GENERAL SPECIFICATIONS (ELECTRICAL)

1. **SPECIAL INSTRUCTIONS**

   Actual work shall be carried out by persons holding valid PWD Wireman License. The electrification work shall be supervised by persons holding PWD Supervisors License.

2. **QUALITY OF THE MATERIAL**

   Site Engineer's of MDL approval in writing shall be obtained prior to commencement of the work to the following:-

   (a) Layout of wiring

   (b) Sizes of Cables

   (c) Make of the materials, fittings / fixtures, etc. which shall be of the approved make.

   All the materials shall be new from the fresh stock and shall conform to I.S. specifications. When standard does not exist, such material / sample shall be submitted for site Engineer's of MDL approval, with Test Certificate from Government approved laboratories.

   Contractors shall produce, on demand, such details as called for by the site Engineer of MDL to prove the genuineness of the material.

   Rejected materials must be replaced by the contractors within 7 (seven) days.

3. **WORKMANSHIP**

   The work shall be carried out keeping in mind the aesthetic requirement of individual site and matching of final work with the surrounding by proper finishing as necessary to maintain uniformity. Good workmanship is an essential requirement of this contract. Poor workmanship will be liable for penalization.

4. **MEASUREMENT & CANCELLATION OF THE PART CONTRACT**

   The bill of the quantities is based on the plans of the buildings/ individual office showing the approximate location of all outlets, switchgear, etc. and are approximate only. The contractor shall be paid at actual as measured jointly by the representatives of the Contractor and Site Engineer of MDL.

5. **INSPECTION & TESTS**

   The Contractor shall offer each and every equipment for test at the works or otherwise test certificate shall be furnished in case inspection is waited.

   All the materials shall be approved before starting the work.

   Teak wood switchboards shall be inspected before and after the application of shellac varnish.

   Wiring shall be approved before boards or blocks are fixed up.\

   Casing-N-Capping / Conduit pipes shall be inspected before erection.

Mounting arrangement of the ceiling fans / fluorescent fittings / spot lights shall be inspected and approved by the Site Engineer, MDL.

Connections to earth electrodes shall be inspected and got approved by the Site Engineer, MDL, prior to connection.

6. **DRAWINGS & CERTIFICATION:**

The contractor shall submit, following certificates, in duplicate, to the Site Engineer, MDL, for record purpose after the completion of the work.

(a) Completion Drawings.

(b) Copies of Completion Certificate and Test Report submitted to Manufacturer.

(c) Any other Certificate / Reports as called for by the Site Engineer, MDL.

(d) Instruction & Operation Manuals, Catalogues, etc.

(e) On completion of the work, 3 (Three) sets of wiring diagram with proper symbol shall be prepared and submitted to the Site Engineer, MDL.

All wiring diagrams shall indicate clearly the main Power Distribution Board, MCB Distribution Board, switchboards, the runs of various mains and sub-mains and position of all the points and their control. All circuits shall be clearly indicated and numbered in the wiring diagrams and all points shall be given the electrical connection.

7. **WIRING :**

All the wiring shall be done on the distribution system with the main and branch distribution boards at convenient physical and electrical load center.

All runs of wiring shall be laid in such a manner that crossing is avoided.

All runs of wiring and exact position of all points and switchgear shall be first marked on the building itself and approved by the Site Engineer, MDL.

Single / multi-strand single / double PVC wires shall be from fresh stock. Lights and fans shall be wired on a common circuit, including socket outlets.

As regards power circuits, in no case, there shall be more than 2 (Two) power points (16/6 Amp.) on each circuit.

Each sub-circuit 'Power' or 'Lighting' shall be protected by a fuse / ELCB / MCB.

When conductors pass through wall and floors, the conductors shall be wired through rigid pipe PVC sleeves of suitable size permitting easy pass of the wires. The ends of sleeves shall be nearly fixed with PVC bushings.

All ceiling fans shall be wired to ceiling-rose through connector to which fan rod wires shall be connected and suspended from hooks or shackles with the insulators between hooks and suspended rods.

