SECTION – 2.12

ILLUMINATION SYSTEM

1.0.0 INTRODUCTION

This section covers requirement of illumination system for the entire BESS plant and substation. All buildings / sheds shall be provided with adequate light fixtures, luminaires and etc.

2.0.0 SCOPE OF WORK

The scope of work shall include the following:

- Lighting for BESS plant includes PCS platform, HT switchgears and peripheral area, BESS area Outdoor lighting for transformer yard, Auxiliary transformer yard, Switchyard, , storage area, car parking area etc.
- Streetlights for internal roads of BESS plant and approach roads to BESS Plant and approach road to 132 kV switchyard and MCR (Main Control Room)
- Ceiling fans / Wall fans in all rooms / area.
- Existing Lighting Towers (One number at 132 kV switchyard and 2 Numbers at BESS Plant area) may be utilized subject to validation of its suitability.
- Any area not specifically listed above but generally requiring illumination in view of the project requirements shall be included in the scope of the Bidder.

3.0.0 CODES AND STANDARDS

All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of techno-commercial bid opening. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.

16101:2012	General Lighting. LEDs and LED modules Terms and definitions
16102(Part 1):2012	Self-Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.
16102(Part 2):2012	Self-Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.
16103(Part 1):2012	LED modules for General lighting Safety Requirements.
15885(Part 2/Sec.13):2012	Lamp control gear Part 2 particular Requirements Section 13 D.C. or A.C. Supplied Electronic control gear for LED modules
16104 :2012	D.C. or A.C Supplied Electronic control gear for LED modules - Performance Requirements.
16105 :2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.
16106 :2012	Method of Electrical and photometric Measurements of Solid-State Lighting (LED) Products.
16107 :2012	Luminaire Performance.
16108 :2012	Photobiological safety of Lamps and Lamp Systems.
IS 513	Cold rolled low carbon steel sheets and strips.
IS 12063	Classification of degree of protection provided by enclosures.
IS 14700	Part-3 Sec. 2: Electromagnetic compatibility (EMC) – Limits for Harmonic current emission – THD < 15% (Equipment, input current < 16 Amps. per phase).
IS 9000 (Part 6)	Environment testing: Test Z – AD: composite

	temperature/humidity cyclic test.
IS 15885 (Part 2/Sec. 13) IS 16004 – 1 and 2)	Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules.
IS 4905	Method for random sampling
IEC 60598	Ingress protection, luminaire performance and Safety.
IEC 61000-3-2	Total Harmonic Distortion.
IEC 61000-4-5	Surge Protection.
IES-LM 80 TM 21/ IS 16105 TM 21/ IS 16105	Lumen Depreciation and Rated life of LED chip.
IES-LM 79 / IS 16106	Luminaire optics and colour parameter and electrical parameter.

4.0.0 TECHNICAL REQUIREMENTS

4.1.0 The following lighting systems are envisaged:

a) Normal AC Lighting System: AC lighting system 415V, 3Phase, 4wire, will be fed from LT Panels..

b) Emergency AC Lightning System: The emergency lighting system consisting of 30% of the lights shall be fed from directly and continuously form UPS DB. Load of the same has to be considered for UPS sizing. Bidder shall provide indoor and outdoor emergency lighting at each control room and other areas. No emergency lighting is envisaged for internal and approach roads.

c) .
Outdoor and Exit light fixtures with IP 65 or better shall be LED fixtures and shall be provided above the building exit doors. For indoor areas, average lumen method shall be adopted to calculated luminance. Lighting level design shall include a Maintenance factor as of 0.8 for all areas for lamp lumen depreciation, luminaries surface dirt and room surface dirt, etc. Exit and Entry fixtures shall be powered form UPS.

4.2.0 All the lamps, indoor and outdoor lighting fixtures shall be with energy efficient LED luminaire with Luminous Efficacy of 110 lm/W or, better.

