SCHEDULE 'C'
Tools and plants to be hired to the contractor

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description</th>
<th>Hire charges per day</th>
<th>Place of issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NIL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SCHEDULE 'D'
Extra schedule for specific requirements/documents for the work, if any. - NIL

SCHEDULE 'F'
Reference to General Conditions of contract.

Name of work: “Internal Electrical works for Floor – 5 of College Block of Indira Gandhi Medical College and Research Institute at Kadirkamam, Puducherry”.

Estimated Cost of Work: Rs. 59,68,852/-
Earnest money: Rs.1,19,377/-
Performance Guarantee: 5% of the tendered value.
Security Deposit: 5% of the tendered value

General Rules & Directions :
Officer inviting tender
EXECUTIVE ENGINEER – Electrical
IGMC&RI, PUDUCHERRY

Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with clauses 12.2 & 12.3 see below

Definitions:
Engineer-in-Charge
EXECUTIVE ENGINEER – Electrical,
IGMC&RI,PUDUCHERRY.

Accepting Authority:
As per delegation of powers to IGMC&RI officers.

Percentage on cost of materials and labour to cover all overheads and profits.
15%

Department (Society)
IGMC&RI
Clause 1

i) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance, in days. 15 days

ii) Maximum allowable extension beyond the period provided in i) above in days 7 days

Clause 2

Authority for fixing compensation under Clause 2 As per delegation of powers to IGMC&RI officers

Clause 2A

Whether Clause 2A shall be applicable Yes

Clause 5

Number of days from the date of issue of letter of acceptance for reckoning date of start 10 days

Mile stone (S) as per table given below:-

**TABLE OF MILE STONE (S)**

| SI.No. | Description of Mile Stone (Physical) | Time allowed in days (from date of start) | Amount to be withheld in case of non-achievement of milestone.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td>DELETED</td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
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<td></td>
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<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(Or)
<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Financial Progress</th>
<th>Time allowed (from date of start)</th>
<th>Amount to be withheld in case of non achievement of milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1/8 TH (of whole work)</td>
<td>1/4th (of the whole work)</td>
<td>In the event of not achieving the necessary progress as assessed from the running payments, 1% of the tendered value of the work will be withheld for failure of each milestone.</td>
</tr>
<tr>
<td>2.</td>
<td>3/8TH (of whole work)</td>
<td>1/2 (do-)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>3/4TH (of whole work)</td>
<td>3/4th (do-)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Full</td>
<td>Full.</td>
<td></td>
</tr>
</tbody>
</table>

Time allowed for execution of work  
6 (Six) months.

Authority to give fair and reasonable extension of time for completion of work.  
As per the powers delegated to the officers of the IGMC&RI.

Clause 7
Gross work to be done together with net payment / adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment  
AS PER CPWD WORKS MANUAL

Clause 10CC  
Deleted

Clause 11  
Specifications to be followed for execution of works  
CPWD SPECIFICATIONS and special specification as enclosed in the tender documents

Clause 12  
12.2 & 12.3 Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for building work  
30 %

12.5 Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for foundation work  
100 %

Clause 16  
Competent Authority for deciding reduced rates  
As per the powers delegated to the officers of the IGMC&RI.
**Clause 36 (i)**

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Minimum Qualification of Technical Representative</th>
<th>Discipline</th>
<th>Designation (Principal Technical/Technical Representative)</th>
<th>Minimum Experience</th>
<th>Number</th>
<th>Rate at which recovery Shall be made from the Contractor in the event of not fulfilling provision of clause 36 (i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Graduate Engineer</td>
<td>Electrical Engineer</td>
<td>Principal Technical Representative</td>
<td>5 Yrs</td>
<td>1No</td>
<td>Rs.10,000/- per month Rupees Ten thousand per month</td>
</tr>
</tbody>
</table>

**DEDUCTION OF “CESS”**

During the course of contract period deduction of “CESS” to provide social security and various welfare benefits through the Puducherry Building and the other construction worker’s Board under section 18 of the building and other construction workers Cess collection (RECS) Act 1996 shall be made at the rate of 1% (one percent) of the gross amount of each bill or as per the advice of the Government of Puducherry.
ADDITIONAL CONDITIONS

1. The contractor shall make his own arrangements for obtaining electric connections if required and make necessary payments directly to the department concerned.

2. Other agencies doing works related with this project will also simultaneously execute the works and the contractor shall afford necessary facilities for the same. The contractor shall leave such necessary holes, openings etc. for laying/burying in the work of pipes, cables, conduits, clamps, boxes and hooks for fan clamps etc. as may be required for other agencies. Conduits for electrical wiring/cables will be laid in a way that they leave enough space for concreting and do not adversely affect the structural members. Nothing extra over the agreement rates shall be paid for the same.

3. Some restrictions may be imposed by the security staff etc., on the working and for movement of labour, materials etc. The contractor shall be bound to follow all such restrictions/instructions and nothing extra shall be payable on this account.

4. The contractor shall give a performance test of the entire installation(s) as per standing specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

5. The Contractor shall furnish along with the tender his proposed methodology and programme of construction in comprehensive manner of executing and completing the work with in the stipulated period. The programme shall consists of the various components for each part of the work stipulated to be completed and a bar chart may be appended in this connection.

6. The contractor shall provide necessary watch and ward for guarding the society materials kept within the site of work for which nothing will be paid extra.

7. Royalty, if any that may have to be paid to local bodies and other organization shall be paid by the contractor. The quoted rates of relevant items are deemed to include such charges and nothing extra shall be paid.

8. Architectural Drawings are available with the Executive Engineer - Electrical, IGMC& RI, Pondicherry. Tenderer are advised to look into the drawing before tendering and acknowledgement of having seen the drawings to be given to Executive Engineer - Electrical, Pondicherry.

9. Any damages to work resulting from rains or from any other cause until the work is taken over by the society after completion, will be made good by the Contractor at his own cost.

10. The Contractor will have to work according to the Programme of work, decided by the Engineer - in - Charge.

11. If there are any restrictions from the local body for erection of labour sheds in the place of work, the Contractor shall be bound by such restrictions and erect the sheds at permissible places only.

12. The Contractor shall be allowed to set up labour camp one week before the commencement of work and the camp should be got vacated by the Contractor within fifteen days from the actual date of completion of the work.
13. The Contractor shall not deposit any materials which will cause inconvenience to the public. The Engineer - in - Charge may require the contractor to remove any material which are considered by him to be a danger or causing inconvenience to the public or cause them to be removed at Contractor’s cost and risk.

14. Wherever any reference is made as “As per Architects specification” to any of the item in the “Schedule A” it shall be executed in accordance with the drawings/specificaion/sample provided by the Architect, if the specification for the same is not available with CPWD/IS/BIS specification. The Engineer in charge shall be the sole deciding authority as to the meaning interpretation and implication for the item of work as per Architect specification.

15. The work shall in general be carried out in accordance with CPWD specifications for works with correction slips issued time to time.

16. When working near existing structures, care shall be taken to avoid any damage to such structures, any such damage caused intentionally or unintentionally shall be restored to original and or acceptable condition and to the satisfaction of the Engineer-in-charge.

17. The contractor shall given to the Municipality, Police and other authorities all notices etc. that may be required to be given as per law and obtain all requisite licenses for temporary obstructions, enclosures and pay all fees, taxes and charges which may be leviable on account of the operations during the execution of the contract. No extra claim of the contractor will be entertained by the society on this account.

18. The contractor shall conform to the provision of any Government Acts which relate to works and to the regulations and bye-laws of any local authorities. The contractors shall give all notices required by the said Acts or Laws etc., pay all fees payable to such authorities and allow for these contingencies in his tendered rates including fees for encroachments, costs of restoration etc., and all other fees payable to the local authorities.

