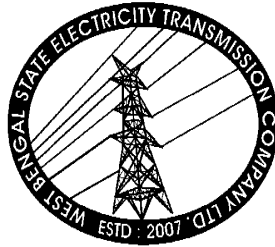


# ILLUMINATION SYSTEM

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**September 2017**

*Engineering Department*

**WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED**

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড  
( পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ )

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## TECHNICAL SPECIFICATION OF SUB-STATION LIGHTING

### 1. **SCOPE :**

- a) The specification covers design, manufacture, shop assembly, testing, supply, delivery, erection and commissioning of illumination system with all its required accessories for total Sub-Station area comprising of switchyard, rooms of all type of buildings, corridors & stairs, utility portions, road & pathways, main gates, equipment halls and all other covered & un covered areas.
- b) This also includes ceiling fans complete with electronic regulators and accessories in all rooms of Control building, utility building & quarters, exhaust fans for GIS Hall, toilets & kitchen, lighting panels & accessories, lighting poles complete with distribution boxes G.I. earth wire, receptacles, telephone socket etc. and allied accessories for such illumination system.
- c) There shall be provision for DC emergency lighting system in strategic locations including staircase, corridors, control rooms, relay room, GIS hall (if any), battery charger room, LT switchgear room, AC/DC switchboard room (if any), Communication room, firefighting pump house etc so that the operating personnel can safely find their way during emergency due to total AC failure. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage or total AC failure occurs in the main AC system.
- d) **LED / energy efficient lamps shall be used** for designing of the system.

### 2. **STANDARDS :**

- a) The equipment and materials to be furnished under this specification shall be designed, manufactured and tested in accordance with the latest revision of relevant Indian Standards, IS : 3646 and manual of layout of Sub-station by CBIP.
- b) The electrical installations shall meet the requirement of Indian Electricity Act - 1910 and Indian Electricity Rules 1956 as amended up-to-date.
- c) IEC: 364-5-54, Electrical Installation of buildings.

### 3. **I) DEVIATION:**

Normally the offer should be as per Technical Specification without any deviation.

### **II) MODIFICATION :**

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

#### 4. **DESIGN CRITERIA :**

- a) A.C. lights will be connected to A.C. lighting panels.  
There shall be main lighting system for full illumination in different area under normal AC supply condition and that will be connected to main lighting distribution boards (MLDB).
- b) **A.C. Emergency lighting (if applicable)** - This system will be available in control room building, fire fighting pump house, DG set room, GIS Hall, relay room, switchgear MKs and switchyard. AC lighting load will be connected to this system, which will be normally 'ON'. The lighting panels of the system will be connected to the Emergency lighting distribution board (ELDB), which is fed from diesel generator during the emergency.
- c) **D.C. Emergency lighting**  
There shall be minimum lighting system in the strategic locations including staircase, corridors, control rooms, relay room, GIS hall (if any), battery charger room, LT switchgear room, AC/DC switchboard room (if any), Communication room, firefighting pump house and other important places during total failure of AC supply with the help of 220 V +/- 10% DC supply from battery for safe movement of operating personnel. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage occurs in the AC main lighting distribution board.
- d) The main lighting system shall operate through a separate lighting distribution board, which shall receive power from the Sub-station L.T AC switchboard installed in the control room building.
- e) The lighting distribution board shall be designed for operation in a 400 V, 3 phase, 4 wire, 50 Hz. neutral grounded system with a fault level of 15 KA at 400 V. The emergency lighting system operating from 220 V +/- 10% DC system shall be automatically placed into service in the event of loss of AC main supply.
- f) The maintenance factor shall be taken as 0.6 and 0.7 for different outdoor and indoor lighting systems respectively.
- g) Illumination level as specified below are to be provided at various locations of the switchyard area, other adjoining areas, colonies and control room buildings.

