support IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
	The switch should support Local MAC Authentication
	Resiliency and high availability
	The switch should support IEEE 802.1s Multiple Spanning Tree
	The switch should support IEEE 802.3ad link-aggregation-control protocol (LACP) and port trunking
	The switch should provide easy-to-configure link redundancy of active and standby links
	Management
	The switch should support automation and programmability using built-in Python scripts.
	The switch should support SNMPv1, v2, and v3

	The switch also should support Sflow/Jflow/ Net flow or equivalent
	Layer 2 switching
	The switch should support IEEE 802.1Q (4094 VLAN IDs) and min 120 VLANs simultaneously
	The switch should support Jumbo packet support
	The switch should support IEEE 802.1v/ 802.1Q protocol VLANs
	The switch should support Rapid Per-VLAN Spanning Tree (RPVST+)
	The switch should support GVRP and MVRP
	The switch should support encapsulation (tunneling) protocol for overlay network that enables a more scalable virtual network deployment
	Security
	The switch should support IEEE 802.1X The switch should support Web-based authentication The switch should support MAC-based authentication The switch should support Multiple IEEE 802.1X users per port The switch should provide IP Layer 3 filtering based on source/destination IP address/subnet and source/destination TCP/UDP port number The switch should support Source-port filtering The switch should support RADIUS/TACACS+ The switch should support Secure shell The switch should support Secure Sockets Layer (SSL) The switch should support Port security The switch should support MAC address lockout The switch should support Secure FTP The switch should support Switch management logon security The switch should support STP BPDU port protection The switch should support DHCP protection The switch should support Dynamic ARP protection The switch should support STP root guard The switch should support Identity-driven ACL or equivalent The switch should support Per-port broadcast throttling The switch should support Private VLAN or equivalent All above mentioned features should be available from day 1. Any license required to be factored from day 1
	Environmental Features
	Shall support IEEE 802.3az Energy-efficient Ethernet (EEE) to reduce power consumption Operating temperature of 0°C to 45°C Safety and Emission standards including EN 60950; IEC 60950; VCCI Class A; FCC Class A
	OEM Criteria
	The OEM shall be consistently present in Leaders or Challengers quadrant in Gartner's Magic Quadrant for Wired and Wireless LAN Access Infrastructure for last three years Switch / Switch's Operating System should be tested for EAL 2/NDPP or above under Common Criteria Certification.

24 Port Access Switch

	Specifications
	Architecture
	24 RJ-45 autosensing 12/120/1200 ports and fixed 4 SFP+. Shall be 19" Rack Mountable The switch should have RJ45 out of band management port and RJ-45/USB-micro-B console port Min of 2 GB SDRAM, 4GB of Flash Memory and min 6 MB Packet buffer size or more or sufficient DRAM, Flash & Buffer to be provided from Day1 Shall have switching capacity of minimum 128 Gbps or more Shall have up to 95million pps switching throughput or More The Switch should support min 16000 MAC address Quoted 24 port POE / 24 port non-POE / 48 port non-POE switches should support stacking with one other from day 1 with minimum of 4 Switches in a stack and stacking modules and cables to be provided from day one for POE switches only.
	Features
	The switch should support HTTP redirect function Solution should Support Network Visibility and Analytical Capability
	Quality of Service (QoS)
	The switch should support Traffic prioritization (IEEE 802.1p) to allows real-time traffic classification into eight priority levels mapped to eight queues The switch should support Layer 4 prioritization to enable prioritization based on TCP/UDP port numbers The switch should support Class of Service (CoS) to sets the IEEE 802.1p priority tag based on IP address, IP Type of Service (ToS), Layer 3 protocol, TCP/UDP port number, source port, and DiffServ The switch should support Rate limiting to sets per-port ingress enforced maximums and per-port, per-queue minimums The switch should have Modular operating system
	IPv6 Feature
	The switch should support IPV6 host to enable switches to be managed in an IPv6 network The switch should support Dual stack (IPV4 and IPV6) to transition from IPv4 to IPv6,

	supporting connectivity for both protocols The switch should support MLD snooping to forward IPv6 multicast traffic to the appropriate interface The switch should support ACL with 1200 access control entries (Ingress) and QoS for IPv6 network traffic
	Security
	The switch should support RA guard, DHCPv6 protection, dynamic IPv6 lockdown, and ND snooping The switch should have Energy-efficient design The switch should support Energy-efficient Ethernet (EEE) to reduce power consumption in accordance with IEEE 802.3az The switch should support very low latency, increased packet buffering, and Optimum power consumption Selectable queue configurations The switch should have facility to allow for increased performance by selecting the number of queues and associated memory buffering that best meet the requirements of the network Applications
	Convergence
	The switch should support IP multicast routing and PIM Sparse and Dense modes to route IP multicast traffic The switch should support IP multicast snooping and data-driven IGMP The switch should support LLDP-MED (Media Endpoint Discovery) The switch should support IEEE 802.1AB Link Layer Discovery Protocol (LLDP) The switch should support Local MAC Authentication
	Resiliency and high availability
	The switch should support IEEE 802.1s Multiple Spanning Tree The switch should support IEEE 802.3ad link-aggregation-control protocol (LACP) and port trunking The switch should provide easy-to-configure link redundancy of active and standby links
	Management
	The switch should support automation and programmability using built-in Python scripts. The switch should support SNMPv1, v2, and v3 The switch also should support Sflow/Jflow/ Net flow or equivalent