4.3.0 The colour temperature shall be 5700K to 6000K for outdoor & indoor type LED luminaire.

4.4.0 AC lighting fixtures and accessories shall be suitable for operation on 240V, AC, 50 Hz supply with supply voltage variation of ±10%, frequency variation of ±5% and combined voltage and frequency variation of absolute sum of 10%.

4.5.0 Indoor and Outdoor lighting circuits shall be separate.

4.6.0 Adequate numbers of power sockets 6+16 A shall be provided in all indoor areas. (e.g. power sockets, electric kettle, & power sockets for laptop, mobile charging points for office, conference room areas). Details shall be finalized as per purchaser's requirement. Receptacles with decorative cover plates shall be used in office / control rooms.

4.7.0 Wall mounted switches shall be provided at the entrance to storage, battery, and equipment / office rooms..

4.8.0 For areas illuminated by more than one circuit, adjacent circuits shall be fed from different phases. Load balance on all the 3 phases shall be maintained for lighting as well as 1 phase power distribution circuit.

4.9.0 Wiring for indoor lighting installation shall be carried with PVC insulated wire with following sizes laid in conduit. Earthing wire shall be of same size that of phase wire.

- Lighting panel to lighting fixtures : 2.5mm^2 copper
- Switch box to lighting fixtures : 1.5mm^2 copper
- Lighting panel to sockets (for AC, Coolers) : 4mm^2 copper

4.10.0 Wiring for lighting circuits of normal AC system shall run in separate conduits.

4.11.0 Wiring for lighting fixtures and receptacle units shall be fed from different circuits and shall run in separate conduits. Conduits for power, data & firefighting system cables shall be separate. Two different phase circuits shall not be laid in the same conduit.

4.12.0 All conduits shall be FRPVC and surface mounted in general. In office rooms and control rooms, conduit shall be concealed type. Conduit fill criteria shall be 40%. Conduits should have the minimum number of bends in their run with pull boxes at suitable locations. Conduits shall be sloped to avoid water accumulation and draining into the equipment at its end.

4.13.0 AC lighting panels shall comprise 63A TPN MCB as incomer and required number of 10kA, 20A rated SPN MCB as outgoing feeders. Moreover, it will consist necessary components e.g. Normal supply failure sensing, auxiliary contactors for auto supply change over scheme from normal to emergency (UPS) supply. Each outgoing circuit (normal & emergency) shall have ELCB of required rating and sensitivity. UPS lighting fixtures shall be identified for uniform illumination and shall be fed from separate circuit.

4.14.0 20A, 240V, single phase industrial receptacles shall be provided in Substation area to provide 240V supply outlets for small power services such as drilling, grinding etc.

4.15.0 Welding sockets shall be rated for 415V, 32A. Number of receptacles per circuit shall be not more than two. Each welding receptacle unit shall have dedicated MCB unit installed adjacent to the receptacle. All power sockets of universal type i.e. 6+16A type shall be provided.

4.16.0 Generally the lighting load in an individual MCB circuit shall be limited to about 1500 watts.

4.17.0 For Substation lighting, PVC insulated, PVC inner sheathed, armoured, FRLS PVC outer sheathed aluminum / copper conductor cables shall be provided. Wiring for lighting circuits of normal AC system shall run in separate conduits.

4.18.0 The lighting panels shall be rated for 415V, 3 phase, 4 wire, AC with neutral bus (cross sectional area of natural bus shall be same as phase bus) and earth bus Floor mounting.

4.19.0 Outdoor lighting panel (as applicable) shall be provided with the following:

- 415V, , TPN MCB incomers of required ampere rating – separate for normal & emergency (UPS) supply
- 4 pole TPN Surge Protection Device, type-2 for incomer
- Required no. of 16 A, SP suitable class (B or C) MCB outgoing feeders .
- ELCB of required rating and sensitivity in each outgoing feeder.
- 20% (rounded to next whole number) spare feeders of each type and rating
- Appropriate IP protection
- Control supply 230V AC tapped from incoming 3 phase 4 wire supply or from UPS supply