19. All manufactured materials used on the work shall have ISI mark. In case of materials for which no manufacturer has been licensed to manufacture the materials with ISI marking, the material shall conform to the provision's of C.P.W.D. / IRC /MORTH/ CPHEEO specifications or the ISI code (In the absence of C.P.W.D. specifications or other specification mentioned above for any particular material). In the case of all materials, tests shall be conducted to ensure that they conform to the specifications of codes mentioned above.

20. All materials which are to be tested before use on the work should be procured at least 2 months before use on the work so that enough time is available for testing them before they are actually used.

21. The cost of samples and all other incidental charges such as packing, transportation, to the laboratory etc., shall be borne by the contractor. The testing fee shall be paid by the Engineer-in-Charge if the material passes the test.

22. BIS marked materials may also be got tested as per the decision of the Engineer – in – Charge. Contractor shall be responsible to ensure the stipulated quality even if the material have BIS certification marks.
A. TECHNICAL SPECIFICATION:

1. This specification covers general principles to be followed for the selection of electrical equipment and their installation, testing & commissioning. The electrical system consist of the following sub-systems,
   - LV Switchgears
   - Lighting system
   - Earthing system
   - Cabling system
   - DATA/Telephone/MATV system

2. The supply, erection, testing and commissioning of the entire electrical works shall be in line with local electrical norms, Indian standards and also basic concepts developed and laid down in this Technical specification. The battery limit of present contract starts from Main Distribution Boards and further distribution inside.

B. STANDARDS AND CODES:

1. All electrical equipment and installations shall confirm to the latest publication of Bureau of Indian Standards and codes of practice for installation and maintenance.

2. In case where Indian Standards are not available, the equipment and accessories shall confirm to the latest publications of International Electro technical Commission (IEC) or latest standards and codes of practice published by any other recognized National Standards Institutions.

3. All electrical equipment and installations shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation.

4. All installations shall comply with the statutory requirements of Government of Puducherry.

C. EXECUTION:

1. It is contractor’s responsibility rendering all such assistance as may be required by the Client to obtain State Electrical Inspector’s approval for the installation and carrying out any modification called for by the inspector.

2. The contractor shall co-ordinate with all other services like Civil, Structural, Plumbing and other agencies at site.
3. All required openings on wall/floor/ceiling shall be properly planned, the cut-out openings shall be made, properly finished and related all debris shall be removed by the contractor.

4. If any discrepancy on dimensions against drawings shall be brought to the notice of the engineer in charge.

5. If required shop floor drawings shall be prepared by the contractor and the same shall be submitted for approval of Client/Consultant.

6. Contractor shall produce all equipment / system vendor drawings in three sets for Client / Consultants approval.

7. The LT Panel board manufacturing clearance shall be issued to the contractor by Client / Consultant.

8. The contractor is responsible to update time to time changes (if any) in the hard copy of all the drawings for preparation of As-built documentation and it shall be approved by the Engineer in charge.

D. **LV SWITCHGEAR**

   **Equipment specification:**

1. All the 415V AC, devices/equipment like bus support insulators, circuit breakers, VTs, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions:
   
   - Variation in supply voltage : ± 10%
   - Variation in supply frequency : ± 5%
   - Combined voltage and frequency variation : 10%

2. The switchgear panel shall be designed, manufactured and tested in accordance with relevant Indian Standards. The panels shall be indoor, metal enclosed, single front, free standing type.

3. The sheet steel (CRCA) used for fabrication shall be of 2.0mm for non-load bearing members and load bearing members. The panels shall be supplied with required base channels.

4. The insulators shall be made of high epoxy resin moulding.

5. The busbars and cable chambers shall be housed in separate chambers. The busbar and cable chambers should be fitted with bolted covers with gaskets and should be shrouded to avoid direct access to live parts immediately after opening respective
covers. The busbars and jumper connections shall be insulated to full maximum operating voltage. The cubicle shall be designed for IP4X protection. The vermine proofing shall be such that the vermine cannot enter from one compartment to another/busbar chambers. Neoprene gaskets shall be used for all doors, covers and openings.

6. The busbars and connectors shall be made of high conductivity Aluminium. The busbars shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding the total temperature of 85°C. Unless otherwise stated, the entire busbar shall be rated for the continuous rated current of the incomer. When sectionalised with a bus coupler, both the busbars shall be of the same rating. The entire switchboard along with all components shall be designed for the ambient site condition. The minimum area of cross section of the neutral shall be half that of the phase busbar, unless otherwise specified.

7. The busbars and their connections shall be capable of withstanding, without damage, the thermal and mechanical effects of through fault currents equivalent to the short time rating of the switchgear. It shall be possible to extend the switchboard on both sides. The busbars shall be sleeved and with respected phase colour. The sleeves shall be rated for an insulation level of 660V. Each compartment shall have hinged doors with gaskets.

8. Suitable lifting hooks shall be provided. These hooks when removed shall not leave any opening on the enclosure. Switchgear shall be designed for a bottom/top cable entry. The same shall be decided to suit site condition during detail engineering.

**Insulators:**

9. Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index. Insulators, barriers made out of hylam, synthetic resin bonded paper, treated wood will not to be accepted.

10. Insulators shall be mounted on the switchgear structure such that there is no likelihood of their being mechanically over-stressed, during normal tightening of the mounting and busbars, connections etc.
**MCCBs / SFUs**

11. The MCCBs shall confirm to the latest applicable standards. MCCBs shall be of Three/four pole construction arranged for simultaneous four pole manual closing and opening.

12. Operating mechanism shall be quick-make, quick-break and trip free type. The ON, OFF and TRIP positions of the MCCB shall be clearly indicated and visible to the operator.

13. Operating handle for operating MCCBs from door of board shall be provided.

14. MCCB / Switch fuse units terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

15. The switches shall be with silver plated contacts and capable of breaking safely full load current of associated equipment. Switches shall be quick make and break type and capable of breaking the circuit even if the mechanism spring fails. Barriers shall be provided to prevent inter phase arcing.

**Current Transformers**

16. The instrument transformers shall have synthetic cast resin insulation and be of the single phase type.

17. The primary & secondary connections shall be clearly labelled.

18. All current transformers shall have insulation level and short time rating as per main switchgear. All current transformers shall be dimensioned to carry continuously a current of 120% of the rated current. The ratios shall be furnished in your drawings for our approval.

**Meters, Relays and Other Accessories:**

19. All relays shall be of switchboard pattern type suitable for flush mounting and fitted with dust tight cases and provided with reset devices. The relays shall conform to IS 3231 or BS 3950 and BS 142. Wherever called for, APFC relays of adequate steps shall be provided in the MCC panels.

20. Required CTs shall be provided in the incomer of the panels for feeding the APFC relay. The APFC relay shall be intelligent micro processor based type.

21. The capacitor panel shall form part of the MCC panel. The capacitor panel shall consist of required no. of fuse switch, contactors, Aux. Contactors, timers and capacitors of specified rating. The scheme for capacitor feeders shall be suitable for Auto/ manual operation. In the auto mode, the capacitor feeders shall be controlled by
APFC relay. In the manual mode the same shall be controlled by ON/OFF pushbuttons mounted on the front of respective feeders.

22. Suitable timers shall be provided in the manual mode of operation to ensure that a capacitor is not switched ON immediately after switching OFF.

