

Annexure Illumination

Illumination System: BOQ for receipt of material at Site, Unloading, Inspection, Verification , Storage, Up-keeping, Safety & Security, Material Handling, Erection Testing & Commissioning (ETC).

Supervision of ETC works shall be provided by the equipment supplier. The works include but not limited to the following:

1. ETC of Lighting Panels (LP) - including installation of accessories / mounting hardwares / anchor fastener / foundation bolt etc complete in all respect. For outdoor lighting panels cabling in trenches, GI/ PVC pipes or directly buried etc. is covered under the cabling items.
2. ETC of Lighting Luminaires - including installation of accessories i.e. mounting hardwares, anchor fastener, screw, nut bolt, mounting brackets for wall , ceiling, false ceiling, structure, street light pole, lighting mast, hanger pipe / chain etc complete in all respect.
3. ETC of Switchboards consisting of switch boxes, switches, switch plates and fixing accessories etc complete.
4. ETC of Junction boxes - including mounting hardware / accessories complete in all respect.
5. ETC of Receptacles - including mounting hardware / accessories complete in all respect.
6. ETC of fans - all types, emergency exit signboards, occupation sensors and other indoor items as per approved drawings.
7. ETC of PVC Wires.
8. Installation of conduits, erection hardware, and accessories.
9. Cabling (Covered as separate BOQ item) including laying, tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, hanger, supports, underground, buried in ground or through GI/PVC pipe over/under ground, through wall etc. All erection materials viz. ferrules, cable ties / straps, Al. tags, markers, GI / PVC wall sleeves with rubber / nylon bushes, cable lugs etc shall be supplied by bidder. Excluding supply of Cable Gland which are covered separately (as separate BOQ item). Machine ferruling shall be adopted.
10. ETC of lighting high mast and street lighting poles as per specification.
11. Handing over of ladders - All types.
12. EARTHING - The earthing includes earthing of illumination equipment, structures, illumination trenches etc complete for illumination system. GS strip including cutting, bending, welding with 40 mm dia MS rod riser/GS strip, clamping to structure/building wall etc. to complete. Consumable required for welding is in bidder's scope. Hardware required for connecting of earthing material on structure, equipment, luminaries, switches etc complete included in scope. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound. (Excluding supply of GI Flat, GI wire, Cu wire / braid, Al flat)

Indicative BOM of the supplies is attached as below which may be changed during engineering stage. Technical specification of illumination (Chapter-27, Volume IV) is attached. Bidder to quote accordingly.

CHAPTER 27 : ILLUMINATION SYSTEM

Instead of conventional type lighting fixtures, LED luminaires (BHEL supplied) will be installed by contractor.

1.00.00 SCOPE OF WORK

- 1.01.00 This scope of work shall cover the design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport F.O.R. site of POWER PLANT INDOOR AND OUTDOOR LIGHTING SYSTEM, complete with all materials and accessories for efficient and trouble-free operation.
- 1.02.00 The scope of work shall include complete installation, testing, commissioning and putting into successful commercial operation of the Lighting System of Power House, Mill building, Transformer Yard and all areas covered under power plant EPC package. This includes the supply of all labor, tools, implements and supplies.
- 1.03.00 The major areas to be illuminated under the scope of this package are listed in Annexure-4. The areas listed are however indicative only for the purpose of guidance to the bidder and is subject to change during detail engineering after finalization of plant layouts.

2.00.00 SCOPE OF SUPPLY

- 2.01.00 The equipment and materials within the scope of supply shall include but not limited to:
- i. Lighting transformer.
 - ii. Lighting fixtures with lamps and accessories and LED type fixtures for main roads, secondary roads, secondary roads & perimeter compound lighting.
 - iii. Lighting panels/boards: Main lighting distribution boards, emergency lighting distribution boards, emergency DC lighting panels, lighting panels, street lighting panels etc. All panels shall be provided with Energy Saving System.
 - iv. Street lighting poles, flood lighting towers and high masts.
 - v. Ceiling fans, pedestal fans, receptacles, switches, switchboards, portable emergency lighting unit, portable 24V supply module including handset maintenance equipment etc.
 - vi. Cables, wires, splicing/termination kits/connection accessories.
 - vii. Conduit and accessories, junction and pull boxes, terminal blocks.
 - viii. Grounding materials and connections.
 - ix. All fittings, supports, brackets, anchors, clamps and connections.
 - x. Steel for field fabrication of supports and brackets.
 - xi. Datasheet and technical leaflets on each of equipments / devices.

