

ELECTRICAL GENERAL PROVISIONS**PART 1 – GENERAL****1.01 WORK DESCRIPTION**

- A. The scope of works for all electrical works and systems comprises engineering, supply, delivery, installation, testing and commissioning, handover, training, maintenance and warranty all as described or reasonably implied in the Contract. The Contractor is obliged to provide fully functioning works and systems in conformance with the requirements of the Contract. In the event certain items are not fully described or indicated in the Contract, but deemed essential by the Engineer for the performance of the works and systems then the provision of such items shall form part of the Contractors scope of works at no additional cost to the Owner.
- B. The Contractor shall be responsible to co-ordinate the equipment and services and shall produce properly co-ordinated shop drawings to demonstrate the installation comply with the performance requirement with shop drawing, calculations and details.
- A. Shop drawings shall take into account actual measurement and setting out dimensions/levels obtained and determined by the Contractor on site, actual equipment/material used, actual routing of services, co-ordination with all installation, and site conditions/constraints. This specification is intended to cover installation, testing and commissioning of LV Panels and associated equipment/ materials, panels, etc.

1.02 SCOPE OF WORK:

- A. The Electrical and ELV installation shall generally include the following:
1. Common Services:
 - a. Liaison with the local supply Authority to obtain and coordinate provision of incoming electricity supply.
 - b. Installation, testing & commissioning of MV system including incoming electricity supply, consumer main MV switchboard, cabling to component MV switchboards, cabling to power transformer, power transformers and associated accessories to SEB requirement and arrange SEB acceptance upon completed.
 - c. Supply, installation, testing & commissioning of telephone system including incoming telephone lines, component telephone distribution panel at each level, interconnecting cablings and associated accessories.
 - d. To provide telephone cabling as specified on the drawings.
 - e. Complete central earthing systems for connection with component electrical systems.
 2. Internal Services
 - a. Complete LV distribution system including main LV switchboard, automatic power factor correction devices, sub-boards and distribution boards, UPS and associated distribution main and sub-main cabling and associated accessories.
 - b. Complete lighting and power installation including all final circuiting work and associated accessories.
 - c. Normal and emergency lighting supply and installation and associated accessories.
 - d. Complete earthing system.
 - e. Complete lightning protection system and associated accessories.
 - f. Complete telephone cabling system and associated accessories.
 - g. Complete wiring work to external/landscape and public area architectural/special lighting and dimming systems and associated accessories.
 - h. Complete cable support system for future structure cabling system and associate works.
 - i. Miscellaneous works like providing and fixing of rubber mats, fire buckets, first aid box, fire extinguishers, etc.
 - j. All associated interfacing power supply work to other mechanical installations.

- k. All interfacing works with the Building Management System for remote control and monitoring.
 - l. All associated interfacing works with other M&E installations.
 - m. Other works as shown on the Drawings and described elsewhere in the Contract documents.
- B. The item rate shall remain valid for variation to any extent of the estimated quantities given in the Schedule of Quantities.
- C. All equipment shall be of the class most suitable for working under the conditions specified and shall withstand the atmospheric conditions without deterioration.
- D. Minor civil work is included in the contractor's scope of work. Further, the responsibility of coordination with the civil and other contracting agencies ensuring completion of turnkey contract rests with the contractor.
- E. Contractor shall co-ordinate with all other agencies working at site for interconnection and safety aspects.
- F. Also the Contractor shall furnish back up combined guarantee minimum for 1 year from the date of successful commissioning from the manufacturer. In case there is any defect, the free replacement of any part or in whole will be made immediately at no extra cost to Owner.

