

Standard Specification
for
Lighting System

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1. GENERAL:

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 with electronic regulators, exhaust fans with accessories, lighting panels, Sub-Lighting Panels, lighting poles with distribution boxes, PVC conduits, lighting wires, G.I. earth wire, receptacles, tag block & telephone socket, switchboards, modular switches, junction boxes, pull out boxes, **aluminum ladders for maintenance**, complete with accessories.

The following specific areas are included in the scope of lighting as applicable:

1.1. Indoor Lighting

- a. Control Room cum administrative building.
- b. Fire-fighting pump house
- c. Switchyard panel rooms
- d. GIS Building
- e. Township & Transit Camp
- f. Auxiliary Room (As applicable)
- g. Other Buildings

1.2. Outdoor Lighting

- a. Switchyard Area including DG Set & LT Transformer area.
- b. Street Lighting
- c. Open Store

2. GENERAL DESIGN CRITERIA:

The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare-free illumination. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in the lighting fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period illumination. The type of Lighting Fixture to be used in different areas shall be as per [Annexure-I](#).

For Indoor and Outdoor Illumination, detailed drawings showing the lighting layout and electrical distribution diagram shall be prepared by the Contractor and submitted for approval. **Conduiting shall be done as per approved Lighting Layout and no separate drawings for the same shall be submitted for approval.** The above layout drawings will include disposition and location of lighting fixtures, receptacles, lighting panels etc. While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipment should be taken into account to have adequate illumination at desired locations. **In false Ceiling, surface wiring is permissible, but all down run conduit will be concealed in wall below the false Ceiling.**

2.1. Indoor Illumination

Indoor illumination shall be done by LED Luminaries as per the requirement of false ceiling and non-false ceiling of buildings.

Following Average lux (at working plane of height 1.2Mtrs from floor level) levels to be maintained for design of illumination system:

| S. No. | Building/Room Type | Average Lux Level to be maintained |
|--------|---|------------------------------------|
| 1. | Control Room /Station-In charge Room /Administrative Room/Conference Room / | 300 Lux |

| | | |
|----|---|---------|
| | Switchyard Panel Room/ GIS Relay Panel Room | |
| 2. | Electronic Test Lab | 250 Lux |
| 3. | GIS Hall/ Battery Room/ACDC & DCDB Room | 200 Lux |
| 4. | AHU Room/GIS Store room/ Pantry /Reception/ FFPH Building | 150 Lux |
| 5. | Corridor/ Toilets | 100 Lux |
| 6. | Periphery of the Building | 50 Lux |
| 7. | Switchyard/Roadway | 20 Lux |
| 8. | Any other room/building | 200 Lux |

Note: Outdoor switchyard average illumination level shall be 50 lux on main equipment and 20 lux on balance area of switchyard. In the outdoor switch yard, the area covered by Transformer/Reactor should have 50 lux.

The minimum lux level to average lux level ratio should not be less than 0.6 (i.e. $E_{min}/E_{avg} > 0.6$). The maintenance factor for indoor illumination design shall be considered as 0.8.

The contractor shall submit lighting design calculation for deciding the number of fixtures in each building/room.

2.2. Outdoor Illumination

Outdoor illumination shall be done by LED luminaries as per the requirement. **For Outdoor Switchyard area, LED fixtures shall be installed at gantry structures (For 400kV & below voltage level) & available lightning masts (if any). However, for 765kV Switchyard, LED fixtures will be installed at 28 meter height on the towers.** For other outdoor areas, Street Lighting, lighting poles & nearby buildings (if any) shall be used for installation of LED fixtures. Additional firewall mounted Flood Lights have to be provided for Transformer & Reactors as per requirement. Mounting structure /Accessories for Mounting of LED Lighting Fixtures will be prefabricated and will be hot dip galvanized.

Portable Flood Light Panel (PFLP): Portable Flood Light Panel along with fixture is to be supplied for maintenance purpose of the Substation. The detailed drawing for the PFLP shall be as per the drawing attached in the specification ([Annexure-III](#)). Fixture shall be FL-2 type on PFLP.

3. LIGHTING SYSTEM DESCRIPTION:

The lighting system shall comprise of the following:

3.1. AC Normal Lighting System

All the Lighting fixtures connected to the AC Normal Lighting system in different areas will be fed from the 415V main lighting distribution board through Lighting Panel & Sub-lighting panels (SLP).

3.2. AC Emergency Lighting System

The lighting panels of this system will be connected to the 415V Emergency lighting distribution board (ELDB) which is fed from diesel generator during the emergency. This system will be provided in Control Room building, GIS Building, Switchyard Panel Room, Firefighting pump house, Switchyard Area including DG Set & LT Transformer Area. AC Emergency lighting load will be connected to this system which will normally be 'ON'.

Approximately 25 % of lighting fixtures (distributed over all above areas) shall be connected to an AC emergency lighting system.

3.3. D.C. Emergency lighting System

DC emergency LED lighting fixtures of 8W DC Input Down Lighter shall be operated on the 220V DC system and will be provided in the strategic locations in Control Room Building, Fire Fighting Pump House and GIS Building.

The supply to the DC lighting panels shall be automatically switched ON in case of loss of Normal & Emergency AC supply at station or when under voltage occurs in the MLDB/ELDB. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.

Exit Lightings Signage are to be provided in all rooms of Control Room Building, Fire Fighting pump house & GIS Building including Corridors & Staircase so that the operating personnel can safely find their way even during emergency of total AC failure.

4. DESCRIPTION OF ITEMS:

The Contractor shall supply and install the following equipment and accessories in accordance with the specification and applicable standards:

4.1. LED Luminaires

LED Luminaries shall be used for the lighting of all the indoor and outdoor areas. In false ceiling area, LED luminaries shall be recessed mounting type & in non-false ceiling area, the LED luminaries shall be surface mounting type.

Suitable heat sink with proper thermal management shall be provided in the luminaries. All LED Luminaries shall be EMPLOYER approved make. The marking on luminaries & safety requirements of luminaries shall be as per IS standards.

Necessary Care shall be taken so that there is no water stagnation anywhere in the luminaries. The entire housing shall be dust and waterproof protection as per IEC 60529. Parameters of outdoor & indoor Lighting fixtures are detailed in [Annexure-II](#).