Sl.No.	Particulars of Sub-Station Area	Required Illumination (LUX) at Ground Level
1)	CONTROL ROOM / Switch gear Room / Relay Room	300
2)	Battery Room	150
3)	Communication Room	300
4)	Offices/Engineers' Room/Other Office Room	300
5)	Toilet	100
6)	Switchyard area including road	30
7)	Stairs	100
8)	Corridor	100
9)	Road within campus including colony area	30
10)	Maintenance room	150
11)	Any other spot where high level of illumination required	150
12)	Dormitory & 'C' type quarters	150
13)	Auxiliary Buildings like Pump room and other houses	150
14)	ACDB- DCDB room/Store / Store Office	150
15)	Conference room	300
16)	Tiffin room/Kitchen	150
17)	GIS Hall	150

- h) The minimum lux level to average lux level ratio should not be less than 0.3 i.e.  $E_{min}/E_{av} > 0.3$ .
- i) All wiring shall be concealed type.
- j) All switch board shall be flush type and in each switch board there shall be provision of one 15/5 A socket.
- k) All the lamps in room shall be energy efficient LED pin type and rating of the lamp shall be according to the design criteria of required lux homogeneous to the room.

## **5 LIGHTING FIXTURE :**

- a) The lighting fixtures shall be designed for use in 230 V A.C.  $\pm 10\%$  V, 50Hz, AC system with frequency variation  $\pm 5\%$  and combined voltage and frequency variation of  $\pm 10\%$ .
- b) The emergency lighting fixtures shall be designed for use in 220 V  $\pm 10\%$  DC system.
- c) Temperature rise of different components shall be limited to the specified value as per relevant standard over an ambient temperature of 50<sup>o</sup> C. All equipment and accessories shall be suitable for continuous operation.
- d) All lighting fixtures complete with lamps, tubes and accessories shall be within the scope of the bidder.
- e) Light fittings shall be so arranged that the required lux values specified are maintained, with supply of required fixtures and supports.
- f) Each lighting fixture shall be provided with an earthing terminal suitable for connection to earthing conductors.
- g) All fixtures shall be designed for minimum glare. The finish of the fixture shall be such that no bright spots are produced either by direct light source or by reflection.
- h) MCCB & MCB shall be from one of the following manufacturer complying with technical specification & relevant IS & IEC
  - a) M/s Siemens
  - b) M/s L & T
  - c) M/s ABB
  - d) M/s Schneider
  - e) M/s GE

## 6 **LAMPS :**

- a) All tubes shall be bi-pin type and white coloured.
- b) High pressure sodium vapour lamps with all fittings and accessories shall be use for switchyard lighting. For achieving specified lux levels in the switchyard, the contractor can provide luminaries of 400W/ 250W as per requirement.
- c) Bidder shall submit detailed calculation for reaching the above lux level. They shall conform to the LUX levels at different locations by measurement. During commissioning, the contractor shall arrange for measurement of achieved lux level at different points in presence of representatives of WBSETCL.
- d) The distribution of fittings over the three-phase supply shall be such that any particular area is not completely void of supply in case of failure in any phase.
- e) Ceiling fans (1400 mm sweep, AC 230 Volts) complete with electronic regulator and switch, and all required accessories shall be provided in all buildings. Mechanical ventilation using Exhaust fans of suitable dia shall be provided in the GIS Hall, battery room (if required), toilets, kitchen/pantry of all buildings.
- f) All such ceiling, wall mounted fan, exhaust fans and all accessories and fittings shall be within the scope of supply of the bidder.
- g) **One no. A-type Aluminium ladder of 3.0 metres vertical height and one no. cart wheel mounted Al. ladder having vertical height 7.5 M when extended shall be supplied** by the contractor for maintenance purpose for sub-station.

## 7 **ACCESSORIES :**

Each LED, CFL and sodium vapour fixtures shall be furnished complete with suitable choke ballast, p.f. improvement capacitors, starters, lamps, holders etc. with all accessories complete as per individual requirement.