**Ammeters, Voltmeters, Kwh Meters:**

23. These ammeter, voltmeter and KW meter shall be of moving iron static type. Ammeters for motor feeders shall be of extended scale type. The KW Meter and KWH meter shall be suitable for measuring unbalanced loads on a 3-phase, 4 wire system. The KW Meter, KWH meter and voltmeter shall operate on 415V 3φ, 4 wires supply.

**Indicating Lamps / Push Buttons:**

24. These shall be switchboard type, low power consumption, LED type lamps complete with necessary accessories. Lamps shall be provided with screwed translucent covers to diffuse light. The lamp covers shall preferably be unbreakable, moulded, heat resistant material and shall be provided with chromium plated bezels.

25. Push Buttons shall be heavy duty, push to actuate type with coloured button and inscription marked with its function. Each push button shall have minimum 2 NO + 2 NC contacts or as required, rated 10 A at operating voltage.

26. Push button shall be shrouded type except for emergency trip button (if provided) which shall be mushroom type for easy identification. Push button colour shall be as follows

- **Stop/off** - Red
- **Start/ON** - Green
- **Reset** - Yellow
- **Test** - Black

**Name Plate:**

27. Suitable anodised aluminium name plate of 1.2 mm thick shall be provided on all the switchboards and individual compartments.

**Earthing:**

28. An earth bus of requisite section shall be provided. It shall extend throughout and solidly connect all panels in a line with proper terminals, at the end to connect to the station earthing system. The terminal arrangement at the ends shall be suitable for connection by 50x6 mm GI flat and shall be complete in the bimetallic washers etc.


**Painting**

29. All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structure shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under surface shall be made free from all imperfections before undertaking finishing coat.

30. After preparation of the under surface, the switchgear panel shall be spray painted with two coats of final paint. Colour shade of final paint shall be RAL 7032 (epoxy based). The finished panel shall be dried in staving oven in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run off paint etc. The vendor shall furnish painting procedure details along with the drawings submission.

31. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust corrosion. If these parts are on moving element, then these shall be greased.

**General:**

32. Deviations from our specification (if any) shall be brought out separately clause wise and explicitly. Deviations indicated in the guaranteed technical particulars (or) elsewhere shall not be considered / accepted.

33. The supplier shall furnish the following drawings in three sets for the switchgear and before manufacturing approval shall be obtained from the Client / Consultant.

34. Overall outline dimensions and general arrangement including plan, front elevation, rear & side elevations, clearances recommended in front and back.

35. Switchgear layout plan including floor openings, fixing arrangements and loading details

36. Schematic control diagrams to cover controls, protection, interlocks, instruments, etc.

37. Inter panel interconnection wiring diagram including terminal numbers and ferrule numbers.

38. The supplier shall be entirely responsible for the correctness of the internal wiring diagrams.

39. The supplier shall ensure that the characteristics of the CT’s, fuses, protection relays, VT’s and all other devices offered by him are such as to be suitable for the purpose.
Test Certificates

40. Type test certificates of all standard component parts, e.g. contactors, breakers, switches, fuses, relays, CT’s, VT’s, and for the standard factory built assembly shall be submitted by the supplier.

INSTRUCTION MANUALS

41. The supplier shall furnish specified number of copies of the instruction manual which would contain detailed instructions for all operational & maintenance requirement. The manual shall be furnished at the time of dispatch of the equipment.

42. **Specific Requirement:**

<table>
<thead>
<tr>
<th></th>
<th>System voltage</th>
<th>:</th>
<th>415V</th>
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<tbody>
<tr>
<td>2</td>
<td>No. of phase</td>
<td>:</td>
<td>Three</td>
</tr>
<tr>
<td>3</td>
<td>System frequency</td>
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<tr>
<td>4</td>
<td>Voltage variation</td>
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<td>5</td>
<td>Frequency variation</td>
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<td>6</td>
<td>System Neutral Earthing</td>
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<td>Effective earthed</td>
</tr>
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<td>7</td>
<td>Design ambient</td>
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<td>50°C</td>
</tr>
<tr>
<td>8</td>
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<tr>
<td>9</td>
<td>Type</td>
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<tr>
<td>10</td>
<td>Degree of protection</td>
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<tr>
<td>11</td>
<td>Thickness of sheet steel</td>
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</tr>
<tr>
<td>a</td>
<td>Front</td>
<td>:</td>
<td>2mm thick CRCA</td>
</tr>
<tr>
<td>b</td>
<td>Sides</td>
<td>:</td>
<td>2mm thick CRCA</td>
</tr>
<tr>
<td>12</td>
<td>Paint</td>
<td>:</td>
<td>Pebble Grey shade (RAL 7032)</td>
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<tr>
<td>13</td>
<td>Support insulators</td>
<td>:</td>
<td>Epoxy</td>
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<td>Protection</td>
<td>:</td>
<td>Refer respective SLD</td>
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<tr>
<td>16</td>
<td>Indication</td>
<td>:</td>
<td>Refer respective SLD</td>
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<tr>
<td>17</td>
<td>CT &amp; Protections</td>
<td>:</td>
<td>As per SLD.</td>
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</table>
Switch Gear Erection:

43. This shall be applicable to LT switchgear panels and other power and lighting distribution boards etc. Manufacturer’s instructions, drawings, and instructions of the Engineer-in-charge should be studied and strictly followed during handling, erection, testing and commissioning of the switchgear.

44. The switchgear shall be handled with care, avoiding impact to the equipment by the experienced riggers under the guidance of the competent supervisor.

45. Dragging of the panels shall be avoided and use of a crane & trailer shall be made for the handling purposes while transporting to various sites.

46. The switchboards shall be properly supported on the truck / trailer by means of ropes to avoid any chances of damage or tilting due to heavy vibrations.

47. The switchboards shall be lifted by making use of lifting eye bolts only, fully tightened after ensuring that panel supports, nuts and bolts are all intact and tightened.

48. When lifting panels in packed conditions, utmost care shall be taken to avoid any damage to insulators, bushings, metering & protective equipment.

49. The panels shall be preferably kept inside the packing cases till foundations are ready.

50. Base channels shall be grouted, leveled in cement concrete pad for 415V switchgear panels and other cubicle panels. A level benchmark in each electrical room shall be given by purchaser as reference level and further all levels shall be checked and kept with the theodolite by the contractor. Pedestal type panels and MCCs shall be erected by grouting base channels by bolts. A proper bonding surface shall be made by chipping the floor while making cement concreting. All foundations, grouted bolts shall be cured for a minimum period of 48 hours.

51. The switchboard panels shall be taken out from the packed cases and moved one by one to the proper place. All the panels shall be assembled, aligned and leveled and it shall be ensured that panel to panel coupling bolts, bus bar links fit properly without any strain on any part. It shall also be checked up that lowering, lifting, racking in and out operation of the breaker and all other motions are free from any obstructions. The fixing bolts shall be grouted only after satisfying all these requirements.

52. The panels shall be checked for correct vertical position using pendulum weight and spirit levels. LT switchgear panels can be tack welded at suitable intervals for each shipping section.
53. After completion of panel erection, all the cubicles, switches, starters, CT and PT chambers, bus bar chambers shall be cleaned and checked for tightness of all the components. All loosely supplied items shall be fitted up. All the wiring connections shall also be checked with drawings and tightened. Metering and protective CTs, Alarm, indications and protective relays shall be fitted up. Phase sequence and polarity of CTs and PTs shall be checked. Contact resistance of all bus bar joints and contactors shall be checked up.

54. Any part of insulator shall be checked for any possible damage. All the starters, switches, contacts shall be cleaned. Silver tipped contacts shall never be filled or polished with sandpaper. All the moving parts shall be checked for easy and free movement. Hinges of panel doors shall be lightly lubricated to give free and noiseless movement. All opening shall be kept completely closed to avoid ingress of any foreign particles inside the panel.