4.2. Lighting Panels

i. Constructional Features of Lighting Panels

- a. The Lighting panels shall conform to IEC 61439.
- b. **All Outdoor Lighting Panels shall be Stainless sheet steel (Grade 304) of at least 1.5 mm thick or aluminum enclosure of at least 1.6 mm thick** and shall be dust, water and vermin proof and smoothly finished, leveled and free from flaws. Stiffeners shall be provided wherever necessary.
- c. The panels shall be of front single door hinged construction, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets. Indoor Lighting panels shall be modular flush mounted, and wall embedded of slim depth.
- d. All panels shall have a dead front assembly provided with hinged door(s) and with suitable locking arrangement.

- e. All Outdoor panel's removable covers and doors shall be gasketed all around with Neoprene/EPDM gaskets/ puff arrangement.
 - f. The outdoor panels shall be suitable for cable/conduit entry from the bottom. Suitable removable cable gland-plate shall be provided in the bottom of panels. **For indoor lighting panels the provision of cable/conduit entry shall be from both top and bottom side** with suitable removable gland plate. The thickness of the gland plate shall be 3 mm. Necessary number of double compression brass type cable gland shall be supplied, fitted on to these gland plates.
 - g. The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.
 - h. Each panel shall have a caution notice fixed on it.
 - i. Each panel will be provided with laminated as built circuit diagram suitably pasted in the panel.
 - j. **Main Bus Bars**
Bus bars shall be of Copper/aluminum alloy conforming to IS: 5082 and shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. **Maximum operating temperature of the bus bars shall not exceed 85 °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.**
 - k. All Outdoor Lighting Panels shall be erected such that a **minimum height of 1000mm** is maintained between FGL & bottom of the Lighting Panel. Size of Outdoor Lighting panels shall be such that cables are properly terminated and wires are dressed with provision of loops.
- ii. **Configuration of Indoor and Outdoor Lighting Panels.**

| Type of Panel | Description | Detail of Feeders |
|---------------|--------------------------------------|--|
| ACP 1 | Indoor AC Lighting panel | Bus Bar: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. |
| | | Incomer: One no. 415V, 63A TPN MCB with 300mA 63A Four Pole RCCB. |
| | | Outgoing: 12 nos. 230V, 16A Single Pole MCB and 1 no. 5/15A Switch with Socket. |
| | | Mounting: The indoor ACP shall be of slim depth suitable for embedding in the wall and will be flush mounted. |
| ACP 2 | Outdoor Switchyard AC Lighting panel | Bus Bar: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. |
| | | Incomer: One no. 415V, 63A TPN MCB & Contactor with suitable Photo-sensitive automatic switching system. |
| | | Outgoing: 6 nos., 230V, 20A Single Pole MCB and 3 Nos. 230V, 32A TPN MCB and 1 |

| | | |
|---------------|----------------------------------|--|
| | | no. 5/15A Switch with Socket. |
| | | Mounting: Suitable for Outdoor applications. |
| ACP 3 | Outdoor Street AC Lighting Panel | Bus Bars: 415V, 63A, 3 phase 4 wire bus bars with Colored LED indication lamps with fuse for each phase. |
| | | Incomer: One no. 415V, 63A TPN MCB & Contactor with suitable Photo- sensitive automatic switching system. |
| | | Outgoing: 3 nos. 32A TPN MCB and 1 no. 5/15A Switch with Socket. |
| | | Mounting: Suitable for Outdoor applications. |
| DCP | Indoor DC Lighting panel | Bus Bar: 220V DC 32A two wire Bus Bar. |
| | | Incomer: 220V DC with one 32A DP Contactor (for AC fail Logic) backed up by 32A double pole MCB with DC test push button. |
| | | Outgoing: 6 nos.16A Double Pole MCB |
| | | Mounting: The indoor DCP shall be of slim depth suitable for embedding in the wall and will be flush mounted |
| SLP | Outdoor AC Sub-lighting panel | Incomer: 415V, 32A TPN MCB |
| | | Outgoing: 8 nos. terminal blocks suitable for cable up to 16 mm ² cable. |
| | | Mounting: Suitable for Outdoor applications with Loop in and Loop out facility. |
| Sub-DB | Indoor AC Sub Distribution Box | Incomer: 415V, 32A TPN MCB. |
| | | Outgoing: 6 nos. 230V, 16A Single Phase feeder with Single Pole MCB. |
| | | Mounting: The Sub-Distribution Box shall be of slim depth suitable for embedding in the wall and will be flush mounted/surface mounted as per site requirement. |

iii. AUXILIARY ITEMS FOR LIGHTING PANELS

a. Terminal Blocks

Each terminal shall be suitable for termination of suitable size of Cable/Wire Conductors without any damage to the conductors or any looseness of connections.

b. Residual Current Circuit Breakers (RCCB)

For indoor panels (ACP 1), 63A, 4pole 300 mA RCCB conforming IEC 61008 will be provided along with incomers.

c. 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 IEC 60898 will be used for Illumination purposes.
- The MLDB panel's MCCBs and MCBs together shall be rated for full fault level. In case the MCB rating is less than the specified fault level, the Contactor 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 blow 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/Al wire connection at both the incoming and outgoing side by copper/Al lugs or for bus bar connection on the incoming side.
- The terminals of the MCBs and the 'open/trip' and 'close' conditions shall be clearly and indelibly marked.

d. **Contactors**

Contractors shall be of the full voltage, direct-on line, air break, single throw, electro-magnetic type. They shall be provided with at least 2NC and 2NO auxiliary contacts. 3-Phase Contactor shall be provided with the three elements, 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 check the adequacy of the Contactors rating, wires with respect to lighting load.

e. **Push Buttons**

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

f. **Labels**

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

g. **Earthing Terminals**

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

4.3. **Earthing & Lightning Protection for Control Room Building, GIS Building**

Earthing and lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.

- a) Code of practice for Earthing IS: 3043
- b) Code of practice for the protection of Building and allied structures against lightning IEC: 62305.
- c) Indian Electricity Rules 1956 with latest amendments.

4.4. **Power And Control Cables**

Power and Control cables required under lighting shall conform to standard technical specification, Section-Power and Control cables.

4.5. Receptacles

All receptacles shall be of heavy-duty type, suitable for fixing on wall/column and complete with individual switch. The outdoor Receptacles shall have IP 55 protection. The receptacles shall be of following types:

Type RO: 20A, 240V, 3 pin type (third pin grounded) plug and socket with body earthing arrangement with Single Pole MCB, metal clad with gasket having cable gland entry suitable for 2Cx6 mm² PVC/aluminum armoured cable and a spring-loaded cover suitable for installation in moist outdoor location. Receptacles shall be housed in a box made of stainless steel (Grade 304) of at least 1.5 mm thick or aluminum enclosure of at least 1.6 mm thick with hinged doors with suitable locking arrangements. Door shall be lined with good quality gasketing.

