

1.0 LIGHTING SYSTEM

1.1 The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories, 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,

Street lighting of switchyard shall be done by “Solar based energy efficient pole mounted lighting system” to achieve the desired lux level specified. Technical specifications of “Solar based energy efficient pole mounted lighting system” are attached at Annexure-III. In addition to Solar lighting, all street lighting shall also be connected with normal lighting system. A suitable changeover arrangement shall be provided in each street pole to switchover to normal lighting in case of prolonged outage of solar grid.

The entire control room building, fire fighting pump house lighting , Valve Hall , Valve Cooling, Valve Hall Ventilation, DG Room, Auxiliary supply room, guard hut, store building, office building in the present scope shall be done by LED based low power consumption luminaries to achieve desired lux level specified.

The lighting of conference room and control room in the control room building shall be powered by solar grid lighting arrangement. A changeover in the panel shall be provided to switchover on normal lighting in case of requirement. The execution of entire arrangement including design, solar grid interface with existing distribution, associated electrical panel, VRLA battery set, cabling etc shall be in the scope of the bidder.

1.1.1 SYSTEM DESCRIPTION

The lighting system shall comprise of the following:

1.1.2 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.

1.1.2 AC Emergency Lighting

This system will be available in control room building, Fire fighting pump house , & 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.

1.1.4 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. LED lamp down lighters in false ceiling area and Bulkhead fixtures in non false ceiling area to be used.

1.1.5 Exit Lightings

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

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

a) Outdoor switchyard

Equipment and working area: 30 lux

Non working areas: 20 lux

These illumination levels shall be achieved at 2 metres from gravel level. Uniformity ratio (minimum/average) shall not be less than ~~0.25~~. 0.30.

b) Roads

Service roads: 30 lux

Other roads: 20 lux

Service roads shall include approach road to the station and road around the converter building.

c) Valve Hall Building: 200 lux

d) Control rooms, telecommunication rooms, offices, workshops, first aid rooms, conference room: 350 lux

- e) **Battery room, Janitor Room, Passage, Pantry, Toilets, Corridors** - **100 Lux**
- f) Other Rooms:200 lux

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 and fire fighting pump house** by measurement.

1.1.7 Ceiling fans (1400 mm sweep, AC 230 volts) shall be provided in , fire fighting pump house and non AC rooms in the control room building as per the requirements. Exhaust fans shall be provided in toilets and pantry.

1.1.8 One no. of aluminum ladder of each size shall be supplied by the contractor for maintenance purpose.

1.1.9 Not Used

1.1.10 For Outdoor Illumination

The switchyard and street lighting, 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.

1.1.11 For Indoor Illumination

The conduit layout drawing for substation buildings, 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 cum Administrative Office Building and Fire Fighting pump house. In case where false ceiling surface conducting is permissible, all down run conduits will be concealed in wall below the false

ceiling.

- 1.1.12 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.
- 1.1.13 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.
- 1.1.14 Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanised iron plate embedded in concrete block.
- 1.1.15 The location of under ground cable joints if any, shall be clearly indicated with cable marker with an additional inscription "cable joint".
- 1.1.16 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.

2.0 DESCRIPTION OF ITEMS

2.1 DESCRIPTION OF ITEMS FOR SUBSTATION LIGHTING

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

2.1.1 LIGHTING PANELS

2.1.1.1 OUTDOOR

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

Type Of Panel	Description	Detail Of Outgoing Feeders
ACP 2	Outdoor	6 nos- 20 A single pole MCB and 3 No. 32 A Triple pole MCB with Neutral and suitable timer and contactor for automatic switching.
ACP 3	Outdoor Street lighting Panel	3 nos.-32A Triple pole MCB with Neutral with suitable timer and contactor for automatic switching

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

2.1.1.2 INDOOR

415 V indoor AC lighting panel ,63 A 3 phase 4 wire bus and one number 63 amp FP MCB with 300ma 63 A FP 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
ACP 1	Indoor	18 nos outgoing ,16 Amps SP MCB

220V DC indoor type change over board and 220V DC 32A two wire bus and one 32A contractor 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

2.1.1.3 Sub-Lighting Panels

Type Of Panel	Description	Detail Of Outgoing Feeders
SLP	Outdoor	4 pole 32A Isolator suitable for 415V, 50 cycles AC supply, wlith LILO facility using 8 nos terminal blocks suitable for cable upto 16 mm sq cable Enclosure shall be suitable for outdoor use with IP-55 degree of protection as per IS:13947 (Part-1).