1.03 FEE, PERMITS & TESTS:

- A. The contractor shall obtain all sanctions and permits required for the above said works from all the relevant authorities. All actual fees payable in this regard will be reimbursed against receipt/documentary proof (evidence). On completion of the work, the Contractor shall obtain N.O.C from concerned authorities including SEB, Chief Electrical Inspectorate, of State. The original of the same shall be delivered to the Owner through Consultants.
- B. The Owner shall have full power regarding the equipments/ materials get tested by authorized/ recognized independent agency at the contractor's expense in order to prove their soundness and adequacy. The contractor will rectify the defects/ suggestions pointed out by independent agency through Owner at contractor's expense.
- C. The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations (for F.F. etc.) as amended up to date, there under and special requirements, if any, of the State Electricity Boards etc. The contractor shall be liable to furnish the list of authorized licensed persons/ employed/ deputed to carry out the works/ perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

1.04 CODES & STANDARDS:

- A. The design, manufacture, inspection, testing and performance shall comply with all the currently applicable statutes, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (BS), International Electro Technical Commission (IEC) publication, NEMA & VDE Standards amended up to date.
- B. The design engineering, manufacturing and the installation shall be in accordance with established codes, sound engineering, practices and specifications. Further, the same shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities, e.g. Electrical inspector, SEB or any other agency as applicable before commissioning of electrical system if required.
- C. Some of the relevant Indian and British Standards are listed below.
1. Indian Electricity Act.

2. Indian Electricity Rules.
3. Factory Act.

Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.

In case of any deviation/conflict of this specification with the codes & standards, the following order of precedence shall govern

1. Engineer's decision.
2. Local codes of practice
3. Drawings.
4. Specifications
5. International standards & requirements.

1.05 DESIGN:

- A. The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipment offered by the contractor shall be complete in all respects. Any materials or accessories, which may not have been specifically mentioned, but which are usual and necessary for the completion of the system and satisfactory & trouble free operation and maintenance of the equipment shall be provided without any extra cost to the Owner. This shall also include spares for commissioning of the equipment.
- B. This specification defines the basic guidelines to develop a suitable electrical system as necessary for the Complex. All data required in this regard shall be taken in to consideration to develop a detailed engineering for the system. Site conditions as applicable are mentioned elsewhere.
- C. Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.
- D. All work to be performed and supplies to be made as a part of contract shall require specific approval/review of Owner or his authorized representative
- E. The engineering activities shall comprise the submission for approval of the following from Consultants/Owner

1.06 BIDDER SHALL BE RESPONSIBLE FOR:

1. Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
2. Preparation of bill of materials for electrical works.
3. Protection co-ordination drawings/ tables for complete power system.
4. Shop inspection and testing procedures.
5. Field-testing and commissioning procedures.
6. Preparation of as built drawings.

Bidder shall also be responsible for:

Any other work/activity which is not listed above, however is necessary for completeness of electrical system

Bidder shall clearly understand and quote accordingly:

To ensure that all clauses given in this part of the specifications shall also apply to all other electrical works of other segments. The bidder shall bring to the notice of the Owner the differences, if any, and get the same clarified failing which the Owner may impose the more stringent of the specification/ clauses at the sole risk and costs of the contractor.

1.07 DATE OF COMMENCEMENT AND COMPLETION PERIOD:

- A. The contractor shall be allowed admittance to the site on the date of commencement as described in the General Conditions and he shall thereupon and forthwith begin the works and shall regularly proceed with and complete the same on or before the date of completion subject, nevertheless to the provisions for the extension of time. The time being the essence of the contract, the Contractor will adhere to the time, progress chart and project schedule and will give proportional output/progress in proportional time

1.08 SCHEDULE AND MANNER OF OPERATIONS:

- A. Time being the essence of this Contract, the Contractor will be expected to furnish all labour and materials in sufficient quantities and at appropriate times, expedite and schedule the work as required and so manage the operation that the work will be completed within the time stated in the Contract.

1.09 PROJECT SCHEDULE:

- A. The contractor will have to submit a detailed project schedule.

- 1 For various items of works to be carried out by him.
- 2 For various associated works to be carried out by other agencies.

so that the work gets completed within the contractual completion time. This schedule shall be submitted by the contractor in Microsoft project software format. The contractor shall follow this schedule meticulously and shall also coordinate/ follow up with other agencies to expedite the works associated with his own work. Liquidity damages clause will become applicable for any delay in completion of the work.

- B. The contractor will submit within 7 days of the award of work, a detailed schedule of program of work.
- C. No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedules even though the time schedule is approved by the Consultant/Engineer-in-Charge.

