

Request for Proposal

For

REFURBISHMENT OF GANDHI MANDAP

Design, Build and Operate Basis

Volume II C: SCOPE OF WORK & SPECIFICATIONS FOR ELECTRICAL WORK

Client:



**GSCL,
Guwahati, Assam**

DOCUMENT NO: TCE.10477A-AC-1007-1300

GANDHI MANDAP

BIDDING DOCUMENT FOR REFURBISHMENT OF GANDHI MANDAP

Design and Development of Landscaping works consisting of Softscaping, Hardscaping and related Civil works along with Maintenance of Entire Garden for period of One years at Gandhi Mandap , sarania Hill.

VOLUME II C

TECHNICAL BID - EMPLOYERS REQUIREMENT AND SPECIFICATION FOR ELECTRICAL WORK

Employer

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1. SCOPE OF WORK:

- 1.1. The scope of document covers the design, detailed engineering, preparation of construction drawing, manufacture, acceptance testing at manufacturer's works or at any accredited agency, supply, packing, forwarding and delivery from manufacturer's works/ place of storage to erection site including transit insurance, unloading, storage at site, assembly, erection, testing, installation, commissioning & performance demonstration and handing over along with all necessary spares of original ratings & specifications on Design Build basis. Inland and overseas transit insurance, transport, testing at site shall be Contractor scope. Contractor to ensure that design & equipment's shall be as per specification requirements.
- (a) Lighting System for the Garden
 - (b) Earthing System
 - (c) Outdoor Feeder pillar
- 1.2. The Contractor shall prepare design calculations based on parameters/ design criteria indicated in the specifications. The Contractor shall prepare detailed engineering and construction purpose drawings to make his/ her own estimate of ratings & quantities for entire electrical systems including all items, systems such as equipment's, cabling system, lighting system, earthing, civil works required for completion of Works.
- 1.3. Contractor shall take into consideration the AMC work for all equipment's installed in the garden for one year from the date of handover.
- 1.4. Contractor shall submit each document/ calculations of system which is included in scope to Purchaser/ Consultant for final review/ approval. All design documents/ calculations prepared by Contractor shall be with ISO documentation i.e. with duly signed by qualified authorities and stamped. Design documents/ calculations prepared by sub-Contractors shall be approved by Contractor and stamped copy of approval along with no-deviation sheet from sub-contractor shall be submitted by the Contractor to Purchaser/ Consultant for final review/ approval.
- 1.5. Expert or manufacturer supervision for sub-contractor supplied material shall be provided by Contractor and included in offer.

- 1.6. Contractor shall be solely responsible for any shortages or damages in transit for his supply scope, handling and/ or in storage of any materials and erection of the equipment, supply of erection tools at site. Contractor shall ensure that it will not affect any activity or project schedule. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.
- 1.7. Contractor should visit site and get himself/ herself ascertained regarding the scope of work for the complete Electrical works before submission of quote/ offer.
- 1.8. Even if all components of a system included in this specification are not explicitly identified and/ or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate proper operation and easy maintenance of the plant. Any and all other works not indicated above but necessary/ required to complete the job in all aspects, are included in the Contractor's scope.
- 1.9. Nothing in this specification shall be constructed to relieve the Contractor of his/ her responsibilities towards following best engineering practices established in the country.
- 1.10. If the incremental electrical demand due to new development of Gandhi mandap as per this RFP does not get accommodated within the existing contract demand, All - Obtaining approval including load sanction/ release from APDCL, No Objection Certificates from APDCL, Electrical Inspector (CEIG), relevant government agencies, and statutory authority, as applicable is included in Contractor's scope. All necessary legal fees required for various applications to APDCL, relevant government agencies, statutory authorities shall be paid by the Purchaser. Tariff metering equipment & electric supply connection shall be provided by APDCL for which necessary liaison shall be done by Contractor. Incoming point of supply till tariff meter is in the scope APDCL. Further, the entire distribution is in the scope of contractor only.
- 1.11. The Contractor shall include start up spares, essential spares, recommended spares and a set of special tools necessary for operation, routine maintenance of equipment supplied for a period of Three years.
- 1.12. Whether specifically called for or not, all accessories required for normal and satisfactory operation (as deemed by the Purchaser) of the equipment shall be considered to be a part of the Contractor's basic scope of supply and/ or work and no claims whatsoever,

for extra payment on these grounds, will be accepted.