55. Individual feeder functional scheme verification shall be carried out and minor wiring modifications in the panel wiring as per requirement at site shall be done as per the directions of Engineer-in-charge. Special attention is to be paid to CT circuit’s polarity, wiring continuity and correctness in the protection as well as measurement circuits.

56. Auto transfer scheme shall be simulated and verified. During the course of scheme verification, tests, any defective parts as well as functionally improper components shall be taken out after bringing to the notice of Engineer-in-charge and be replaced by the component supplied by the contractor.

57. Should the switchgear be wet or having a low IR value due to bad wiring, insulators, bushings or any other insulated parts, the entire switchgear be dried up according to the instructions of the Engineer-in-charge and the IR value shall improve to a safe level for commissioning the same. Care shall be taken to protect the surrounding insulation from direct local heating during the drying up process.

58. All the metering instruments, protective relays and other relays and contractors shall be tested and cleaned as per manufacturer’s recommendations (or) according to the instructions of the Engineer-in-charge.

59. All the control wiring, PT, bushing, bus bars and other live parts of the switchgear, incoming and outgoing cables shall be meggered with 500/1000V megger.

60. Electrical simulation test shall be carried out for all the protective, alarm and annunciation relays along with the manual operation of the circuit breaker.

61. Panels must be cleaned with vacuum cleaner.
E. **LIGHTING SYSTEM**

1. The intent of this clause is to define the requirements for the supply, erection, testing and commissioning of the lighting system. The work shall be carried out in conformity with this specification, relevant codes of practice of the Indian Standards, approved drawings and the instructions of the Engineer-in-charge.

2. The light fixtures in the common areas are fed from lighting panel and group controlled. The wiring shall be done as specified in the DBR/Drawings, all joints of conductors in Switch boards/JBS/Fitting shall be made only by means of approved Mechanical connectors (nylon/PVC connectors). Bare or twist joints are not permitted anywhere in the wiring system.

3. The lighting layouts furnished by Client/Consultant shall indicate approximate location of lighting fixtures. The electrical contractor shall determine, with approval of the Engineer-in-Charge, the exact location of each fixture in order to avoid interference with piping or other mechanical equipment and also with a view to obtain as uniform illumination as practicable, and to avoid objectionable shadow. The circuit numbering shall be provided in the drawings for the light fixtures, conduit run shall be laid out by the contractor to suit field conditions as per directions of the Engineer-in-Charge.

4. On walkway, outdoor areas, light fixtures shall be nearer to landing of stairs or ladders, panel boards and other equipment requiring good illumination.

5. In pump and compressor areas and other location at ground level, unless otherwise called for on the drawing or directed, lighting fixtures shall be mounted preferably 4 meter above level of the floor. Where this is impracticable, the minimum height of any lighting fixture shall be preferably not less than 2.5 meters above the floor level.

6. Lighting on walkways shall be not more than 2.5 meters above the walkways in order to permit re-lamping without the use of a ladder.

7. Fixtures shall be firmly supported in concrete structures, where metal inserts are not available; fixtures will be fixed to or supported from concrete surfaces with the help of anchor fastener. In such cases special care shall be taken to see that anchoring is firm. For smaller weight equipment, nylon (or metallic) sleeve anchors shall be used.

8. All hardware shall be galvanized or zinc passivated.

9. Main runs of wiring from LDB and tapings to individual fixtures/sockets shall be in sizes specified on the DBR / drawings.
10. Fixtures shall be firmly supported in concrete structures where metal inserts are not available; fixtures having a weight up to 2.5 kg shall be supported by minimum two numbers nylon sleeve anchors. Flameproof or other heavier fixtures shall be supported by using metallic anchor fasteners of approved size. All supports shall be thoroughly cleaned and painted in an appropriate colour to suit the fixture.

11. In case of false ceilings fixtures shall be supported from true ceiling. Exact location of fixtures shall be finalized in consultation with air-conditioning contractor and as indicated on electrical drawings. Wiring above false ceilings shall not be left loose and shall be supported along the structures/ceiling. Wiring above false ceiling shall be on surface and below false ceiling it shall be concealed. To facilitate easy maintenance looping back system of wiring shall be followed throughout. Accordingly supply tapings and other interconnections are made only at fixture connector blocks or at switch boards. Intermediate junction boxes shall be used for wire pulling as inspection boxes.

12. All wires in conduit shall be color coded. Each circuit shall have independent phase and neutral wire. Unless otherwise specified, insulated conductors of AC supply and DC supply shall be bunched in separate conduits.

13. Building conduit lighting system of wiring generally consists of two parts. The first part includes the work necessary from lighting panel up to switch boards. The second part is point wiring which shall include the work necessary from tapping point in the switch board up to various fixture or fan outlets.

14. In case of group control of light points, point to point distance shall be measured and classified for subsequent points.

**Light Fixtures (Luminaries) – General Requirements**

15. Fluorescent, CFL, MH and HPSV type luminaries shall be complete with accessories like lamps, ballasts, power factor improvement capacitors, starters etc. These shall be mounted as far as possible in the luminaries housing only. If these cannot be accommodated integral with the luminaries then a separated metal enclosed control gear box shall be included to accommodate the control accessories together with a terminal block suitable for loop-in, loop-out connections. Outdoor type fixtures shall be provided with outdoor type weatherproof box. Electrical/pump room: 1x36W TKC24, Facility room : 2x36W TMS055 and Corridor/Staircase/Car park/toilet/security rooms : 1x36W TMS520 or Philips/equivalent, Ramp: 1x18W 2625 K-lite or Equivalent.
**Lamps**

16. Lamps / tubes shall conform to relevant standards.

17. **Fluorescent Lamps**

   Fluorescent lamps luminaries shall be with T5 lamps, low wattage consumption, high efficiency and longer burning life. Lamps shall be of warm white or cool day light type with suitable for operation on 240 V, single ph, in standard length of 4 feet.

18. **Compact Fluorescent Lamps**

   These compact fluorescent lamps shall be of low pressure, low wattage type with integral glow switch starter with inbuilt ballast. Suitable for operation on 240 V, single phase AC, with long burning life. Lamps shall be rated 9W, 11W, 18W, 36W for compact fluorescent lamps.

19. **HPSV/MH** :

   These lamps shall be used for street lighting, building façade lighting, this shall have, integral control gear, reflectors and accessories. Suitable for operation on 240 V, single phase AC, with long burning life. Lamps shall be rated 150W and 250W.

**Light Control Switches**

20. The switches shall be suitable for use on 240V, 1 phase, 50Hz supply; the switches shall be of flush type for mounting on an insulated plate with suitable enclosure. The switch box / enclosure may be recessed into or mounted on wall as per requirements of project layouts. The size of enclosure boxes shall be chosen to accommodate the number of switches to be installed at the particular location. The enclosures shall be made of 1.2 mm thick CRCA sheet steel, stove enameled / galvanized. The enclosure box shall be with insulating cover. An enclosure intended for surface mounting shall not have holes or gaps in its sides other than those expressly provided for cable entry. The switches shall conform to the relevant standards. For common areas like corridors, car park, staircases the lighting control shall be from MCB control from DB, they need not be controlled from switches.

