Specifications for the work "Electrical Renovation works for 10 nos of G+1 Type-II buildings at DAE housing colony, NFC Hyderabad"

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1. INTRODUCTION:

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer'sworks, supply in suitable packing, installation, testing and commissioning of all equipment like 415V Power Distribution boards , 415V MCB& MCCB Distribution Boards, 1.1KV Power Cables and their terminations, light fittings, point wiring, earthing etc required

2. GENERAL:

2.1 All the equipment and material shall be designed and manufactured and tested in accordance withthe latest applicable IS / IEC specifications except where the same is modified or supplemented inthis specification

2.2 Equipment and materials confirming to any other standard which ensures better quality mayaccepted. In such case copies of the standards adopted shall be submitted along with the bid. The installation shall meet the requirement of latest Indian Electricity rules, Indian Electricity Act,BIS and IS. In addition, other rules or regulations applicable to the work shall be followed

2.3 All the documents appended to this specification shall form part of the specifications andagreement. Any material or accessory which may not have been specifically mentioned but which isnecessary for satisfactory and trouble free operation of the equipment shall be furnished without anyextra price.

2.4 Before starting manufacture of any equipment the contractor shall have to take approval for thedrawings from the Engineer in charge of the work. Also pre dispatch inspection (acceptance tests) shall be carried outby the department personnel at manufacturer works before issue of dispatch clearance.

3. GENERAL INSTRUCTIONS FOR EXECUTION OF THE WORK:

3.1 The work has to be executed in accordance with detailed site use drawings/instructions which will be issued progressively after the placement of the work order to suit the progress of work at site.

The logistics involved in handling heavy equipment among the following items may be submitted to the department along with original documents of vehicles and test certificates of critical components used in handling.

The tenderers are advised to visit the proposed site of work to acquaint themselves with the site and the working conditions.

3.2 The tenderers shall carefully go through the clauses in the notice inviting tenders, Tender and contract, General Rules and directions, conditions of contract, clauses of contract, safety code, model rules for Labour Regulations, etc. and special

instructions to the renderers as also specifications and shall include in their rates, any sum they consider necessary for the fulfilment of the various clauses contained therein. The items of work and unit rates quoted in the schedule of quantities shall be inclusive of everything necessary to complete the said items of work within the contemplation of the contract and the rates may be quoted accordingly. Makes indicated in Schedule of Quantity are suggestive only. No extra payment beyond the quoted unit rates shall be allowed for incidental or contingent work, labour, materials or plant unless the exclusions are specifically brought out in schedule of quantities.

3.3 The rates quoted by the tenderer shall **include:**

- Necessary care and precaution against damage/theft to equipment/materials, if any, supplied by the Department.
- Safe custody and storage of materials at site.
- Accommodation of contractor's staff
- Protecting all installed equipments in the area of work falling within the scope of the contract

3.4 The payment of minimum wages as notified by the State/Central Government and implementation of all regulations under contract Labour (Regulations and Abolitions) Act1970 (Central) and Central Rules 1971 and the rules and orders issued there under from time to time as amended up to date. Necessary books of account and other document for the purpose of this condition as may be necessary and shall allow inspection the same allowed by a duly authorized representative of Government and further such other information/document as the Engineer-in-charge may require.

3.5 For enforcement of the building and other construction workers (Regulations Employment& Conditions of Service) Act 1996 and building and other Construct Workers (RE & CS) Central Rules 1998.

3.6 All wastages and taxes including seignior age tax, educational cess, VAT/turnover service tax, labour welfare cess etc., as applicable.

3.7 Following all the safety and security rules and regulations as required by the Department including deploying supervisor exclusively for safety.

3.8 Contractor shall take the responsibility for the safe execution of the work following safety instructions issued by Safety Engineering Division of NFC

3.9 Contractor shall be responsible for the delivery, handling , storage and protection of all material and equipment required to complete the work as specified herein

3.10 Contractor shall store the products , immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact and legible. Contractor shall provide suitable temporary weather tight storage with lock and key facilities as may be required for materials that will be damaged by storage in the open. Temperature and humidity inside storage shall be maintained as per manufacturer's instructions. Unpacked and loose products shall be stored on shelves, in bins or in neat group of like items. Contractor shall periodically inspect stored product on a scheduled basis. Contractor shall verify that storage facilities comply with manufacturer's product storage requirements and verify that manufacturer's required environmental conditions are maintained continually. Contractor shall perform scheduled maintenance of equipment in storage as recommended by manufacturer. A record of all items in the storage shall be made, along with maintenance record, and shall be turned over to Engineer in charge when the equipment is installed.