- 1.13. 415V LV metal enclosed IP 65 outdoor feeder pillar, including astronomical time switch and contactor, required for distribution for power to the light fixture shall be in the scope of the contractor.
- 1.14. Cabling system shall consists of various 1.1 kV grade, XLPE/ PVC insulated, multi-stranded Al/ Cu, GI round wire/ flat strip armoured power & associated accessories. All the civil work required for underground laying of the cable in the DWC pipe shall be in the scope of the contractor.
- 1.15. Earthing for LV equipment's. The general design shall be on the basis of following codes and standards (their latest amendments) in line with design criteria & specification requirements.
- 1.16. Lighting system for all outdoor areas of gardens shall be done as per applicable IS 1944.
- 1.17. Two way junction boxes shall be provided for each luminaire within the radius of 2 meters from luminaire.

2. PROJECT INFORMATION:

2.1. SITE/ ENVIRONMENTAL CONDITIONS:

- a. Ambient temperature : 45°C.(site specific)
- b. Relative Humidity : 5 - 95%
- c. Area Classification : Non Hazardous / Hazardous
- d. Seismic Data : As per IS 1893 latest issue

2.2. NOMINAL SYSTEM VOLTAGE:

- a. Incoming supply : 415V, 3 ph, 4 wire, 50 Hz AC
- b. General lighting: 240V, 1 ph, 2 wire, 50Hz, AC

2.2.1. Voltage variation:

- a. 415 V supply : $\pm 10\%$
- b. Frequency variation : $\pm 5\%$
- c. Combined voltage and frequency variation : $\pm 10\%$

2.3. SYSTEM EARTHING:

- a. 415 V, 3 ph, AC system : Neutral solidly earthed
- b. 240 V, 1 ph, AC system : Neutral solidly earthed

3. DESIGN CRITERIA FOR ELECTRICAL SYSTEMS:

3.1. GENERAL:

- 3.1.1. The design criteria, given below has to be followed by the contractor for designing/ sizing of electrical equipments covered under Contractor's battery limits;

3.2. SWITCHGEAR SIZING/ SELECTION:

- 3.2.1. The bus-bars shall be sized considering the following criteria:

- a) Sleeves made of insulating material on all bus bars.
- b) Design ambient temperature 45°C .
- c) Final temperature of the bus-bars complying with requirements of IS 8623 & IEC 60947.
- d) Bus bars being inside the panel; De- rating for enclosure and ventilation.
- e) Bus bar suitability for carrying rated current continuously. The current density (A/sqmm) of the bus bar shall not exceed 0.8 for Aluminium bus and 1.2 for Copper bus.
- f) Configuration of bus bars and Proximity effect
- g) The main bus shall be designed based on the load rating as well as the actual fault level for specified duration at the location of the Panel/ board with 10% tolerance

- h) Earth bus of the panel shall be sized suitable for the above fault level for the same duration.
- 3.2.2. In-panel de-rating of minimum 20% or as provided in Manufacturer's catalogue, whichever is higher shall be considered
- 3.2.3. CABLE SIZING: The Contractor shall ensure that cable and wires associated with the power distribution, plant wiring and all other installations throughout the Works are adequately rated for their use.
- 3.2.4. The following main aspects shall also be considered while deciding the final size of the cables-
- a. Supply voltage and frequency
 - b. All cables shall be selected to carry the corresponding full load current under site conditions.
 - c. Route length and disposition of cables
 - d. Maximum allowable temperature rise under normal full load condition based on the material of cable insulation (XLPE/ PVC).
 - e. Maximum short circuit current duration (fault clearing time) and final temperature of cable during short circuit current flowing through the cable.
 - f. For Cables emerging from MCCB/MCB outgoing, fault clearing time shall be considered as 0.1 second
 - g. Contractor to note that, the above fault clearing times are minimum to be considered & fault clearing time shall be considered as per actual relay co-ordination study.
 - h. Appropriate de-rating factors as per cable manufacturer's catalogue and enlisted below shall be considered for sizing the cable:
 - i. Ambient Air Temperature (minimum 45°C).
 - ii. Ambient ground temperature (minimum 45°C to be considered)