Canopies on top and bottom of suspension rod shall be effectively suspended and connected to fan motors respectively.

The fluorescent fittings shall be suspended by suspension rods, wherever specified, from the ceiling with special couplers fixed on to single teak wood blocks or suitable size G.I. clamp./GI chain. The suspension rods shall be screwed to the couplers and end of the pipe shall touch within coupler to maximum extend and shall in addition be secured by means of split pins. Two such suspension rods shall be provided for each fitting.

All the fluorescent fittings shall be supplied complete with all the standard accessories and they shall be duly wired. Ceiling rose shall be of 3-plated terminal so as to terminate Earthing wire.

All ceilings roses, brackets, pendants and accessories attached to walls or ceilings shall be mounted on PVC or teakwood switchboards. Teakwood switchboard shall be varnished. Switchboard shall not be less than 25 mm/40 mm deep. Screws shall be used for attaching fittings and accessories to their switchboard. The PVC / Teakwood round blocks shall be fixed with long length screw.

All the teakwood articles shall be given one coat of varnished shellac conforming to I.S. 347-1952 over an application on marketed articles. If no application has been made earlier, two coats of varnish shellac conforming to I.S. 347-1952 shall be given.

Suitable size danger boards in MARATHI & ENGLISH shall be fixed at every service position and where supply voltage exceeds 230 Volts.

Casing –n- Capping and accessories shall be of same make and as per IS 14927 Part-1. In casing –N-Capping wires, shall be laid in one length without any joint. Casing- N-Capping shall have minimum joints,

The casing –n- capping shall be ISI marked.

All the dimension and thickness shall be as per IS 14927 (Part-I & 2)

Instead of internal working sizes, all external dimension shall be included in specification.

8. **LIGHTING SYSTEM & POWER RECEPTACLES:**

The contractors shall supply all lighting switches, power receptacles, distribution boards and sub-distribution boards complete with switch fuses, junction boxes, pull boxes, terminal blocks, glands, conduits and accessories (elbows, tees, crosses, bends, etc), supporting and anchoring materials, to make the installation complete. The contractor shall also supply all lighting fixtures complete with fluorescent tubes / incandescent lamps and lighting cables. All materials, fittings and appliances used in the electrical installation shall conform to the I.S. specifications.

Wiring shall be colour coded so as to enable easy identification of phase, neutral and earth wire.

Main and sub-distribution boards shall conform to the stipulations of IS 732 or as approved by the Site Engineer, MDL at site. These shall be weatherproof and dust-proof.

Receptacle and lighting fixtures shall be fed from different circuits.

All receptacles and switches to be installed in offices, control rooms and other decorative/finished are shall be flush mounted.

All exposed metal parts of the plug, when the plug is in complete engagement with the socket outlet, shall be in effective electrical connection with the earthing pin.

Conduits and fixtures shall be grounded properly by tinned copper wires by means of approved type grounding clamps efficiently fastened to the conduit pipe with earthing clips. To achieve perfect electrical continuity, the conduits shall be bounded effectively on either end of couplings and other points. Conduits shall be grounded at the ends adjacent to switchboards at which they originate or otherwise at the commencement of the run by a grounding conductor connected to an earth clip, clamp or gland in active electrical contact with the conduit.

Installation tests stipulated in IS 732 and other codes or practices shall be carried out by the contractor in the presence of the Site Engineer, MDL, before putting the installation in service.

9. **LIGHTING FIXTURES:**

(a) The lighting fixtures offered shall comply with the following requirement:

- The fixtures shall be suitable for operation on a normal supply of 240 Volts, Single Phase, 50 Hz, A. C. with a voltage variation of ± 6%.
- All fixtures shall be designed for minimum glare. The finish of all parts of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.
- All fixtures shall be designed for continuous operation under atmospheric conditions specified without reduction in lamp life, deterioration of material and internal wiring.
- For multi-lamp fluorescent fittings, the circuit should be designed in such a manner as to reduce the stroboscopic effect to the minimum.

