

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

SECTION- LIGHTING SYSTEM

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1.0 SCOPE

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories, Lighting transformers, ceiling fans complete with electronic regulators, exhaust fans for toilets and pantry & accessories, lighting panels, lighting poles complete with distribution boxes, galvanized rigid steel /rigid PVC conduits, lighting wires, G.I. Earthwire, receptacles, tag block & telephone socket, switchboards, switches, junction boxes, pull out boxes complete with accessories, The bidder shall quote on lump sum basis on the basis of design criteria specified for bays under present scope.

The entire control room building lighting shall be done by LED based low power consumption luminaries to achieve desired lux level specified. The bidder shall quote on lump sum basis on the basis of design criteria specified for control room building.

2.0 SYSTEM DESCRIPTION

A typical arrangement of lighting system is shown in enclosed sketch. The lighting system shall comprise of the following:

2.1 AC Normal Lighting

AC lights will be connected to AC lighting panels. All the lights connected to the AC lighting system in different areas will be connected to the main lighting distribution boards.

2.2 AC Emergency Lighting

This system will be available in control room building, & switchyard. AC lighting load will be connected to this system which will be normally 'ON'. The lighting panels of this system will be connected to the Emergency lighting board which is fed from diesel generator during the emergency. 25% of lighting fixtures shall be connected on AC emergency lighting.

2.3 D.C. Emergency lighting

A few DC emergency lighting fixtures operated on the DC system will be provided in the strategic locations including staircase, corridors, electrical rooms, Battery charger room, LT switchgear room in control room building, and Fire fighting pump house so

that the operating personnel can safely find their way even during emergency of a total AC failure. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage occurs in the AC main lighting distribution board. GLS lamp down lighters in false ceiling area and Bulkhead fixtures in non false ceiling area to be used.

2.4 Exit Lightings

All Exit lightings in the buildings shall be fed by DC lighting panels. All necessary wiring and its termination shall be in the contractor's scope.

- 2.5 The lighting layout for and around Control Room Building & BOQ for items shall be prepared and submitted by the contractor for owner's approval during detailed engineering.

The lux levels to be maintained shall be as per following:

Sl. No.	Area	Average Lux Level
1	Control Room Building,	<p>SN. Area level</p> <p>Average Lux at floor</p> <p>level</p> <p>i) Control Room - 350 Lux</p> <p>ii) Battery room, Passage, Lux</p> <p>Pantry, Toilets, Corridors etc</p> <p>iii) All other rooms (LT rooms, DG set room, tool room etc.,)</p> <p>- 100</p> <p>- 200 Lux</p>

The minimum lux level to average lux level ratio should not be less than 0.6 (i.e $E_{min}/E_{av} > 0.6$). The maintenance factor for indoor illumination design shall be considered as 0.8. The surface reflectance for ceiling/wall/floor shall be 50/30/10. The contractor shall submit detailed calculation for reaching the above Lux level for Employer's approval during detailed engineering. Contractor shall conform the Lux levels at different locations of the control room building by measurement.

- 2.6 The Lux levels to be maintained in the switchyard shall be as per following:

- a) 50 Lux on main Equipments (i.e. **Transformer**, Reactor, ISO, CB, CT, CVT, SA) at first level (Equipment connections level)
 - b) 20 Lux on balance area of switchyard and street/Road at ground level.
 - c) 10 Lux (Area between fence and peripheral roads around the switchyard). The lighting between the fence and the peripheral road around switchyard shall be done by providing the lighting fixtures on lighting pole of suitable height, if required.
- 2.7 The minimum Lux level to average Lux level ratio should not be less than 0.3 (i.e $E_{min}/E_{av} > 0.3$). The maintenance factor for outdoor illumination design shall be considered as 0.65.
- 2.8 For achieving the specified Lux levels in the switchyard, the contractor can provide luminaries of 1x400 W/ 1x250 W and 2x400 W/ 2x250 W flood light as per requirement.
- 2.9 The contractor shall submit detailed calculation for reaching the above Lux level. Contractor shall conform the Lux levels at different locations of the switch yard and street lighting by measurement.
- 2.10 In addition to the normal lighting provided in the switchyard area to maintain the desired lux levels, high beam fixtures(Type SF4- 8 nos) on swivel support shall be provided in strategic locations near equipments for substations which shall be kept normally OFF and these shall be switched ON in case of maintenance work.
- 2.11 Ceiling fans (1400 mm sweep, AC 230 volts) shall be provided in non AC rooms in the control room building as per the requirements. Wall mounted fans shall be provided in the conference room, control room, shift manager and substation incharge rooms in control room building. Exhaust fans shall be provided in toilets and pantry.
- 2.12 One no. of aluminum ladder of each size shall be supplied by the contractor for maintenance purpose.
- 2.13 The following specific areas are included in the scope of lighting:
- a) Switchyard Area including open storage area.
 - b) Switchyard Control Room Building
 - c) Street lighting (peripheral) inside switchyard fencing (Street lighting shall be done using street lighting poles)