## 8 **LIGHTING PANEL :**

- a) No. of panels have to be provided as per design requirement for convenience of operation access. Each panel shall be provided with one incoming 3-phase miniature circuit breaker(MCB) with neutral link and with overload thermal element and outgoing feeders through double pole/triple pole MCB/MCCB, as per requirement. The panel shall conform to IS:8623.
- b) The bus bars, MCBs/MCCBs shall be of suitable continuous rating and short time rating depending on full fault level. MCB/MCCB's shall be suitable for manual closing, opening, automatic tripping under over load and short circuit. The MCB/MCCB's shall also be trip free and generally conform to IS:8828. MCB/MCCB's shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper wire connection at both incoming and outgoing side by Cu-lugs or for bus bar connection on the incoming side. MCB/MCCBs shall be of single pole as well as three pole versions as per requirement.
- c) The MCBs, MCCB shall be rated for full fault level. In case MCB rating is less than the specified fault level, the bidder shall co-ordinate these breaker characteristics with the back up MCCB in such a way that if fault current is higher than breaker rating, the MCCB should trip earlier than the breaker. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.
- d) The terminals of MCBs/MCCB's and 'Open', Close and 'trip' conditions shall be clearly and indelibly marked.
- e) The panel shall be fabricated from a minimum of 14 SWG sheet steel, and shall be dust proof, galvanised with front hinged door having locking arrangement.

- f) The panel shall be constructed so as to permit making terminal connection by opening the hinged door in the front. Incoming and outgoing feeders shall be connected from the bottom/top of the panels. The panels shall be suitable for structural mounting as well as floor mounting.
- g) Each panel shall be identified at the front with suitable designation plate.
- h) Each panel shall have a CAUTION notice on it. The circuit diagram shall be fixed on inside the door.
- i) Each panel shall have provision of two separate and distinct ground terminals each for connections with Cu flat of suitable size.
- j) All panels shall be tested for the following test and test certificates shall be furnished.
  - i) Wiring continuity test.
  - ii) High voltage and insulation test.
  - iii) Operation test.
- k) **Main Bus Bars :** For outdoor lighting panel, Bus shall be of aluminium alloy conforming IS:5082 and shall have adequate cross section to carry the rated continuous and withstand short circuit current. Maximum operating temperature of the bus bars shall not exceed 85°C. The bus bar shall be able to withstand fault level of 9KA for 1 sec. for AC panels and 4KA for 1 sec. for DC panels. The indoor lighting panels shall have Aluminium bus bar.

## **9 RECEPTACLE WITH PLUG :**

- a) All receptacles shall be of modular type suitable for maintaining on wall/column and of flush mounting type complete with individual plug and switches. The receptacle shall be 15A/230V, 2-Pole,3-Pin type with 3rd pin grounded and suitable for indoor and outdoor installation. The receptacles shall be housed in an enclosure made of 2 mm. thick GI sheet with hinged doors with padlocking arrangement. Door shall be lined with good quality gasketing. This shall conform to IP:55.
- b) The other type of receptacles lines 5/15A, 6 pin with switches (modular type with flush mounted type switches and electroplated metal enclosure and 63A, 400V, 3Phase, 4 Pin interlocked plug and switch with earthing contact and any other type as per requirement shall be within the scope of contractor. Other descriptions of receptacles are identical to above.

## **10 SWITCH AND SWITCHBOARD :**

- a) All switchboard/boxes shall be of modular type with standard material presently used for electrification work.
- b) All switchboards shall have adequate space to accommodate all accessories and wires. All switches shall have quick make and quick break mechanism. Small duty switches shall be piano type with service marking on the switches. The switches shall be of reputed make, modular type.
- c) All switch board/boxes, 5/15A plugs & sockets and electronic fan regulators located in office and other building area shall be modular flush mounted type.
- d) The exact no. of switches including regulator for fans and layout of the same in the switch board shall suit the installation requirement as per approved drawing.
- e) Switch board/boxes shall have conduit knock outs on all the sides. Adequate provisioning shall be made for ventilation of these boxes.