3.11 Contactor shall be responsible for all damages that occur in connection with the care and protection of material and equipment until completion and final acceptance of the work by the owner. Damaged material and equipment shall be immediately removed from site and replaced.

3.12 **NOTE**:

i. Non deployment of safety supervisor at site will be charged as per schedule 'F'
ii. Minimum quantity of PPE proposed to be brought to site for use for implementation at site.
iii. Delay in progress of work/completion of work in the effort of complying of safety whatsoever pertaining to it will not be considered as a genuine reason/cause for extent of time/or any other financial implications.
iv. Record of safety compliance to maintained.
v. Contractor shall be responsible for any unsafe incident/accident during the course of work and shall be penalized in the event of any accident including fatality.
vi. All the tools including tools required for digging should be properly insulated to the satisfaction of Engineer-in-charge.

3.13 **Police verification certificate shall be taken for all laborers engaged in the work and also medical certificate indicating their fitness. Following the procedure envisaged in Special instructions to the contractors for entry and exit of men and materials or as per latest criteria envisaged by security Personnel**.

3.14 Contractor has to submit Medical certificates, ESI &PF particulars for staff engaged for the work. The workmen employed for this work shall have a distinct uniform. The contractor is responsible for removal / shifting to an identified location the debris/ scrap produced during the execution of the work

3.15 Contractor shall follow and plan the works to meet the policies of NFC line ISO 9001, ISO14001 & 18001

3.16 Procurement source and makes for the materials shall be got approved from the Department well in advance before initiating procurement.

3.17 Provided that where any provision of the specification is repugnant to or at variance unless adifferent intension appears, the provision of the schedule of quantities shall be deemed to override the provision of the specifications and shall to the extent of such repugnance or variation prevail.

4. TECHNICAL SPECIFICATION

4.1 415V POWER DISTRIBUTION BOARDS:

Construction:

- The power distribution boards shall be indoor, IP43, dead front, sheet steel enclosed type, vermin and dust proof construction suitable for installation in dusty atmosphere, metal clad floor mounting &MCCB feeders. They shall withstand 36KA/1sec fault current. The design and construction of the panel shall be such that the same can be extended on either side. PDB shall be wall mounted.

- Panel shall be type tested as per IS 61439, Form IV B construction.

- The equipment shall be suitable for use in 415 V + 6% 3 phase 4 wire system having a symmetrical short circuit rating of 36 KA/1sec as specified in SOQ

- Panel shall be type tested as per IS 61439, Form IV B construction of approved OEMs or channel partners as mentioned.

- The panel shall be made out of 2 mm thick sheet steel and gland plate shall be 3mm thick. The panel shall be painted with synthetic enamel paint both inside and outside with approved color shade. Before painting all the metal parts shall be subjected to seven tank pre-treatment processes

- The maximum operating height of any feeder shall be restricted to 1800 mm from the floor level and minimum operating level for switches shall be 300mm from the operating level.

- Each circuit breaker shall be housed in a separate cubicle complete with individual front access door. Each vertical section shall have a removable back door. All the doors shall be fixed with gaskets

- Switch gear cubicle shall be sized such that the front door can be closed even if the circuit breaker is in draw out / isolated condition.

- All the meters, indicating lamps etc shall be flush type.

- Suitable shrouds shall be provided to the live parts to avoid accidental contact whenever the doors are open.

- The bus bars shall be of TPN high conductivity E91EWP grade aluminium sized for specific current ratings with maximum temperature rise limited as per the relevant Indian Standards.

- All the bus bar joints shall be maintained with adequate contact pressure by using double bolts, plain and spring washers. Bimetallic connectors shall be provided for connections between dissimilar materials.

- Bus bars and connections shall be fully insulated with colour coded sleeves for working voltage and with adequate clearances. Insulation shrouds shall be provided for bus joints.

- Bus bar supports shall be flame retardant type with high creepage surface.

- Bus bars shall be designed and supported to with stand the forces developed during short circuit and to take care of the thermal expansion.

- Horizontal and vertical bus bars shall be housed in separate compartments so that no live bus bar is accessible while working on outgoing of any breaker. Adequate clearances shall be provided between bus bars of different phases for easy maintenance.

- Separate copper earth bus rated to carry maximum fault current for the specified time of 1 second shall be provided along the full length of each board. Each stationary unit shall be earthed directly to this earth bus by two separate and distinct connections and also the earthing contact bar of all breakers shall be brazed to it.

- Hinged doors shall be earthed through flexible earthing braids. All non-current carrying metal parts shall be effectively bonded to the earth bus.

- Each breaker shall be provided with emergency manual TRIP button, mechanical ON/OFF indicator, mechanical spring charge / discharge indication

- Each breaker shall be provided with auxiliary switches. There shall be at least 4 NO and 4 NC (potential free) spare contacts after using the required contacts for the control wiring.