- d) DG area lighting
- e) LT Transformer area
- f) Approach road, Gate lighting, Security shed if any, parking area, Fence / Boundary wall

2.14 For Outdoor Illumination

The switchyard and street lighting design including lux level calculations, surface illuminance diagram at varying equipment surface levels, detailed drawings showing the lighting layout and Electrical distribution diagram shall be prepared by the Contractor and submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, etc.

2.15 For Indoor Illumination

The conduit layout drawing for substation buildings based on the civil tender drawings, Electrical distribution diagram for substation buildings, & for substation yard etc. shall be prepared by the Contractor. All wiring including telephone wiring (tinned two pair copper) shall be in concealed conduit. Concealed MS junction boxes for sockets and light points shall be provided in all the rooms of Control Room Building. In case where false ceiling surface conducting is permissible, all down run conduits will be concealed in wall below the false ceiling.

- 2.16 Each cable run shall be tagged with number that appear in the cable schedules. Cables shall be tagged at their entrance and/or exit from any piece of equipment, junction or pull box, floor opening etc.
- 2.17 The tag shall be made up of aluminum with the number punched on it and securely attached to the cable by not less than two turns of G.I. wire. Cable tags shall be rectangular in shape for power cables and circular shape for control cables.
- 2.18 Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanised iron plate embedded in concrete block.
- 2.19 The location of underground cable joints if any, shall be clearly indicated with cable marker with an additional inscription "cable joint".

- 2.20 The marker, which is a concrete block, shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change of direction. It shall also be located on both sides of the road or drain crossing.

3.0 DESCRIPTION OF ITEMS

3.1 DESCRIPTION OF ITEMS FOR SUBSTATION LIGHTING

The Contractor shall supply and install the following equipment and accessories in accordance with the specification.

3.1.1 LIGHTING PANELS

a) OUTDOOR

415 AC lighting panel with 415V, 63A, 3 phase 4 wire bus and one no. 63A, TP, MCB with neutral unit as incomer and 20A, SP MCB as outgoing feeders, the details are as follows:

The type & quantity needs to be revised as per the Lighting masts quantity.

Type of Panel	Description	Detail of Outgoing Feeders
ACP 2	Outdoor	6 nos- 20 A single pole MCB and 3 No. of 32A Triple pole MCB with Neutral and suitable timer and contactor for automatic switching.
ACP 3	Outdoor street lighting panel	3 nos- 32 A Triple pole MCB with Neutral with suitable timer and contactor for automatic switching. All timer-based Lighting Distribution panels should have an Auto-manual selection also built in scheme for maintenance purposes.

Note: The number of outgoing feeders indicated above are the minimum.

b) INDOOR

415 V indoor AC lighting panel ,63 A 3 phase 4 wire bus and one number 63 amp TP MCB with 300mA, 63 A TP RCCB. Flush

mounted with per phase isolation and LED indication lamps. The DB will be flush mounted and double door type.

Type of Panel	Description	Detail of Outgoing Feeders
ACP1	Indoor	18 nos outgoing, 16 Amps SP MCB

Note: The number of outgoing feeders indicated above are the minimum. The bidder to design and decide the no. of feeders as per requirements.

220V DC indoor type change over board and 220V DC 32A two wire bus and one 32A contactor backed up by 32A double pole MCB as incomer. The panel shall have local push button controls. Following are the various types of panels required with control timer.