Type RP - 63A, 3-phase, 415V AC receptacles shall be provided for welding purposes in GIS Halls and near major equipment in switchyard. 63A, 415V, 3-phase, 4 pin interlocked plug and socket with body earthing arrangement with TPN MCB. Receptacles shall be housed in a box made of stainless steel (Grade 304) of at least 1.5 mm thick or aluminum enclosure of at least 1.6 mm thick, with hinged door with suitable locking arrangement. The receptacle shall be suitable for 3.5C x 35/3.5Cx70 mm² and suitable for installation in moist outdoor location. Aluminum conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of similar size. Door shall be lined with good quality gasketing.

Type RQ-1 (250A)/ Type RQ-2(400A): - 250A/400A Receptacle shall be provided for oil filtration purpose near alternate Transformer/Reactor. 250A/400A, 415V, 3-phase, 4 pin, Switch Box with body earthing arrangement with TPN MCB, suitable for outdoor application. The enclosure shall be made of 1.5 mm thick Stainless Steel (Grade 304) of at least 1.5 mm thick or aluminum enclosure of at least 1.6 mm thick with hinged door with suitable arrangement and having cable gland entry suitable for 3.5C X 300 mm² XLPE armoured cable. The bus bar shall have adequate cross-section to carry the rated continuous current and withstand short circuit currents. The receptacle shall be suitable for loop-in and loop out connection of cables of similar size. Door shall be lined with good quality gasketing.

4.6. Lighting Accessories

Various accessories mentioned below shall be supplied as per site requirement and cost of the same shall be deemed to be included in overall Lighting System cost.

i. Junction Boxes

- a) The Indoor junction boxes shall be provided with 4-way knockouts suitable for two numbers 10 mm² wire/ Cable. These junction boxes shall be concealed type for indoor lighting.
- b) The outdoor 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 required size. The junction boxes shall be provided with 4-way knockouts suitable for street lighting/switchyard lighting terminals suitable for 2 numbers 4C x 16 mm² Al. cable or as per requirement. All Outdoor Junction boxes shall be of stainless steel (Grade 304) of at least 1.5 mm thick or

aluminum enclosure of at least 1.6 mm thick. Outdoor Junction Boxes shall be suitable for mounting on columns, structures etc. for Outdoor Lighting. The outdoor Junction shall have IP 55 protection.

- c) 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.

ii. **Switch And Switchboard**

- a) All Switch board/boxes and electronic fan regulators located in office/building areas shall be modular flush mounted type.
- 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 suitable as per the requirement during installation.
- d) **The maximum 8 nos. number of luminaries shall be controlled by one no. 6 Amp Switch. However, each Switchboard shall have a minimum of 2 Nos. of 6A Switches to control the Luminaries.** For DC fixtures there will be no switch and the same shall be directly controlled from DCP.
- e) The Luminaries shall be wired in such a fashion that luminaries on each phase are evenly distributed all over the room.
- f) 6/16A, 240V AC modular flush mounted socket with switch outlet shall be provided in indoor areas like offices, cabins, Security Room, Control Room, Switchyard Panel Room etc.
- g) 25A, 240V AC modular flush mounted socket with switch shall be provided at strategic locations in GIS Halls, ACDB/Switchgear room etc.

iii. **Conduits & Conduit Accessories**

- a) The conduits shall be Rigid PVC conduits of 20/25 /32 mm diameter for Lighting, Telephone wiring & LAN Cabling and shall be ISI marked.
- b) Flexible conduits wherever required shall be PVC type.
- c) All conduits' accessories shall be ISI marked.
- d) Galvanized Steel Conduits for Surface Conductor (e.g. GIS Hall).

iv. **Pull Out Boxes**

- a) The pull-out boxes shall be concealed type The pull-out boxes shall be concealed, typed for indoor lighting and suitable for mounting on column, structures-etc., for outdoor lighting.
- b) The pull-out boxes shall be circular of minimum 16 SWG sheet steel and shall have cover with good quality gasket lining.
- c) The pull-out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

v. **Ceiling, Wall Mounted & Exhaust Fans and Regulators**

- a) The Contactor shall supply and install **1400 mm sweep 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 shall be of 400 mm sweep. Exhaust fans shall be of 300mm size.**
- b) Winding of the fans shall have Class-E insulating material. Winding shall be of copper wire.

vi. Lighting Wires

- a) Wiring from Lighting/Sub-Lighting Panels to junction boxes / Switchboards/ fixtures etc. is covered under Lighting Wires. The wiring used for lighting shall be standard products.
- b) The wires shall be of 630V grade (Phase to ground), PVC insulated products.
- c) The conductor sizes for wires used for point wiring shall be 1.5 mm²,
- d) 2.5 mm², 4 mm² and 6 mm² stranded copper wire as required.
- e) The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fixtures shall be single core copper stranded conductor, 630V grade (Phase to ground) flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 mm².
- f) 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)

Green for Earth

4.7. Lighting Poles

- (i) The Contactor shall supply, store and install the following types of galvanized steel tubular lighting poles required for street lighting and decorative lighting, as per the attached drawing of poles.
 - a. Type L1 Street Lighting Pole of 6 meter - for SL-L1 type fixture.
 - b. Type D1 Post top lantern pole of 4 meter - for Sl-D1 type fixture.
- (ii) "L1" type poles shall be used for street lighting. "D1" type (Decorative post top lantern) poles and Bollards shall be installed in front of control room building, Fire Fighting Buildings as finalized during detailed engineering.
- (iii) Lighting poles shall be complete with fixing brackets. Cable termination box will be built inside the pole itself as per drawing enclosed.
- (iv) Poles and its Cable termination box shall be hot dip galvanized and PU (Polyurethane) coated in Suzuki silver color and inside with bituminous paint.
- (v) Terminal strips provided in street lighting poles shall be suitable for terminating up to

2 nos. 4C x 16 mm² aluminum cables.

- (vi) 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 mm² Copper wire laid inside the tubular pole.
- (vii) Distance of center of pole from street edge should be approximately 1000 to 1200 mm or as per site conditions.
- (viii) Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through 3M long, 20 mm dia, earth electrode.