2.1.2 Lighting Fixtures

Please Refer Annexure-1

2.1.3 RECEPTACLES

Type Of Receptacle	Description	Detail Of Outgoing Feeders
RO	Outdoor	15A, 240V, Receptacle 2 pole, 3- pin type

RP	Outdoor	63A, 415V, Interlocked switch socket, receptacle
RI	Indoor	5/15A, 240V, Receptacle 3-pin type (Modular)

2.1.4 **SWITCH BOARDS**

Modular type switches, 5/15 Amp. Receptacles.

2.1.4 **CONDUITS AND ACCESSORIES**

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

2.1.5 **JUNCTION BOXES** - with 5 Nos.of terminal blocks

2.1.6 **LIGHTING POLES** - (Type A1 poles & Type E1 poles)

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

2.1.8 **MAINTENANCE EQUIPMENT**

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

2.1.9. **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, 4 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.

2.1.10. LIGHTING PANELS (L.P.)

2.1.10.1 Each panel shall be provided with one incoming triple pole MCB with neutral link and outgoing miniature circuit breakers as per clause 2.0. The panels shall conform to IS-8623.

2.1.10.2 Constructional Features

- a) 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 .
- b) 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.
- c) 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.
- d) All out door panels, removable covers, doors and plates shall be gasket all around with neoprene gaskets.
- e) 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.
- f) The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.
- g) Each panel shall have a caution notice fixed on it.
- h) 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.

i) Each Outdoor lighting panel shall be provided with one no. ‘ON’ indicating lamp for each phase alongwith fuses.For indoor lighting panels din mounted phase indication lamps will be provided , mounted along side of the MCB

j) 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.

2.1.10.3 **JUNCTION BOXES**

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

b) Junction boxes shall be of square/rectangular type of 1.6 mm sheet steel with minimum 6 mm thick pressure die cast aluminium material LM-6 and shall have bolted cover with good quality gasket lining.

c) The junction box and cover of sheet steel construction shall be hot dip galvanised.

d) 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.

e) The junction boxes shall have the following indelible markings

- (i) Circuit Nos. on the top.
- (ii) Circuit Nos. with ferrules (inside) as per drawings.
- (iii) DANGER sign in case of 415 volt junction box.

f) The junction boxes shall be weather proof type with gaskets conforming to IP 55 as per IS:13947 (Part I) .

2.1.10.4 **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 10 minutes to control the illumination in the area.

2.1.10.5 **LED LUMINAIRES**

Indicative models of LED luminaries are indicated in Annexure-I. The offered luminaries shall have minimum 50 lumens/watt capacity(ie ratio of total output

lumens & input power) including driver. The quantity of these luminaries 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)*

2.2 **Not used**

2.3 **DESCRIPTION OF COMMON ITEMS FOR LIGHTING**

2.3.1 **LIGHTING FIXTURES AND ACCESSORIES**

2.3.1.1 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.

2.3.1.2 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.

2.3.1.3 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.

2.3.1.4 Lighting Fixtures

- a) The lighting fixtures for *LED luminaries* has been specified elsewhere in this section.
- b) 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.
- c) All lighting fixtures shall be complete with LED lighting as specified and shall be suitably wired up.
- d) Not used
- e) 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.
- f) Each lighting fixture shall be provided with an earthing terminal suitable for connection to 16 SWG GI earthing conductors.
- g) All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light output as specified by the manufacturer.

- h) 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.

2.3.1.5 ACCESSORIES

2.3.1.5.1 Not Used

2.3.1.5.2 Not Used

2.3.1.5.3 Not Used

2.3.1.5.4 Lamps

- a) General Lighting Services (GLS) lamps shall be provided with screwed caps and shall be of 'clear' type unless otherwise specified.
- b) The Bidder shall furnish typical wiring diagram for LED fitting including all accessories. The diagram shall include technical details of accessories
- c) Flexible conduits if required, for any fixture shall be deemed to be included in Contractor's scope.