1.010 DESIGN CONDITIONS:

- A. Design ambient: 45 Deg. C maximum dry bulb temperature & 2 Deg. C minimum dry bulb temperature
- B. Altitude: 300 m above sea level
- C. Relative Humidity: 98% maximum
- D. Site Environment: Normal.

1.10 COORDINATION OF WORK

- A. Contract documents establish scope, materials and quality but are not detailed installation instruction.
- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other divisions will permit. Provide off-sets, fittings, and accessories which may be required but not shown on the drawings. Investigate the site, and review drawings of other divisions to determine conditions affecting the work, and provide such work and accessories as may be required to accommodate such conditions.

- D. The locations of thermostats, switches, panels and other equipment indicated on the drawings are approximately correct. Exercise particular caution with reference to the location of panels, thermostats, switches, etc., and have the precise and definite locations accepted by the Engineer before proceeding with the installation.
- E. The drawings show only the general run of services and approximate location of equipment, outlets, panels, etc. Any significant changes in location of equipment, outlets, panels, etc., necessary in order to meet field conditions shall be brought to the determine attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost to the Contract.
- F. Carefully check space requirements with other division works to ensure that equipment can be installed in the space allotted.
- G. Wherever work interconnects with work amongst different installation, coordinate with other trades to insure that they have the information necessary so that the Contractor may properly install the necessary connections and equipment. Identify items requiring access in order that the Ceiling Trade will know where to install access doors and panels.
- H. Consult amongst installation so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- I. Furnish and set sleeves for passage of risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each riser passing through building surfaces.
- J. Provide fire stopping around all pipes, conduits, ducts, sleeves, etc, which pass through fire compartments.
- K. Provide required supports and hangers for equipment suitably so as not to exceed allowable loading of structures.
- L. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of record drawings.
- M. Coordinate with the local utility companies/authorities for their requirements for service connections and provide all necessary provisions, grounding, materials, equipment, labor, testing, and appurtenances.
- N. Before commencing works, examine adjoining works on which this work is in any way affected and report conditions which prevent performance of the works. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- W. The Contractor is responsible to any modifications required due to service not properly coordinated.

1.11 ELECTRICAL POWER SUPPLY INTERFACES

- A. The Contractor shall provide power supply points/isolators at certain designated locations within the development for all mechanical and electrical installations as indicated on the drawings. It is the responsibility of the Contractor to coordinate and make connections to these power supply points/isolators and to provide all the necessary 'down-stream' power supply distribution board/network to the mechanical system's control panels, equipment, sensors, field devices, etc.

1.12 BUILDING MANAGEMENT SYSTEM AND INTERFACES

- A. The Contractor shall co-ordinate the mechanical system and equipment to interface with the Building Management System in accordance with the point schedules specified on the Drawings. All necessary interfacing works shall be included in the Contract.

1.13 CENTRAL CONTROL ROOM INTERFACES

- A. The Contractor shall include the supply and installation of a custom-built control console of proprietary make in the Fire Command Centre and each building component's Security Room to integrate all control panels, mimic panels, and central equipment of the following systems:
1. Building Management system
 2. Security systems, including CCTV, access control, door monitoring, watchman tour, panic alarm system, etc.
 3. Fire Alarm and Detection system
 4. Ventilation Control Panel for all emergency operation fans/systems
 5. Lift system
 6. Escalator system
 7. Fireman Intercom system
 8. Fire Protection Pumps Control Panel
 9. Fireman's Override Control Panel
 10. Public Address and Emergency Evacuation Announcement systems
 11. MATV System
 12. all other systems to be housed inside the Fire Command Centre/Security Room