4.8. Ladder

Following ladders shall be supplied for maintenance purpose of illumination system:

- (i) A type of Aluminum ladder of 3 Mtr vertical height.
- (ii) Cartwheel mounted aluminum ladder Vertical Extendable from 5.1m to 11m.

5. TYPE TEST REQUIREMENT:

5.1 Lighting Panels, Receptacles, Junction Boxes etc. shall conform to following degree of protection:

- i. Installed outdoor: IP- 55
- ii. Installed indoor in air-conditioned area: IP-31
- iii. Installed in covered area: IP-52
- iv. Installed indoor in non-air-conditioned area where possibility of entry of water is limited: IP-41.

5.2 Lighting fixtures LED type shall conform to type test requirements of LM-79 (Electrical and photometric measurements of solid-state lighting products), LM-80 (Lumen depreciation of LED module or chip over a period of time).

6. LIGHTING SYSTEM INSTALLATION WORKS:

6.1 General

In accordance with the specified installation instructions as shown on the 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. Tolerance shall be as established in manufacturers drawing or as stipulated by Employer.

All apparatus, connections and cabling shall be designed to minimize risk of fire or any damage which will be caused in the event of fire. All Lighting accessories mentioned in Clause 4.6 shall be supplied and erected as a part of Lighting System Installation works. **Cost of Erection, Foundation & Civil Works of the above accessories and Lighting Poles are to be included in the Cost of the erection of Lighting system, no extra payment shall be made on account of the same.**

Further, lighting control in GIS Hall has to be done in staggered way for the minimum basic illumination. Further separate switchboard should be provided to have enhanced lighting for each bay.

6.2 Conduit System

- i. 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, check nuts, male and female bushings (brass or galvanized 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. In case of false ceiling surface conduiting is permissible however all down run conduits will be concealed in wall below the false ceiling. The conduit fittings shall be of the same material as conduits. Separate Conduit should be laid for Communication purpose. The contractor shall also supply & install 20mm PVC conduit and accessories for telephone wiring and LAN Cabling wherever feasible. Telephone and LAN cabling can be laid in the same conduit.
- ii. In case of false Ceiling surface conduiting (GI Pipe) is permissible under the ceiling.
- iii. All unarmored cables/wires shall run within the conduits from lighting panels to lighting fixtures, receptacles. etc.
- iv. Size of conduit shall be suitably selected by the contractor.
- v. Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.
- vi. Conduit supports shall be clamped-on 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 raw plugs. Wooden plugs inserted in masonry or concrete for conduit support is not acceptable.
- vii. 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.
- viii. For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.
- ix. Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.
- x. 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.
- xi. The entire GI conduit system (if used) 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.
- xii. 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.

6.3 Wiring

- i. The scope also includes wiring from nearest Lighting/Sub-Lighting Panel to the Controlling Switch/MCB/Lighting Fixtures.
- ii. Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing of wires is permissible.
- iii. Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where required, suitable junction boxes should be used.
- iv. Wiring shall be spliced only at junction boxes.
- v. 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.
- vi. Maximum two wires can be terminated to each way of terminal connections.
- vii. AC and DC wiring should run through separate conduits. Similarly, Communication & LAN cables shall run in separate conduit than that of AC & DC Conduits.

6.4 Lighting Panels

- i. The lighting panels shall be erected at the locations to be finalized during detailed engineering.
- ii. Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.
- iii. The Sub lighting Panel shall be provided where independent switch of fixtures are required.

6.5 General Requirements for Cabling Work

- i. Each cable run shall be tagged with number that appears 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.
- ii. 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.
- iii. Location of cables laid directly under ground shall be indicated clearly by cable marker made of galvanized iron plate embedded in concrete block.
- iv. The location of underground cable joints, if any shall be clearly indicated with cable marker with an additional inscription "cable joint".
- v. 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.

- vi. Road crossing of cables through suitable size of GI pipe/Hume pipe as required at site.

6.6 **Foundation & civil works**

- i. Foundation for street lighting poles and panels shall be done by the Contractor.
- ii. 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.
- iii. 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.

7. ANNEXURE-I: BILL OF QUANTITY (Indicative)

| Sr. No | Locations | Type & No of Lighting Fixture | With Anti-Glare Film over the Fixture | Type of Fans |
|------------|---|-------------------------------------|---------------------------------------|-------------------|
| 01. | Control Room cum Administrative Building-Single Story (As applicable) | | | |
| (i) | Control Room | RSQ-I: 10 Nos. | Yes | -- |
| (ii) | Station- In Charge Room | RSQ-I: 4 Nos. and RC-I: 4 Nos. | Yes | -- |
| (iii) | Administrative Area | RSQ-I: 12 Nos. and RC-I: 9 Nos. | Yes | Pedestal Fans |
| (iv) | Conference Room | RSQ-I: 9 Nos. and RC-I: 4 Nos. | Yes | Wall Mounted Fans |
| (v) | Electrical Room / Telecommunication Room | RSQ-I: 4 Nos. and RC-I: 2 Nos. | Yes | Wall Mounted Fans |
| (vi) | ACDB/DCDB Room | SL-I: 16 Nos. | Yes | Ceiling Fan |
| (vii) | Battery & Battery Charger Room | RL-I: 6 Nos. | Yes | -- |
| (viii) | Corridor & Reception | SC/RC-I: 8 Nos. and SL/RL-I: 2Nos. | Yes | Ceiling Fan |
| (ix) | Toilets | SC-I: 2 Nos. (in each Toilet) | No | Exhaust Fans |
| (x) | Pantry | SL-I: 2 Nos. and SC-I: 1 No. | Yes | Exhaust Fans |
| (xi) | Periphery of the Building | BL: 10Nos. | No | -- |
| 02. | Control Room cum Administrative Building- Double Story (As applicable) | | | |
| (i) | Control Room | RSQ-I: 12 Nos. | Yes | -- |
| (ii) | Station- In Charge Room | RSQ-I: 4 Nos. and RC-I: 2 Nos. | Yes | -- |
| (iii) | Administrative Area | RSQ-I: 16 Nos. and RC-I: 12 Nos. | Yes | Pedestal Fans |
| (iv) | Conference Room | RSQ-I: 9 Nos. and RC-I: 5 Nos. | Yes | Wall Mounted Fans |
| (v) | Electronic Test Lab/ Telecommunication Room | RSQ-I: 4 Nos. | Yes | Wall Mounted Fans |
| (vi) | ACDB Room | SL-I: 16 Nos. | Yes | Ceiling Fan |
| (vii) | DCDB Room | SL-I: 9 Nos. | Yes | Ceiling Fan |
| (viii) | Battery & Battery Charger Room | RL-I: 6 Nos. | Yes | -- |
| (ix) | Store | SL-I: 6 Nos. | No | -- |
| (x) | Lobby/ Waiting Area | SSQ-I: 5 Nos. and RC-I: 4 Nos. | Yes | Ceiling Fan |
| (xi) | Toilet | SC-I: 2 Nos. (in each Toilet) | No | Exhaust Fans |
| (xii) | Pantry | SL-I: 2 Nos. and SC-I: 1 No. | Yes | Exhaust Fans |
| (xiii) | Corridors | SC/RC-I: 36 Nos. and SL/RL-I:6 Nos. | No | -- |
| (xiv) | Periphery of the Building | BL: 15 Nos. | No | -- |