**Receptacle Units**

21. Receptacle units shall consist of socket outlet with associated switch. The socket outlet and switch or MCB shall be flush mounted within a stove enameled / galvanized 1.2 mm thick CRCA sheet steel enclosure with insulating cover, the box may be recessed into or mounted on a wall as per requirements of project layouts.
22. The outdoor type receptacles shall be housed in a 2 mm thick CRCA sheet steel epoxy painted enclosure with gasket, hinged door having locking arrangement. The enclosure shall be with rain canopy and removable gland plate entry for bottom, composite receptacle with switch modules housed in a box shall be with degree of protection IP 66. The receptacle units shall be suitable for 240V, 1 Phase, 50Hz/415V, 3 Phase, 50 Hz supply as indicated in project layouts.

23. Wiring for exhaust fans shall be terminated in ceiling roses/receptacles and the connection from ceiling rose/receptacle to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires. The switch for control of the exhaust fan shall be mounted at an operable height and the receptacle shall be mounted near to the fan.

**Lighting Wires**

24. The wires of wiring in lighting system shall be 1100V, 1 core, PVC insulated, unarmoured with stranded copper conductors. The wires shall conform to the applicable standards.

The size and no of Cu wires shall be as follows,

25. **LIGHTING:**
   - DB to Switch board/First fixture - 2#2.5sqmm, 1#1.5sqmm
   - Switch board/First fixtures to Lighting point - 3#1.5sqmm

26. **POWER SOCKET:**
   - 5/15A Power sockets - 2#2.5sqmm, 1#1.5sqmm
   - Geyser sockets - 2#4sqmm, 1#2.5sqmm
   - Air conditioners - 2#4sqmm, 1#2.5sqmm

27. **COLOUR CODING OR WIRES**
   - R – Phase - Red
   - Y - Phase - Yellow
   - B – Phase - Blue
   - Neutral - Black
   - Earthing - Green or Yellow green
28. Conduits and their associated fittings shall conform to applicable standards. The conduit shall be surface / concealed installation. Supply of conduits shall include all associated fittings like couplers, bends, tees, JBs, pillboxes, GI wires to pull the Cu wires etc.,

The following conduit sizes shall be used for surface/concealed,

- PVC conduit 20mm dia, 2mm wall thickness
- PVC conduit 25mm dia, 2mm wall thickness
- PVC conduit 32mm dia, 2mm wall thickness
- MS conduit 20mm dia, 1.6mm wall thickness
- MS conduit 25mm dia, 1.6mm wall thickness
- MS conduit 32mm dia, 1.6mm wall thickness

29. For MS Conduits only threaded type conduit fittings shall be used. Pin Grip type or clamp type fittings are not acceptable. Conduit ends shall be free from sharp edges or burrs. The ends of all conduits shall be reamed and neatly bushed with Bakelite bushings.

30. In order to minimize condensation of sweating inside the conduit system, all outlets shall be properly drained and ventilated in such a manner so as to prevent entry of insects.

31. The outer surface of the conduit pipes, including all accessories forming part of the conduit system, shall be adequately protected against rust, particularly when such system is exposed to weather. In all cases, bare threaded portion of the conduit shall not be allowed unless such bare threaded portion is treated with anti corrosive preservative or covered with approved plastic compound.

32. Conduit connection to outlet boxes shall be by means of screwed hubs or check nuts on either side.

33. Conduit pipes shall be fixed by 16 gauge GI saddles on 25 x 6 mm GI Saddle bars in an approved manner at intervals of not more than 25 cms. Saddles shall be fixed on either side of couplers, bends or similar fittings, at a distance of 30 mm from the center of such fittings.

34. Where concealed wiring is to be adopted, conduits shall be laid in time before concreting of the slab. The contractor shall coordinate his work with other agencies involved in the civil works in such a way, that the work of these other agencies is not hampered or delayed because of any section on his part.
35. Vertical conduit runs shall be made either through columns or chases prepared in the walls. Contractor shall fill these chases or any other openings made by him after completing the work and neatly finish the surface. During installation, care shall be taken to see that adequate covers are provided to prevent rusting of conduits. If required, conduit runs may be concealed in the floor for low level receptacles.

36. After erection, the entire conduit system shall be tested throughout, for mechanical and electrical continuity and shall be permanently connected to earth by means of earthing clamps, in accordance with Indian Electricity Rules.

**Outdoor Junction Boxes**

37. Junction boxes with terminals shall be supplied for branching and terminating lighting cables when required for outdoor areas, terminals shall be suitable for TP N E, rating shall be in line with requirement. The junction boxes shall be dust and vermin proof and shall be fabricated from 1.2 mm to 2 mm CRCA sheet steel depending on the size of the junction box and shall be complete with removable cover plate with gaskets two earthing terminals each with nut, bolt and washer. Boxes shall be additionally weather proof when specified.

**MCB Distribution boards:**

38. The distribution of light fixtures / receptacles shall be such that the loading on each phase of LDB is approximately equal. The loading on each circuit shall be restricted to 80% of the MCB rating and the voltage drop shall not exceed 5%.

39. Lighting Distribution Boards (LDB) shall be of sheet steel enclosed. For outdoor, canopy sloping towards rear side of the panel shall be provided to achieve a degree of protection IP-55. The lighting panels for road lighting and floodlighting of open areas shall be provided with an adjustable timer or photocell for automatically switching “ON” and “OFF” every day.

40. LDB shall have incomer and outgoing breakers to suit the load requirements. Apartment DB will be having ACCL (Auto Changeover cum Current limiter), its function is to change over from EB to DG and to restrict the flat owners not to cross their allotted current limit.
F. EARTHING SYSTEM:

1. The earthing system shall be designed as per IS 3043.

2. The work shall be carried out in the best workman like manner in conformity with this specification, and as per IS 3043, approved drawings and instructions of the Engineer-in-Charge.

3. The main grid conductor for electrical power distribution system shall be hot dip galvanized G.I. Flat and for other systems like networking, UPS etc shall be copper conductor. Sizes for main conductor shall be as marked on the drawings. Earth electrodes shall be as per the standard drawings. Thickness of hot dip galvanizing shall not be less than 75 microns.

4. The earthing installation shall be done in accordance with the earthing drawings, specification and the standard drawings. The entire earthing system shall fully comply with the Indian Electricity Act and Rules framed there under. The contractor shall carry out any changes desired by the Electrical Inspector or the owner, in order to make the installation conform to the Indian Electricity Rules at no extra cost. The exact location earth conductors, earth electrodes and earthing point on the equipment shall be determined in field, in consultation with the Engineer-in-Charge.

5. Excavation and refilling of earth, necessary for laying underground earth bus loops shall be the responsibility of the contractor.

6. The earth loop impedance to any point in the electrical system shall have value, which will ensure satisfactory operation of protective devices.

7. The main earth loop shall be laid at a depth of 600 mm below grade level. Wherever cable trenches are available, the earth lead shall be laid in the trenches and shall be welded to the cable tray support structural. The earthing strip shall be protected against mechanical damage.

8. Wherever specified, the earthing flat shall be run along cable trays. The earthing cable shall be suitably cleared to the cable tray at regular intervals.

9. Joints and tapping in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade shall be welded and suitably protected by giving two coats of bitumen and covering with Hessian tape. All joints above ground shall be by means of connectors/lugs as far as practicable. Tee connectors / tee joints shall be used for tapping earth leads from the main loop wherever it is installed above ground.
10. Metal Conduits, in which cables have been installed, shall be effectively bonded and earthed. Cable armors shall be earthed at both ends.

11. Earth pipe electrodes shall be installed as shown in the earthing layout drawings and in accordance with the standard drawing of reference and IS: 3043. Their location shall be marked to enable accurate location by permanent markers.

12. All earth electrodes shall preferably be driven to a sufficient depth to reach permanently moist soil. Electrodes shall preferably be situated in a soil which has a fine texture and which is packed by watering and ramming as tightly as possible. Wherever practicable, the soil shall be dug up, all lumps broken and stones removed in the immediate vicinity of the electrodes.