1.14 INTERFACING WITH ALL SERVICES AND SYSTEMS

- A. General
1. The Contractor shall provide all necessary provisions for interfacing amongst installation, services, and equipment. All necessary sensors, current/voltage transformers, voltage-free contacts, relays, auxiliary contacts, terminals, transducers, etc. for interfacing works shall be provided by the Contractor.
 2. All control/monitoring wiring from sensors, equipment, and components for the interfacing shall be terminated at a separate interfacing compartment located at the respective equipment/system's switchboard or control panel. The interfacing compartment shall be completed with all necessary connectors, terminals, and with proper identifications to allow interfacing works to be easily carried out. The compartment shall clearly indicate "Extra Low Voltage Cable Only. No Power Cable Connection". Where there is no equipment/system switchboard or control panel involved, the Contractor shall provide separate interfacing panels with provisions same as the interfacing compartment as described above. The locations of the switchboard/control panels and the interfacing panels shall be properly coordinated.
 3. For every control panel and each module of the switchboard, at least five (5) spare terminals shall be provided for future interfacing works.
 4. Wiring and cables for interfacing with the fire alarm system and other fire protection and life safety systems shall be fire rated to comply with Civil Defense's requirements.
 5. Unless otherwise specified or shown on the Drawings, interfacing wiring from Fire Alarm and Building Management systems shall be provided and terminated at the terminals of the interfacing compartments or panels by the Fire Alarm System and Building Management System installation respectively. The Contractor shall co-ordinate the current and voltage requirements for the interfacing works/provisions. The type of provisions for interfacing signals shall be as follows, unless otherwise specified:
 6. Digital inputs and outputs : voltage-free dry contact
 7. Analog inputs and outputs : 4 – 20 mA or 0 – 10 mV
 8. All the interface provisions shall be DC operated and rated not more than 50 mA.

9. For interfacing works between Fire Alarm System and Building Management System, the Contractor shall provide the Fire alarm installation with interface wiring and terminate them at the Building Management System's interfacing compartments or panels.
10. The Contractor shall provide and make all power cable connections from mechanical equipment, local control panels, and distribution boards to the electrical isolators or power points (including cable termination) provided under Division 16 works. Location of power supply isolators and power points shall be properly coordinated.
11. In addition to the interfacing requirements shown on the Drawings, interfacing provisions as described below shall also be provided and included in the Contract.

B. Electrical Installation

1. The Electrical Installation shall provide the following:
 - a. Isolators and power points (fused spur units) for all mechanical equipment and systems. Where shown on the Drawings, the Electrical installation shall include direct power cable connections to the mechanical system's main motor control centres.
 - b. Earthing terminal in the Fire Command Centre and all other plant rooms for supplementary equipotential bonding of mechanical equipment and systems.
 - c. Power failure signal to the Lift System (including wiring terminations into the Lift interfacing panel in the Lift Motor Room), Fire Alarm System and the Building Management System.
 - d. Electrical bonding of all roof equipment and external metal cladding including provisions and connection of bonding cables.
 - e. Fuel main storage tank and day tank High/Low level alarm signals to the Building Management System.
 - f. Emergency power supplies to Building Management System (including all field panels), Fire Alarm System, car parking system, and all security systems.
 - g. Emergency power supplies to all fire shutters, smoke shutters/curtains, and automatic doors.
 - h. Power point in each toilet for the plumbing installation (for connection to automatic sanitary sensors and flush valve under the Plumbing and Sanitary installation).
2. Power supply to variable air volume (VAV) boxes and the ACMV system's control components/sensors shall however be provided under the ACMV installation from the corresponding equipment motor control panel.

1.15 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work, based on examination of the site or other information. Failure to examine the drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

1.16 EXCAVATION AND BACKFILL

- A. Where ever required provide trenches details, duly approved by the consultant with all relevant section etc. as per IS codes to the Civil contractor, minimum before 1 month of laying the pipes, etc. Co ordinate with the civil contractor during the excavation, and ensure that the excavation and backfilling is being properly done as per requirement.
- B. Where ever it is asked by the Owner/ consultant for providing trenches in contractor's scope. It is deemed that the cost of the pipe is inclusive of trench digging and backfilling. The following points needs to be taken care of while making the trenches.
- C. The trench shall be of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the

depths indicated. Where rock excavations are required, excavate rock to a minimum over depth of four inches below the trench depths indicated on the drawings or required. Backfill over depths in the rock excavation and unauthorized over depths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95% to standard proctor density or 75% relative density or as specified by the Engineer. Wherever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

- D. Excavate trenches for utilities that will provide the following minimum depths of cover from existing grade or from indicated finished grade as required by local authorities.
- E. Trenches should not be placed within 3 meters of foundation or soil surfaces which must be resist horizontal forces.
- F. Do not backfill until all required tests have been performed and installation observed by the Engineer. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive soil with limited porosity. Deposit in 15 cm layers and thoroughly and carefully tamp until the work has a cover of not less than 30 cm. Backfill and tamp remainder of trench at 30 cm intervals until complete. Uniformly grade the finished surface.