4.20.0 Indoor lighting panel (as applicable) shall be provided with the following:

- 415V, , TPN MCB incomers of required ampere rating – separate for normal & emergency (UPS) supply
- 4 pole TPN Surge Protection Device, type-2 for incomer, Required no. of 16 A, SP suitable class (B or C) MCB outgoing feeders

- ELCB of required rating and sensitivity in each outgoing feeder.
- 20% (rounded to next whole number) spare feeders of each type and rating
- Appropriate IP protection
- Control supply 230V AC tapped from incoming 3 phase 4 wire supply

4.21.0 Receptacle panel (as applicable) shall be provided with the following
- 415V, , TPN MCB of required ampere rating incomer with ELCB
- Required numbers . of 20A, SP MCB outgoing feeders with ELCB
- 20% (Rounded to next whole number) spare feeders of each type and rating.

4.22.0 Ceiling fans are to be provided in all areas except battery room. (Also to be provided where AC's are considered). Ceiling fan shall be of BLDC technology with highest energy efficiency rating (Specifications similar to Atomberg).The Contractor shall supply and install ceiling fans complete with electronic regulator and board for mounting switch, suspension rod, canopy and accessories. The electronic regulator for Ceiling fans will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches. The wall mounted fans are normally not acceptable except for the area where installation of celling fans are not feasible. Exhaust fans shall be of appropriate size. Winding of the fans shall have Class-E insulating material. Winding shall be of copper wire

4.23.0 Earthing of the panels shall be done at two separate locations by means of earthing terminal block mounted on suitable din rails by single core unarmoured multistrand PVC insulated copper cable fixed with suitable gland and heavy-duty long barrel copper ring type nickel plated lugs to the nearest earthing conductor say GI flat.

4.24.0 Suitable capacity, 3 phase, 4 wire power socket panel, canopy, appropriate IP, 4 pole MCCB with spreader and interphase barrier on outgoing side (MCCB & it's accessories - OEM supply only) shall be provided for 70 MVA Transformer Yard in the vicinity within 10 Mtr area for standard oil filtration machine.

4.25.0 Separate modular switchboards for UPS (Emergency) lighting. Colour of the switchboard along with its components shall be different from normal switchboards. (Color of normal switchboards - white and preferred color for UPS is black)

4.26.0 Indoor Lighting fixtures layout shall be proposed considering equipment layout and furniture lay out. Superimposed drawing of lighting layout and furniture/equipment layout shall be submitted during detailed engineering stage.

4.27.0 Panel internal cubicle lamps shall be of LED types only

4.28.0 AC circuit shall be separate for individual AC. Separate circuit shall be provided for water cooler,. of required rating more than 1.5KW.

4.29.0 Party shall provide product data sheet for Lighting fixtures, Modular Switches, Sockets, Plates, Concealed Boxes, Wires, Conduits, MCB's, ELCB's, Exhaust Fans, Ceiling fans, AC etc. BOQ & BOM shall be provided with detailed model number.

4.30.0 Photometry calculations & design data shall be provided to purchaser during detailed engineering stage.

4.31.0 Building peripheral lighting shall cover all walls of the building and at least 3 meter parallel to building wall.

5.0.0 CONSTRUCTIONAL FEATURES

5.1.0 Lighting Fixture, Lamps & Accessories

5.1.1 All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.

5.1.2 AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum) of 10%.

5.1.3 All lighting fixtures shall be complete with lamp(s), lamp holder(s), LED chip assembly, terminal blocks, clamps, locking arrangements, fixing brackets etc. Driver circuit/Control gears shall be provided as applicable / specified. The fixtures shall be fully wired up to terminal block. The internal wiring of the fixtures shall be done with suitable low smoke halogen free thermo-plastic or silicon rubber insulated or fire-retardant PTFE copper conductor wires of suitable size and type. Further fuse protection of suitable rating in input side shall also be provided specifically for LED luminaires. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.

5.1.4 All lighting fixtures shall be provided with an external earthing terminal suitable for connecting earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity throughout the fixture.