- All MCCB feeders shall be provided with ON/ OFF/ TRIP indications.

- All the indications shall be provided with relevant markings and shall be of LED type operated on 230 V AC.

- **Multi-function meter** shall be provided on all incoming feeders and shall monitor and display voltage, current, power factor, frequency, power, energy, phase angle, no. of on-hours, date, time etc. It shall have a suitable communication interface and MODBUS/MODBUS RTU protocol. It shall communicate all the above parameters to a

PC. It shall be connected on SCADA network. Current transformer required for MFM shall be of Accuracy class 0.5

- All the meters shall be switch board type, flush mounted digital type, anti-glare glass and accuracy class of 2%.

- CT wiring shall be with 2.5 Sq.mm FR copper wire and other wiring with 1.5Sq.mm FR Copper wire.

- All the feeders shall be provided with overload, short-circuit and ground fault protection releases. Necessary Current Transformers on the 3 phases and neutral shall be provided to achieve the desired protections.

- The switchgear shall be fully wired at factory to ensure proper functioning of the control, protections and interlocking schemes.

- Each wire shall be identified at both ends with permanent markers / ferrules

- All terminations shall be with suitable crimping type connectors, insulation sleeves etc.

- The terminal block used for the panel shall be 660 V grade box clamp type with marking strips similar to Elmex make. Terminals for the CTs shall be shorting and disconnection type.

- Not more than 2 wire shall be connected in any terminal. 20 % of the terminals used shall be provided as spare terminals in each vertical section

- Location of the terminal block shall be such that they can be accessed easily

- All openings in sheet steel partitions for carrying out inter-panel wiring shall be provided with rubber/PVC grommets.

- The switchgear shall be designed for cable entry from both top and bottom
- All provisions and accessories shall be provided for termination and connection of cable including removable gland plates, cable supports, chrome plated terminal bolts and nuts with spring washers

- All connecting bus shall have the same continuous rating as associated switchgear bus and shall be fully supported to with stand the specified short circuit currents.

- Nameplates of approved design shall be furnished at each cubicle and at each instrument and device mounted on or inside the cubicle. The material shall be lamicoid or approved equal, 3 mm thick with white letter on black background.

- The nameplate shall be held in place with self-tapping screws. Nameplate size shall be minimum 20 x 75 mm for instrument/devices and 40 x 150 mm for panels.

- Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

- Each PDB shall be provided with thermostat controlled space heater and 5A, 3 pin plug socket in any one vertical panel.

- Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch-fuse units shall be provided at each cubicle for A.C supplies.

- 25 Sq.mm Flexible single core copper cable shall be brought up to cable chamber for feeders of rating up to 63 A and terminals shall be provided. 16Sq.mm Single Core copper cable shall be used for 32A feeders. For feeders of 125 A and above rating, bus bars of adequate cross section shall be brought up to cable chamber.

- All MCCBs shall be microprocessor based of suitable rating with earth fault release, rotary handle for door interlock.

- Spreader links shall be used for all the feeders for obtaining suitable clearance between bus bars.

- All feeders shall be identified by painting after the feeders are connected to the respective loads.

- The clearances and creepage distances shall be as per IS.

- Make of the components shall be strictly as per specification.

Smart Energy Meter:

The equipment shall conform to the latest applicable Indian and International standards, including but not limited to:

- **Indian Standards:** IS-13779, IS-15884, IS-16444 (Part 1), and IS-15959.
- **IEC Standards:** IEC 62052-11, IEC 62053-21, IEC 62053-24, IEC 62052-31, and the IEC 62056 series (DLMS/COSEM).
- **Certifications:** The meter must be compliant with MTCTE guidelines issued by the Ministry of Power and possess appropriate CERT/MEIT security certifications. Type test reports from a Govt Lab/NABL/ILAC accredited laboratory are mandatory.

i) Electrical Characteristics

- **Connection Type:** AC 3-phase, 4-wire, direct connected.
- **Nominal Voltage:** 3 x 230V / 240 V (Phase to Neutral), with a permissible variation of ± 10%.
- **Current Rating:** Basic current (I_basic) of 10 A, and maximum current (I_max) of 100 A.
- **Frequency:** 50 Hz ± 5%.
- **Accuracy Class:** Class 1.0.
- **Metrology:** Two LEDs for active and reactive energy.