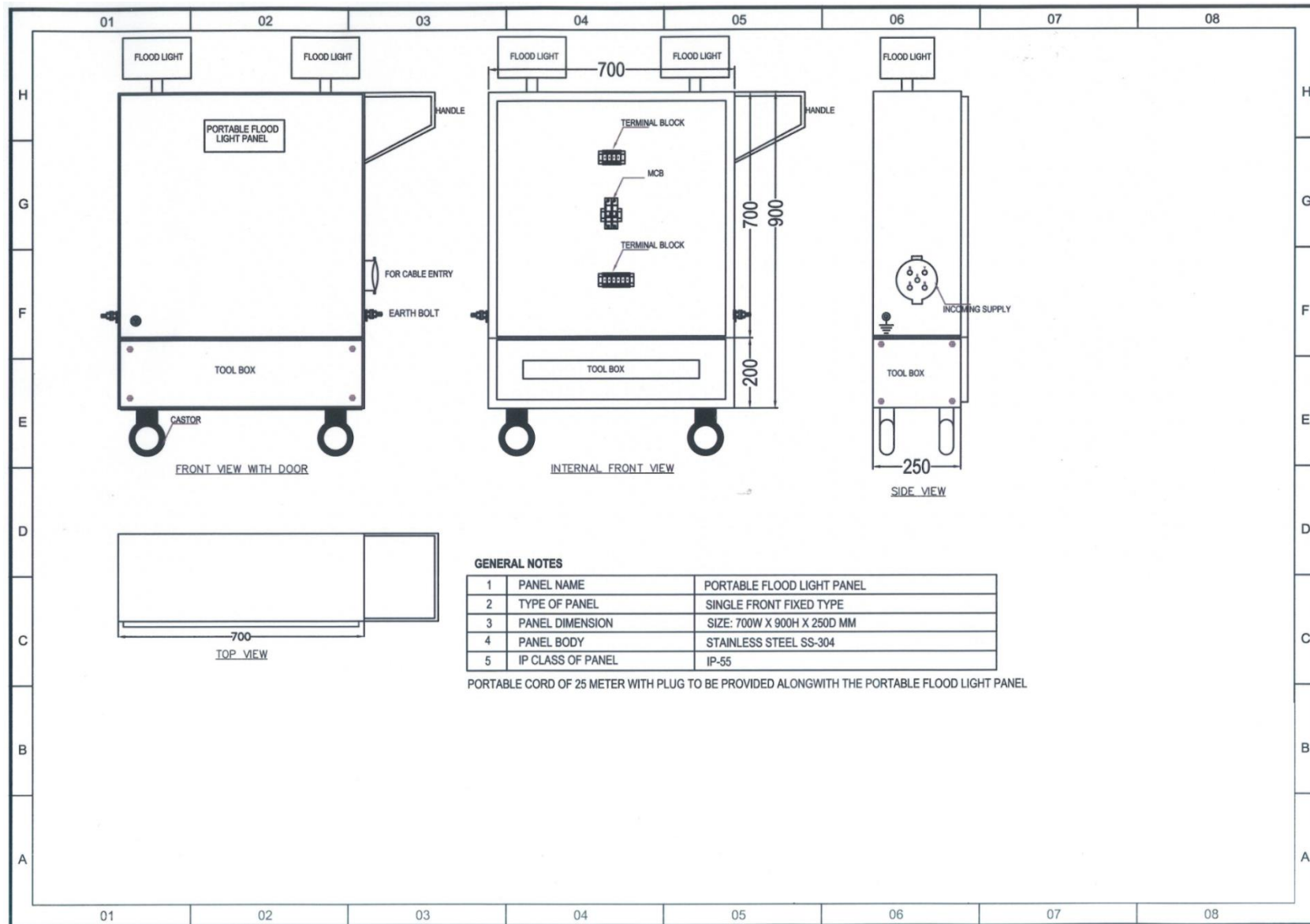
| | | | | |
|------------|---|----------------------------|-----|------------------|
| 03. | GIS Building | | | |
| (i) | 765kV, 400kV & 220kV GIS Hall | IHB: As required | No | -- |
| (ii) | AHU Room | SL-1: As required | Yes | -- |
| (iii) | C&R Room | RSQ-I: As required | Yes | -- |
| 04. | Fire Fighting Pump House | | | |
| (i) | FFPH Building | SL-1: 9 Nos. | Yes | Wall Mounted Fan |
| (ii) | Periphery of the Building | BL: 4 Nos. | No | -- |
| 05. | Switchyard Panel Room (SPR) (9 meter) | SSQ-I: 10 Nos. | Yes | -- |
| 06. | Switchyard Panel Room (SPR) (6 meter) | SSQ-I: 8 Nos. | Yes | -- |
| 07. | Switchyard and Outdoor Substation Area | FL-1 & FL-2: As required | No | -- |
| 08. | Street lighting roads | SL-LI & SL-DI: As required | No | -- |