Type of Panel	Description	Detail of Outgoing Feeders
DCP	Indoor	6 nos outgoing, 16 Amps DP MCB

Note: The number of outgoing feeders indicated above are the minimum. The bidder to design and decide the no. of feeders as per requirements.

c) Sub-Lighting Panels

Type of Panel	Description	Detail of Outgoing Feeders
SLP	Outdoor	6 nos- 20 A single pole MCB and 3 No. of 32A Triple pole MCB with Neutral and suitable timer and contactor for automatic switching. with LILO facility using 8 nos terminal blocks suitable for cable upto 16 Sq.mm cable Enclosure shall be suitable for outdoor use with IP-55 degree of protection as per IS: 13947 (part-1)

3.1.2 Lighting Fixtures

Please Refer Annexure-1

3.1.3 Receptacles

Type of Receptacle	Description	Detail of Outgoing Feeders
RO	Outdoor	15A, 240 V, Receptacle 2 pole, 3 pin type
RP	Outdoor	63A, 415V, Interlocked switch socket, receptacle
RI	Indoor	5/15A, 240V, Receptacle 3-pin type (Modular)

3.1.4 SWITCH BOARDS

Modular type switches, 5/15 Amp. Receptacles.

3.1.5 CONDUITS AND ACCESSORIES

Galvanised Rigid steel or Rigid PVC conduits of 20/25 /32 mm for Lighting and Telephone wiring

3.1.6 JUNCTION BOXES - with 5 Nos.of terminal blocks

3.1.7 LIGHTING POLES

3.1.8 FANS- 1400 mm Sweep with Electronic regulator and 450 mm Wall Mounted fans

3.1.9 MAINTENANCE EQUIPMENT

- i) A type Aluminium ladder of 3 mtr vertical height.
- ii) Cartwheel mounted aluminium ladder Vertical Extendable from 5.1m to 11m.

3.1.10 RECEPTACLES

- a) All receptacles shall be of cast steel/aluminium, heavy duty type, suitable for fixing on wall/column and complete with individual switch.
- b) In general the receptacles to be installed are of the following types :
 - i. Type RO-15A, 240V, 2 pole, 3 pin type with third pin grounded, metal clad with gasket having cable gland entry suitable for 2Cx6 sq.mm. PVC/aluminium armoured cable

and a metallic cover tied to it with a metallic chain and suitable for installation in moist location and or outdoor. The switch shall be of rotary type. Receptacles shall be housed in an enclosure made out of 2 mm thick GI sheet with hinged doors with padlocking arrangements. Door shall be lined with good quality gasketing. This shall conform to IP-55.

- ii. Type RI The 5/15 amp 6 pin receptacles with switches will be of Modular type with flush type switches and electroplated metal enclosures of approved make.
- iii. Type RP - 63A, 415V, 3 phase, 5 pin interlocked plug and switch with earthing contacts. Other requirements shall be same as type RO. The receptacle shall be suitable for 3.5C x 35/3.5Cx70 sq.mm. aluminium conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of identical size. Receptacle shall be suitable for outdoor application. Receptacles shall be housed in a box made out of 2mm thick G.I. sheet, with hinged door with padlocking arrangement. Door shall be lined with good quality gasketing. This shall conform to IP-55.

3.1.11 LIGHTING PANELS (L.P.)

- a) Each panel shall be provided with one incoming Four pole MCB and outgoing miniature circuit breakers as per clause 3.0. The panels shall conform to IS-8623.
- b) Constructional Features
 - i. Panels shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be of thickness not less than 2.00 mm (cold rolled) smoothly finished, levelled and free from flaws. Stiffeners shall be provided wherever necessary. The indoor lighting panels will be ready made DB of minimum 1.6 mm sheet thickness.
 - ii. The panels shall be of single front construction, front hinged and front connected, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor panels in control room shall be flush mounted.

- iii. Panels shall have a dead front assembly provided with hinged door(s) and out door panels will be with padlocking arrangement with single key supplied in duplicate.
- iv. All out door panels, removable covers, doors and plates shall be gasket all around with neoprene gaskets.
- v. The outdoor panels shall be suitable for cable/conduit entry from the top and bottom. Suitable removable cable gland-plate shall be provided on the top and bottom of panels. Necessary number of double compression cable gland shall be supplied, fitted on to this gland plate. The glands shall be screwed on top and made of tinned brass.
- vi. The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.
- vii. Each panel shall have a caution notice fixed on it.
- viii. Each panel will be provided with directory holder in which printed and laminated as built circuit directory would be kept inside a document holder/pasted at site.
- ix. Each Outdoor lighting panel shall be provided with one no. 'ON' indicating lamp for each phase along with fuses. For indoor lighting panels din mounted phase indication lamps will be provided , mounted along side of the MCB
- x. Main Bus Bars

Bus bars shall be of aluminium alloy conforming to IS:5082 and shall have adequate cross-section to carry the rated continuous and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 KA for 1 sec. for DC panels. The Indoor lighting panels shall have copper bus bar

c) JUNCTION BOXES

- i. The junction boxes shall be concealed type for indoor lighting and suitable for mounting on columns, lighting poles, structures etc., for outdoor lighting.