ii) Functional & Smart Features

- **Operational Modes:** The meter shall natively support dual-mode switching (Credit to Prepay and Prepay to Credit) via authenticated remote commands or locally via BLE.
- **Load Control:** Equipped with a built-in load limiting/connect-disconnect switch across all three phases, meeting UC3 performance categories. The load limits must be configurable remotely via the Head End System (HES) or wirelessly via a mobile application.
- **Metering Capabilities:** Four-quadrant metering with import/export registration, accommodating peak and off-peak management.
- **Data Profiling:** In-built support for 15, 30, or 60-minute instantaneous data logging for voltage, current, power factor, power, frequency, and cumulative energies.

iii) Communication & Data Transfer:

- **Wide Area Network (WAN):** Bi-directional communication module supporting NBIoT cellular communication or GPRS for remote connection, disconnection, and periodic data delivery to the HES.
- **Local Communication (NAN/PAN):** IEC optical port for local reading and configuration, alongside Bluetooth Low Energy (BLE) for direct mobile application access.
- **Protocol:** Must be DLMS/COSEM open protocol compliant for interoperability.
- **Security:** AES128 encrypted security for all data transmissions.
- **Mobile & Fallback Access:** The system must provide a mobile application (Android/iOS) for consumers to view electrical parameters, receive alerts, and facilitate local token entry for credit transfers during WAN/communication outages.

iv) Revenue Protection & Tamper Mechanisms:

- **Tamper Logging:** The meter must be tamper-proof and capable of detecting, logging, and immediately reporting tamper events to the HES.
- **Physical Security:** Detection sensors for terminal cover open, front cover open, and communication module open events. The enclosure must be designed to "break to open" with additional sealing provisions on the meter body and terminal block.
- **Outage Reporting:** Capability to report power outage detection reliably to the HES.

v) Construction & Environmental Specifications:

- **Enclosure:** Manufactured from engineering plastic with an IP 54 ingress protection rating.
- **Insulation:** Protective Class II.
- **Display:** Intuitive 8-digit LCD with backlight and status icons. The meter must include a capacitive touch keypad or suitable interface for display navigation.
- **Operating Conditions:** Suitable for operating temperatures from -10°C to +60°C and a non-condensing humidity of up to 95%.

vi) Software, Support, & Warranty:

- **Software Integration:** The vendor must provide the necessary OEM software suite for meter configuration and integration. Software installation and staff training on smart meters and data customization are required.
- **Warranty:** The meter, SIM, metering accessories, and OEM software shall carry a comprehensive 10-year lifetime warranty against manufacturing defects from the date of commissioning.
    - **Support:** The supplier must provide 24x7 customer support via a toll-free number.

Tropical Protection:

- All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

- Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

Painting:

- All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease & rust.

- After cleaning, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and stoves after each coat.

- The switchgear shall be finished in light grey (shade no. 631 of IS-5) with two coats of synthetic enamel paint.

- Sufficient quantity of touch-up paint shall be furnished for application at site.

Guaranteed Performance:

The performance figures quoted in the Technical Particulars sheets shall be guaranteed within the tolerance permitted by relevant standards. In case of failure of the equipment to meet the guarantee, the purchaser reserves the right to reject the equipment until the new equipment meeting the guarantee requirement is supplied by the supplier. However the supplier will be given an opportunity to rectify his equipment at his own cost. Also purchaser reserves the right to use rejected equipment till it is rectified. The period of guarantee of the equipment shall be as per the NIT.

4.2 MV POWER CABLES

- MV 1.1KV grade XLPE insulated, PVC extruded ST-2 inner sheathed, GI round wire armoured, FRLS PVC ST2 outer sheathed cable as per IS 7098 part-I shall be supplied and laid on cable trays/trenches as per IS 1255. Cables shall be properly dressed and clamped on the cable trays using MS flat at every 2m distance.
- All the cable openings made on wall shall be sealed with the fire barrier material (HILTI / 3M firestop) suitable for fire withstand capacity of 2 hours
- Minimum bending radius shall be ensured while laying the cable. Labelling of cable using aluminium cable tags shall be carried out at all appropriate locations. Also cable route markers shall be placed along the dug route if any excavation is involved.

- The Contractor shall arrange cable jacks and cable pulling rollers and other equipment required for laying cables and they shall maintain a record for the I.R. values of the cable drums received by them before and after installations.

4.3 POINT WIRING AND CONDUITING:

- All materials and equipments supplied by the contractor shall be new. They shallbe of such design, size and materials as to satisfactorily function under the ratedconditions of operation and to withstand the environmental conditions at site.

- All circuits shall be indicated and numbered in the wiring diagram and the pointsshall be given the same number as the circuit to which they are electricallyconnected.

- TheContractor shall coordinate the work with architectural, structural and airconditioning, and the drawings of other trades for exact dimensions, clearancesand roughing-in locations: The contractor shall cooperate with all other trades inorder to make minor field adjustments to accommodate the work with others.