	Layer 2 switching
	The switch should support IEEE 802.1Q (4094 VLAN IDs) and min 120 VLANs simultaneously The switch should support Jumbo packet support The switch should support IEEE 802.1v protocol VLANs The switch should support Rapid Per-VLAN Spanning Tree (RPVST+) The switch should support GVRP and MVRP The switch should support encapsulation (tunneling) protocol for overlay network that enables a more scalable virtual network deployment
	Layer 3 services
	The switch should support DHCP server
	Layer 3 routing
	The Switch should support VXLAN The switch should support OSPFv2, OSPFv3 protocols for routing between access and the next layer on the LAN.
	Security
	The switch should support IEEE 802.1X The switch should support Web-based authentication The switch should support MAC-based authentication The switch should support Multiple IEEE 802.1X users per port The switch should provide IP Layer 3 filtering based on source/destination IP address/subnet and source/destination TCP/UDP port number The switch should support Source-port filtering The switch should support RADIUS/TACACS+ The switch should support Secure shell The switch should support Secure Sockets Layer (SSL) The switch should support Port security The switch should support MAC address lockout The switch should support Secure FTP The switch should support Switch management logon security The switch should support STP BPDU port protection The switch should support DHCP protection The switch should support Dynamic ARP protection The switch should support STP root guard The switch should support Identity-driven ACL The switch should support Per-port broadcast throttling The switch should support Private VLAN or equivalent
	Environmental Features
	Shall support IEEE 802.3az Energy-efficient Ethernet (EEE) to reduce power consumption Operating temperature of 0°C to 45°C

	Safety and Emission standards including EN 60950; IEC 60950; VCCI Class A; FCC Class A
	Warranty and Support
	The below Warranty shall be offered directly from the switch OEM. Vendor should provide 3 years warranty which will provide NBD advance hardware replacement and24x7x365 days a year online TAC support. A proof of this offering to be submitted Software upgrades/updates shall be included as part of the warranty The Proposed Switches, transceivers, wireless, equipment's and NMS shall be from the same OEM. All above mentioned features should be available from day 1. Any license required to be factored from day 1
	OEM Criteria
	The OEM shall be consistently present in Leaders or Challengers quadrant in Gartner's Magic Quadrant for Wired and Wireless LAN Access Infrastructure for last three years Switch / Switch's Operating System should be tested for EAL 2/NDPP or above under Common Criteria Certification.

SMF 12 Transceiver

Specification	
Speed	**12Gbps**
Type	**Single mode**
Connection	LC
OEM	Same as Switch OEM
Distance	12 KM

MMF 12G Transceiver

Specification	
Speed	**12Gbps**
Type	**Multimode**
Connection	LC
OEM	Same as Switch OEM
Distance	550 meters

SMF 1G Transceiver

Specification	
Speed	**1Gbps**
Type	**Single mode**
Connection	LC
OEM	Same as Switch OEM
Distance	12 KM

As per the above proposed scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including related calculations (if any), supporting documents and SLD in accordance with the relevant codes.

Scope of work and Technical specifications for Water Supply Pumping System:

WATER PUMPING SYSTEMS:

Sl. No.	Name of the Building	No. of Floors	No.of Blocks/ Buildings	Domestic Water Pump System.	Flush Water Pump System
1	New Campus School Building at IITH	G + 1	1	1 W + 1 S	1 W + 1 S

The scope of work includes Planning, designing, preparation of drawings, obtaining approvals from statutory bodies (if applicable), third party vetting, obtaining approval of the Department, supply, installation, testing and commissioning of water supply pumping system consisting of domestic water supply pump sets and flushing water supply pump sets (combination of one working and one stand by separately for each type of water supply i.e., domestic water supply and flushing water supply). Domestic water supply pump sets and flushing water supply pump sets are of smooth operation drive based, Surface Monoblock/open well submersible type (centrifugal) of pump sets. Execution of work as per the approved design and drawings and directions of Engineer-In-Charge.

The selection of capacity and discharge of Domestic water supply pump sets should be such that the minimum discharge of each pump at desired height shall be designed so as to fill the terrace tanks on the building within One (1) hours' time through one working pump.

Similarly, the flushing water pump sets capacity and minimum discharge shall be designed considering to transfer the treated water received from STP Plant (specifically treated water tank) to terrace overhead tank meant for flushing/ gardening purpose and to fill the same within 30 min. time, combination of one working and one stand by separately for each building. This includes Electrical control- panels with incoming and outgoing MCBs, starters with dry run protection, Automatic cut off for Pump and auto start as per water level controllers for automatic operation of pumps between OH tank and UG Sump/STP treated water tank , incoming and outgoing XLPE insulated and PVC sheathed aluminium/ copper conductor armoured cables (Up to 16 sqmm size cable shall be with copper conductor) of appropriate rating including laying and connections/terminations at both pumps and panels ends, earthing and loop earthing etc. as per CPWD specifications as amended up to date and additional conditions/ specifications of this Sub head.

The scope of work includes Supplying, Installation, Testing, Commissioning, handover and training of water pumping system for the campus as per the actual requirement at site.

The requirement of pumping shall be described as below:
(i)For new Bldgs., the new UG sump near BLDG. shall be constructed of appropriate capacity. That UG sump shall be having 2 Nos (1W+1S) pump-sets responsible for feeding the OH water tank of individual bldg. From OH Tank water shall be feed to each discharge point through gravity. Pumps shall be designed to fill the OH tank in one hour duration. Accordingly, each pump shall fill the OH tank in one hrs.

(ii) STP treat water tank shall be having 2 Nos (1W+1S) for pump-sets responsible for feeding the water to flush tank of individual block. Capacity shall be sufficient to feed all the flush tanks in 30 min.

(iii) The pump sets of 2 nos (1W+1S) of appropriate capacity to fill the overhead tank. The overhead tanks of capacity as prescribed already in Part A & Part B shall be filled up completely in maximum 1 hour of pump operation. The head and discharge rate of pumps shall be selected accordingly.

(iv) The pump room shall be equipped with 2 Nos (1W+1S) of dewatering pump sets to be installed at the point having lowest level of the pump room at as specified in NIT. The capacity shall be designed to expel out the water in minimum time with level sensors for automatic operation.

(v) All pumps, comprising of multistage/single stage centrifugal pumps (suitable to work in hydro pneumatic system) submersible type or floor mounted type (as per the direction of Engineer- In-charge), booster pumps, valves, piping, cabling, motor control panels with water level indicator with sensor based automatic operation, to fulfil different requirement/utilities of the buildings like drinking, utilities, firefighting system, Wash basin etc. One additional pump of each type and of same capacity shall be provided as stand by.

(vi) The water requirement of the Campus shall be calculated based on the discharge rate of each outlet of the building shall be as per the NBC requirements subjective to GRIHA norms as applicable. The water requirement of the building shall be derived separately based on the requirement of Hot water, domestic water and STP treated water.