1.17 CUTTING AND PATCHING

- A. All kinds of cutting and repairing of brick Walls or Partitions, etc. for the proper routing of pipe, shall be in the scope of the contractor. However, cutting and repairing of RCC wall, or ceiling shall be in the scope of civil contractor.
- B. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled trade people of the trades required at no additional cost to the Contract.
- C. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Contract.

1.18 SEALING OF PENETRATIONS

- A. Air Tight Seals
 - 1. All penetrations through the building fabric subject to suction or pressurization shall be sealed airtight.
- B. Holes in Roof
 - 1. Roof penetrations for passage of conduits or circular PVC and PVC Cables shall be sealed watertight using a flexible polypropylene conical sleeve manufacturer to seal the cable to the roof structure, regardless of the roof profile.
 - 2. All sharp metal edges, which may come in contact with the cable, shall be suitably bushed.
- C. Fire Rated Penetrations
 - 1. Where services penetrate any fire rated barrier, the Contractor shall seal the penetration with the use of an appropriate material to ensure the integrity of the fire barrier.
 - 2. The Contractor shall seal the cable enclosures through fire rated barriers to ensure the integrity and rating of the fire barrier.

D. Acoustic Penetrations

1. Where services penetrate acoustic barriers, sealant shall be supplied and installed to maintain the acoustic separation at least equal to the barrier penetration.

1.19 MOUNTING HEIGHTS

- A. Verify exact locations and mounting heights with the Engineer before installation.

1.20 SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and equipment room.
- C. Provide supporting frames or racks for equipment which is installed in a free standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on ducts, pipe, electric conduits, raceways, or cables for support.
- F. Equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splinters, runners, bars and the like in the plane of the ceiling). Provide independent support of equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for equipment so that loading will not exceed allowable loading of structure. Equipment and supports shall not come in contact with work of other trades.

1.21 FASTENINGS

- A. Fasten equipment to building in accordance with the best industry practice.
- B. Where weight applied to the attachment points is 45 kg or less, conform to the following as a minimum:
- | | |
|--|-----------------|
| 1. Wood | : Wood screws |
| 2. Concrete and solid masonry of appropriate ratings -HILTI/FISHER | : Dash Fastener |
| 3. Solid metal screws in tapped holes or with welded studs | : Machine |
- C. Where weight applied to the building attachment points exceeds 45 kg, but is 135 kg or less, conform to the following as a minimum:
1. At concrete slabs provide 60 cm x 60 cm x 13 cm steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top slabs screed line, where no fill is to be applied.

2. At steel decking or sub-floor for all fastenings, provide through bolts and threaded rods. The tops of bolts and rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 135 kg, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall suitably weld or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- E. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars.

1.22 IDENTIFICATION

- A. Identify equipment with permanently attached black phenolic nameplates with 13 mm high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with cadmium plated screws; peel and stick tape or glue on type nameplates is unacceptable.
- B. Services runs shall be properly identified as per the requirements in the Contract.
- C. See individual section for additional identification requirements.

1.23 PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.
- B. Required test lab certification labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

1.24 EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide all details with proper sections for the equipment pads and anchor. The equipment pads casting and making provision for anchor fastening shall be as per the final UNALTERED drawing duly approved by the consultant, shall be in the scope of Civil contractor. However, the Contractor shall ensure the proper coordination with the civil contractor.
- B. All equipment pads for all vibrating equipments shall have cork vibration pads sandwiched between the finish surface and the bottom surface of required thickness suggested by the civil consultant, to ensure that the minimum vibration can travel below.
- C. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.