2.3.1.5.5 SWITCH AND SWITCHBOARD

- (a) 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.
- (b) Switch boards/boxes shall have conduit knock outs on all the sides.
- (c) 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.
- (d) 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

- (e) The luminaires shall be wired in such a fashion that luminaires on each phase are evenly distributed all over the room.

2.3.1.5.6. **CONDUITS & CONDUIT ACCESSORIES**

- a) 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.
- b) Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro-galvanised mild steel strips or PVC/Plastic.
- c) All conduits accessories shall conform to relevant IS and shall be hot dip galvanized or High quality virgin PVC and shall be ISI marked.

2.3.1.5.7 **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.

2.3.1.5.8 **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 bolts, nuts and screws required for the erection shall be included in the installation rates.
- b) The pull out boxes shall be circular of cast iron or 16 SWG sheet steel and shall have cover with good quality gasket lining.
- c) The pull out boxes and cover shall be hot dip galvanised.
- d) The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

2.3.1.5.9 Residual Current Circuit Breakers (RCCB)

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

2.3.1.5.10 Miniature Circuit Breaker (MCB)

- a) 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.
- b) Single pole as well as three pole versions shall be furnished as required in the Schedule of Lighting Panels.
- c) 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 back up MCCB in such a way that if fault current is higher than breaker rating, the MCCB should blow 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 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.
- e) The terminals of the MCBs and the ‘open’ ‘close’ and ‘trip’ conditions shall be clearly and indelibly marked.
- f) 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.
- g) The MCB shall generally conform to IS:8828.

2.3.1.5.11 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.

2.3.1.5.12 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.

2.3.1.5.13 Labels

- a) 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.
- b) All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-rusting metal or 3 ply lamincold. Labels shall have white letters on black or dark blue background.

2.3.1.5.14 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.

2.3.1.5.15 Type test reports for following tests on all lighting panels shall be submitted for approval as per clause 9.2 of section : GTR.

- (i) Wiring continuity test
- (ii) High voltage (2.5 KV for 1 minute) and insulation test
- (iii) Operational test
- (iv) 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))
- (v) Heat run test

2.3.1.5.16. **LIGHTING POLES**

- a) The Contractor shall supply, store and install the following types of steel tubular lighting poles required for street lighting.
 - i) Type A1 Street Lighting Pole - for one fixture
 - ii) Type E1 Post top lantern pole - for one fixture
- b) In front of control room building , and Fire Fighting Buildings, decorative post top lantern (Type E1) poles and Bollards shall be installed.
- c) Lighting poles shall be complete with fixing brackets and junction boxes. Junction boxes should be mounted one meter above ground level.
- d) The lighting poles shall be coated with bituminous preservative 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).

- e) 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.
- f) 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.
- g) Distance of centre of pole from street edge should be approximately 1000 to 1200 mm.
- h) 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.

2.3.1.5.17 CEILING & WALL MOUNTED FANS AND REGULATORS

- a) 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
- b) 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.
- c) Winding of the fans and regulators shall be insulated with Class-E insulating material. Winding shall be of copper wire.
- d) Electronic regulator with stepped control shall be provided.
- e) Ceiling Fans and Wall mounted Fans shall be of Alstom / Crompton Greaves / Bajaj Electricals / Usha Electricals make.

2.3.1.5.18 LIGHTING WIRES

- a) The wiring used for lighting shall be standard products of reputed manufacturers.
- b) The wires shall be of 1100 V grade, PVC insulated product of reputed manufacturers.
- c) The conductor sizes for wires used for point wiring beyond lighting panels shall

be 2.5 sq.mm, 4 sq.mm, 6 sq.mm and 1.5 sq.mm stranded copper wire.

- d) 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.
- e) 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)

2.3.1.5.19 LIGHTING SYSTEM INSTALLATION WORKS

2.3.1.5.19.1 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.

2.3.1.5.19.2 Conduit System

- a) 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.
- b) All unarmoured cables/wires shall run within the conduits from lighting panels to

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lighting fixtures, receptacles. etc.

- c) Size of conduit shall be suitably selected by the Contractor.
- d) Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.
- e) 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.
- f) Where conduits are along with cable trays they shall be clamped to supporting steel at an interval of 600 mm.
- g) For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.
- h) For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.
- i) Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.
- j) 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.
- k) 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.
- l) 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.

2.3.1.5.19.3 Wiring

- a) 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.
- b) 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.