| S. No. | Technical Specification | SL-1 (Surface Mounted Linear LED Tube with Box) | RL-I (Recessed Mounted 4 x 1 Feet LED Panel) | SC-I (Surface Mounted Circular LED Downlight Luminaire) | RC-I (Recessed Mounted Circular LED Downlight Luminaire) | SSQ-1 (Surface Mounted 2x2 LED Luminaire) | RSQ-1 (Recessed Mounted 2x2 LED Luminaire) | IHB (LED Indoor High Bay) |
|--------|-----------------------------------|--|---|--|---|--|---|------------------------------------|
| 1 | System Wattage | ≤ 2 x 20 W | ≤ 40 W | ≤ 15 W | ≤ 15 W | ≤ 40 W | ≤40 W | ≤150W |
| 2 | System Lumen Output | ≥ 3600 | ≥ 3600 | ≥ 1200 | ≥ 1200 | ≥ 3400 | ≥ 3400 | ≥14000 |
| 3 | System efficacy (Lumens/Watt) | ≥ 100 | ≥ 100 | ≥ 80 | ≥ 80 | ≥ 85 | ≥ 85 | ≥ 100 |
| 4 | Housing | CRCA Housing | CRCA Housing | Pressure Die Cast Housing | Pressure Die Cast Housing | CRCA Housing | CRCA Housing | Pressure Die Cast Aluminum Housing |
| 5 | Ingress Protection | IP-20 | IP-20 | IP-20 | IP-20 | IP-20 | IP-20 | IP-65 |
| 6 | Surge Protector | 2kV | 2kV | 2kV | 2kV | 2kV | 2kV | 4kV (Internal) & 10kV (External) |
| 7 | Mounting | Surface Mounted | False Ceiling | Surface Mounted | False Ceiling | Surface Mounted | False Ceiling | Hanging Type under Shed |
| 8 | Total harmonic distortion (THD) | <10% | <10% | <10% | <10% | <10% | <10% | <10% |
| 9 | Color rendering index (CRI) | >80 | >80 | >80 | >80 | >80 | >80 | >70 |
| 10 | Corelated color temperature (CCT) | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k |
| 11 | Power Factor | >0.95 | >0.95 | >0.95 | >0.95 | >0.95 | >0.95 | >0.95 |
| 12 | Ik Protection | NA | NA | NA | NA | NA | NA | IK-05 |
| 13 | Operating Humidity | 90% RH | 90% RH | 90% RH | 90% RH | 90% RH | 90% RH | 90% RH |
| 14 | Burning Hours | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| 15 | Operating Temperature | -5°C to 45°C | | | | | | |
| 16 | Lumen Maintenance | 70% at the End of Burning Hours | | | | | | |

(b) Outdoor Application:

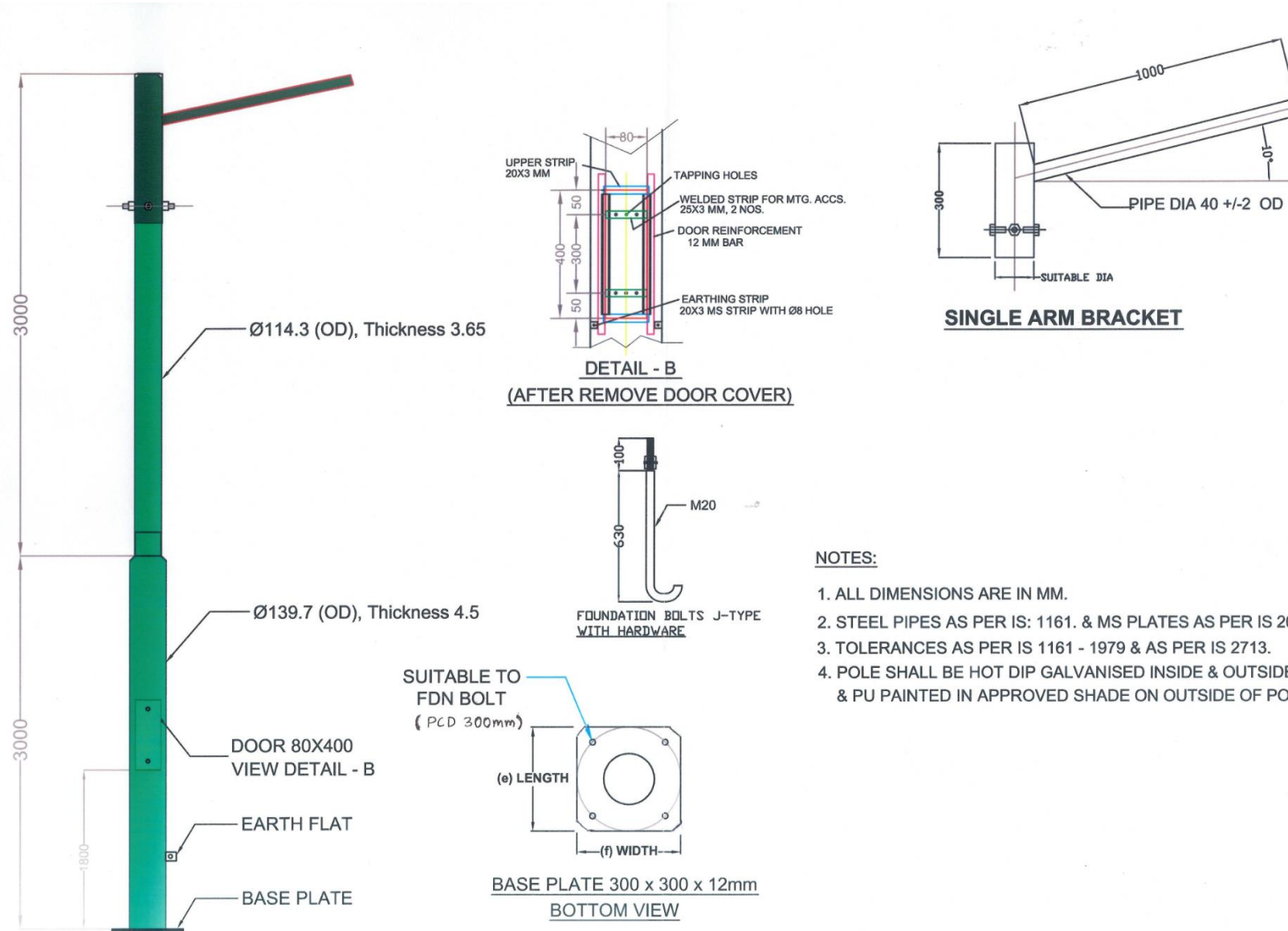
| S. No. | Technical Specification | BL (Surface Mounted Bulkhead) | SL-L1 (LED Street Light Luminaire) | SL-D1 (Pole Mounted LED Post Top Luminaire) | FL-1 (LED Flood Light Luminaries) | FL-2 (LED Flood Light Luminaries) |
|--------|-----------------------------------|---|---------------------------------------|--|--------------------------------------|--------------------------------------|
| 1 | System Wattage | ≤ 10W | ≤45W | ≤ 30W | ≤150W | ≤250W |
| 2 | System Lumen Output | ≥ 800 | ≥ 4000 | ≥ 2600 | ≥ 14000 | ≥ 23000 |
| 3 | System efficacy (Lumens/Watt) | ≥ 80 | ≥ 100 | ≥ 90 | ≥ 100 | ≥ 100 |
| 4 | Housing | Pressure Die Cast Housing and with Polycarbonate diffuser | Pressure Die Cast | Die Cast Aluminum | Pressure Die Cast Housing | Pressure Die Cast Housing |
| 5 | Ingress Protection | IP-65 | IP-65 | IP-65 | IP-65 | IP-65 |
| 6 | Surge Protector (Internal) | 3kV | 3kV | 3kV | 3kV | 3kV |
| 7 | Surge Protector (External) | 10kV | 10kV | 10kV | 10kV | 10kV |
| 8 | Mounting | Wall Mounting | Pole Mounting for 40mm max O. D | Suitable for 60mm max O. D | On Lattice Structure | On Lattice Structure |
| 9 | Total harmonic distortion (THD) | <20% | <10% | <10% | <10% | <10% |
| 10 | Color rendering index (CRI) | >70 | >70 | >70 | >70 | >70 |
| 11 | Corelated color temperature (CCT) | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k | 5700k±300k |
| 12 | Power Factor | >0.90 | >0.95 | >0.95 | >0.95 | >0.95 |
| 13 | Ik Protection | IK-09 | IK-05 | IK-05 | IK-05 | IK-05 |
| 14 | Operating Humidity | 90% RH | 90% RH | 90% RH | 90% RH | 90% RH |
| 15 | Burning Hours | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| 16 | Operating Temperature | -5°C to 45°C | | | | |
| 17 | Lumen Maintenance | 70% at the End of Burning Hours | | | | |