- D. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an attached to 15 cm square, galvanized metal back plates which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

1.25 MISCELLANEOUS:

- A. A site order book will be maintained at site, which will be in the custody of the Owner, or his representative and all instructions given to the contractor will be recorded in the site order book and the same has to be signed by the contractor to comply with the instructions given therein.
- B. After completion of the work the whole installation shall be tested by the contractor in the presence of the Consultant/Engineer-in-Charge. The tests shall comply the following I.E.E. Regulations and shall be submitted along with the final bill:
1. The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
 2. Test shall be carried out to ascertain that all the non-linked SP switches have been connected to the phase conductor.
 3. The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.
- C. If the result of the above tests does not comply with the I.E.E. Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.
- D. The contractor shall be responsible to provide all the necessary testing instruments, such as megger insulation tester, earth tester multi-meter, AVO meter etc for carrying out the above tests.
- E. The work will not be considered as complete and taken over by the Owner till all the components of the work after being completed at site in all respects have been inspected/ tested by the Consultant/Owner to his entire satisfaction and a completion certificate issued by the Owner/Consultant to this effect.
- F. Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.
- G. At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing to Owner of each layout drawings drawn at approved.
- H. Contractor's Superintendence:
1. The contractor shall provide all necessary superintendence during the execution of the works and as long thereafter as the engineer may consider necessary. The contractor or his competent and authorized agent or representative approved of in writing by the owner/ Engineer (which approval may at any time be withdrawn) is to be constantly on the works and shall give his whole time to the superintendence of the same. Such authorized agent or representative shall receive on behalf of the contractor, directions and instructions from the Engineer-in-charge or his representative.
 2. The contractor shall provide detailed organization of the execution team deployed for the works with names and CV's, of all key staff before the commencement of work and get it approved of in writing by the Owner/ Consultant. Contact telephone or pager numbers for emergency and/or twenty-four (24) hour call shall also be included.
 3. If in any case of withdrawal of any worker/ technician/Engineer from the execution team, the replacement of the same shall be done with equivalent qualification, and shall be approved in writing by the Owner/ Consultant.

PART 2 – PROUCT, TESTING & COMMISIONING

2.01 DESIGN CRITERIA**A. Electrical Details for Incoming Supply:**

1. Supply Voltage: as approved by SEB
2. Fault Level (Sym.) at supply point (Designated): MVA (to be confirmed from State Electricity Board by Bidder).
3. Neutral: Grounded
4. Voltage Regulations: $\pm 10\%$
5. Frequency Regulations: $\pm 3\%$
6. Combined Regulations: $\pm 10\%$

B. LT Power Distribution System:

1. Voltage: 415 V
2. Frequency: 50 Hz
3. Neutral: Grounded
4. Short Circuit Fault withstand capacity: 20 to 50 KA for 1 sec., as per BOQ and specifications

C. Control supply for Electrical System:

The various supply voltage to be used in the control panels for the main equipment shall be as under:

1. Spring charge motor: 230 V AC or 24 V DC (Universal Motor)
2. Closing/ Trip Coil: 24 V DC
3. Alarm/ Indication/ Relays: 24 V DC
4. Heaters: 230 V AC

D. Painting of Panels:

Powder coating of approved shade as per Specification. (Refer clause of painting)

E. Painting of Cable Trays and Structural steel:

Powder coating of approved shade as per Specification. (Refer clause of painting)

F. Cable Details:

1. LT Control Cables: Copper conductor armoured PVC insulated 1.1 KV grade.
2. LT Power Cables: Aluminium conductor armoured XLPE insulated.
3. Grounding Conductors: Copper/ G.I. as specifications and BOQ

G. Accuracy Class of Meters:

1. Revenue Meters: Class-I or as approved by SEB
2. Ammeters, Voltmeters & Other Instruments: Digital Type

2.02 DRAWINGS:

A. The list of drawings is enclosed along with this specification. These drawings are meant to give general idea to bidder regarding the nature of work covered by these specifications.

B. Any information/data shown/not shown in these drawings shall not relieve the contractor of his responsibility to carry out the work as per the specifications. Additional information required by the bidder for successfully completing the work shall be obtained by him.