13. All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests shall take place in dry months, preferably after a protracted dry spell. If necessary, a number of electrodes shall be connected in parallel to reduce the earth resistance. The distance between two electrodes shall not be less than twice the length of electrode.

14. The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.

15. The exact location and number of earth electrodes required at each location shall be determined in the field in consultation with the Engineer-in-Charge, depending on the soil strata and resistivity, to meet the ohmic values prescribed in the relevant IS. Earth Electrode shall be located avoiding interference with road, building foundation, column etc.

16. Individual earth electrode shall be provided for each lightning Arrester. The electrodes shall be so placed that all lightning protective earths may be brought to earth electrode by a short and straight a path as possible to minimize surge impedance.

17. The isolating facility shall be provided for the individual earth pits to check their earth resistance periodically. All the earth electrodes shall be suitably numbered and this should be indicated in as built drawings.

18. All electrical equipment shall be doubly earthed by connecting two points on equipment to a main earthing ring. The earthing ring will be connected via link to several earth electrodes. The earth grid formed shall be a closed loop with earth electrodes connected to the grid with double strip connection. The cable armor will be earthed through the cable glands.
19. The following shall be earthed.
   - All switchgear and their earth bus and bus duct.
   - Motor Frames.
   - Non-current carrying metallic parts of electrical equipment such as switchgear racks, panel boards, motor control center, lighting, power and instrument panels, push button stations, cable trays, pipe, conduits, terminal boxes etc.
   - All fences, gates/enclosures housing electrical equipment.
   - All steel structures, rails, etc, including bonding between section.
   - Structural steel and columns.

20. The earthing connection shall be properly made. A small flexible aluminium cable loops to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastening bolts when there is a lightning surge, high voltage surge or failure of the bushings. The neutral of all transformers shall be connected to the earth pit through a test link.

21. All paint, scale and enamel shall be removed from the contact surface before the earthing connections are made.

22. All hardware used for earthing installation shall be hot dip galvanized or zinc passivated. Spring washers shall be used for all earthing connections of equipment.

23. Light fixtures shall be earthed through the extra core provided in the lighting cable for this purpose.

24. Following sizes shall be used to carry out the earthing,
   - MDB / MCC - 25 mm X 3 mm GI Flat
   - MCB DB - 8 SWG G.I. Wire

25. There shall be two types of earth pits GI / CU, the type, location, usage, shall be referred in the respective drawings.

**TESTING**

26. Earthing systems / connection shall be tested as follows:
   - Resistance of individual electrodes shall be measured after disconnecting it from the grid.
   - Earthing resistance of the grid shall be measured after connecting all the electrodes to the grid. The resistance between any point on the metallic earth grid and the general mass of earth shall not exceed 1 ohm.
27. **The resistance to earth shall be measured at the following:**
   - At each electrical system earth or system neutral earth.
   - At each earth provided for structure lightning protections.
   - At one point on each earthing system used to earth electrical equipment enclosures.
   - At one point on each earthing system used to earth wiring system enclosures such as metal conduits and cable sheaths or armor.
   - At one point on each fence enclosing electrical equipment.
   - Measurement shall be made before connection is made between the ground and the object to be grounded.

G. **CABLING SYSTEM:**

1. Cables shall be armoured / Unarmoured, according to the system requirement and the same is mentioned in the cable schedule.
2. All LT power cables shall be single/multi-core, 650/1100V grade, XLPE insulated. Minimum size of the power cable shall not be less than 2.5 sq. mm in case of copper and 4 sq. mm in case of aluminium.
3. Outer sheath of all cables shall be black in color. The outer sheath is to protect the cable against termite attack. Sequential marking of the length of the cable in meters shall be provided on the outer sheath at every one meter. The embossing shall be legible and indelible.
4. The overall diameter of the cables shall be strictly as per the standards. PVC/Rubber end caps shall be supplied for each drum.
5. Armoured cables shall be laid underground directly in trenches at depth of 750mm to 1500mm as per the requirements. The cable trenches shall be prepared by earth work in excavation in all types of soils and across roads.
6. The contractor shall carry out all the necessary shoring, strutting and bailing out water wherever required. The trenches shall be kept dry. The trench bottom shall be rammed, leveled and filled with a layer of fine 75mm thick dry cables shall be laid over it. Utmost care shall be exercised to prevent any damage to the cables while handling. The cables shall be single length without any joints in between wherever practicable.
7. The cables so laid and tested in the trench above the sand cushion shall be covered with a layer of 200mm thick fine dry river sand. The thickness of this layer of sand shall be from the bottom of the cables. The sand layer shall be lightly pressed for consolidation, but not causing any damage to the cables.
8. Thereafter a protective layer of 75mm thick second class red brick laid on flat shall be placed to cover the trenches. The remainder of the trenches shall then be back filled with the excavated soil and tamped, Excess earth after back filling if any shall be disposed off as directed by the Engineer-in-charge.

9. Bottom of trenches shall be free of large stones and foreign materials which could damage cables. A minimum total cover (sand, bricks and back fill) of 600mm shall be provided between the top of the top most cable and grade level.

10. A separation layer of brick shall be placed between high voltage and medium voltage cables where ever they are running in the same trench. If more than one layer of cables are laid, each layer must be separated by fine dry river sand of 200mm depth (between axis of the two layers)

11. A minimum clearance of 300mm shall be maintained between cable trench and parallel runs of underground piping of foundation. If it is not possible the cables shall be protected in rigid steel galvanized conduits for that particular length.

12. Cable trenches shall be identified by means of markers. These markers shall be placed at locations of changes of directions of cables and at intervals of not more than 2 meters. Such markers shall have the directional arrow for the cable from feeding plant towards connected load.

13. Cables shall be identified with cable tag attached to each cable. The tags shall be stamped with the cable number as per cable schedule marking. Tags shall be attached to cables at minimum intervals shall be 10 meters at every straight run, starting and ends points. A minimum of 2nos of tags shall be attached to the cables inside the Distribution boards/MCC’s electrical rooms.

14. Ample stock and if necessary a loop shall be left at every straight through joint to permit re jointing at the same place.

15. Where cables rise from trench to motors, push buttons / junction boxes, etc. they shall be taken in rigid steel galvanized conduits for mechanical protection up to a minimum of 300mm above grade.

16. Minimum distance between the different types of cables viz. High voltage power cables, medium voltage power cables, copper control cables and LV cables while laying in the trenches shall be maintained as per the drawings.

17. Open cable trenches inside the buildings shall be provided with cast iron chequered plates.
18. LT cables on bottom tiers, Control and special signal cable any on the topmost tiers.

19. Cable network shall include power, control and lighting cables, which shall be laid in trenches, cable trays or pipes as detailed in the relevant drawings and cable schedules. Erection of cable trays as required shall be the responsibility of the contractor.

20. All tray levels shall be checked after erection and marked in as built drawing. Cable routing given on the layout drawings shall be checked in the fields to avoid interference with structures, heat sources, drains, piping, air-conditioning ducts, false ceiling support members etc. and minor adjustments shall be done to suit the field conditions wherever deemed necessary.

21. High voltage, medium voltage and other control cables shall be separated from each other by adequate spacing or running through independent pipes, trenches or cable trays, as applicable. All communication cables shall run on separate trays / ducts / trenches / pipes. Wherever these are not available, cables shall be taken in the same trench as that of power cable, but in a separate tray.

22. All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient length for the final connection of the cable to the terminal of the equipment. The various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables.