- ii. Junction boxes shall be of square/rectangular type of 1.6 mm sheet steel with minimum 6 mm thick pressure diecast aluminium material LM-6 and shall have bolted cover with good quality gasket lining.
- iii. The junction box and cover of sheet steel construction shall be hot dip galvanised.
- iv. The junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of Cable glands of dia 20 mm, 25 mm, 32 mm, 40 mm on all sides. The junction boxes shall be provided with 4 way terminals suitable for two numbers 10 sq. mm. wire & for street lighting/switchyard lighting suitable for 2 numbers 4C x 16 Sq.mm Al. cable.
- v. The junction boxes shall have the following indelible markings
 - Circuit Nos. on the top.
 - Circuit Nos. with ferrules (inside) as per drawings.
 - DANGER sign in case of 415 volt junction box.
- vi. The junction boxes shall be weather proof type with gaskets conforming to IP 55 as per IS:13947 (Part I) .

d) Occupancy Sensors:

Sufficient number of occupancy sensors shall be provided in the stairs area and corridors of control room cum administrative building. Each occupancy sensor shall be used for indoor use with time delay programmable in the minimum range of 1 sec. to 2 Hour to control the illumination in the area.

3.1.12 LED LUMINAIRES

Indicative models of LED luminaires are indicated in Annexure-I. The offered luminaires shall have minimum 50 lumens/watt capacity(ie ratio of total output lumens & input power) including driver. The quantity of these luminaires shall be decided on the basis of design criteria specified and lux level required at various

rooms/locations. The bidder shall submit complete type test certificates & photometry reports of offered luminaries duly certified/conducted at accredited laboratory for owner's acceptance. The luminaries / drivers should generally comply with following relevant standards.

- 1) CISPR – 15/ EN 55015 (for RFI / EMI)
- 2) IEC 61347 – 2 – 13 (for safety)
- 3) IEC 62384 (for performance of controlgear)
- 4) IEC 61547 (for EMC immunity requirements)
- 5) IEC 61000- 3 -2 (for harmonics)

3.2 DESCRIPTION OF COMMON ITEMS FOR LIGHTING

3.2.1 LIGHTING FIXTURES AND ACCESSORIES

a) General

All lighting fixtures and accessories shall be designed for continuous operation under atmospheric conditions existing at site, without reduction in the life or without any deterioration of materials, internal wiring.

b) Temperature Rise

All lighting fixtures and accessories shall be designed to have a low temperature rise according to the relevant Indian Standards. The design ambient temperature shall be taken as 50 deg.C.

c) Supply Voltage

Lighting fixtures and accessories meant for 240V A.C. operation shall be suitable for operation on 240V A.C. 50Hz, supply voltage variation of $\pm 10\%$, frequency variation of $\pm 5\%$ and combined voltage and frequency variation of $\pm 10\%$.

Lighting fixture and accessories meant for 220V DC operation shall be suitable for operation on 220V DC with variation between 190 to 240 Volts.

d) Lighting Fixtures

- i. The lighting fixtures shall be Philips or Bajaj or Crompton Greaves make except for LED luminaries for which make has

been specified elsewhere in this section. The different types of lighting fixtures are also indicated elsewhere in this Section.

- ii. All 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.
- iii. All lighting fixtures shall be complete with fluorescent tubes / incandescent lamps/mercury vapour/sodium vapour lamps as specified and shall be suitably wired up.
- iv. All fluorescent lamp fixture shall be complete with all accessories like ballasts, power factor improvement capacitors, lamps, starters, holders etc.
- v. High beam fixtures shall be suitable for pendant mounting and flood lights shall have suitable base plate / frame for mounting on steel structural member. Hook mounted high beam fixtures are not acceptable.
- vi. Each lighting fixture shall be provided with an earthing terminal suitable for connection to 16 SWG GI earthing conductors.
- vii. All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light output as specified by the manufacturer.
- viii. Height of fixtures should be such that it is easy to replace the lamps with normal ladder/stool. In case the ceiling height is very high, the fixtures may be placed on the walls for ground lighting.

e) ACCESSORIES

i. Lamp holders and Starter Holders

- Lamp holders/starter holders for fluorescent tubes shall be of the spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation value, contact resistance or retention of the lamp/starter. They shall hold the lamp/starter in position under normal condition of shock and vibration.