- iii. Laid in Air / ducts/ directly in ground etc.
 - iv. Depth of cable burial (minimum 750 mm for LT)
 - v. Thermal Resistivity of Soil (minimum 150°C Cm/ W to be considered)
 - vi. No. of cables in a group-touching each other or separated by a distance
 - vii. Any other de-rating factors as applicable & as per Manufacturer's catalog.
- i. In running condition, cumulative voltage drop (at 100% rated load) shall not exceed 2% (measured at load end) for the LV loads.

4. Power Distribution Philosophy

The power supply to the new development of the Gandhi Mandap area shall be provided from the nearest existing outdoor feeder pillar. If the existing feeder pillar is not available within the 300m coverage of the proposed lighting or required feeder pillar spare feeder and power supply capability is not as per the requirement, a new IP65 outdoor feeder pillar shall be installed near the stage location. The power to this new feeder pillar shall be supplied from main feeder pillar located near transformer. The power from this new or existing DB shall be distributed to the stage and landscape lighting.

5. ILLUMINATION SYSTEM:

5.1.1. Illuminated is required so as to obtain the sufficient and required Lux level for proper mobilization.

5.1.2. The illumination levels for outdoor areas shall be as per IS 1944.

Sr. No.	Area	Illumination Level (Lux) - Average values
1	Garden area	8-10 Lux
2	Walkway	8-10 Lux

Based on the application of the area, various type of lighting system can be implemented in respective area with help of LED fixture as indicated below.

Table 1 LIGHTING FIXTURE

Sr No.	Type of fixture	Typical Fixture	Place
1	Bollard Philips Make BCP151 LED150/WW PSU 220-240V 7043 or equivalent		Lawn/Garden /Walkway
2	Uplighter Philips Make BBP330 HP/NW 220-240 121N or equivalent		Near statue area/Stage area
3	Post Top on 4m Pole Philips Make BGP151 LED2000/WW PSU 220-240V 7043		Along the Road/Pathway
4	Step Light Philips Make BWG150 LED50/WW PSU 220-240V IP 67 7043 or equivalent		Along the Pathway

5.1.3. Lighting design shall be performed using DiaLux Software Version 4.5 or its latest version/ Original Equipment Manufacturer (OEM) validated software. The Validation Report along with software and data files shall be acceptable to Purchaser/ Purchaser's representative.

5.1.4. Various design factors shall be considered as following:

- a) Maintenance Factor: : 0.8
- b) Uniformity (Min. / Avg.) : 30% for outdoor

6. LIGHTING SYSTEMS:

6.1. Scope

6.1.1. The scope of the Contractor shall include design, supply and installation of all equipment necessary for a complete lighting system. The lighting system includes Lighting fixtures (outdoor), lighting outdoor feeder pillar JBs, cables/ wires for lighting etc.

6.1.2. The various types of lighting fixtures as per specified in this specifications shall be assembled, installed, tested & commissioned by the contractor.

6.2. Applicable Standards: The design, manufacture and performance of equipment shall conform to the latest standards specified below. In case of conflict between the standards and this specification, this specification shall govern.

6.3. Maintenance Requirements:

- a) CONTRACTOR shall supply maintenance tools including special tools, if required, for attending to the equipment supplied at no extra cost. As far as practicable, the equipment and accessories shall be so designed that no special tools are necessary for installation and maintenance of the equipment. However, if special tools are required, the CONTRACTOR shall include price of one complete set for each type of equipment

6.4. Storage At Site

- a) CONTRACTOR shall indicate the specific requirements, if any for proper storage of the equipment supplied at site.
- b) In general, while shipping the equipment to site, Vendor shall ensure that each assembly or component shall be crated, boxed or otherwise suitably protected against damage or loss during shipment and to facilitate site storage. All openings shall be effectively sealed with temporary closures to prevent entry of dust, dirt, moisture and other foreign matter.