23. The quantity that indicated in the cable schedule is only approximate. The contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site and avoiding interference with structure, foundation, pipelines or any other services. Before the start of cable laying, cable drum schedule shall be prepared by electrical contractor and get that approved by engineer-in-charge to minimize / avoid straight through joints. Contractor shall work out the actual number of straight through joints required.

24. Cables shall be neatly arranged in the trenches / trays in such a manner so that crises crossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cables within the trenches / trays shall be the responsibility of the contractor.

25. Cable routing between lined cable trench and equipment / motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 45° the trench wall. In case of larger dia cables i.e. 50 mm and above, adequately sized pipe with larger bending radius shall be provided for ease of drawing of cable or for replacement. In places where it is not possible, a smaller trench / groove may be provided if approved by Engineer-in-Charge.
26. All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted.

27. The electrical contractor shall do removal of covers for purposes of cable laying and reinstalling them in their proper positions after the cables are laid. Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with a protective pipe or cover, until the final termination to the equipment is completed.

28. Cable ends shall be carefully pulled through the pipes, to prevent damage to the cable. Where required, approved cable lubricant shall be used for this purpose. Where cable enters pipe the cable should be bent in large radius. Radius shall not be less than the recommended bending radius of the cables specified by the manufacturer.

29. Following guidelines shall be adopted for sizing the pipe.

   o 1 cable in pipe - 53% fill maximum
   o 2 cables in pipe - 31% fill maximum
   o 3 cables in pipe - 43% fill maximum
   o 4 cables or more - 40% fill maximum

30. After the cables are installed and all testing is complete, pipe ends above grade shall be plugged with a suitable weatherproof plastic compound for sealing purpose. Alternatively G.I. Lids or PVC bushes shall be employed for sealing purposes.

31. Where cables pass through foundation, walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Engineer-in-Charge before cutting is done.

32. At road crossings and other places where cables enter pipe Sleeves adequate bed of sand shall be given so that the cables do not stack and get damaged by pipe ends. Spare pipes for future use shall also be provided.

33. Drum number of each cable from which it is taken shall be recorded against the cable number in the cable schedule.

34. Individual cables or small groups that run along structures/walls etc. will be clamped by means of 16 SWG GI saddles on 25x6mm saddle bars. Alternatively small group of cables can be taken through 100 mm slotted channel / ISMC 100. They shall be rightly supported on structural steel and masonry individual or in groups as required.
35. All G.I. Pipes shall be laid as per layout drawings and site requirements. Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the contractor), all the burrs from the pipes shall be removed. G.I. Pipes with bends shall be buried in soil/concrete in such a way that the bends shall be totally concealed. For G.I. Pipes buried in soil, bitumen coating shall be applied on the buried lengths. Installation of G.I. Pipes shall be undertaken well before paving is completed and necessary co-ordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. Plugs after they are laid in final position.

36. Cables laid on supporting angle in cable trenches, structures, column and vertical run of cable trays shall be suitably clamped by means G.I. Saddles / Clamps, whereas cable in horizontal run of cable tray shall be tied by means of nylon straps.

37. Cables shall be uniformly spaced, properly supported and protected in an appraised manner. All bends in runs shall be with due consideration to avoid sharp bending and kinks of the cables. The bending radius of value types of cables as per IS: 1255 shall not be less than those specified **

38. Type of cables and Minimum Bending radius
   o Voltage grade single core multi core
   o 1.1 kV PVC 15 D 12 D

39. Where cables are required to cross roads and surface drains they shall be taken through G.I. / PVC pipes at a minimum depth of 1000 mm.

40. For crossing water, sewage pipes etc. cable shall be taken through PVC pipes shall be placed in such a manner that the distance between top or bottom of service pipes shall be 250 mm minimum.

CABLE TERMINATION:

41. All PVC cables up to 1.1 kV grade shall be terminated at the equipment by means of compression type cable glands. They shall have a screwed nipple with conduit electrical threads and check nut.

42. Power cables wherever color coding is not available shall be identified with red, yellow and blue PVC tapes. Where copper to aluminum connections are made, necessary bimetallic washer shall be used. For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the switchgear/Control panels and Control Switches.
43. In case of control cables their terminal numbers by means of PVC ferrules or self-sticking cable markers shall identify all cores at both ends. Wire numbers shall be as per schematic/wiring/inter-connection diagram. All unused spare cores of control cable shall be neatly bunched and ferruled with cable tag at both ends.

44. Where threaded cable gland is screwed into threaded opening of different size, suitable galvanized threaded reducing bushing shall be used of approved type. Contractor shall drill holes for fixing glands wherever necessary. Gland plate shall be of non-magnetic material 3mm sheet steel.

45. The cable shall be taken through glands inside the panels or any other electrical equipment such as motors. The individual cores shall then be dressed and taken along the cableways (if provided) or shall be fixed to the panels with polyethylene straps. Only control cables of single strand and lighting cables may be directly terminated on to the terminals.

46. Cable leads shall be terminated at the equipment terminals, by means of crimped type soldieries connectors. Crimping shall be done by hand crimping / hydraulically operated tool and conducting jelly shall be applied on the conductor. Insulation of the leads should be removed immediately before the crimping. Conductor surface shall be cleaned and shall not be left open.

**CABLE TESTING:**

47. Before energizing, the insulation resistance of every circuit shall be measured from phase to phase and from phase to ground.

48. Where splices or termination are required in circuits rated above 600 volts., measure insulation resistance of each length of cable before splicing/terminating.

49. Measure the insulation resistance of directly buried cable circuits before cable trenches are back-filled. Repeat measurement after back filling. For cables up to 1.1kV grade, 1000V megger and for HV cables 2.5/5kV megger shall be used.

50. D.C. High Voltage test shall be conducted after installation on the following and test results shall be recorded.

51. For record purposes test data shall include the measured values of leakage current verses time. The D.C. High Voltage test shall be performed as detailed below in the presence of the Engineer-in-Charge.

52. Cables shall be installed in final position with the entire straight through joints complete. Terminations shall be kept unfinished so that motors, switchgears, transformers etc. are not subject to test voltage.
53. Cable schedule and layout drawings must be marked for AS BUILT conditions during the installation work and shall be approved by Engineer-in-charge.

H. DATA/TELEPHONE/MATV SYSTEM:

1. Some of the areas are provided with adequate number of data/telephone/TV points. The exact number of points shall be obtained from respective layouts.

2. These LV points are connected by means of following cables,
   - CAT 6 for DATA points
   - RJ6 for TV points
   - 2pair for Telephone points.
CODES AND STANDARDS:

Design and construction of various components of the system shall be in accordance with the latest editions of the relevant Indian standards, which are listed below.