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- c) Wiring shall be spliced only at junction boxes with approved type terminal strip.
- d) 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.
- e) For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.
- f) Maximum two wires can be terminated to each way of terminal connections.
- g) Separate neutral wires are to be provided for each circuit.
- h) AC and DC wiring should not run through the same conduit.

2.3.1.5.19.4 Lighting Panels

- a) The lighting panels shall be erected at the locations to be finalised during detailed engineering.
- b) Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.

2.3.1.5.19.5 Foundation & civil works

- a) Foundation for street lighting poles, panel foundation and transformer foundation shall be done by the Contractor..
- b) 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.
- c) 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.

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ANNEXURE-1

SI. No.	Type of Lighting Fixture	Description	Philips Catalogue No	CGL Catalogue No	Bajaj Catalogue No
	LED LUMINAIRES				
	Type	Description	Phillips	Insta Power	
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	INSTA PRISMA 45W/OMEGA 45W	
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 220-240V WH	INSTA DL12W-6SH	
c)	S-LED	Street lighting luminaries	BETA Power BRP320 1x24LED- HP/CW PSU GR	VERSAT-2-48	

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ANNEXURE-II

SI No	Item	Abbreviation	Item Description	Make(s)
1	TELEPHONE BOX/TELEVISION BOX	TB	Termination box for Television and Telephone	Approved makes
2	FLAT DB TYPE A	DB	240V Indoor AC Distribution board, 63A or 32A, DP RCCB as Incomer with 12 Nos. 16A SP MCBs as outgoing. DB shall be flush mounted type.	Legrand/Hager
3	METER DB TYPE-A & TYPE-B	MB	For feeder details, please refer drg no. C/ENGG/TS/STD/COMMON/SLD/01	Approved makes
4	SWITCHBOARD WITHOUT 6A SOCKET	SBA	MODULAR SWITCHBOARD WITH 5A SWITCHES AS REQUIRED	Anchor/Crabtree
5	TWO WAY SWITCHBOARD FOR STAIRS	SBB	MODULAR SWITCHBOARD WITH 5A TWO WAY SWITCH	Anchor/Crabtree
6	SWITCHBOARD WITH 6A SOCKET	SBC	MODULAR SWITCHBOARD WITH 1 No. Socket and 5A SWITCHES AS REQUIRED	Anchor/Crabtree
7	TELEPHONE POINT	TP	Modular Socket	Anchor/Crabtree
8	TELEVISION POINT	TV	Modular Socket	Anchor/Crabtree
9	AIRCONDITIONER 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 1 X 60 W LED Lamp	Any Reputed Make
13	BELL PUSH	BP	Modular Type	Anchor/Crabtree
14	BELL	BELL	Call Bell	Anchor/Crabtree
15	EXHAUST FAN	EFC	300 mm sweep Trans'Air	CGL/Bajaj/Usha
16	CEILING FAN	CFC	1200 mm sweep with electronic regulator	CGL/Bajaj/Usha

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Annexure-III

Solar Based Energy Efficient Pole Mouted Street Lighting System

I. SCOPE

A stand alone solar based energy efficient pole mounted street lighting system comprising of galvanized steel tubular pole, LED type light source, lead acid tubular type maintenance free battery, photovoltaic (PV) module (s), control electronics, inter-connecting wires / cables, Module mounting hardware, Battery box, any other item for safe and trouble free operation etc shall be provided with each unit.

II. DUTY CYCLE

The system should be designed to automatically switch ON at dusk. operate through out the night and automatically switch OFF at the dawn under average daily insolation of 5.5 kWh /sq.m. on a horizontal surface.

III. LIGHT SOURCE

- i. The light source shall be of white LED type, single lamp or multiple lamps can be used. View angles shall be of wider range with a minimum of 120 degree and above. The luminous performance of LEDs used should not be less than 50 lumen/watt including driver. LEDs which emit ultraviolet light is not acceptable.*
- ii. The light output from the white LED light source should be constant through out the duty cycle.*
- iii. The lamps should be housed in an assembly suitable for outdoor use. The make, model number, country of origin and technical characteristics of white LEDs used in the lighting system must be furnished.*

IV. BATTERY

- i. The battery shall be of maintenance free lead acid tubular type.*
- ii. The battery will have a minimum rating of 12V, 75 Ah (at C/10) discharge rate.*
- iii. 75 % of the rated capacity of the battery should be between fully charged & load cut off conditions.*