6.5. Documents to be submitted by CONTRACTOR

- a) Contractor shall submit all following test reports for LED lighting fixtures before dispatching of material at site. All tests shall be carried as per IES/IEC/BIS approved methods defined in the respective standards (LM-82).
- b) LM-80 for measurement of lumen of LED source.
- c) LM-79 for fixture-Electrical & Photometric measurement.
- d) TM-21 test for LED life.
- e) Thermal Characteristic- Test for Lumen output temperature dependency.
- f) Electrical Characteristic- Test for the calculation of efficacy.
- g) Driver testing for Power factor, THD & Isolation.
- h) IP Protection test against ingress of dust & solid objects for both indoor & outdoor LED fixtures.
- i) IS 10322 (All relevant Parts) – For General Requirements, constructional requirements, screw and screw less terminals, methods of tests and particular requirements for luminaires.
- j) IS 16106 - For Electrical and Photometric Measurements of Solid State Lighting (LED) Products. Data sheet of offered Luminaries along with GA dimensional drawings with all views of Luminary.

- k) Data sheet of offered Luminaries along with GA dimensional drawings with all views of Luminary
- l) Operating/fixing manuals / technical leaflets giving all the details of Installation, operation and maintenance
- m) Internal road Lighting and Area lighting layout with type of mounting details and fixture details and its datasheet
- n) Bill of quantities of fixture, mounting equipment and all other accessories
- o) Post Top pole details and Foundation details

7. **CABLING SYSTEM:**

7.1.1. The scope shall be inclusive of supply, installation, testing & commissioning of power, cable terminations, cable accessories, stripping of cable insulation, supplying and fixing of Aluminium lugs for aluminium cables & tinned plated copper lugs for copper cables and crimping the same to the conductor, supply and fixing of double compression cable glands including all labour supply and consumable material required for jointing/termination. The rate shall also include the laying of cable in ground cleating to structure etc.

7.1.2. Applicable Standards:

The cables shall confirm to the latest applicable standards specified below. In case of conflict between standards and this specification, this specification shall govern.

PVC insulated cables (for voltage up to 1100 V)	:	IS: 694
Cross linked polyethylene insulated	:	IS: 7098
Methods of test for cables	:	IS: 10810

- 7.1.3. Cabling of all the other outdoor light fixture shall be done with armoured 4C X 4/10/16 Sq mm Al cable laid in 50/75/110 NB DWC flexible pipe buried 600mm below ground. This cable shall be looped between the fixtures with help of Junction box buried under ground below the fixture.
- 7.1.4. A 16/10 Sq mm armoured cable shall be used for supplying power to the new feeder pillar from the main or nearest feeder pillar as per the availability of feeder.
- 7.1.5. The LV cables shall be 1.1 kV grade, multi-stranded Copper/ Al conductor, XLPE insulated, colour coded, inner and outer extruded PVC sheathed, galvanized steel round wire/ flat strip armoured cables. LT shall be conforming to IS 7098 Part I for XLPE cables and IS 1544 – Part I for PVC cables.
- 7.1.6. Cable installation works shall be carried out in accordance with IS 1255, latest version.
- 7.1.7. Cable Terminations:
- a) Cable Lugs
 - i. Cable lugs shall be of tinned copper, solder less crimping type for Cu cables & AL lugs for the AL cables.
 - ii. The current rating of the lugs shall be same as that of the respective cable conductors.
 - iii. Bi-metal strip/ Bi-metallic lug shall be used whenever two different metals are to be connected together.
 - iv. Anticorrosion/ anti-oxidation compounds shall be used for crimping lugs. This shall especially be ensured for Al cable terminations & bimetallic terminations shall be used wherever required.
 - v. If termination is done with crimping tool employing crimping die then forming dies shall be used to make the sector shaped conductor into a round conductor before crimping the lugs on the conductor. The lug must not be crimped directly on the sector conductor. Before crimping the lug, the conductor shall be thoroughly cleaned and special jelly applied over it to prevent further oxidation.