- If directed by the Engineer-in-Charge, the Contractor shall, without extra charge,make reasonable modifications in the layout as needed to prevent conflict withworks of other trades or for proper execution of the work.

- The contractor shall maintain two full size sets of as-built drawings which willbe kept current during construction of the project, to include all contract changes,modifications and clarifications.

- Materials and equipments to be used in the work shall be inspected by theDepartmental officers. Such inspection will be of following categories:
    - Inspection of materials/ equipments to be witnessed at the manufacturer'spremises in accordance with relevant BIS/ Agreement Inspection Procedure.
    - To receive materials at site with Manufacturer's Test Certificate(s).
    - To inspect materials at the Authorized Dealer's Godowns to ensure delivery of genuine materials at site.
    - To receive materials after physical inspection at site.

- The tender specifications/EIC will stipulate the inspection requirements or theirwaiver for various materials/ equipments including norms of inspection inspecific cases.All components shall conform to relevant Indian Standard Specifications,wherever existing. Materials with ISI certification mark shall be preferred.

- The Indian Standards, including amendments or revisions thereof up to the dateof tender acceptance, shall be applicable in the respective contracts.Good workmanship is an essential requirement to be complied with. The entirework of manufacture/fabrication, assembly and installation shall conform tosound engineering practice.

- Thecontractorshallbealicensedelectricalcontractorofappropriateclasssuitableforexecution of the electrical work. He shall engage suitably skilled/ licensedworkmen of various categories

for execution of work supervised by supervisors/ Engineer of appropriate qualification and experience to ensure proper executionof work.

- Prior to testing the system, the feeders and branch circuits shall be continuousfrom main feeders to main panels, to sub panels, to outlets, with all breakersin place. The system shall be tested free from shorts and grounds. Suchtests shall be made in the presence of the Engineer-in-Charge. Pre-test electricalequipment and systems and make corrections required for proper operation ofsuch systems before requesting final tests. Final test will not be conducted unlesspre-tested.

- After the work is completed, it shall be ensured that the installation is testedand commissioned.The testing and commissioning of the entire systems shall be taken up and doneonly when the complete work of the respective system is completed and thetaking over of the entire systems covered in this contract will be as whole andnot as parts.

- The Contractor shall guarantee the materials and workmanship for a period oftwelve (12) months from the time the installation is accepted by the Department.If, during this time, any defects should show up due to any defective materials,workmanship, negligence or want of proper care on the part of this Contractor,he shall furnish any new materials as necessary, repair said defects, and put thesystem in order to the satisfaction of the Engineer-in-Charge at his own expense on receipt of written notice of such defects from the Engineer-in-Charge.

- References to the IS SP:30 --- National Electrical Code (NEC) and IndianStandards (IS) are minimum installation requirement standards.Drawings and other specification sections shall govern in those instances whererequirements are greater than those specified in the above standards.

- Recessed conduit work in walls and non-false ceiling area slabs was carried outby civil contractor. Surface conduit work shall be installed in both false ceilingareas(slab) and non-false ceiling areas (slabs and walls). In addition, surfaceconduit works are to be installed in areas where recessed conduit were choked.

- Flexible non-metallic conduits shall be used only at terminations and whereverspecified.All non-metallic conduit pipes and accessories shall be of suitable material complying with IS 2509:1973 and IS 3419: 1989 for rigid conduits and IS 9537(Part 5): 2000 for flexible conduits. The interior of the conduits shall be free fromobstructions. The rigid conduit pipes shall be ISI marked.

- The maximum number of PVC insulated aluminium/copper conductor cables of650/1100 V grade conforming to IS 694: 1990 that can be drawn in oneconduit of various sizesConduit pipes shall be fixed by heavy gauge non-metallic/PVC coated metallicsaddles with base, secured to suitable approved plugs with screws in an approvedmanner, at an interval of not more than 60 cm, but on either side of couplers orbends or similar fittings, saddles shall be fixed at a closer distance from the centre of such fittings. Slotted PVC saddles may also be used where the PVC pipe canbe pushed in through the slots.

- Gas or water pipe shall not be used as earthing protective conductorsAll fixing accessories such as Sleeves, crimping lugs, number ferrules,poly/rubber conduit bushes, etc., etc. as required.Phenolic laminated (or any other material approved by the Engineer-in-Charge) sheet covers over junction boxes & pull boxes.(Note: In areas where false ceiling is provided, termination of wiresshould be at the recessed fittings. This shall be included within the scopeof point wiring. Cost of Flexible conduits from ceiling junction box to thefittings duly coupled at both ends shall be included in the cost quoted forrecessed light fittings.)