(b) Lighting fixture ballast shall be designed, manufactured and supplied in accordance with the relevant standard and shall function satisfactorily under site conditions specified. The ballast shall have a long service life and low power loss.

- Ballast shall be mounted using self-locking, anti-vibration fixture without

(c) Lighting fixture starter shall be of the safety type i.e. if the lamp fails to ignite at the first start, no further starting must be possible without attending to the tube light. Starter shall have bimetal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without the use of any tool. Starter shall have brass contacts and radio interference capacitor.

(d) Lighting fixture capacitors shall have constant value of capacitance and shall be connected across the supply of individual lamp circuits.

Each capacitor shall be suitable for operation at 240 Volts (+6%) single phase, 50 Hz with a suitable value of capacitance so as to correct the power factor of its corresponding lamp circuit to the extent of 0.98 lag.

The capacitors shall be hermetically sealed preferably in a metal container to prevent seepage of impregnating material.

(e) Lamp holders for fluorescent tubes shall be spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation value, contact resistance or lamp holding quality. Rotors shall hold the lamp in position under normal condition of shock and vibration. Lamp holders for incandescent and manufactured in accordance with the relevant standard and designed to give long and satisfactory service.

(f) Lighting fixture reflectors shall generally be manufactured from sheet steel or aluminium of not less than 22/24 SWG. Fixtures shall be readily removable from the housing for cleaning and maintenance without disturbing the lamp and without the use of tools. Fixtures shall be securely mounted to the housing by means of positive fastening devices of a captive type. For the lighting fixtures in Category-I the gauge of the C.R.C.A. sheet shall be as per manufacturer's design.

(g) Polystyrene eggs box type louvers shall be provided whenever specified. Appropriate captive type fixing devices shall be incorporated for securing these.

(h) Each fixture shall be complete with a four way terminal block for the connection and looping of incoming and outgoing supply cables. Each terminal shall be able to accept two 6 sq.mm solid aluminium conductors.

(i) Each lighting fixture shall be provided with a grounding terminal suitable for connecting 2.5 sq. mm stranded tinned copper grounding conductor terminal.

(j) On completion of manufacture, all surfaces of the fixtures shall be thoroughly cleaned and degreased. The fixture shall be free from scale, dust, sharp edges and burrs.

- The enamel finish shall be as per standard, non-porous and free from blemishes, blisters and fading.

- The surface shall be scratch resistant, and shall have no signs of cracking or flaking when bent through 90 degree on a 12mm diameter mandrel.

- All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light specified.

- All reflectors and louvers shall be finished to the standard as the fixture housing.

(k) The following routine tests shall be conducted as per the relevant Indian Standards:

- Each fixture shall be tested at 1500 Volts R.M.S. at 50 c/s for one minute and no flashover or breakdown shall occur between current carrying parts and ground.

- Each fixture completes with its proper lamp / lamps shall operate satisfactorily at its normal voltage and frequency.

- Each fixture shall be examined visually to ensure that it is complete in all respects and satisfactorily finished.

- All luminaries provided with glass covers shall be subjected to thermal shockproof test. This test shall be conducted to ensure that the cover glass will withstand sudden variation in surface temperature due to rainfall or splashing water when the lighting fixture is fitted. The cover glass shall be heated in an oven to attain a steady temperature of 100ºC and then plugged into cold water. No crack should develop.

- Energy Efficient Tube light System :

  The system shall have following specification:

  i) Operating range 130 V to 300 V A. C., 50Hz.

  ii) Flicker free starting and illumination.

  iii) No stroboscopic effect.

  iv) Hum free operation.

  v) Safety from shock hazards.

  vi) Wing reflector to deliver uniform.

  vii) Programmed preheat for full utilization of lamp life.

  viii) EMI & RFI conforms to IS 6842.

  ix) Harmonics contents conforms to IEC 1000-3-2.

Economy: The lamp rated life of upto 10,000 burning hours and for heavy duty operation with a higher rated lamp life of upto 20,000 burning hours.

It shall be possible to fix into the conventional tube light fixture without any change in fixture and wiring, with bypassed existing choke in circuit.