b) Cable Glands

- i. Glands shall generally be of the double compression hexagonal type brass glands. Earth continuity of brass glands shall be assured.
- ii. Double compression type cable glands shall be used. Cable glands shall be brass casting, machine finished and Nickel-plated to avoid corrosion and oxidation. Rubber components used in cable gland shall be of neoprene.
- iii. Cable glands shall be with metric threads.
- iv. Where holes for cable entries are not provided it shall be the responsibility of the Contractor to mark out and drill such holes. Burrs and swarf shall be removed, care being taken to ensure that swarf and filings, etc do not enter the equipment.
- v. For non-hazardous areas cable glands in situations where moisture may be present shall be double seal weatherproof type, gland shrouds shall be used and entry shall be sealed.

7.1.8. Tests Before and After Laying of Cables at Site: Following Routine & acceptance tests on each drums as per IS 10810, IS 7098 standard & other specified relevant standards shall be performed by the manufacturer and witnessed by Purchaser/ Purchaser's Representative.

a) For 1.1 kV Power & Control cables:

- i. Dimensional & visual check
- ii. Conductor resistance test
- iii. Insulation Resistance Test
- iv. High voltage test

b) Cables shall be checked for insulation resistance before and after jointing. The voltage rating of the Megger for cables of different voltage grades shall be as indicated below.

Voltage Grade	Megger rating
1.1kV	500V

- c) Following tests in the presence of Purchaser/ Purchaser's representative shall be carried out at site before commissioning of cables.
- i. Insulation Resistance test between phases and phase to Neutral and phase to earth.
 - ii. Continuity test of all the phases, neutral and earth continuity conductor.
 - iii. Sheathing continuity test.
 - iv. Earth resistance test of all the phases and neutral.

7.1.9. Drawings/ Documents Required:

- a) As a part of the Bid, Contractor shall furnish the following :
- i. General information
 - ii. Principal technical data
- b) After award of contract it shall be the responsibility of Contractor to work out a detailed layout for the complete garden cabling system. The layout drawing shall be furnished for the approval of Purchase/ Purchaser's representative before commencement of installation.
- c) Contractor to submit following Drawings/ Details after award of contract
- i. Cable Sizing calculations
 - ii. Cable routing lay out inside and outside the plant with route marker provided at 30 meter interval.
 - iii. Bill of quantities of cables, lugs and glands.

8. EARTHING SYSTEM:

8.1. The safety earthing will be generally on the basis of following codes and standards (including their latest editions).

- a. IS 3043 -1987: Code of practice for Safety Earthing.
- b. IEEE 80 - 2000.
- c. CEA guidelines - 2010: Measures related to safety & electric supply.

8.2. The fault levels considered shall be as follows:

System	Fault level in kA
b) 415V System	Based on the rating of Transformer

8.3. Following factors shall be considered for sizing the earthing conductor:

- a) Design Ambient Temperature : 50°C
- b) Allowable temperature rise for steel welded joints : 500°C
- c) Fault clearing time : 1 Second
- d) Overall earthing resistance : ≤ 1 Ohms

8.4. Following factors shall be considered for sizing the earthing conductor:

8.5. Each luminary shall be provided with an earthing terminal suitable for connection to the earthing conductor of 12 SWG GI wire.

8.6. Where separate control gear box is provided for housing the accessories the same shall be provided with an earthing terminal suitable for connecting earthing conductor of 12 SWG GI wire.

8.7. All metal or metal enclosed parts of the luminaries/control gear box shall be bonded

and connected to the earthing terminal so as to ensure satisfactory earthing continuity.