## **11 CABLES :**

- a) All lighting cables (ISI marked) shall be 1.1 KV graded PVC insulated with stranded Aluminium / Copper conductor. Multicore cables shall have extruded PVC inner sheath, single run GI wires armouring and overall extruded PVC outer sheath. All cables for lighting shall be from approved manufacturer of Power & Control Cable listed in the Maker's List of equipment. Entry of the cables shall be through suitable and appropriate cable sockets and glands.
- b) Final conceal wiring / cable routing shall be done based on fixture location and other site conditions.
- c) For outdoor areas, main runs from outdoor lighting panels shall be done by means of AYWY / YWY cables, directly buried in ground outside cable trench with proper protection as per relevant I.S.
- d) When buried cables cross road/ railway track, additional protection to be provided in form of HDPE / hume / GI pipe.
- e) The size and number of cores of all the cables shall be determined as per scheme requirement keeping provision of spare cores. The size of cables shall be supported by cable-sizing calculation.
- f) Cable size shall be such that the voltage drop between the current consuming devices and supply distribution board shall not exceed 3% of supply voltage when entire illumination system is in operation.

Cable shall be standard product of reputed manufacturer and shall conform to relevant Indian Standards.

## **12 JUNCTION BOX :**

The Junction Box shall be concealed type for indoor lighting and suitable for mounting on column, lighting poles, structure etc. for outdoor lighting.

The Junction Box shall be of 3mm sheet steel and shall have bolted cover with good quality gasket lining and the box including its cover shall be hot dip galvanised. The junction boxes shall be square/rectangular type. Each junction box shall have the following marking with indelible ink :

- i) Circuit numbers on the top.
- ii) Circuit numbers with ferrule (inside).
- iii) Danger sign in case of 415 V junction box.

Junction box shall be weather proof type with gaskets conforming to IP 55 as per IS:13947 (part I). The conduit connections shall also be properly sealed to prevent entry of water.

## **13 TERMINALS BLOCK :**

Multi-way terminal block of Elmex/Connectwell make 1100V grade and of approved type complete with screw, nuts, washer and marking strip shall be furnished for termination of incoming and outgoing wires. Each terminal shall be used for only one termination. 20% spare terminal blocks shall be provided for future use.

#### **14 PULL OUT BOXES :**

- a) The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc. for outdoor lighting. The supply of all accessories required for erection of the same shall be included within the scope of the contractor.
- b) The pull out boxes shall be circular of cast iron or 16SWG sheet steel and shall have cover with good quality gasket lining.
- c) Pull out boxes with cover shall be hot dip galvanized.
- d) Pull out boxes shall be provided at approximately 3 meters interval in a conduit run.

#### **15 PUSH BUTTONS :**

All push buttons shall be of push to actuate type having 2 NO and 2NC self reset contacts. They shall be provided with integral escutcheon plating engraved with their functions. Push button shall be of reputed make.

#### **16 LABELS :**

- a) The lighting panels shall be provided with on the front with panel designation labels on a 3 mm. thick plastic plate of approved type. The letter shall be block engraved on white back ground.
- b) All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-resting metal or 3 ply lamincold. Labels shall have white letter on black or blue background.

#### **17 PVC CONCEAL WIRING:**

The PVC conceal wiring layout for substation buildings, cable schedule for substation yard etc. for wiring of these equipment shall also be prepared by the Contractor.  
All conceal wiring shall be made of fire retardant PVC inside the control room building, quarters and other houses. Sufficient space shall be kept inside each conduit for future requirement.