- **LEVEL SENSOR & LEVEL CONTROLLER:**

- **SCOPE**

This scope includes providing and fixing water level indicators cum controllers, for pump operations, working on hydrostatic pressure measurement principle made of Stainless Steel for installation in storage tanks, and capable of providing 4 to 20 mA analogue signals compatible with PLC signal inputs, including all wiring and piping as required complete as per working requirements for details of equipment below.
These level sensors and panels are for operating the submersible pumps in the Underground Tanks, for filling of the Terrace Tanks, and the Motorised valves installed at the inlet of the tanks, as the case may be.
The pumps would be provided with their respective starter panels, which have to be integrated with the level sensor panels, and Potential free contacts to monitor On /Off & Trip status.
The scope includes integration of the pump starter panels, electrically actuated butterfly valves and level sensors.
The level sensors would be located in the Terrace tanks and Underground Tanks, and the cabling from the terrace tanks to the submersible pump panel near the Underground tanks and underground tanks to the valves in the site, are included in this scope.
All cabling, wiring, conduiting, etc required for this job are included in the scope.
This scope also includes providing and fixing local level controllers near / on each overhead tank, comprising of control module and level sensor SS guide and float type, to close the Motorised valve (installed at the inlet line of the tank) when the level in the tank is high and open the valve when the level in the tank is low. (The power to this controller shall be provided to the vendor at the installation point).
The scope shall also include one number of bypass assembly including fittings, specials and flanges etc. as required. (The complete set up shall be required to be installed just before the inlet of overhead tank which can be 12 - 15 feet above the roof top terrace level. The contractor should take this into account while quoting. It should be compatible with BMS System.

- **MATERIAL**

The water level indicator shall be designed to operate on hydrostatic pressure measurement principle. The MOC shall be principally of Stainless-steel.
Remote Position Indicator:

a) A 4-20 mA remote position analog signal transmitter shall be provided in the level sensor.
b) The remote position indicator shall continuously indicate the status of the level indicator. Internal wiring for power and control circuits shall be appropriately sized for MOV actuator rating.

c) Each wire shall be identified at both ends using PVC ferrules.
d) The terminal compartment shall be separated from the inner electrical components of the level sensor by means of a watertight seal so that the sensor's electrical components are protected from the ingress of moisture and foreign materials when the terminal cover is removed during installation and maintenance.
e) Contractor shall be solely responsible for the compatibility of the for the selection and sizing of various electrical devices and components in the sensor.
f) The sensor shall be provided with minimum three adequately sized cable entries viz., one for power cable and two for control cables.

All control outputs to MCC panel shall be included as per requirements.
All MCC panels should be provided with pedestals / wall mount facility, and shall be installed.
All MCC Panels shall have weatherproof cabinets with IP - 65 for housing the level controller and electronic unit of level indicator, potential free contact for compatibility with BMS. complete as approved and specified.

- **TESTING**

The sensor shall be tested as per the relevant standard & duly stamped. Test certificate shall be submitted for material & hydraulic testing.
Should the Engineer-In-Charge require, he may ask for a Factory Acceptance Test, and for this the contractor is bound to make the adequate arrangements for the factory visit at no extra charge.

After fixing in the tanks, the system shall be hydraulically tested for 2 working days for any variations in the readings / operation of the solenoid valves. In case of fall-outs the contractor shall rectify/replace sensors / valves at his own cost.

- **PUMP - MOTOR SET**

DESIGN & CONSTRUCTION FEATURES

Two types of pumps i.e. inline vertical multistage or horizontal type centrifugal pump shall be provided. Variable frequency drive shall be provided with all the pumps, with potential free contacts to monitor on/off status & trip status. The pump motor set and shall be suitable for 1Ph or 3 Ph., 230 or 415 V, 50 Hz. AC power supply and having 1450/ 2900 RPM speed. The packaged variable speed water pressure booster station shall be complete with vertical multi stage centrifugal pumps connected in parallel, with high efficiency IE 5 motors, an air-cooled external variable frequency drive, intelligent multi-pump controller, the controller shall be mounted in a control cabinet with an IP 41 enclosure of suitable rating having potential free contacts to monitor On/Off & Trip status with necessary sensors/switches; hot Dipped Galvanised suction and delivery manifolds; isolation ball valves on suction and discharge of each pump; non return valve on discharge side of each pump; hot dip galvanised common base frame; and diaphragm pressure vessel. A dedicated intelligent multi-pump logic controller for control and monitoring of pumps shall be from the pump manufacturer with easy interface graphical 320 X 240 Pixels colour display unit with key function. controller should able to monitor multiple operating parameters (flow, inlet pressure, outlet pressure, instant flow estimation, cumulative flow and speed etc) to calculate best operating algorithm to pump sequence

optimally. Mentioned features should be available, automatic pump alternations for run time equalization, programmable number of starts/stops per hour to prevent pump hunting, Stand by pump selection, pump test run, friction loss compensation, redundant primary sensor for pressure monitoring, soft pressure built-up, log graph display for key parameters, clock program for multiple set point for scheduled system operation. Multi pump controller should have on-board Ethernet facility for BMS. Complete (Skid mounted / wall mounted / floor mounted) electrical control panel comprising of all accessories such as PLCs, pressure switches, pressure transducers, control wiring and any other necessary imports etc. (list to be provided by the vendor). All installations such as electrical wiring from Electrical Panel to Pump panel, civil foundations, etc is included in this scope. The pump shall be installed with isolation gate/ butterfly valve, non-return valve, etc. The detailed specification for pump & motor is as below:
The design and manufacture of the pump shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The pump shall can develop required total head at rated capacity. Impeller shall be closed type and shall be dynamically balanced. The pump shall have non-overloading characteristics. The casing shall be of rigid construction and shall have side suction and side delivery in case of vertical multistage pump and side suction and central delivery in case of horizontal centrifugal pump.