- 8.8. The light fixture shall be earth through 8/12 SWG wire carried along with the cable in the 50/80/110NB DWC pipe.
- 8.9. The outdoor feeder shall be connected to the existing earth grid via adequate size GI strip as per the design basis mention above.
- 8.10. The underground joints in the system shall be properly welded or brazed and the bolted type connection shall be made with structures/ equipments. Petroleum jelly shall be applied to contact surface of the bolted joints, which will be covered with bituminous compounded and tapes.
- 8.11. For equipment earthing, two earthing leads will be used if rated voltage of the equipment is 250 volts & above and one earthing lead will be provided for equipment rated below 250 volts.
- 8.12. The earthing conductors in outdoor areas shall be installed at a minimum depth of 600 mm below FGL.
- 8.13. All civil works, such as excavation, backfilling for the installation of the earth electrodes shall be in the scope of Contractor.
- 8.14. Drawings/ Documents Required:

The Contractor should prepare Layout drawings, after award of contract and before commencement of work for Purchaser's approval, showing the existing location of earthing grid, electrodes, interconnection with the newly installed feeder pillar etc. should be accompanied by design calculations.

9. Outdoor Feeder Pillar:

- 9.1. Feeder Pillars (FP) shall be Outdoor type, Wall/ Column/ Steel Support mounting, Weatherproof, single door, single front, non-compartmentalized enclosure with locking facilities with Din rail mounting arrangement.
- 9.2. Enclosure should be with impact resistance of IK10 & Ingress protection of IP 65.
- 9.3. The FP (Feeder Pillar) shall be of sheet steel enclosed and shall be fully dust and vermin proof, providing as degree of protection of IP 55 with canopy. The sheet steel used shall be cold rolled and 2 mm thick. The gland plate shall be 3mm thick.
- 9.4. The feeder pillar shall have cable entry at the bottom suitable for terminating double compression glands for 1 Runs of 3.5 C X 16 sq.mm Aluminium conductor, XLPE insulated armoured cable at the incoming terminal and 6 Runs of 4 core 10 sq.mm. Aluminium conductor, XLPE insulated armoured cable at the outgoing terminal.
- 9.5. The feeder pillar shall consist of Four Pole (FP) MCCB/MCB and RCCB and Outgoing of TPN MCB
- 9.6. The power and control components are as listed below;
 - a. All MCCBs shall be comply with the relevant IS and IEC standards. It shall be current limiting type and shall provide a cut off in, < 10 ms for prospective currents during faults. It shall be provided with fixed thermal overload, short circuit and earth fault release. The breaking capacity of the MCCB shall be 16kA for 1 sec and rated for $I_{cs} = I_{cu} = 100\%$. The maximum rating of the MCCB shall be 63A.
 - b. All MCCBs shall be with Utilization Category "B" (i.e. offering time discrimination with downstream devices).
 - c. All the contactors shall have high rupturing capacity rated for 3 phase 440 V, 50 Hz, , Four Pole, AC 3 duty.
 - d. Copper bus bar with SMC support insulators shall be provided for power distribution within the feeder pillar. The size of phase and neutral shall be equal.
 - e. All connecting power & control wiring shall be carried out with stranded copper conductor PVC insulated LSHF wires. Minimum size of control wiring shall be 1.5 sq. mm and power wiring shall be 4 sq. mm.
- 9.7. An Aluminium / GI Earth bus shall be run at the bottom of the Feeder Pillar which shall

be connected to the earth leads at the two extreme ends for connecting the GI earthing strip from the electrode.

- 9.8. Two nos. Pipe Earthing electrode shall be provided for each Feeder pillar and connected with 25X6 mm GI earth strip. The pipe electrode shall be as per the latest version of IS 3043
- 9.9. The feeder pillar shall be mounted on prefabricated Galvanised Steel Support structure duly fastened with a concrete foundation with grade M20

10. Junction Boxes

- 10.1. Junction boxes with terminals shall be supplied for branching and terminating lighting cables when required for outdoor areas etc.
- 10.2. The junction boxes shall be dust and vermin proof and shall be fabricated from 14 SWG sheet steel 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.
- 10.3. The boxes shall have provision for wall, column, pole or structure mounting and shall be provided with cable/conduit entry knock outs, terminal blocks, as required.
- 10.4. The terminal blocks, with specified number of terminals, shall be mounted securely on brackets welded to the back sheet of the box. The terminals shall be 600 V, grade, one piece construction complete with terminals, insulation barriers, galvanised nuts, bolts and washers and provided with identification strips of PVC. The terminals shall be made of Copper alloy and shall be of box clamp type.
- 10.5. The boxes shall be painted with one shop coat of red oxide zinc chromate primer followed by a finishing coat of paint.