5.1.5 The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.

5.1.6 The reflectors shall be manufactured from CRCA sheet steel or aluminum as specified. The aluminum reflector shall made of high purity aluminum sheet, polished electrochemically brightened and anodized or proven alternate arrangement of anodizing.

5.1.7 LED luminaires body shall such designed that heat sink/heat dissipating housing shall be mounted outside the overall luminaires fixture housing and shall be suitably clearing the driver circuit. Further for outdoor type LED luminaires, the exposed heat sink shall be suitably designed to avoid dust/foreign particles accumulation on the same.

5.1.8 LED luminaires housing/body shall be pressure die cast aluminum or extruded Aluminum or CRCA as specified along with finished powder coating. Care shall be taken in the design that there is no water stagnation anywhere.

5.2.0 Junction Boxes, Conduits, Fitting & Accessories

5.2.1 Junction box for indoor lighting shall be made of fire-retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type.

5.2.2 Junction boxes for street lighting poles and lighting mast / Tower as applicable, shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55.

5.2.3 All switches and receptacles up to 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox.

5.2.4 Heavy duty PVC conduits conforming to IS: 9537 Part-III along with various accessories shall be used for indoor wiring in the buildings. These conduits shall be concealed in the wall/floor/roof.

5.2.5 Pull out boxes shall be provided at suitable interval in a conduit run. Boxes shall be suitable for mounting on Walls, Columns, etc. Pull-out boxes shall have cover with screw. Pull out boxes

used outdoor shall be weatherproof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degrees of protection.

5.2.6 Each switchboard shall have minimum two numbers of space for future use. Unused modules shall be covered with blanking plates

5.3.0 Lighting Poles

5.3.1 The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of BESS panels. The poles shall be hot dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 80 micron. The System shall be capable of withstanding the appropriate wind load etc. as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.

5.3.2 The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated residual current circuit breaker with overcurrent protection (RCBO).

5.3.3 Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable. If JB is outdoor, it shall be IP 67.

5.3.4 Existing poles wherever available may be utilized subject validation of it's suitability and replacement of its luminary and pole junction box.

5.4.0 Lighting Wires

5.4.1 Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/ wire for fixed wiring installation. Colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R, Y, B phases & neutral, respectively, and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5. Sq.mm. for copper.

5.4.2 All wiring shall be carried out in concealed manner. Where complete concealment is not practicable, the wiring shall be concealed to the maximum possible extent, and the remaining portion shall be executed in exposed mode.

5.5.0 Earthing

5.5.1 Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run along with each conduit run. Cable armours shall be connected to earthing system at both the ends.

5.5.2 Alternately Vendor may offer technically superior and proven product subject to approval of Owner.

5.6.0 Average Illumination Level

Location	Average Illumination Level (Lux)	Type of Fixture
Control building indoor areas	350	LED Luminaries
Inverter/Transformer Yard/Outdoor area of PCS & HT Switchgear Platform	100	LED Luminaries (Flood Lighting)
Street lighting-Roads	20	LED Luminaries
Other indoor areas	200	LED Luminaries

5.7.0 Warranty

5.7.1 All the equipment included in the scope shall satisfy the warranty of 12 months from the date of Commissioning, or 18 months from the delivery at site whichever later.

5.8.0 Quality Control

5.8.1 Bidder shall submit the MQAP, FAT and FQP for the illumination system.

6.0.0 DRAWINGS, DATA AND MANUAL

6.1.0 **To Be Submitted After Award of Contract**

- Technical data sheet
- General arrangement drawings for luminaries, receptacles, switch boxes etc.
- Design calculations
- Lighting layout
- Pole details
- Mast details (as applicable)
- Quality plan
- Test certificates
- O&M manual

7.0.0 TESTS

7.1.0 Equipment offered shall be type tested and proven type. Type test reports shall be submitted for approval. All routine, acceptance and special tests in accordance with the latest versions of applicable standards shall be conducted.