9. ANNEXURE-III: Portable Flood Lighting Panel

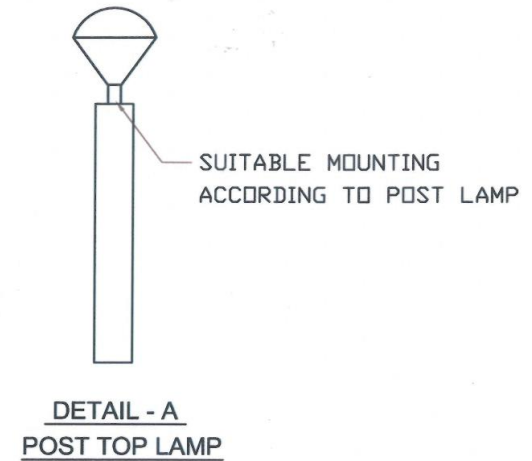
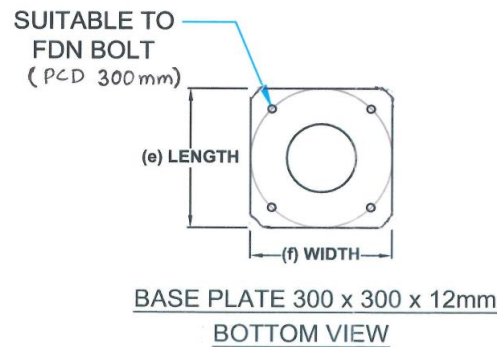
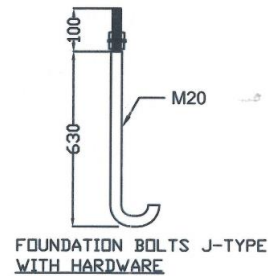
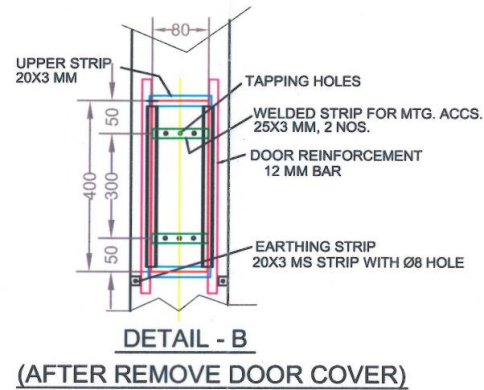
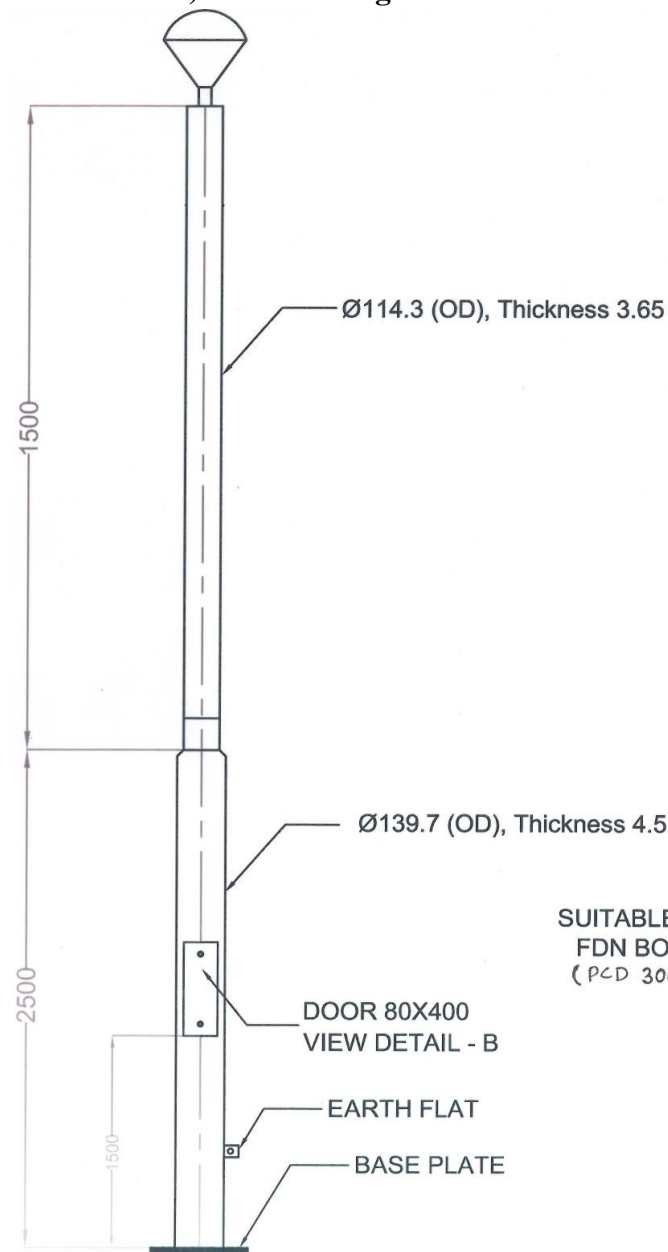