2.03 SHOP DRAWINGS:

- A. The contractor shall prepare detailed coordinated electrical shop drawing indicating Panel layout, with other relevant services and submit to the Consultant for approval or the Engineer-in-Charge before commencing the work. The shop drawings shall indicate all setting out details and physical dimensions of all components with wiring and cable details including system operating write up in the system i.e. Control and Relay Panel and fixing details for the above mentioned work. All work shall be carried out on the approval of these drawings. However, approval of these drawings do not relieve the contractor of his responsibility for providing maintenance free and full proof system including any missing component/accessories to meet with the intent of the specifications. Contractor will submit 2 (two) prints for preliminary approval and finally 6 (six) prints for distribution.

2.04 MANUFACTURER'S INSTRUCTIONS:

- A. Where manufacturers have furnished specific instructions, relating to the material/equipments to be used on this job, covering points not specifically mentioned in this document, manufacturer's instructions should be followed.

2.05 COMPLETION DOCUMENTS AND DRAWINGS:

- A. Three copies of operation manuals/catalogues of all standard equipment are to be furnished by the contractor immediately after commissioning of plant.
- B. Three copies of write up on preventive maintenance, trouble shooting and operating instructions of the system along with as-built drawings are to be supplied by the Contractor at the time of commissioning.
- C. On completion of the work in all respects, the Contractor shall supply five portfolios (300x450 mm), each containing complete set of drawings on approved scale, clearly indicating complete layouts, location; wiring and sequencing of automatic controls, location of all concealed wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The Contractor shall frame under glass, in the Panel rooms, one set of these consolidated control diagrams.

2.06 MATERIALS AND EQUIPMENT:

All the materials and equipments shall be of the approved make and design. Unless otherwise called for any approval by Owner's Engineer-in-Charge, only the best quality materials and equipment shall be used.

- A. **Space Heaters:**
Suitable number of adequately rated heaters thermostatically controlled with On-Off switch and fuse shall be provided to prevent condensation in any panel compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.
- B. **Fungi static Varnish:**
Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.
- C. **Ventilation Opening:**
In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.
- D. **Degree of Protection:**

The enclosures of the control cabinet, junction boxes and marshalling boxes, panels. etc to be installed shall provide degree of protection as detailed her under.

1. Installed indoor : IP-55
2. Installed indoor in air-conditioned area : IP-31
3. Installed in covered area : IP-42
4. Installed indoor in non air-conditioned area where possibility of entry of water is limited :IP-41
5. For LT Switchgear (AC and DC distribution boards) :IP-42

The degree of protection shall be in accordance with IS: 13947 (Part –I) IEC-947 (Part –I). Type test report for degree of protection test, on each type of the box shall be submitted for approval.

E. Rating plates, Name plates and Labels:

LV panel and auxiliary items installed in the building is to permanently attach to it in a conspicuous position. A rating plate of non-corrosive material with engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of loading conditions of equipment in question has been designed to operate and such diagram plates as may require by the owner. The rating plate of each equipment shall be in accordance to IEC requirement.

All such nameplates, instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates on with Hindi and another with English inscriptions may be provided.

F. Design Improvements:

The bidder shall note that the equipment offered to him in the bid only shall be accepted for supply.

If for any reason, contractor wished to deviate from specification, prior permission from owner/ consultant shall be sought.

If any change is agreed upon and that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/ or schedule of completion before the contractor proceeds with the change. Following such arrangements, the provision thereof, shall be deemed to have been amended accordingly in the specification.

G. Quality Assurance Programme:

To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Owner's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Owner after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

1. His organization structure for the management and implementation of the proposed quality assurance programme.
2. Documentation control system.
3. Qualification data for bidder's key personnel.
4. The procedure for purchases of materials, parts components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
5. System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
6. Control of non-conforming items and system for corrective actions.
7. Inspection and test procedure both for manufacture and field activities.
8. Control of calibration and testing of measuring instruments and field activities.

9. System for indication and appraisal of inspection status.
10. System for authorizing release of manufactured product to the Owner.
11. System for maintenance of records.
12. System for handling storage and delivery and.