- THREE runs (P, P & E) of single core 4.0 sq. mm stranded copper flexiblewires from AC/Geysers power point socket to Geysers power pointcontrol switch box/ AC Starter box. (uncontrolled phase wire with earthcan be routed through nearest junction box if available).

- In wiring, no joints in wiring will be permitted any where, except in switchbox or point outlets, where jointing of wires will be allowed with use ofsuitable connector.

- The wiring throughout the installation shall be such that there is no breakin the neutral wire except in the form of linked switchgear.Lights and fans shall be wired in the 'lighting' circuits. 15A/16A socketoutlets and other power outlets shall be wired in the 'power' circuits.5A/6A socket outlets shall also be wired in the 'Light' circuits

- **Following colour coding shall be followed in wiring**:
    - Phase : Red/Yellow/Blue. (Three phase wiring)
    - Live : Red (Single phase wiring)
    - Neutral : Black
    - Earth : Yellow/Green.

- Surface wiring in surface PVC conduit shall run as far as possible alongthe walls and ceiling, so as to be easily accessible for inspection.

- Above false ceiling, in no case, open wiring shall be allowed. Wiring willbe done in recessed conduit or surface PVC conduit.

- In recessed wiring, conduits are already installed during civil works(routes of conduit shall be inspected by the bidder during site visit).Socket outlets modular type shall be 6A 3 pin, 6A 5 pin, 16/6 Amp 6 pin.The third pin shall be connected to earth through protective (loopearthing) conductor.

- Only shutter type of sockets shall be used.

- Every socket outlet shall be controlled by a switch rated equal to or abovethe rating of the associated socket and as directed by the Engineer-incharge. The control switch shall be connected on the 'live' side of the line.

- Copper conductor cable only will be used for wiring.

- **Minimum size of wiring**:

- Light Wiring : 1.5sq.mm.
- Power Wiring : 2.5/4.0 sq.mm
- Insulation : Zero halogen FRLS PVC insulation conforming to BIS Specification.
- Strands: Multi-Stranded

- Control switches (single pole switch) shall be modular type.Modular type AC starter shall be used for controlling the air conditionersand 25A switch with indicator shall be used for controlling geysers.

- All accessories like switches, socket outlets and regulators shall be fixedusing front plates in the switch boxes. Contractor shall select front plateto suit switchbox (already embedded in wall). Necessary dummy modulesas required shall installed to cover the empty modules. Cost of these frontplates and dummy modules shall be included in the cost quoted forrespective wiring devices. NO EXTRA COST will be paid for front platesand dummy plates.

- Accessories like ceiling roses, brackets, batten holders etc. shall be fixedon outlet boxes. Aluminium alloy or cadmium plated iron screws shall beused to fix these accessories to their bases.One number of 4P surge arrester Imax-20kA/pole shall be supplied andinstalled with each distribution board.

- Earth bars/terminals at all switch boards shall be marked permanently,either as "E" or with earth symbolMain earthing terminal shall be marked "SAFETY EARTH – DO NOTDISCONNECTThe cable installation shall include additional clamping of the cables to cable traysand cable supporting arms by means of cable ties / strips (including supply) at 3 mintervals, in their horizontal run, after installation of cables. Interval of clampingshall be 1.5 m for cable trays in vertical disposition. Interval of clamping shall be 1m for wall installation.

- When power cables are laid in the proximity of communication cables, minimumseparation between power and communication cables shall be not less than460mm for single-core cables and 300mm for multi-core cables. Power andcommunication cables shall, as far as possible, cross at right angles to each other

5 GENERAL SPECIFICATIONS:

5.1 METHODS AND MATERIALS

- All work shall be installed in a first-class, neat and workmanlike manner bymechanics/electricians skilled in trade involved.
- All materials shall be new, of best quality and standard products of reputed makes. Suchmaterials shall be got inspected and approved by the Engineer before their use.
- All equipment and connections shall be installed in such a manner as to preserve access toany other equipment installed.
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5.2 PROTECTION OF WORK

- The Contractor shall effectively protect, at his own expense, such of his work, equipment ormaterials as is liable to theft, damage or tampering.

5.3 SAFETY MEASURES

- All safety rules and codes applicable to the work shall be followed without exception.
- All safety appliances and protective devices such as safety belts, hand gloves, aprons,helmets, shields, goggles etc., shall be provided by the Contractor to his personnel.
- The Contractor shall provide guards and permanently display caution notice if access to anyequipment/area is considered unsafe or hazardous.