V. ELECTRONICS

- i. The inverter should be of quasi sine wave/sine wave type. with frequency in the range of 20 - 35 KHz. Half-wave operation is not acceptable.*
- ii. The total electronic efficiency should be at least 80 %.*

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- iii. No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle)*
- iv. The idle current consumption should not be more than 10 mA*
- v. Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery through out the year.*
- vi. Necessary lengths of wires/cables and fuses should be provided. Wires and cables shall be of approved make and shall be BIS marked.*
- vii. The PV module will be used to sense the ambient light level for switching ON and OFF the lamp.*

VI. PV MODULE (S)

- i. The PV module(s) shall contain single or multi crystalline silicon solar cells. Test reports for solar cells being offered shall be duly conducted at accredited laboratory. The module must be manufactured by a company, which has obtained a valid test certificate for module qualification as per prevailing IEC or BIS standards for any of the modules manufactured by that company. A copy of the test certificate must be submitted for owner's acceptance. The power output of the module(s) under STC should be a minimum of 74 W Either two module; of minimum 37 W output each or one module of 74 W output should be used.*
- ii. The operating voltage corresponding to the power output mentioned above should be 16.4 V.*
- iii. The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.*
- iv. The terminal box on the module should have a provision for opening for replacing the cable if required*
- v. A strip containing the following details should be laminated inside the module so as to be clearly visible from the front side.*
 - a) Name of the Manufacturer or distinctive Logo*
 - b) Model or type No*
 - c) Serial No & year of manufacturing.*

VII. ELECTRONIC PROTECTIONS

- i. Adequate protection is to be incorporated under no -load conditions e.g when the lamp is removed and the system is switched ON.*
- ii. The system should have protection against battery overcharge and deep discharge conditions.*
- iii. Fuses should be provided to protect against short circuit conditions.*
- iv. A blocking diode should be provided as part of the electronics, to prevent reverse flow of current through the PV module(s), in case such a diode is not provided with the solar module (s)*

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- v. Full protection against open circuit accidental short circuit and reverse polarity should e provided.**
- vi. The light output should remain constant with variations in the battery voltages.**

VIII. MECHANICAL HARDWARE

- i. A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s) The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that the module(s) can be oriented at the specified tilt angle**
- ii. The pole should be made of mild steel pipe with a height of 4 metres above the ground level, after grouting and final installation. The pole should have the provision to hold the we proof lamp housing It should be painted with a corrosion resistant paint.**
- iii. A vented, acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery.**