#### **18 WIRING :**

All wiring on the wall of each room of control building, dormitory, C-type quarter, pump house, store shed with office, security barrack, security check post / goomty, DG room etc under scope of work shall be concealed type. Wiring shall be carried out by PVC wires in conduit. Wiring shall be spliced only at junction boxes and switchboards, panels, etc. and shall be covered with approved type terminal strips. The size of the cable for wiring shall be suitable for continuous drawal of load for which the same is designed. Separate neutral wires are to be provided for each circuit. AC and DC wiring should not run through the same conduit. Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Wherever required suitable junction boxes shall be used Wires shall be of 1100V grade PVC insulated product of reputed manufacturers. The colour code of wires shall be as follows -

- Red for R-phase.
- Yellow for Y-Phase.
- Blue for B-Phase.
- Black for Neutral.
- White for DC (positive).
- Grey for DC (negative).

The conductor sizes for wires used for point wiring beyond light panel shall be single core 1.5 sq. mm., 2.5 sq. mm., 14 sq. mm. 6 sq. mm. and 10 sq. mm. stranded copper wire.



## 19 **GROUNDING :**

All lighting panels/distribution boards, junction boxes, switchboard, fixtures etc. shall be grounded in compliance with the provision of IE Rules. Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductor of 50x10 G.S. Flat.

## 20 **STEEL STRUCTURES :**

All steel structures required for erection of out door switchyard lighting fixtures shall be designed, fabricated, supplied and erected by the contractor. All steel structures shall be galvanised. Lightning mast can also be used for the purpose of fixing of lighting fixtures.

## 21 **TYPE OF LIGHTING TO BE USED :**

The following type of lighting fixtures shall have to be provided for different applications:

Sl.	Type of Fixtures	Location	Mounting
1)	LED type (with mirror optics and other accessories, recessed mounting type)	Control room, Conference room, Communication room & Relay room	
2)	T5 type 28watt (corrosion proof, industrial indoor luminary & suitable for pendent mounting)	Battery rooms	
3)	T5 type 28watt (indoor industrial in decorative fixture with widespread mirror optics suitable for pendent mounting)	SE / DE's & AE's Chamber, lobby, office, DCDB & battery charger room, ACDB room	
4)	T5 type 28watt (indoor industrial in decorative fixture with reflector suitable for pendent mounting)	Corridor, toilets, stairs, Store shed with office, tiffin room, maintenance room in control room building and Quarters. Security Office near main gate.	
5)	125W HPMV weather proof Post-Top lantern	Main & Switchyard Gate Post	
6)	150W HPSV lamps with special reflector clear acrylic cover & corrosion proof	All roads outside. Switchyard area i.e colony area, control room building area, other utility areas including, DG room, FF pump, House & pump house etc.	
7)	400W/250W HPSV lamps suitable for outdoor mounting	Switchyard area	Lightning Mast/Sub-Stn. structure
8)	LED type / T5 type 28watt (DC emergency light)	Control room, staircase, corridor of control room, Communication room, AC/DC Board room, battery charger room, fire fighting pump house, DG set buildings, open tarrace and other important places for emergency light	Ceiling / wall mounted
9)	Ceiling fans 1400 mm Sweep AC 230V with electronic Regulator,	All rooms of Control building, store shed with office, Conference room (wall mounted fans of suitable sweep	Ceiling/wall mounted

	switch and other required accessories	shall be provided), Fire Fighting pump house, All rooms of residential quarters, Security office as applicable. Number of ceiling fan shall be guided by relevant approved drawings.	
10)	Exhaust fans of suitable Sweep with switch and all other required accessories	GIS Hall, battery room (if required), toilets, kitchen/pantry of all buildings	Wall mounted

**N.B. -** Number of lamps with type of fixture based on offered make & model and number of ceiling fans / exhaust fans / wall mounted fans shall be guided by approved design document of lighting calculation / drawings.