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<td>IS 9900</td>
</tr>
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<td>17</td>
<td>High pressure sodium vapour lamps</td>
<td>IS 9974</td>
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<td>18</td>
<td>Ballast for fluorescent lamps for switch - start circuits</td>
<td>IS 1534</td>
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<td>19</td>
<td>Capacitors for use in tubular fluorescent, high pressure mercury vapour and low pressure sodium vapor discharge lamp circuits</td>
<td>IS 1569</td>
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<td>Three pin plugs and sockets</td>
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<td>B</td>
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<td>23</td>
<td>PVC insulated cables for working voltages up to and including 1100 V</td>
<td>IS 694</td>
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<td>24</td>
<td>Recommended current ratings for PVC insulated cables</td>
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<td>IS 5831</td>
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<td>IS 8130</td>
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<td>Methods of tests for cables</td>
<td>IS 10810</td>
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<td>28</td>
<td>Degree of protection provided by enclosures for LV switchgear &amp; control gear</td>
<td>IS 2147</td>
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<td>Air break switches, disconnector &amp; fuse combination units</td>
<td>IS 4064</td>
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<td>30</td>
<td>Miniature air break circuit breaker for voltages not exceeding 1000V</td>
<td>IS 8828</td>
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<td>31</td>
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<td>Danger notice plates</td>
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<td>35</td>
<td>Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes</td>
<td>IS 5082</td>
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<td>EARTHING AND LIGHTNING PROTECTION</td>
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<tr>
<td>S.NO</td>
<td>ELECTRICAL EQUIPMENTS</td>
<td>LIST OF VENDORS</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>LT panel / LT Busducts</td>
<td>CPRI certified manufacturer</td>
</tr>
<tr>
<td>2</td>
<td>Cast resin current transformer (CT)</td>
<td>AE / Kappa / Control &amp; Switchgear</td>
</tr>
<tr>
<td>3</td>
<td>Control / Potential Transformer (PT)</td>
<td>AE / Kappa / Control &amp; Switchgear</td>
</tr>
<tr>
<td>4</td>
<td>Digital ammeter and Volt meter</td>
<td>L&amp;T / AE.</td>
</tr>
<tr>
<td>5</td>
<td>Protective Relays</td>
<td>L&amp;T / Alstom / ABB / Siemens</td>
</tr>
<tr>
<td>6</td>
<td>Selector switches</td>
<td>L&amp;T / Salzer / Kaycee / Siemens.</td>
</tr>
<tr>
<td>7</td>
<td>Push Buttons/ Indicating Lamps LED</td>
<td>L&amp;T / Siemens / Schneider / Teknik.</td>
</tr>
<tr>
<td>8</td>
<td>MCB</td>
<td>L&amp;T / Siemens / Havells</td>
</tr>
<tr>
<td>9</td>
<td>Moulded Case Circuit breakers</td>
<td>L&amp;T / Siemens / Havells</td>
</tr>
<tr>
<td>10</td>
<td>MCB Distribution Boards</td>
<td>L&amp;T Hager / Siemens / ABB</td>
</tr>
<tr>
<td>11</td>
<td>Residual Current Earth Leakage Circuit Breakers</td>
<td>L&amp;T Hager / Siemens / Legrand</td>
</tr>
<tr>
<td>12</td>
<td>1100 V LT XLPE Al. Cables</td>
<td>Polycab / Finolex / Havells</td>
</tr>
<tr>
<td>13</td>
<td>CAT 6UTP cable</td>
<td>Amp / Krone / Finolex</td>
</tr>
<tr>
<td>14</td>
<td>RG 6 Co-axial cable</td>
<td>SIGMA / DELTON / Skytone</td>
</tr>
<tr>
<td>15</td>
<td>Compression glands and Lugs</td>
<td>Dowells / Comet.</td>
</tr>
<tr>
<td>16</td>
<td>Cu / Al (Crimping type) Cable Lugs</td>
<td>Dowells</td>
</tr>
<tr>
<td>17</td>
<td>Light Fittings with Electronics Ballast</td>
<td>Philips / Bajaj / Havells / Crompton Grooves</td>
</tr>
<tr>
<td>18</td>
<td>Lamps</td>
<td>Philips / Bajaj / Crompton Grooves</td>
</tr>
<tr>
<td>19</td>
<td>PVC conduits, PVC bend, Coupling, etc.</td>
<td>AVONPLAST / VIJAYA</td>
</tr>
<tr>
<td>20</td>
<td>MS Conduits</td>
<td>BHARATH / JK Tupe / Precision.</td>
</tr>
<tr>
<td>21</td>
<td>PVC Insulated Cu. Wires</td>
<td>Finolex / Polycab / Havells</td>
</tr>
<tr>
<td>22</td>
<td>Modular Switches &amp; Socket Outlets</td>
<td>MK / CRABTREE</td>
</tr>
<tr>
<td>23</td>
<td>Metal clad socket outlet with boxes</td>
<td>L&amp;T Hager / Siemens / ABB</td>
</tr>
<tr>
<td>24</td>
<td>Ceiling Fan</td>
<td>Crompton / Havells / Orient</td>
</tr>
<tr>
<td>25</td>
<td>Exhaust fans with Louver</td>
<td>Crompton / Bajaj / Almonard</td>
</tr>
<tr>
<td>26</td>
<td>Switch Fuse Units with HRC fuses</td>
<td>L&amp;T / Siemens / ABB</td>
</tr>
</tbody>
</table>
FORM OF PERFORMANCE SECURITY (GUARANTEE)

BANK GURANTEE BOND

In consideration of the IGMC&RI (hereinafter called “The Society”) having offered to accept the terms and conditions of the proposed agreement between …………………………… and ……………………………………… (hereinafter called “The said Contractor(s)”) for the work ………………… …………………. (hereinafter called “the said agreement”) having agreed to production of a irrevocable Bank Guarantee for Rs. ………………… (Rupees ……………………………………. only) as a security/guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.

We, ………………………………….. (hereinafter refered to as “the Bank”) (Indicate the name of the Bank)

hereby undertake to pay to the Society an amount not exceeding Rs …………………….. (Rupees ……………………………………. only) on demand by the Society.

2. We, …………………. do hereby undertake to pay the amounts due and payable (indicate the name of the Bank)

under this guarantee without any demure, merely on a demand from the Society stating that the amount claimed is required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs……………. (Rupees ……………………………………only)

3. We, the said bank further undertake to pay to the Society any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

4. We, …………………….. further agree that the guarantee herein contained shall (indicate the name of the bank)

remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Society under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-Charge on behalf of the society certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We, ........................................ further agree with the Society that the 
(indicate the name of the bank)
Society shall have the fullest liberty without our consent and without effecting in any 
manner our obligations hereunder to vary any of the terms and conditions of the said 
agreement or to extend time of performance by the said Contractor(s) from time to 
time or to postpone for any time or from time to time any of the powers excisable by 
the Society against the said Contractor(s) and to forbear or enforce any of the terms 
and conditions relating to the said agreement and we shall not be relieved from our 
liability by reason of any such variation, or extension being granted to the said 
Contractor(s) or for any forbearance, act of omission on the part of the Society or any 
indulgence by the Society to the said Contractor(s) or by any such matter or thing 
whatsoever which under the law relating to sureties would, but for this provision, 
have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the 
Bank or the Contractor(s).

7. We ............................. lastly undertake not to revoke this guarantee except 
(indicate the name of the bank) 
with the previous consent of the Society in writing.

8. This guarantee shall be valid up to ................. unless extended on demand by 
Society. Notwithstanding anything mentioned above, our liability against this 
guarantee is restricted to Rs...........(Rupees .................only) and unless a 
claim in writing is lodged with us within six months of the date of expiry or the 
extended date of expiry of this guarantee all our liabilities under this guarantee shall 
stand discharged.

Dated the......... day of .......... for...............(indicate the name of the Bank)
AFFIDAVIT

(to be taken by the contractor on a non-judicial stamp paper before a First Class Magistrate)

I/We have submitted Bank Guarantee for the work ........................................... (name of work) in letter No............................ dated from................................................
(name of bank) to the Executive Engineer-(Electrical) .............................................. towards performance guarantee of security deposit in cash. This Bank guarantee expires on ........................................... I/We undertake to keep the validity of the Bank guarantee in tact by getting it extended from time to time at my/our own initiative upto a period of ........................................... months after the recorded date of completion of the work or as directed by the Engineer-in-charge.

I/We also indemnify the society against any losses arising out of encashment of the Bank Guarantee, if any.

Note: This Affidavit is to be given by the executants before a First Class Magistrate.