IX. OTHER FEATURES

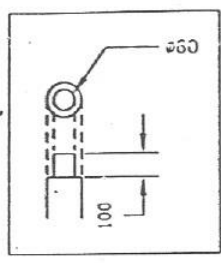
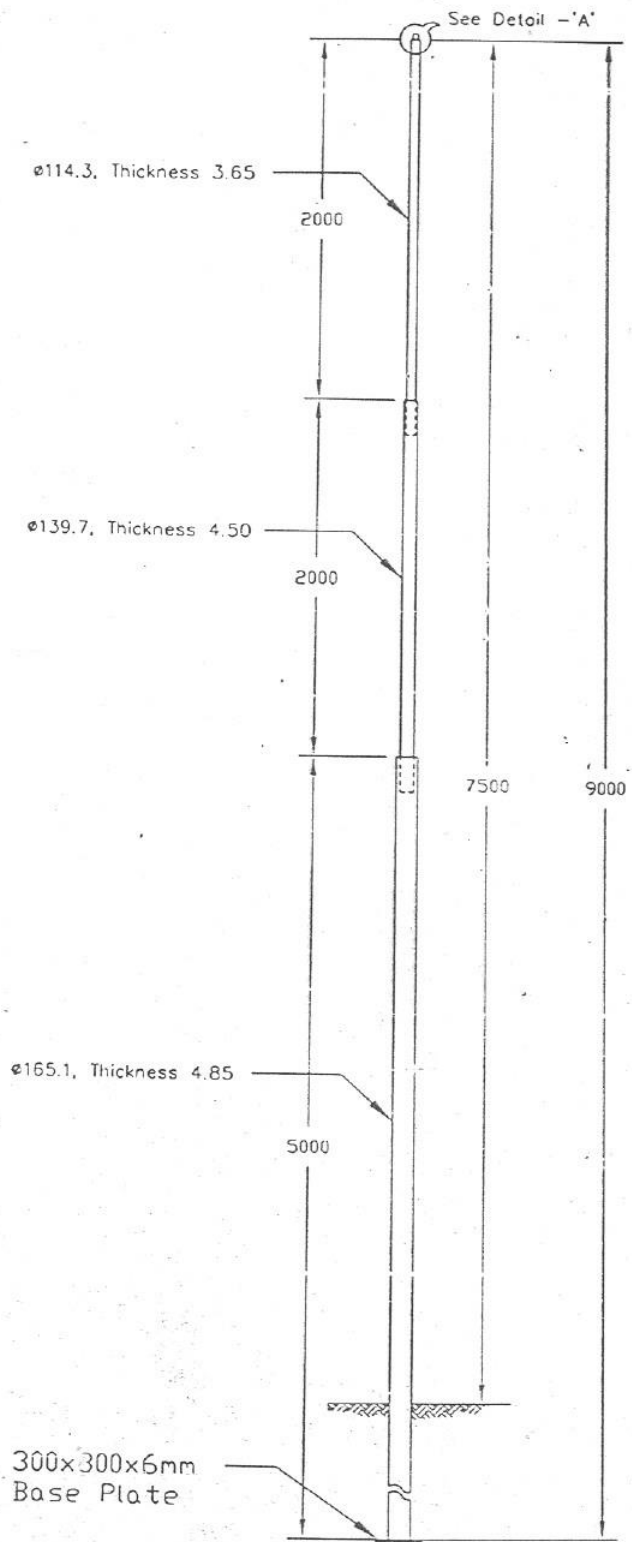
- I. The system should be provided with 2 LED indicators a green light to indicate charging in progress and a red LED to indicate deep discharge condition of the battery. The green LED should glow only when the battery is actually being charged**
- II. There will be a Name Plate on the system which will give**
 - a) Name of the Manufacturer or Distinctive Logo**
 - b) Serial Number & year of manufacture**
- III. Components and parts used in the solar street lighting systems should conform to the latest BIS specifications, wherever such specifications are available and applicable.**
- IV. The PV module(s) will be warranted for a minimum period of 10 years from the date of supply and the street lighting system (including the battery) will be warranted for a period of two years from the date of supply. The Warranty Card to be supplied with the system must contain the details of the system supplied. The manufacturers can also provide additional information about the system and conditions of warranty as necessary.**
- V. An Operation Instruction and Maintenance Manual , in English and the local language should be provided with the solar street lighting system.**

The following minimum details must be provided in the Manual

- a. About Photovoltaics**
- b. About solar street lighting system - its components and expected performance**
- c. About PV module**
- d. About CFL**

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- e. *About battery.***
- f. *Clear instructions about erection of pole and mounting of PV module and lamp housing assembly on the pole.***
- g. *About electronics.***
- h. *About charging and significance of indicators***
- i. *DO's and DON'T's,***
- j. *Clear instructions on regular maintenance and trouble shooting of the solar street lighting system.***
- k. *Name and address of the contact person in case of non-functionality of the solar street lighting system.***



Detail - 'A'
LUMINAIRE MOUNTING PROVISION

NOTES

1. WELDED STEEL TUBULAR POLE 410 SP32 AS PER IS 2713 (PART II)-1980.
2. EXPOSED OUTSIDE SURFACE SHALL BE COATED WITH TWO COATS OF RED OXIDE PRIMER & Zinc Chromate in a synthetic medium.
3. EMBEDDED PORTION WILL BE COATED WITH BITUMINOUS PRESERVATIVE.
4. POLE IS MANUFACTURED FROM STEEL PIPES CONFORMING TO IS 1161 -1979
5. ALL DIMENSIONS ARE IN MM
6. TOLERANCES AS PER IS 2713 AND IS 1161
7. TWO COATS OF LIGHT BISCUIT SYNTHETIC ENAMEL.

G.A. DRAWING FOR STEEL TUBULAR POLE 9 MTRS HEIGHT. (TYPE A1)

POWER GRID CORPORATION OF (I) LTD.

NEW DELHI