10. ANNEXURE-IV: Details of Lighting Pole

A). GA Drawing of 6 Meter Steel Tubular Pole SL-L1



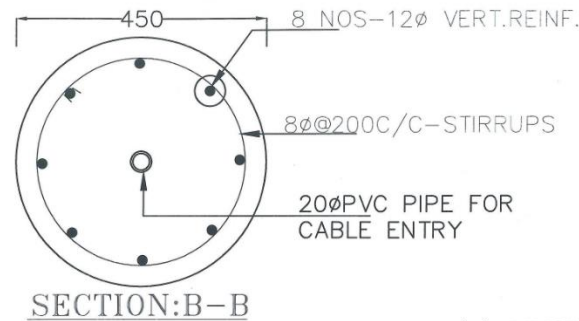
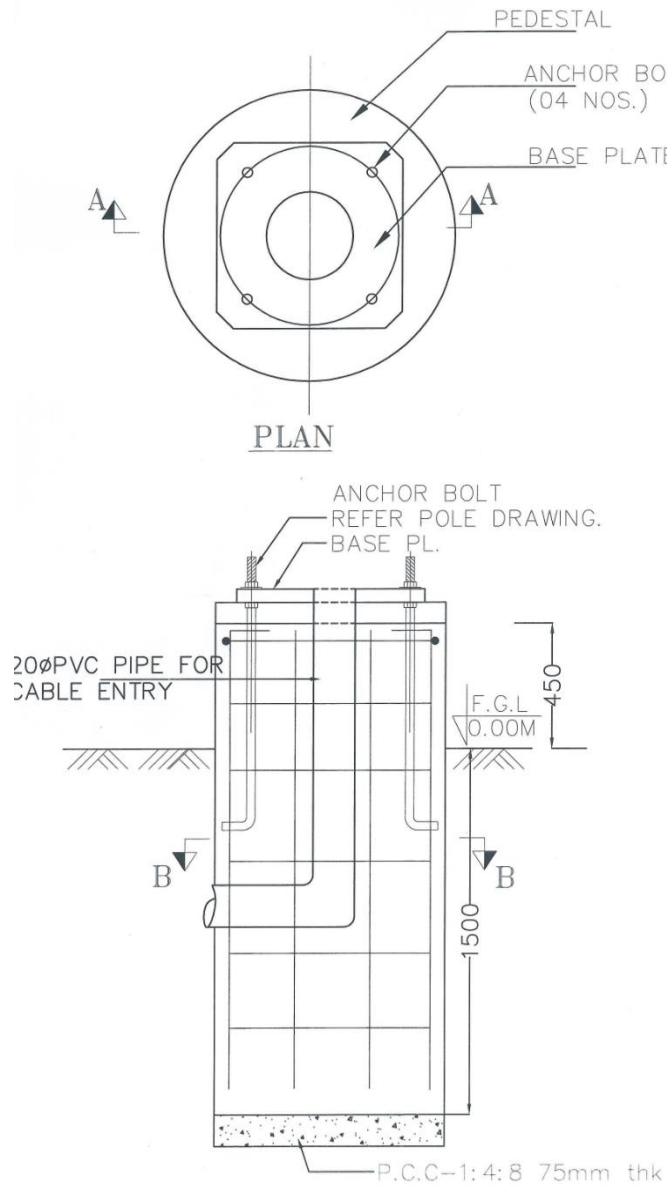
B). GA Drawing of 4 Meter Post Lamp SL-D1



NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. STEEL PIPES AS PER IS: 1161. & MS PLATES AS PER IS 2062.
3. TOLERANCES AS PER IS 1161 - 1979 & AS PER IS 2713.
4. POLE SHALL BE HOT DIP GALVANISED INSIDE & OUTSIDE & PU PAINTED IN APPROVED SHADE ON OUTSIDE OF POLE.

C). Foundation Drawing of pole



(A) GENERAL NOTES:

ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES
 ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED. THE DRAWINGS SHALL NOT BE SCALED.
 ALL STRUCTURAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ARCHITECTURAL
 DISCREPANCY IN DRAWINGS IF ANY SHALL BE BROUGHT TO THE NOTICE OF THE
 DESIGN OFFICE PRIOR TO CONSTRUCTION.
 EXECUTION OF R.C.C. WORKS/STRUCTURAL STEEL WORK AS PER OUR DRAWINGS SHALL BE
 THE RESPONSIBILITY OF SITE ENGINEER.

(B) SPECIFICATION NOTES FOR R.C.C WORK:

(GRADE OF CONCRETE)

CONCRETE FOR ALL WORKS AS PER BPS.

(REINFORCING STEEL)

ALL REINFORCING STEEL EXCEPT M.S LUGS FOR INSERT PLATES SHALL BE HIGH YIELD
 STRENGTH DEFORMED BARS CONFORMING TO GRADE Fe 415. OR Fe 500 AS

LUGS FOR INSERT PLATES SHALL BE PLAIN M.S BARS CONFORMING TO GRADE 1 OF IS:432
 (PART-1) 1966. IF FLATS OR ANGLES ARE USED AS LUGS, THEY SHALL CONFORM TO

(CLEAR COVER TO MAIN REINFORCEMENT)

UNLESS SHOWN OTHERWISE MIN. CLEAR COVER TO MAIN
 REINFORCEMENT SHALL BE AS FOLLOWS

| | |
|------------|-------|
| BOTTOM | 40mm. |
| TOP, SIDES | 40mm. |

(LAP LENGTH OR DEVELOPMENT LENGTH FOR DEFORMED BARS SHALL BE AS FOLLOWS)

—45xDIA OF BAR.

NOT MORE THAN 50% BARS SHALL BE SPLICED AT A SECTION.
 (LOCATION OF SPLICE SHALL BE DECIDED IN CONSULTATION WITH SITE ENGINEER & PRIOR
 APPROVAL OF DESIGN OFFICE).

IMP NOTE : THIS DRAWING IS NOT APPLICABLE FOR MARSHY
 LANDS