10. **CABLES**

(a) Cables shall be capable of satisfactorily withstanding, without damage, during transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected, when operating under the climatic conditions prevailing at the site as indicated in this specification.

(b) Cables shall be capable of giving satisfactory performance when laid in trays, trenches conduit, and ducts and when directly buried in the ground.

(c) Cables shall be capable of operating satisfactorily under a power supply system voltage variation of ± 6% and frequency variation of ± 2%.

(d) Cables shall normally be laid under the following conditions …

i) In air-ambient temperature of 40ºC.

ii) In ground-ground temperature of 30ºC.

iii) Depth of laying in ground – 750 mm.

iv) In conduits – space factor of not more than 60%.

(e) PVC insulated cables shall be 1100 volt grade heat resistant type, whenever specifically mentioned.

(f) If shorter radius appears necessary, no bend shall be made until clearance and instructions have been received from the representative of MDL.

(g) Wherever groups of H.V. and L.V. cables are to be laid along the same route, suitable barriers to segregate these cables physically shall be introduced.

(h) Wherever cables crosses roads and water, oil, gas or sewage pipes or G.I. pipes, the cables shall be laid in reinforced spun concrete pipes. For road crossings the pipe for the cable shall be buried at not less than 1-meter depth.

(i) The armour of the cable shall be bonded to the earthing system of the station.

(j) All new cables shall be megger tested before laying and after jointing is completed, all L.V. cables shall be megger tested and H.V./H.T cables (3.3 KV to 11 KV) pressure tested before commissioning. The voltage for pressure testing shall as per IS:1255. 1100/650 Volts grade cables shall be tested by 1000 volts megger.

(k) Cable cores shall be tested for:

i) Continuity

ii) Absence of cross phasing

iii) Insulation resistance to earth

iv) Insulation resistance between conductors

Contractor shall furnish all testing kit and instruments required for field testing whenever asked by the MDL Site Engineer / Engineer's representative.

(l) DISTRIBUTION BOARDs

The DBs shall be suitable for operation on 3 phase/single phase 415/230 Volts, 50 cycle. The DBs shall comply with the addition of relevant Indian Standards and Indian Electricity Rules and Regulation.

(m) **CONSTRUCTION FEATURES OF DISTRIBUTION BOARDS**:

All distribution board shall be provided with load break switches of appropriate capacity as incoming. All TPN distribution shall be provided with SP MCB's as outgoing. Separate neutral bus bars shall be provided for TPN distribution boards for each phase. Separate ELCB shall be provided on each phase/circuits.

MCBs shall be provided on the phases of each circuit. The individual banks of MCBs shall be detachable. There shall be ample space behind the banks of MCBs to accommodate all the wiring. All the internal wiring of the distribution boards shall be concealed behind 1.5 mm thick M.S. sheet. All the distribution boards shall be completely factory wired, ready for connection. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and the circuit shall be distinctly marked with a small description of the service installed.

(n) **MINIATURE CIRCUIT BREAKERS (MCBs)**

Miniature circuit breakers shall be quick make and break type, and shall conform to relevant Indian Standards. The housing shall be heat resistant and having high impact strength. The fault current shall not be less than 9000 amps at 230 volts. MCB's shall be flush mounted and shall be provided with trip free manual operating lever 'ON' and 'OFF' indicators. The contacts shall be provided to quench the arc immediately. MCB shall be provided with magnetic thermal release for over current and short circuit protection.

The overload or short circuit device shall have a common trip bar in the case of DP and TPN MCBs.

(o) **EARTH LEAKAGE CIRCUIT BREAKER (ELCB)**

The ELCB shall be manufactured in accordance with IS 12640 – 1988/BS 4293 – 1983 as amended up to date.

ELCBs shall be current operated devices which operate on the principle of measurement of different current using a current balance transformer and tripping a switching device through a Bi-polar electro magnetic tripping relay.

The ELCBs shall have an extremely elegant design and should be available in 2 and 4 pole version. The insulating material body shall be made of self extinguishing plastic with very high impact resistance. The mechanism shall be trip free ensuring that the ELCB cannot be reclosed / reset if the earth leakage / fault persist. A test button shall be provided to check the correct operation of the unit.