The pump shall have very small length suction and delivery pipe connections which will result in minimum friction loss. Impeller shall be of one piece and shall be of SS CF8 M. The shaft shall be of S.S. and its surface shall be properly finished. Shaft sleeves shall be provided to protect shaft from any damage. Bearing shall be ball or roller type. Mechanical seal shall be provided to avoid any leakage. Pump shall be mounted on a concrete foundation, projecting at least 15 CM above finished floor level. The pumps base shall be set on an anti-vibration pad.
All the parts of the pumps that are in contact with water e.g. shaft, impeller etc. shall be hot dip galvanized or of stainless-steel construction. Pumps shall be so selected that the design duty point is within 5% of the maximum efficiency point. Shut off head shall be 120% of duty point head.
All pumps and motors shall be of minimum vibration and noise level during operation. Vibration isolators shall be provided for all pump sets. Facilities shall be provided to prevent starting of pumps when the water tank is at low water level. An indicator for this low water level alarm shall be provided. Facilities to select which pump to be duty pump and standby pump shall be provided and be interchangeable. Leakage from pump gland shall be drained to the nearest floor waste. Pump shall be driven by directly coupled squirrel cage induction motor having TEFC enclosure, IP 67 protection & shall be of Class F insulation. Pump motors above 7.5 kW shall be equipped with a spacer coupling which allows changing of shaft seals without removing the motor. All poly-phase motors of (capacity >0.375 kW and operating hours >1500 hours/year) shall follow minimum efficiency level as per IS 12615 for energy efficient motors. Pressure vessel of non-corrosive FRP composite construction lined with NSF and/or FDA listed material, like high density polyethylene with fully replaceable polyurethane. Air cell burst pressure of minimum of 5 times the vessel operating pressure and cycle tested for 80,000 cycles with charging connections to discharge pipe line with necessary flanges, gaskets, isolating valves, nuts/bolts etc complete.

- **INSPECTION & TESTING**

The pump shall be offered for visual inspection before dispatch.
Should the Engineer-In-Charge require, he may ask for a Factory Acceptance Test, and for this the contractor is bound to make the adequate arrangements for the factory visit at no extra charge.
Material test certificates for the various pump components shall be furnished for Engineer's approval.

- **SYSTEM DESCRIPTION**

The system operation will be such that the initial small water demand shall be met by the charged diaphragm pressure vessel. When the water demand continues, the system pressure will dip to a pre-set pump cut-in point when the lead pump starts to operate at reduced speed through the variable speed drive. However, if the system pressure be still below the pre-set value, the controller continuously increases pump speed to meet the system demand. When the lead pump is notable to meet the system pressure at full speed, the second pump also starts to operate.

At peak demand all the pumps operate, similarly, if there is a drop-in water demand the duty pump speed starts to reduce, then standby pumps cuts-off, followed by stopping of the duty pump.

The closed diaphragm pressure vessel shall be of polyethylene material with a pressure gauge and isolating valve. The interior shall be of non-toxic lining suitable for use with potable water. The vessel shall be manufactured to conform to ASME pressure vessel code/standards.

The system shall be under the control of a microprocessor-based control panel.

A pressure transmitter shall detect the pressure at the delivery manifold and feedback to the microprocessor control panel via control circuit.

The system shall incorporate a frequency converter or frequency converter motors on the pumps and the pressure transmitter shall register the actual pressure on the discharge side.

The variable frequency drive pumping system shall maintain a constant pressure regardless of the system demand. If there is a drop-in pressure outside the pre-set point, the Variable Frequency Drive (VFD) pump shall start to run until the pressure increases to the pre-set limit, or it will continue to increase the pump speeds to the upper limit of the frequency. If the water system demand still cannot be met, the second pump shall be called in to run, the VFD will then alter the pump speed to meet the pre-set pressure point. If the set point is still unable to be met, the third pump is then activated to run (in case of 3 pumps units).

This shall be achieved by continuously varying the motor speed of the duty pump according to the demand up to a maximum designed capacity.

Under decreasing hydraulic demand, the reverse sequence to the above description shall apply. Alternatively, pumping system shall be with fixed speed drive motor. By getting the signal from microprocessor-based control panel through pressure transmitter, pumps will operate in sequence & vice a versa.

The frequency converter shall be linked to the motor of the duty pump for continuous speed adjustment and ultimately the water delivery shall be maintained at constant pressure at the pre-set value.

- **CONTROL PANEL**

The motor control panel shall be equipped with all the necessary electrical components including a microprocessor control unit and a frequency drive. The control panel and the microprocessor shall cover the followings functions.

Flexibility and simplicity in allowing the necessary re-adjustment of the pumping system pre-set delivery pressure to operate the pumps within the specified maximum and minimum delivery ranges.

Automatic changeover of the pumps to be controlled by the microprocessor which dictates the duty and standby pumps.

When the system has not been operated for more than 24 hours, it shall automatically start the pumps for a few seconds / day to ensure the pumps readiness always. The standby pumps shall be activated upon failure of duty pump(s).

In event of control failure, the pumps shall be able to be start/stopped manually at the local panel by means of pressure switches.

The microprocessor control panel shall be able to cut-off the pumping system when excess pressure

is registered in the discharge common manifold.

The system shall have the capability of receiving input signal concerning reduced water level in suction tanks and shall have control mechanisms to prevent the pumps from running dry.

Automatically starting the pumps when the water level is back to normal.

In case of pump failure due to motor overload, the standby pump is switched on automatically. Alarm signal is displayed on the LCD Display unit and alarm lights are activated.

Functions to limit the no. of start/stop of pumps per hour.

The system control panel shall incorporate LCD Display.

The system control panel shall be IBMS compatible, with potential free contacts having RS 485 ports for monitoring the on/off status.

- **OPERATION OF CONTROL PANEL**

Auto mode
The desired delivery pressure within the range specified shall be set at the control panel. The differential pressure transmitter shall detect the delivery pressure continuously and give feedback to the microprocessor which will control the variable speed drive frequency converter for speed control of the duty pump. When demand increases, the subsequent pumps in the system will be activated to boost up the pressure. Ultimately the duty pump set shall be operated fully automatically to maintain the delivery pressure constantly at the desired set value.

Manual Mode
The on/off function of the pumps shall be manually adjusted at the microprocessor located at the local control panel.