5.4 ERECTION PROGRAMME

- The Contractor shall submit at least two (2) weeks in advance his erection programme clearlyindicating items of work, their sequence and estimated completion time for each item.
- GA drawings/ technical particulars of all the equipment shall be submitted for approval ofthe department before placing the order. Also department personnel may carry out predispatch inspection of the equipment at manufacturer works.
- The Contractor shall start erection only after obtaining Engineer's approval of hisprogramme and shall adhere to this approved programme as far as practicable.
- The foundation drawings for transformer, DG sets etc shall be submitted for approval of Department.
- Type test certificates from NABL certified laboratory shall be submitted for majorequipment/ switchgear.
- If for any reason the work is held up, the Contractor shall bring it to the attention of theEngineer in writing without any delay.
- To ensure completion within stipulated time, the Engineer shall have the right to instructtheContractor to increase manpower and/or working hours per day and/or tools and tackles,and the Contractor shall comply with such instruction forthwith.
- The Contractor shall arrange cranes for shifting of heavy items like Switchgear / Cabledrums / Transformer etc and shall submit the valid certificates for crane and slings andvehicles used for transporting material.
- In case some minor modification is required and suggested by the purchaser which will notaffect the completion schedule, the Contractor shall adhere to the requirement of the purchaser.

6. COMPLETION OF THE WORK:

- All equipment shall be complete and operative in all details and shall be left in satisfactoryworking conditions.
- All details on the installation shall be electrically and mechanically correct.
- The Contractor shall remove all rubbish, scaffolding, surplus materials etc. to leave thepremises clean and fit for use.
- If any opening or cutting of the building/shed construction is necessary, the same shall beremade to match the original work.
- The Contractor shall be responsible for reconciliation of all materials/equipment and shallsubmit acceptable reconciliation statement to the Purchaser.

7. INSPECTION AND TESTING:

- On completion of erection work, the Contractor shall request the Engineer for inspection and tests with minimum fourteen (14) days advance notice.
- The Engineer shall arrange for joint inspection of the installation for completeness andcorrectness of the work. Any defect pointed out during such inspection shall be promptlyrectified by the contractor at his own cost.
- All rectification, repair or adjustment work found necessary during inspection, testing, commissioning and trial run shall be carried out by the Contractor without any extra cost.
- Field testing of all equipment as per the specification, standards and manufacturer'srecommendations shall be carried out in the presence of purchaser's engineer with priornotice of at least two weeks before commencement of any test. The Contractor shall submitthe list of all field tests to be conducted for all the equipment, accessories forreview/approval of the Purchaser.
- Testing shall include any additional test which is felt necessary by the purchaser because of site condition to ensure to meet the requirement as per specification.
- Testing should be carried out by qualified personnel and the Contractor shall provide alllabour and testing equipment required.
- The Contractor shall submit a list of testing equipment which shall be made available at sitefor field testing.
- The Contractor shall be responsible for any damage to the equipment and material due toimproper testing carried out and shall replace or restore to the original condition of thematerial.
- The Contractor shall maintain a record of the testing to be carried out at site and shallsubmit copies to the purchaser duly signed by the engineers present at the time of testing.
- The Contractor shall submit a list of the pre-commissioning checks required for anyequipment for approval of the Purchaser.

8. TAKING OVER OF INSTALLATION:

- On successful testing, commissioning and trial run, the Contractor shall request Engineer inwriting for taking over the installation.
- The Engineer, on receipt of the request, shall arrange to take over the installation eitherwholly or in part as the case may be after a final inspection.
- Till such taking over, the Contractor shall be held responsible for all equipment or materialsagainst any theft or damage.

9. GUARANTEE:

- The Contractor shall furnish a Guarantee for the supplied items for a period of 12 monthsfrom the date of handing over or 18 months from the date of supply, whichever is earlier,for free replacement of defective/faulty materials.
- The Contractor shall also furnish Guarantee towards the workmanship of the installationdone by him for a period of 12 months from the date of handing over of the completeworks to the department.

10. TESTS:

All equipment and accessories under this specification shall be subjected to routine tests as per the latest relevant standards applicable at manufacturer's works.

Department might inspect the tests of all equipment. Hence prior intimation to be given inorder to depute the Engineer from Department. Pre-dispatch inspection shall be carried out for all Power Distribution Boards, MV Power cables etc.

The pre-commissioning inspection among other requirements shall include visual inspection, checking the workmanship of the installation, the rating of equipment, safety clearances, sizes of cables installed, soundness of switchgear bus connections, wiring properly dressed and labeled, sealing of unused cable entries, checking of all safety interlocks, control/interface functions as per requirement etc.

Pre-commissioning tests shall include but not be limited to the following:

- Continuity test for each winding and power and control circuits. Insulation test for each winding and power and control circuit
- Earth resistance measurement for each earth electrode, and the earthing system as a whole.
- Lighting installation shall be tested for correct illumination levels, with fittings installed.
- Testing of all types of relays/releases for required operation.
- Testing of measuring instruments for proper functioning.
- Earth continuity test for all circuits
- Checking the correctness of wiring schemes, control circuit interlocks for intended functioning.