11. MAKE LIST

Sr. No.	Material/ Equipment	Vendor
1	ACB / MCCB	ABB, Schneider, Siemens ,L&T
2	MCB/RCCB/ SPD/RCBO	ABB, Schneider, Siemens ,L&T
3	MPCB	ABB, Schneider, Siemens ,L&T
4	Contactors	ABB, Schneider, Siemens, L&T
5	Light Fixture	Wipro, Philips,Crompton Greaves , Bajaj ,Havells
6	LED / Driver	Cree, Nichia, Philips, Osram
7	MS Tubular / Octagonal Poles	Bajaj, Philips ,Schreder, Valmount
8	Junction Box	Hensel,Legrand
9	Astronomical Timer	ABB, Siemens
10	Timers	Schneider, Siemens ,L&T, Legrand
11	Terminal Blocks /connectors	Jainson , Elmex, Connect well Wago
12	LT armoured Cable	Finolex , RPG , Polycab ,CCI, Universal
13	LT Flexible Cable	Finolex , RPG , Polycab, Universal
14	Cable Gland	Comet, Dowells
15	Cable Lugs	Comet, Braco, Baliga
16	Cable termination Kit	Raychem, 3M
17	Cable Jointing Kit	Raychem, 3M
18	Earthing Strip, and accessories	Shruti, Profab, Sadhana, Sterlite

Note:-

- (i) Only one of the above makes of the materials will be acceptable. The CONTRACTOR has to comply with the approved makes given in the tender document.
- (ii) The CONTRACTOR shall offer the equipment of makes mentioned above. Other makes are subjected to Client approval before procurement.
- (iii) If any specific item is not mentioned in the make list. CONTRACTOR shall submit the list of make to the CONSULTANT/PURCHASER for the approval.
- (iv) The items manufactured in India shall be permitted only if the items are ISI marked (any other definition of compliance to BIS shall not be acceptable).
- (v) Samples from all the approved makes shall be offered for selection.
- (vi) For standardization, inventory, electrical system coordination, the Employer/ Employer's Representative can insist on any one make from the makes indicated above.
- (vii) The items shall meet specifications. Mere mention of a make as approved make in the above list does not qualify for acceptance of an item

12. LIST OF DRAWING AND DOCUMENTS

- 12.1. Equipment Sizing calculations with assumptions made; General Arrangement; Equipment Data sheet indicating compliance to all the requirement as asked for in the specifications; Type test certificates as required for the key tests like SC test, Temperature rise tests, IP Protections tests; Foundation Drawings with calculations; Cable Schedules; Interconnection Schedule; and other construction drawings shall be provided.
- 12.2. The Following minimum Drawings shall be submitted by the CONTRACTOR to CONSULTANT for the approval
- 12.3. Single Line Diagram for Power Distribution of the garden
- 12.4. Calculations
- (b) Electrical Load List and demand Calculations
 - (c) Earthing Calculations for Electrical System
 - (d) Cable schedule with Sizing Calculations
 - (e) Lighting Calculations for each Area
 - (f) LV Panels
 - (i) GA Drawing
 - (ii) Wiring Diagram
 - (iii) Type test Certificate for Short Circuit withstand capacity
 - (iv) Type test certificate for IP protection
- 12.5. Construction Drawings of the following
- 12.6. The CONTRACTOR shall depute competent engineers to PURCHASER's / CONSULTANT's office for discussions and finalisation of any outstanding issues when called upon by PURCHASER/CONSULTANT
- 12.7. Both hard and soft copies of all CONTRACTOR drawings shall be furnished right from approval stage.

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- 12.8. The CONTRACTOR shall plan his manufacturing schedule so as to allow at least two weeks time for approval of the drawings after their receipt by the PURCHASER.
- 12.9. The PURCHASER shall reserve the right to comment on drawings and documents under information category and inform the CONTRACTOR to treat these drawings and documents as approval category.