- Lamp holders/starter for incandescent lamps and HPMV/HPSV lamps shall be of screwed type, manufactured in accordance with relevant standard and designed to give long and satisfactory service.

ii. Ballasts

- All HPSV/HPMV/Metal halide lamp fixtures shall be provided with wire wound ballasts. All fluorescent fixtures shall be provided with high frequency electronic ballasts. The Ballasts shall be designed, manufactured and supplied in accordance with relevant standard and function satisfactorily under site condition specified. The ballasts shall be designed to have a long service life and low power loss.
- Ballasts shall be mounted using self locking anti-vibration fixing and shall be easy to remove without dismantling the fixtures. They shall be totally enclosed units.
- The wire-wound ballasts shall be of the inductive, heavy duty type, filled with thermosetting insulating moisture repellent polyester compound filled under pressure or vacuum. The ballast wiring shall be of copper wire. They shall be free from hum. Ballasts which produce humming sound shall be replaced free of cost by the Contractor. Ballasts for high pressure mercury vapour/ HPSV lamps shall be provided with suitable tapplings to set the voltage within the range specified. End connections and taps shall be brought out in a suitable terminal block, rigidly fixed to the ballast enclosure.
- Separate ballast for each lamp shall be provided in case of multi-lamp fixtures.
- High frequency electronic ballasts shall be capable of satisfactory performance in adverse environment like that of EHV substation. Ballasts shall consist of AC/DC converter, high frequency power oscillator and low pass filter. The ballasts shall be suitable for use of nominal voltage of 240V +/- 10%, 50 Hz supply. The filter circuit shall suppress the feedback of high frequency signals to the mains. The ballast shall be rated for 36/40W fluorescent fixtures. The ballasts shall confirm to IEC 68-

2-6FC, IEC 929 for performance, IEC 928 for safety and EN 55015, EN 55022A for RFI and EN 61003.

iii. Capacitors

- The capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits.
- Power factor of fluorescent lamp fixtures with HF electronic ballast shall not be less than 0.90 and that of High pressure Sodium Vapour, Mercury Vapour and Metal Halide lamp fixtures shall not be less than 0.85. The capacitors shall be suitable for operation at supply voltage as specified and shall have a value of capacitance so as to correct the power factors of its corresponding lamp circuit to the extent of 0.98 lag.
- The capacitors shall be hermetically sealed in a metal enclosure.

iv. Lamps

- General Lighting Services (GLS) lamps shall be provided with screwed caps and shall be of 'clear' type unless otherwise specified.
- The Bidder shall furnish typical wiring diagram for Fluorescent, HPMV & PSV fitting including all accessories. The diagram shall include technical details of accessories i.e. starters, chokes, capacitors etc.
- Flexible conduits if required, for any fixture shall be deemed to be included in Contractor's scope.

v. SWITCH AND SWITCHBOARD

- All Switch board/boxes, 5/15 Amp Receptacles and electronic fan regulators located in office/building areas shall be modular flush mounted type or brick wall with only the switch knob projecting outside.
- Switch boards/boxes shall have conduit knock outs on all the sides.

- The exact number of switches including regulator for fans and layout of the same in the switchboard shall be to suit the requirement during installation.
- The maximum number of luminaires, controlled by one no 6 amp switch would 4 nos. For DC fixtures there will be no switch and the same shall be directly controlled from DC LP
- The luminaires shall be wired in such a fashion that luminaires on each phase are evenly distributed all over the room.

vi. CONDUITS & CONDUIT ACCESSORIES

- The conduits shall conform to IS:9537 or IS 3419 as applicable. All steel conduits shall be seamed by welding, shall be of heavy gauge and shall be hot dip galvanised.
- Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro-galvanised mild steel strips or PVC/Plastic.
- All conduits accessories shall conform to relevant IS and shall be hot dip galvanized or High quality virgin PVC and shall be ISI marked.

vii. TERMINAL BLOCKS

Each terminal shall be suitable for terminating upto 2 Nos. 10 sq.mm. stranded Aluminium Conductors without any damage to the conductors or any looseness of connections. Terminal strips provided in street - lighting poles shall be suitable for terminating upto 2 nos. 4C x 16 sq. mm aluminium cables.

viii. PULL OUT BOXES

- 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 bolts, nuts and screws required for the erection shall be included in the installation rates.