Frequency Control By-pass Mode
All the pump sets shall be started/stopped automatically with the pump output at fixed maximum rotational speed. All the control and protection functions shall remain active. The cut in/cut out pressure shall be internally calculated by the microprocessor for each pump.

IBMS Compatibility:
The control panel shall be mounted on wall / floor, in a control cabinet with an IP 67 enclosure of suitable rating having Potential free contacts to monitor on/Off & Trip status with necessary sensors/switches.

- **ELECTRICAL COMPONENT**

. Electrical supply to the pump controller shall be protected using an isolating circuit breaker.

- **METHOD OF STARTING**

The panel shall be built to start the pumps in suitable starting modes, i.e. D.O.L., Star/Delta, or using Soft Starters.

- **PUMP PRESSURE VESSEL**

Diaphragm type pressure vessels shall be provided as shown on the drawings. They shall be incorporated into the system so that during normal operation the pump shall not need start within 30 seconds of it switching off, to prevent the pump hunting.

The pressure vessel shall be of adequate capacity to accommodate a considerable fluctuation in

water demand by the system with minimum start/ stop cycles of the pumps. The vessel shall be constructed of steel plate built to ASME Standards for Unfired Pressure Vessel. A rubber diaphragm shall be provided in the vessel for separating the water and pre-charge nitrogen. The pre-charge pressure shall be adjustable and charging port with non-return device shall be provided. The adjustable cut-in and cut-off pressure unit for the pumps shall be built-in at the vessel to suit the system.

- **ACCESSORIES**

The system shall be provided with all accessories such as base plate, mounting pads, foundation bolts, foot valves, pressure gauge, pressure switches, pressure transmitter, level indicator, isolation valve for pressure vessel, etc. all accessories required for proper and safe operation shall be furnished with the pumps.

- **SUCTION AND DELIVERY PIPE, FITTINGS, FLANGES & VALVES**

All suction, delivery and header pipe shall be GI & shall conform to IS: 1239, medium/heavy duty. Fittings shall be as per the pipe thickness. All pipes shall have flanges connection & pipe shall conform to BS 12, Table - D. All hardware shall be zinc plated. The system shall be equipped with suction & delivery valves flanged valves. On suction side ball/gate valve shall be provided while on delivery side ball/butterfly valves shall be provided. Also, spring operated check valves shall be provided on delivery side of each pump & on delivery header. In case of negative suction foot valve shall be provided for each pump suction or suction header as specified in data sheet. Flexible bellows shall be provided on suction &delivery side of each pump.

- **TESTING**

Hydrostatic test shall be carried out at 1.5 times the maximum discharge pressure.

For electrical accessories, necessary tests shall be performed, or factory test certificate shall be furnished.

- **DRAWINGS**

Following drawings shall be furnished by the vendor:

a) Overall dimensional drawing.
b) Pump performance curves.
c) Cross-sectional drawings.
d) Panel GA drawing.
e) Bill of Material and Material of Construction.

- **HORIZONTAL CENTRIFUGAL SUBMERSIBLE PUMP**

- **SCOPE**

The scope includes supply, installation, testing and commissioning of open well horizontal mono block (submersible) pump set with cast iron body.
The scope also includes the starter panels, cables/wires to the pumps, the pump controller shall be mounted in a control cabinet with an IP 67 enclosure of suitable rating having potential free contacts to monitor On /Off & Trip status with necessary sensors/switches, complete for single / three phase submersible motor having (Soft Water transfer from UGT to OHT).
The scope also includes motor, delivery piping up to Discharge Header with necessary pipe, fittings, cabling up to electric panel, pressure gauges, etc.
Each pump shall have isolation gate/ ball valve, Y Strainer & NRV at delivery side & on header.

- **CODES AND STANDARDS**

The design and manufacture of the pump shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed.

- **DESIGN FEATURES:**

The pump shall be capable of developing required total head at rated capacity.
Impeller shall be enclosed type and shall be dynamically balanced.
The pump shall have non-overloading characteristics.
The pump shall be submerged in tank/ reservoir.

- **CONSTRUCTIONAL FEATURES**

The casing shall be of rigid construction and shall have central delivery pipe.
The casing shall be of Cast Iron.
The pump shall have very small length suction and delivery pipe connections which will result in minimum friction loss in case of moonset pumps.
Impeller shall be of one piece and shall be of SS CF 8 M.
The shaft shall be of S.S. and its surface shall be properly finished.
Shaft sleeves shall be provided to protect shaft from any damage.
Bearing shall be ball or roller type.
Mechanical seal shall be provided to avoid any leakage.
Each pump shall be driven by directly coupled squirrel cage induction motor having 1500/2900 RPM, TEFC enclosure & IP 55 protection.

- **INSPECTION AND TESTING**

The pump shall be offered for visual inspection before dispatch.
Material test certificates for the various pump components shall be furnished for Engineer-In-Charge approval.
Hydrostatic test shall be carried out at 1.5 times the maximum discharge pressure.
For electrical accessories, necessary tests shall be performed, or factory test certificate shall be furnished.

- **DRAWINGS:**

Following drawings shall be furnished by the vendor.
Overall dimensional drawing.
Cross-sectional drawings with Bill of Material and Material of Construction. Pump performance curve.

- **SUMP PUMP:**

- **SCOPE**

The scope includes providing and fixing compact Monoblock dry motor submersible pumps of suitable rating, with non-clog free flow open impeller, solid handling capacity of up to at least 28mm suitable for operation on 415 volts +12%, 3 Phase, 50Hz, A.C supply, speed 2900 RPM including oil chamber, guide wire for lifting & lowering of pump, M.S. galvanized lifting chain, duck foot bend complete.