The Owner or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor / his Vendor's quality management and control activities.

H. Quality Assurance Documents

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

1. All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.
2. Welder and welding operator qualification certificates.
3. Welder's identification list, listing welder's and welding operator's qualification procedure and welding identification symbols.
4. Raw material test reports on components as specified by the specification and / or agreed to in the quality plan.
5. Stress relief time temperature charts/oil impregnation time temperature charts.
6. Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.
7. The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

2.07 INSPECTION, TESTING AND INSPECTION CERTIFICATES:

- A. The Owner and the Consultant or duly authorized representative shall have at all reasonable times free access to the Contractor's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Owner and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- B. All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the Owner/Consultant the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test were pending payment would be made on successful completion of type/routine test(s) actually carried out as per Consultant/Owner instructions.
- C. The Contractor shall give the Consultant/Owner thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The Consultant/Owner unless witnessing of the tests is virtually waived will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may

proceed with the test which shall be deemed to have been made in the presence of Owner/Consultant and he shall forthwith forward to the Consultant duly certified copies of tests in triplicate.

- D. The Consultant/Owner shall within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.
- E. When the factory tests have been completed at the Contractor's or Sub-contractor's works, the Consultant/Owner shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Consultant/Owner, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Consultant/Owner. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection, is found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Owner.
- F. For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labor, materials, electricity, fuel, water, stores, apparatus and instruments as may be required by Owner/Consultant or this authorized representative to carry out effectively such tests of the equipment in accordance with the Specification.
- G. The inspection by Owner/Consultant and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- H. The Consultant/Owner will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.
- I. The Owner/Consultant reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Contractor.

2.08 TESTS:

A. Charging (Pre-commissioning tests):

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner/Consultant and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S. / vendor/ bidder submittal and as included in the Contractor's quality assurance programme.

B. Commissioning Tests:

1. The available instrumentation and control equipment will be used during such tests and the Contractor will calibrate all such measuring equipment and devices as far as practicable. However, unmeasurable parameters shall be taken into account in a reasonable manner by the Contractor for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified conditions.
2. All instruments, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
3. Pre-commissioning test shall be carried out as per relevant IS and/or as specified in the relevant clause.

4. The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning of the equipment. However necessary fee shall be reimburse by Owner on production of requisite documents.

2.09 PACKAGING:

- A. All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Owner takes no responsibility of the availability of any special packaging/transporting arrangement.

2.1 PROTECTION:

- A. All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

2.2 FINISHING OF METAL SURFACES:

- A. General:
All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro galvanized. All steel conductors used for earthing/grounding (above ground level) shall be galvanized according to IS: 2629.
- B. Painting:
 1. All sheet steel work shall be degreased, pickled, and phosphated in accordance with the IS-6005 "Code of practice for Phosphating iron and sheet". All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swab shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
 2. After Phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.
 3. Powder coating/electrostatic painting of approved shade shall be applied.
 4. The exterior color of the paint shall be as per IS-5 or as approved by Consultant. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments, if required.
 5. In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures like electrostatic painting etc. the procedure shall be submitted along with the Bids for Owner's review and approval.

2.3 HANDLING, STORAGE AND INSTALLATION:

- A. In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Owner or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.
- B. Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.
- C. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Owner/Consultant. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.
- D. Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
- E. The Contractor shall submit to the Owner every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- F. The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- G. The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment, which require indoor storage.
- H. The words 'erection' and 'installation' used in the specification are synonymous.
- I. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- J. The minimum phase to earth, phase to phase and section clearance along with other technical parameters for the various voltage levels shall be maintained as per relevant IS.

2.4 PROTECTIVE GUARDS

- A. Suitable guards shall be provided for protection of personnel on all exposed rotating and / or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.
- B. The Contractor shall also conform to the general regulations governing personnel on the site and must keep to the working space allocated for their use.
- C. The contractor shall be responsible for any kind of mishap, etc. happened with personnel. The Owner shall not take the responsibility for any of such kind.

2.5 TOOLS AND TACKLES:

- A. The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dismantling and maintenance of the equipments.

END OF SECTION