- The pull out boxes shall be circular of cast iron or 16 SWG sheet steel and shall have cover with good quality gasket lining.
- The pull out boxes and cover shall be hot dip galvanised.
- The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

ix. Residual Current Circuit Breakers (RCCB)

For indoor panels 63A 4pole 300 ma RCCB conforming IS 12640 will be provided along with incomer.

x. Miniature Circuit Breaker (MCB)

- The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free. MCB of Type C tripping characteristics as per IS 8828 will be used for Switchyard lighting.
- Single pole as well as three pole/ four pole versions shall be furnished as required in the Schedule of Lighting Panels.
- The MCBs and panel MCCB together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the bidder shall co-ordinate these breaker characteristics with the backup MCCB in such a way that if fault current is higher than breaker rating, the MCCB should trip earlier than the MCB. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.
- The MCBs shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper wire connection at both the incoming and outgoing side by copper lugs or for bus bar connection on the incoming side.
- The terminals of the MCBs and the 'open' 'close' and 'trip' conditions shall be clearly and indelibly marked.

- The tenderer shall check and co-ordinate the ratings of MCBs with respect to starting characteristics of discharge lamps. The vendor has to furnish overload and short circuit curve of MCB as well as starting characteristics curves of lamps for Employer's approval.
- The MCB shall generally conform to IS:8828.

xi. Contactors

Contactors shall be of the full voltage, direct-on line air break, single throw, electro-magnetic type. They shall be provided with atleast 2-'NC' and 2'NO' auxiliary contacts. Contactor shall be provided with the three element, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The Contactor shall be suitable for switching on Tungsten filament lamp also. The bidder shall check the adequacy of the Contactors rating wire with respect to lighting load.

xii. Push Buttons

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

xiii. Labels

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

xiv. Earthing Terminals

Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductors of size 50x6 G.S. Flat.

xv. Type test reports for following tests on all lighting panels shall be submitted for approval..

- Wiring continuity test
- High voltage (2.5 KV for 1 minute) and insulation test
- Operational test
- Degree of protection (not less than IP-55 test on outdoor Lighting Panels and IP-52 test on indoor Lighting Panels as per IS 13947 (part I))
- Heat run test

xvi. LIGHTING POLES

- The Contractor shall supply, store and install the following types of steel tubular lighting poles required for street lighting.
 - Type A1 Street Lighting Pole - for one fixture
 - Type E1 Post top lantern pole - for one fixture
- Street/flood light poles shall conform to the enclosed drawings. In front of control room building, decorative post top lantern (Type E1) poles and Bollards shall be installed.
- Lighting poles shall be complete with fixing brackets and junction boxes. Junction boxes should be mounted one meter above ground level.
- The 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).
- The galvanised sheet steel junction box for the street lighting poles shall be completely weather proof conforming to IP-55 and provided with a lockable door and HRC fuse mounted on a fuse carrier and fuse base

assembly. The fuses & junction box shall be as specified in the specification. However, terminals shall be stud type and suitable for 2 nos. 16 sq.mm. cable.

- 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 wire.
- Distance of centre of pole from street edge should be approximately 1000 to 1200 mm.
- Earthing of the poles should be connected to the switchyard main earth mat wherever it is available and the same should be earthed through 3M long, 20 mm dia, earth electrode.

xvii. CEILING & WALL MOUNTED FANS AND REGULATORS

- The contractor shall supply and install 1400 mm sweep ceiling fans complete with electronic regulator and switch, suspension rod, canopy and accessories. The wall mounted fans shall be of 400 mm sweep
- The contractor shall supply and install the switch, electronic regulator and board for mounting switch and electronic regulator for ceiling fans. The regulator will be housed in common switchboard for lighting and shall be of similar make and model as that of modular switches.
- Winding of the fans and regulators shall be insulated with Class-E insulating material. Winding shall be of copper wire.
- Electronic regulator with stepped control shall be provided.
- Ceiling Fans and Wall mounted Fans shall be of Alstom / Crompton Greaves / Bajaj Electricals / Usha Electricals make.

xviii. LIGHTING WIRES

- The wiring used for lighting shall be standard products of reputed manufacturers.
- The wires shall be of 1100 V grade, PVC insulated product of reputed manufacturers.
- The conductor sizes for wires used for point wiring beyond lighting panels shall be 2.5sq.mm, 4 sq.mm, 6 sq.mm and 1.5 sq.mm stranded copper wire.
- The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fluorescent fixtures shall be single core copper stranded conductor, 1100V grade flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 sq. mm.
- The wires shall be colour coded 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)

xix. LIGHTING SYSTEM INSTALLATION WORKS

- General

In accordance with the specified installation instructions as shown on manufacturer's drawings or as directed by Employer, Contractor shall unload, erect, install, test and put into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanship manner so that it is level, plumb square and properly aligned and oriented. Tolerances shall be as established in manufacturers drawing or as stipulated by Purchaser.