- **DESIGN & CONSTRUCTION FEATURES**

These shall be fully submersible with a fully submersible motor.
The pumps shall be provided with an automatic level controller and all interconnecting power and control cabling which shall cause the pumps to operate when the water level in the sump rises to a pre-set level and stop when the pre-set low level is reached.
Pumps for drainage shall be single stage, single entry.
Pump shall be C.I. casing and C.I. two vane open type with a dynamically balanced impeller

connected to a common shaft of the motor.
The vane for Sewage sump pump will be open type, while for storm drainage pump, etc. it will be of semi open type.
The MOC of the sump shall be in accordance to schedule of quantity.
Stuffing box shall be provided with mechanical seals.
Each pump shall be provided with a suitably rated induction motor, suitable for 230 / 415 volts, single / three phase, 50 Hz A.C. power supply.
Each pump shall be provided with in built liquid level controller for operating the pump between predetermined levels.
The pumping set shall be for stationary application and shall be provided with pump connector unit.
The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation.
Pump shall be provided with all accessories and devices necessary and required for the pump to make it a complete working system.
Sump pump shall be complete, with level controllers, power and control switchgear, Auto/off/Manual switches, pumps priority selections and control and power cabling up to motor and controller/probes etc. (Including earthing).
Level control shall be such that one pump starts on required level, 2nd pump cuts in at high level and alarms is given at extra high level. All level controllers shall be provided with remote level indications.
The pump sets shall be supplied with required accessories & as per specification with the following:

(a) Necessary cables from pump set to control panel (position of panel marked on enclosed drawings).
(b) Electrical control panel having all necessary accessories & safety devices of standard specifications and suitable for receiving incomer cable to connect complete. (Panels with sump pumps near each sump as per site conditions).

Should the Engineer-In-Charge require, he may ask for a Factory Acceptance Test, and for this the contractor is bound to make the adequate arrangements for the factory visit at no extra charge.

- **MOTOR DESIGN**

The pump motor shall be a squirrel cage induction, housed in air filled watertight enclosure. Oil filled motors are not acceptable. The stator windings shall be Class "F" insulation (155 C° or 311 F°) for general usage and class `H' insulation (180 C° or 317-8 grade 2) for submersible type.
The stator shall be heat shrunk fitted into the enclosure and shall not use bolts, pins or other fasteners that penetrate through the stator enclosure. The starter shall be equipped with a thermal switch embedded in series in the coils of the starter windings to protect the stator from wheel.
The motors shall be designed for continuous running duty type at 230/ 415 volts,1/3phase, 50 Hz power supply and capable of sustaining a minimum of 20starts/stops per hour.

As per the above proposed scheme, the contractor has to prepare and submit a detailed Design Basis Report (DBR), including related calculations, supporting documents and SLD in accordance with the relevant electricity/IS Codes.

List of Approved Makes of Material
For
Electrical and Mechanical components

Electrical System:

Material/ Equipment	Approved Make
ACB	ABB, Schneider, Siemens, L&T
Battery Charger	Max. Power , CALDYNE, VOLSTAT, HBL
Batton Holder, Angle Holder Ceiling Rose	Anchor , CPL, Havells
Cable Gland	Comet , Dowell's, Jainson, HMI,
Cable Lugs	Comet, Dowell's (Biller India) , Jainson , 3D
Cable Trays	OBO ,Indiana, Legrand, Profab Engineers
BLDC Ceiling Fan	Usha, Orient, Atomberg, Havells,
Control Cable (ISI Approved)	Finolex, Havells, Polycab, Lapp India
Copper Conductor PVC Insulated Wires/ Stranded Flexible Wires (FRLS)	Finolex, KEC, HAVELLS, POLYCAB, Lapp India
Current Transformer (Cast Resin Epoxy Coated)	Automatic Electric, Gilbert & Maxwell, Kappa, Pragati,
Cable Management System (Wire Trunking) Raceway	OBO, Legrand, MK, ABB
Distribution Boards (MCB DBs)	Legrand, Schneider, Hager, L&T, ABB
Electronic Digital Meter, Multifunction meter with LED Display.	Schneider (Conzerv), Secure, Elmeasure, HPL, L&T
Fan Box	MS Type Only as approved by E-in-C
HRC Fuse and Fuse Fitting	ABB, GE, Siemens, L&T, Schneider
Indicating Lamps	L&T, Siemens, Schneider, ABB
LED Lamp (where ever required)	Cree, Osram, Nichia, Philips, Siemens
Light Fixtures (Internal)	Philips, Wipro, Osram, Havells
Light Fixtures (External)	Philips, Wipro, Osram, Havells, Bajaj, Jaquar
Lighting Control	Lutron, Schneider, Crestron, ABB, Philips
Lightning Protection System	Dehn, OBO, ABB, L&T
MCB/RCCB / SPD/RCBO	Legrand,Schneider, Hager, L&T, Siemens, ABB
MCCB	ABB, Schneider, Siemens, L&T

Metal Clad Plug & Socket (Industrial)	Legrand, Schneider, Neptune, Mennekes, Hager, ABB
Modular Switches with accessories, Socket Outlets and Wiring Accessories with moulded Cover Plate.	Schneider, Legrand(Arteor), Honeywell; Havells, ABB
MS Black Stove Enameled ERW Conduits (ISI Approved)	AKG, BEC, Steel kraft
Ready-made pole	Bajaj, Philips, Schreder, Crompton
Fabricated pole/Customized pole	As per tender description
Power Distribution Panels (TTA) Totally Type Tested (As per IEC- 61439 - 1 & 2)	Siemens , Schneider, ABB , L&T (Approved OEM Vendors only)
Power Distribution Panels (Non -TTA)	(Project specific Authorized / Approved OEM Vendors only)
Potential Transformer	Automatic Electric, Rishabh, Kappa, Pragati ,
Push Buttons	ABB, L&T, Schneider , Rishabh
PVC Conduit (FRLS) & Accessories (ISI Approved)	Precision ,BEC, AKG, Polycab
Power cables 1100V grade	Universal, Finolex, Polycab, Havells, Gloster
PVC Tape	Anchor, Steelgrip
Sandwiched Type Bus Duct/Rising mains	Schneider, Legrand (Zucchini), IIGM-EAE, L&T , C&S , Henikwon
Sealed Maintenance Free Batteries	Exide, HBL, Amar Raja, Hitachi
Selector Switches (ASS/VSS)	Kaycee, ABB, Siemens,Schneider, L&T, Salzer
Sensor (Occupancy Sensor)	Honeywell, Wipro, Hager, Philips, Theben
Terminal Block	Wago, Jainson, Elmex, Connectwell, Phoenix
FRP/Themoplastic Boxes	Hensel, Splesberg, OBO, Syntex, Hager
Timers	Schneider, Siemens,L&T, ABB , Theben, Legrand
UPS	Vertiv, Schneider (APC) ,Numeric, Socomec , Eaton, GE
Elevator (LIFTS)	Kone, Schindler, Mitsubishi, OTIS
Exhaust Fan	Crompton, Khaitan, Havells, Orient , Atomberg
HT/ LT Jointing Kit & Termination Kits	Birla-3M, Raychem, Safe Kit M seal
VCB : 11 KV & HT Panels	ABB , Siemens, Schneider Electric ,L&T
Anti Vibration Mountings	Gerb, Resistoflex , Dunlop
Motors	ABB , Crompton, Siemens
Flexible Coupling	Resistoflex , Kanwal
Residential Silencer	Same as Engine make
Semi Rotary type hand fuel filling pump	Rotodel, Kitty Binks
Hybrid Capacitor Panels	P2 Power Solutions, Schneider, EPCOS
Master Plan & Parking & Plaza Light Fixtures	Bollard Lighting Preferred make Wipro/ PHILIPS / Osram