Site Acceptance Test procedure for specific equipment shall be furnished by the respective equipment vendor as per relevant IS. The contractor shall provide necessary assistance to the equipment vendor to perform Site acceptance testing to enable the equipment vendor to perform the same

All pre-commissioning checks and tests shall be carried out as per the directions of Engineer-in-charge. In addition to the equipment manufacturer's instructions, pre-commissioning check requirements shall also be complied. All tests shall be carried out by contractor in the presence of Owner' s representatives

The contractor shall bring to site all required tools, tackles, and testing instruments for carryingout field testing. Contractor shall use only calibrated measuring and test instruments and shall maintain valid calibration records.

Contractor shall keep up-to-date records of all activities carried out and test results. Field inspection / test reports shall be submitted to NFC by the contractor in bound volumes (triplicate copies).

Testing of Cables

The contractor shall submit the following documents prior to placement of order:

- Manufacturer details.
- Cable data sheets.

- Test certificates relating to raw materials being used as per List attached in tests to be carried out.
- Type test certificates of cables not older than 7 years from NABL accredited laboratory (Raw material being sourced from same supplier).
- Details of works where the similar cables (Not less than 2 Kms) are used along with the performance certificates issued by user authority not less than Superintending Engineer rank.

The cables shall be tested and inspected at the manufacturer's works. Vendor shall give at least 2 weeks advance notice to NFC.
After completion of manufacture of cables and prior to dispatch, the cables shall be subjected to type, routine, acceptance and special tests as per relevant IS and approved QAP. The test reports for all cables shall be got approved from the Engineer-In charge before dispatch of the cables.
All tests shall be carried out as listed in IS: 7098 (Part-2) XLPE insulated cables.

To be submitted on completion of work

Soft copy of the following documents shall be submitted:

- Drawings of DBs and panels as built.
- Pre-commissioning test reports
- Manuals as required
- Lighting Layouts and all associated Single Line Diagrams, Wiring Diagrams,
- Earth Pit Layout drawings

11. LIST OF MAKES:

SL NO	ITEM DESCRIPTION	SUGGESTED MAKES
1	DB/MCCB	LEGRAND, HAGER, SCHNEIDER, SIEMENS, ABB, L&T, GE
2	MCB/RCBO/SFU	LEGRAND, SCHNEIDER, SIEMENS, ABB, L&T, GE, HAGER,
3	LIGHT FITTINGS	PHILIPS, WIPRO,BAJAJ
4	CEILING FANS	KHAITAN URJA, ORIENT ELECTRIC ECO TECH, BAJAJ ENERGOS, USHA ENERGION 32, ATOMBERG, HAVELLS
5	PEDESTAL FANS	KHAITAN, ORIENT ELECTRIC, BAJAJ, USHA, ALMONARD
6	EXHAUST FANS	KHAITAN, ORIENT ELECTRIC, BAJAJ, USHA,

		ALMONARD
7	METAL CLAD SOCKETS/MCB ENCLOSURE BOX	LEGRAND/ HAGER/SIEMENS / L&T
8	SWITCHBOARDS	CRABTREE MURANO, NORTHWEST ARTISA, LEGRAND ARTEOR, SCHNEIDER ELECTRIC ZENCELO
9	WIRES	KEC INTERNATIONAL LTD, KEI INDUSTRIES LIMITED, TORRENT POWER LIMITED, UNIVERSAL CABLES LIMITED
10	POWER CABLES	KEC INTERNATIONAL LTD, KEI INDUSTRIES LIMITED, TORRENT POWER LIMITED, UNIVERSAL CABLES LIMITED
11	CONTROL CABLES	POLYCAB/ GEM / SPM / RALLISON / UNIVERSAL / TORRENT / RPG / CCI / KEI
12	END TERMINATIONS	DOWELLS, JAINSON, HMI, COMET
13	PVC CONDUITS/ CORRUGATED FLEXIBLE CONDUIT/ GALVANIZED STEEL FLEXIBLE CONDUIT PIPES WITH PVC COATING /ACCESSORIES	SUDHAKAR/AKG
14	DLP PLASTIC TRUNKING/ACCESSORIES	LEGRAND/HAGER/SCHNEIDER
15	STRUCTURAL STEEL	TATA, VIZAG STEEL, JINDAL ISPAT, SAIL
16	EARTH PITS	DEHN/OBO/ERICO/JEF
17	ENERGY METERS/MFM	SECURE/L&T/SCHNEIDER ELECTRIC/SIEMENS