All apparatus, connections and cabling shall be designed so as to minimise risk of fire or any damage which will be caused in the event of fire.

- Conduit System

- Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, checknuts, male and female bushings (brass or galvanised steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits. The contractor shall also supply 20 mm mm PVC conduit and accessories for telephone wiring.
- All unarmoured cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles. etc.
- Size of conduit shall be suitably selected by the Contractor.
- Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.
- Conduit supports shall be clamped on the approved type spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs. Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.
- Outdoor lighting wiring is to be done using cables. Only the FO cables which run from Kiosks to control room shall be pulled through heavy-duty GI conduits, laid on trays within trenches.
- For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.
- Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

- Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.
- The entire metallic/PVC conduit system, shall be embedded, electrically continuous and thoroughly grounded. Where slip joints are used, suitable bounding shall be provided around the joint to ensure a continuous ground circuit.
- Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.
- Wiring
 - Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawings of wires is permissible.
 - Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes shall be used.
 - Wiring shall be spliced only at junction boxes with approved type terminal strip.
 - For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.
 - For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.
 - Maximum two wires can be terminated to each way of terminal connections.

- Separate neutral wires are to be provided for each circuit as well as separate earth-wires also to be provided.
- AC and DC wiring should not run through the same conduit.
- Lighting Panels
 - The lighting panels shall be erected at the locations to be finalised during detailed engineering.
 - Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.
- Foundation & civil works
 - Foundation for street lighting poles, panel foundation and transformer foundation shall be done by the Contractor.
 - All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil works as may be required for erection.
 - Any cutting of masonry / concrete work, which is necessary shall be done by the Contractor at his own cost and shall be made good to match the original work.

ANNEXURE-1

Sl. No.	Type of Lighting Fixture	Description	Philips Catalogue No.	CGL Catalogue No.	Bajaj Catalogue No.
1	F1	2x28W T-5 type fluorescent lamps in Industrial reflector type fixture, complete with accessories & suitable for pendent/surface mounting	TMS 122/228 HF or equivalent	T5GP228E B or equivalent	BTIR 228 or equivalent
2	FF	2x28W T-5 energy efficient fluorescent lamps with low glare, mirror optics suitable for recess mounting type lighting fixture.	TBS 088/228 C5 HF or equivalent	TSCQ1222 8EB or equivalent	BTMRA 228 MATT or equivalent
3	FL	2x28W T-5 energy efficient fluorescent lamps with low glare mirror optics suitable for pendent/surface mounting with all accessories	TCS 398/228 D6 HF or equivalent	-----	BTSMU 228 MSS or equivalent
4	TL	Sleek and Functional electronic decobatten suitable for use with 1 x 'TLD' 36W fluorescent lamp with dual tone end caps. Pre-phosphated & powder coated CRCA steel channel complete with all electrical accessories like electronic ballast, lamp holders all prewired up to a terminal block	TMS 500/136 HF or equivalent	DMLU14E B or equivalent	BCIR 136 WEB or equivalent
5	IB	60/100W GLS lamp bulkhead fixtures with cast Al. alloy body, suitable for column, wall & ceiling mounting finished stove enameled silver grey outside.	NXC 101 or equivalent	1BH1110/B C or equivalent	BJDB 100BC or equivalent
6	BL	Aesthetic wall/ ceiling mounted luminaire suitable for 1 x PL-C 13W or 11W CFL. Low loss O.C. Copper ballast, built in high glass anodized reflector. Twin finished UV stabilized SAN diffuser for protection & elimination of lamp glare	FMC 21/113 or equivalent	TLN11 or equivalent	BJC 111 or equivalent
7	SL	Aesthetic ceiling mounted luminaire for ecotone crystal/ décor CFL of 2x9 W or	FL 343/118 or equivalent	CBHE29 or equivalent	-----