	Street Lighting Preferred make Wipro / PHILIPS / Osram Post Top Lighting Preferred make Wipro / PHILIPS / Osram
Geysers	AO Smith/Racold/Jaguar/Havells

ELV SYSTEM

Material/ Equipment	Approved Makes
2 X 1.5 Sq. Mm. FRLS flexible wire/ armoured cable for Fire Detection & Alarm and PA system	FINOLEX, HAVELL'S, POLYCAB , Lapp India
F/UTP CAT6A Cabling System – Cables, IO, Patch Panels and other components	COMMSCOPE -SYSTIMAX, BELDEN, PANDUIT-PANNET, R & M
Communication Cables / Signal Cable	COMMSCOPE -SYSTIMAX, BELDEN, FINOLEX, FUSION, POLYMER, R & M
UTP CAT6A Cables (for IBMS System)	COMMSCOPE -SYSTIMAX, BELDEN, PANDUIT-PANNET, R & M
Networking Switches for IBMS System	Cisco, HP-Aruba, JUNIPER
Fiber Optics Cables & Components (Data & Voice/Telecom, Single Mode – Cables, LIUs, Shelves, Pigtails, Patch-cords, Connectors, Adapters, Cassettes, Couplers, Splices/Splice closure Kit / Splice trays – Indoor / Outdoor Fiber Cabling Infrastructure	COMMSCOPE -SYSTIMAX , BELDEN, PANDUIT-PANNET, R & M
Telephone Tag Block/MDF	KRONE, POUYET
SFP Module	HPE/CISCO/DELL
Networking Racks, Data Centre racks, Distribution Racks – from sizes 15U to 42U	APW-VERO PRESIDENT, NETRACK, PANDUIT, RITTAL
Addressable Fire Alarm System (UL/CE/FM, EN/Vds Listed)	BOSCH, EDWARD, ESSAR, MIRCOM, NOTIFIER, SIEMENS, Schneider.
Public Address System	ATEIS, BOSCH, HONEYWELL, TOA
IBMS Server	DELL, HP, LENOVO
IBMS Workstation/Client PC/LED Monitor	DELL, HP, LENOVO
A3 Size Laser color Printer	CANON, EPSON, HP
IBMS Software Suite	HONEYWELL-TREND, JOHNSON CONTROLS, SCHNEIDER, SIEMENS, TRANE
Standalone 32 bit BacNet Based DDCs & Modbus/ BacNet Integrators, Gateways, Routers; Network area controller	HONEYWELL-TREND, JOHNSON CONTROLS, SCHNEIDER, SIEMENS, TRANE
DDC Panel (Enclosure)	BHARTIYA CUTLER HAMMER, RITTAL, SCHNEIDER ELECTRIC

Material/ Equipment	Approved Makes
DP Sensor – Water	DWYER, HONEYWELL, HUBA CONTROL, JOHNSON CONTROLS, OMICRON, SCHNEIDER, SIEMENS, TRANE
DP Switch – Air	DWYER, HONEYWELL, JOHNSON CONTROLS, OMICRON, SCHNEIDER, SIEMENS
DP Switch - Water	DWYER, HONEYWELL, JOHNSON CONTROLS, OMICRON, SCHNEIDER, SIEMENS, TRANE
Pressure Sensor – Water	DWYER, HONEYWELL, HUBA CONTROL, JOHNSON CONTROLS, OMICRON, SCHNEIDER, SIEMENS, TRANE
Terminals/Lugs	PHOENIX, WAGO
Water Flow Switch	DWYER, HONEYWELL, JOHNSON CONTROLS, OMICRON, SCHNEIDER, SIEMENS, TRANE
Level Switch/Flameproof Level Switch	BANNER, GENERAL INSTRUMENTS CONSORTIUM, LEVCON INSTRUMENTS PVT. LTD.,MAGNETROL INDUSTRIAL INC., NIVELCO, OMICRON
Manageable Network switch	ARUBA/CISCO/HPE
POE Switch	ARUBA/CISCO/HPE
Distribution switch	ARUBA/CISCO/HPE
Wifi Access Point	ARUBA/CISCO/HPE

HVAC System

Material/ Equipment	Approved Make
'TF' Quality expanded polystyrene	Beardsell/ Styrene/ Toshiba
Air handling Units /treated fresh air units	Zeco/ Edgetech/ VTS/ Systemair/ Citizen
Air Washer / Scrubber	Zeco/ Edgetech/ Systemair/ Ravi Aircon/ Citizen
Al. Sheets	Hindalco/ Balco/ Nalco
Aluminum tape	Johnson/Birla 3M
Anchor/Fastener	Hilti/Fisher/ Rawl Plug
Auto Air Vent	Anergy/ Rapid Cool/ SKS/ SANT/ Honeywell
Balancing Valves	Advance /Honeywell/ Danfoss/ Castle
Butterfly Valves & Ball Valve	Audco/ Oventrop/ Advance/ Honeywell/Zoloto
Cabinet Fans	Zeco/ Edgetech/ Systemair/ Citizen
Centrifugal Fans for ventilation/ AHUs/ Air washer/ Scrubber	Kruger/ Nicotra/ Comefri/ Green heck
Check Valves	Advance/ Honeywell/ Oventrop/Castle/ Emerald
Closed Cell Nitrile rubber insulation/ EPDM insulation	Armacell / K- Flex/ A-Flex