## **22 LIGHTING POLES :**

- a) The contractor shall supply and install the following types of steel tubular lighting poles required for street lighting.
  - i. 9.0 M high street light pole for one fixture with 7.5M height above ground.
  - ii. Post top lantern pole – for one fixture
- b) Lighting poles shall be complete with fixing brackets and junction boxes. Junction Boxes should be mounted one meter above ground level.
- c) Lighting poles shall be coated with bituminous preserving paint on the inside as well as on the embedded outside surface. Exposed outside surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium).
- d) Galvanised sheet steel junction box of street light pole shall be conforming to IP:55 and provided with lockable door and HRC fuse mantled fuse carrier and fuse base assembly. The terminal shall be stud type and suitable for 2 nos. 16 sq. mm. cable.
- e) Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm. cu. wire.
- f) Distance of centre of pole from street edge should be approximately 1200 mm.
- g) Earthing of the pole should be connected to switchyard main earthmat wherever it is available and the same should be earthed through 3M long. 20 mm. dia, earth electrode.
- h) Pole is to be manufactured from steel pipes conforming to IS 1161-1979 and tolerance shall be guided as per IS:2713 and 1161.
- i) Lighting poles shall be placed 20 meter apart (max.).

## **23 FOUNDATION AND CIVIL WORKS :**

Foundation for street light poles, panel foundation shall be within the scope of contractor.

## **24 GUARANTEE:**

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

**25 CONTRACT DRAWINGS AND CATALOGUE :**

- a) In the event of placement of Letter of Award the contractor shall submit six (6) copies of detailed design calculation and drawings as specified in Clause no. 18 above including inter-connection diagram of the different LDB's for each Sub-station for approval. Leaflets /Catalogues of the lighting tube / lamps, ceiling and exhaust fans together with fixtures, fittings etc. shall also be submitted.
- b) Four (4) sets of approved drawings and catalogue of each equipment both in soft and hard format shall be submitted for our record and distribution to site.

**26 TEST :**

All tests as required for successful commissioning as well as per relevant IS's shall be carried out by the Contractor at manufacturer's works as well as site in presence of the site Engineers of WBSETCL. WBSETCL reserves the right to reject any equipment / auxiliaries if not found to comply with the requirement of relevant IS/Test and this specification.

The following tests have been carried out for all lighting panels.

- i) Wiring Continuity test.
- ii) High voltage (2.5 KV for 1 min.) and insulation test.
- iii) Operational test.

GUARANTEED TECHNICAL PARTICULARS FOR SUB-STATION LIGHTING

*(To be filled in and signed by the Bidder)*

1	<b>General</b>	
1.1	Name of the Designer of Illumination System	
1.2	Designed Lux value of Switch Yard	
1.3	Designed Lux value of Control Room	
2	Outdoor Illumination	
2.1	Manufacturer of Lamp & Luminaries selected	
2.2	Type & Model of Luminaries selected	
2.3	Type & Model of Lamp selected	
2.4	Watt of Each Lamp	
2.5	Total Number of Lamps	
2.6	Average Height of Lamp & Luminaries from the GL	
3	Building Illumination	
3.1	Manufacturer of Lamp & Luminaries selected	
3.2	Type & Model of Luminaries Selected	
3.3	Type & Model of Lamp selected	
3.4	Watt of Each Lamp	
3.5	Total Number of Lamps	
3.6	Average Height of Lamp & Luminaries from the FL	
4	Lighting Panels	
4.1	Manufacturer	
4.2	Type & Model as per manufacturer	

4.3	Panel Dimension ( L x W X H ) in mm	
4.4	Sheet metal thickness	
5	Busbars	
5.1	Material	
5.2	Size ( W X Thickness) - mm	
5.3	Bus Rating (A ) - Continuous Current	
5.4	SC Current for 1 sec	
6	MCB	
6.1	Manufacturer	
6.2	Type	
6.3	No of Poles	
6.4	Rated Voltage	
6.5	Current Continuous (A)	
6.6	SC Current for 1 sec	
6.7	Breaking capacity	
6.8	Total interrupting time (ms)	
6.9	Type of blowout devices	
6.10	Type of over load (Thermal / Magnetic)	
7	Fuse	
7.1	Make	
7.2	Type	
7.3	Rupturing Capacity	
7.4	Cut off characteristic	