		1x18W.ABS housing pre wired with porcelain lamp holder. Pre phosphated plated CRCA gear tray.			
8	BH	Bulkhead luminaire suitable for use with PL-S 9W CFL. Single piece pressure die-cast Al. & cover retaining frame. Opal acrylic cover along with a gasket made of EPR	FXC 101/109 or equivalent	ICBH10 or equivalent	BJBE 19 or equivalent t
9	BLD	2x9 or 1x18W CFL bollard light for landscape lighting having FRP/LLDPE housing	FGC 202/118 or equivalent	CFBL1229 or equivalent	BJBOL 0329 CFL or equivalent t
10	DLR	2x18 Watt CFL Down lighter with HF ballast suitable for recess mounting	FBH 145/218L HF or equivalent	DDLH218T G or equivalent	BJDR 65C 218 DL or equivalent t
11	DSM	1x13 WATT surface mounted CFL	FCS 100/113 or equivalent	-----	BJDS 110/113C WEB or equivalent t
12	IF	Incandescent GLS lamp down light	DN 622 or equivalent	DDL10BC or equivalent	BJDR 100W or equivalent t
13	SF1	1x400W HPSV lamps in high flood lighting fixture with integral control gear	SWF 330/1x400 or equivalent	FA140IH or equivalent	BJFL 400SV TS or equivalent t
14	SF2	2x400W HPSV lamps in high flood lighting, non integral control gear:	RVT 302/2x400W or equivalent	FHD1424 or equivalent	BJENF 22 or equivalent t
15	SF3	1x250W HPSV lamps in high flood lighting fixture with integral control gear:	SWF 330/1x250 or equivalent	FA1125IH or equivalent	BJFL 250 SV TS or equivalent t
16	SF4	150W HP metal halide MHNTD lamps in flood lighting fixture with integral control gear:	SWF 230/150 MHNTD or equivalent	FAD1215IH /MH	BGEMF 150MH DE
17	SF5	125 HP MV lamp in weather	HPC-101/125	MPT11121	BJDPTI

		proof post top lantern for mounting on pole top	HPF	L/BM/ES or equivalent	125MV or equivalent
18	SC	150W SON-T Tubular sodium vapour lamp in street lighting	SRX-51/150 or equivalent	SSG2315I H or equivalent	BGEST 150SV or equivalent
19	LED LUMINAIRES				
a)	I-LED1	2x2, luminaries with high efficacy and low power consumption suitable for general office lighting, conference room and cabins applications.	QUADRA LED BCS705 20xLXML/NW PSU-E-220-240V BBS705 20xLXML/NW PSU-E-220-240V BBS 805 2xLLM1800/840 PSU-E 220-240V or equivalent	INSTA PRISMA 45W/OMEGA 45W or equivalent	
b)	I-LED2	19W, Recessed type LED luminaries with high efficacy and low power consumption for passages, corridor and toilet areas.	LUX SPACE BBS480 1XDLED-4000 PSU-E 220-40V WH or equivalent	INSTA DL12W-6SH or equivalent	
c)	S-LED	Street lighting luminaries	BETA Power BRP320 1x24LED-HP/CW PSU GR or equivalent	VERSAT-2-48 or equivalent	

ANNEXURE-II

Sl. No	Item	Abbreviation	Item Description	Make(s)
1	Telephone box/Television box	TB	Termination box for Television & Telephone	Approved makes
2	Flat DB Type A	DB	240V indoor AC distribution board, 63 A or 32A, DP RCCB as incomer with 12 nos. 16A SP MCB's as out going. DB shall be flush mounted type	Legrand/Haggar
3	Meter DB type A & Type B	MB	For feeder details please refer Drg. No.	Approved makes
4	Switch board without 6A socket	SBA	Modular switch board with 5 A switches as required	Anchor/Crabtree
5	2 way switch board for stairs	SBB	Modular switch board with 5 A 2 way switch	Anchor/Crabtree
6	Switch board with 6A socket	SBC	Modular switch board with 1 no. socket and 5 A switches as required	Anchor/Crabtree
7	Telephone point	TP	Modular socket	Anchor/Crabtree
8	Television point	TV	Modular socket	Anchor/Crabtree
9	Air conditioner point with 15A switch	RAC	Socket with switch metal clad type	Anchor/Crabtree
10	15A power point with 15A switch	RB	Modular socket with switch	Anchor/Crabtree
11	5A power point with 5A switch	RA	Modular socket with switch	Anchor/Crabtree
12	Chandelier	CH	Decorative fixture with 1x60W GLS lamp	Any Reputed make
13	Bell push	BP	Modular type	Anchor/Crabtree
14	Bell	BELL	Call bell	Anchor/Crabtree
15	Exhaust fan	EFC	300mm sweep Trans'air	CGL/Bajaj/Usha
16	Ceiling fan	CFC	1200mm sweep with electronic regulator	CGL/Bajaj/Usha