(p) MOULDED CASE CIRCUIT BREAKERS (MCCB)

MCCB shall be manufactured in accordance with IS 1300 and BS 77 as amended up to date. MCCBs shall comprise a switching mechanism contact system, arc extinguishing device and a tripping unit contained in a compact moulded case and cover.

The insulating case and cover shall be made of high strength, heat resistance and flame retardant thermosetting insulating material.

The switching mechanism shall be quick make / quick break type utilizing a trip-free toggle mechanism. The series of grid plates in mounted in parallel between supports of insulating material. The profile of deion steel plates extends directly over the contacts and draws the arc from the moving contact up into the divider chamber. The arc shall be thus confined, divided and extinguished.

The tripping system of moulded case circuit breakers shall be of thermal magnetic type and full magnetic type. The tripping elements shall be provided on each pole of the MCCB, operates on common trip bar, thereby preventing single phasing in the event of fault occurring on any of the phases. The tripping device shall be factory calibrated for application at ambient temperature of 40 degree centigrade.

The handle position should give positive indication of whether the breaker is ‘ON’ (Top), ‘OFF’ (Down) or ‘Tripped’ (Mid Way).

(q) FUSE SWITCH UNIT

The fuse switch unit shall be 3 pole double break type suitable for load duty quick make and break action. Separate neutral link shall be provided in the switch. All fuse switch units shall be provided with hinged doors duly interlocked with operating mechanism, so as to prevent opening of the door when the switch is ‘ON’ position and also to prevent closing of the switch when the door is not properly secured. All contacts shall be silver plated and all live parts shall be provided with switch fuse units and shall be accordance with IS: 9224 (Part II) – 1979 and having rupturing capacity of not less than 31 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to show that they have operated.

(r) **EARTHING**

(a) All the non-current carrying metal parts of electrical installation such as metal conduits, switchgear, distribution switchboards and all other parts of metal shall be bonded together and connected by means of two separate earth continuity conductor to earth electrode.

(b) The earth pin of socket outlets shall be effectively connected to earth.

(c) Each building and each pump-set shall have an independent earth electrode.

(d) Earth continuity conductors shall be high conductivity. G.I. wire of cross sectional area not less than 10 gauges shall be used.

(e) Protection against mechanical damage / corrosion shall be provided wherever necessary by carrying earth conductor in 'B' Class G.I. pipes of 12 mm nominal dia and 12 mm G.I. bend at one end or suitable size 'B' Class G.I. pipe and G.I. bend.

(f) Earthing conductor shall be so placed and connected so that it is not likely to be accidentally damaged or cut. It shall be fixed over its entire length by clamps, clips, saddles, and staples, which in no way will damage the conductor.

(g) Joints in earthing conductor shall be avoided.

(h) The entire system of earthing shall be tested for mechanical and earth continuity.

(i) Supply and fixing earthing bare wire, G.I. / Copper as instructed, to be laid along with cables or from panels to switch gear D.Bs / Equipments, etc.

s) **LIGHTENING PROTECTIONS**:

i) Providing one set of 5 pronged air terminal, projecting at least App. 300mm. in length comprising App. 100mm. dia. copper hollow sphere. It shall be fitted on App. 25mm. dia. copper tube with not less than 2mm. wall thickness and 1.2 meter in length to be welded to suitable size M.S. / G.I. base plate which shall be grouted to the parapet wall/slab at the highest level of the bldg. as per site condition with 4 Nos. of G.I. nuts, bolts and washers.

ii) Supply and fixing common bus G.I. / Copper flat complete with nuts & bolts washer for termination of earth wire coming from different points fixing clamps hardware etc. The earth bus shall be fixed on wall with proper mounting arrangement in approved manner. The bus shall be either connected with welded to the other earth bus.

iii) Separate two earthing stations shall be provided at two different place (5 Mtrs. Apart) and shall be connected to earth bus, grid and lightening protection.