Material/ Equipment	Approved Make
Flexible Duct	Twiga/ Atco/ Kimmco
Fibre Glass Insulation	Owens corning/U.P.Twiga
Flow switch	Rapid cool/ Siemens/ Anergy
FRP Material	Reichhold/ Equivalent
G.I. Pipes	Sail/ Tata/ Jindal
G.I. Sheets	Sail/ Tata/ Jindal
Grills/ Diffusers/ Fire Dampers/ Louvers/ Volume Control Dampers/ Back Draft Dampers/ Sound attenuator	Systemair/ Titus/ Brightflow/ Caryaire/ Tristar/ Cosmos/Trox
GSS Factory Fabricated Ducts/ Duct Flanges	Rolastar/ Zeco/ Ductofab/ Ecoduct/ Dustech
Inline Fans	Kruger/ Green heck/ Air flow/ Caryaire/ Systemair/ Maico
M.S. Pipes	Tata/ Jindal Hissar / Sail
M.S. Sheets	Sail/ Tata/ Jindal
Motorized Actuator for Valves & Damper	Belimo/ Honeywell/ Siemens/ Johnson Controls
Motorized Butterfly valves	Johnson Controls/ Oventrop/ Belimo/ Siemens
Motors	ABB/ Siemens/ CGL/ BBL
PPGL sheets for Ducts	JSW/ Shreya Polymers/ Malur Tube/ HV metal Arc
PPGL Ducts Manufacturer	Corrosion Control equipment/ Sagar Plastic/ Ppi projects/ Citizen
Pressure Gauge	Feibig/ H. Guru/ Emerald
Pressure Relief Dampers	Trox/ Titus/ Systemair
Propeller Fans	Kruger/ Green heck/ Air flow/ Caryaire/ Systemair/ Maico
Puff pipe support	Malanpur/ lloyd/ Beardsell
PVC Eliminators	Munterz/ BKB extrusions
PVC Pipes	Finolex/ Prince/ Supreme/ KML Classic
Refrigerant Piping	Mandev/ Rajco/ Indigo/ RR Shramik
Rock Wool insulation	Roxul-Rockwool/ Rockwool india/ Lloyd
Screw Water chilling machine	Carrier/Trane/York/Daikin-Mcquay
Spiral Round/ Oval ducts	GP Spira/ Dustech/ Ductofab
Split / Window AC	Carrier/ Daikin/ Hitachi / Toshiba/LG/Blue star
VRF	Toshiba/Daikin/ LG/Samsung/ Mitsubishi Electric
Star bond/Lag Protective Coating	Paramount polytreat/ Pidilite
Thermometers	Feibig/ H. Guru/ Emerald
Tube Axial flow Fans	Kruger/ Green heck/ Air flow/ Nicotra/ Systemair/ Maico
Vane Axial flow Fans	Kruger/ Green heck/ Air flow/ Nicotra/ Systemair/ Maico
Variable frequency drive	ABB/ ALLEN BRADLEY/ DANFOSS/ Siemens
VAV Boxes	Trox/ Trane/ Johnson Controls
Water Pumps	Armstrong/ Xylem/ Grundfos
Welding Rods	Advani/ L&T/ ESAB
Note:-All electrical items makes to be considered from electrical list of makes	

Fire fighting system

Material/ Equipment	Approved Make
Air Vessel	Fabricated
Batteries	AMCO / Amar Raja / Exide
Sluice Valve	Audco / Leader / Sant / Zoloto
Branch pipe & Coupling	Minimax / Newage / Swati / Safex / SBJ / Winco
Fire Pumps	Grundfos / Mather & Platt - Wilo / Xylem / Kirloskar
Coating wrapping material for underground pipe	IWL / STP / Tikidan
Diesel Engine	Caterpillar / Greaves / KOEL / Cummins
Fire Alarm Valve	HD / Newage / Tyco / Viking
Fire Bridged Inlet Connection	Minimax / Newage / Safex / Shah Bhogilal Jethalal
Fire Extinguishers	Cease Fire / Minimax / Safex
Flow Switch	Honeywell / Potter / Switzer / Danfoss / Newage
Ball Valve	Leader / Sant / Zoloto
Hydrant Valve	Minimax / Newage / Safex / Shah Bhogilal Jethalal
Hose Pipe	Minimax / Newage / Safex / Shah Bhogilal Jethalal
Hose Reel	Minimax / Newage / Safex / Shah Bhogilal Jethalal
Hose Box	Minimax / Newage / Safex / Shah Bhogilal Jethalal
Sprinklers & Flexible Hose	HD / Viking / Tyco / Newage
Kitchen FireSuppression System	UL Listed of approved make

MECHANICAL WORKS

Material/ Equipment	Approved Make
Electro-mechanical Equipment's & Plants	
Pumps	
Motors	Xylem / Grundfos / Wilo / Kirloskar
Hydro Pneumatic System	Xylem / Grundfos / Wilo / Kirloskar
Submersible Pumps	Xylem / Grundfos / Wilo / Kirloskar
De watering Pump for Rain water	Xylem / Grundfos / Wilo / Kirloskar
Mud pump for Drainage	Xylem / Grundfos / Wilo / Kirloskar
Drinking Water Equipment's	
Domestic UV system	Aquila / Kent / Eureka Forbes
Water Cooler	Blue Star/ Voltas/ Usha
Drinking Water Combined System of Cooler with R.O. Plant	Blue Star/ Oasis/ Voltas/ Aquatek
Hot Water Equipment's	
Electric Geyser	A O Smith / Racold / Jaquar
Thermostat	Honeywell / Zoloto / Sant
Temperature Gauges	Honeywell / Zoloto / Sant
Hand drier	Jaquar / Euronics/Kohler/ Dolphy