3.00.00 SCOPE OF SERVICE

- i. Carrying out of detail engineering including detail design calculations, preparation of lighting layouts showing location of fixtures, cable wires and conduit, preparation of cable schedule, and other related drawings as detailed in subsequent clauses and also consider the Energy Saving System.
- ii. Furnishing of all labour (skilled and unskilled), supervisory personnel, erection tools and tackles, testing equipment, implements, supplies, consumables & hardware and transport for timely and efficient execution of the contract work.
- iii. Preparation of **AS-BUILT** drawings showing field modifications, if any.

4.00.00 CODES AND STANDARDS

4.01.00 The design, manufacture and testing of equipment shall be carried out as per the latest Indian/International Standards, Indian Electricity Rules, Relevant Code of Practices and requirements of Govt. of Uttar Pradesh

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

4.03.00 Lighting Fixtures and Accessories

IS: 1913 General and safety requirements for luminaires.

IS: 2148 Flame proof enclosures of electrical apparatus.

4.04.00 Lighting Panels, Switch-boxes, Receptacles and Junction Boxes

IS:2147 Degree of protection provided by enclosures for low-voltage switchgear and control gear.

4.05.00 Electrical Installation Practices & Miscellaneous

IS: 1944 Code of practice for lighting of public thorough fare

IS: 3646 Code of practice for interior illumination.

IS: 5572 Classification of Hazardous areas (other than Mines) having flammable gases and Vapours for electrical installation

IS: 6665 Code of practice for industrial lighting.
National Electrical Code
Indian Electricity Rules.
Indian Electricity Act

5.00.00 DESIGN CRITERIA

5.01.00 The system provides lighting and electric power supply to all plant areas covering both BTG and BOP. In addition, it also provides lighting to selected areas during plant emergency conditions.

5.02.00 The system will be installed in an adverse industrial environment. Equipment in some areas will be subject to vibration, coal-dust and oil / water vapours as prevalent in a thermal power generating plant.

5.03.00 The design shall be such as to provide minimum lighting levels & lighting fixtures for different areas as per Annexure.

The systems shall be suitable for operation on available power supply having characteristics as given in Annexure.

All fittings of control room/office shall be energy efficient type.

6.00.00 SYSTEM CONCEPT

The lighting system shall comprise of following sub-systems:-

6.01.00 Normal A.C. Lighting

This will be provided by A.C. lighting fixtures distributed throughout the plant. These lights will be ON as long as the A.C. supply is available.

A.C. lighting fixtures will be fed from respective area lighting panels, which in turn will be connected to main lighting distribution board. The main lighting distribution boards will be fed through respective unit ratio lighting transformer, which forms a part of the MLDB. Normal A.C. supply thus made available by the MLDB is 415V-3ph-4W-50HZ effectively grounded. Both the MLDB and the lighting panels shall be provided with at least 20% spare outlets.

6.02.00 Normal cum Emergency A.C. Lighting

Emergency A.C. lighting will be provided in selected areas of the powerhouse, boiler area, boiler galleries, in some selected areas close to the power house, Control room, DG set control room switchgear room etc. for general visibility, safe movements and operation of important auxiliaries.

The emergency LDBs (ELDB) are similar to the MLDB except that lighting transformers in this case are fed from station A.C. Emergency bus having D.G. System backup. Thus power for A.C. emergency lighting is 415V-3ph-4W, 50HZ, effectively grounded.

The lighting fixtures connected to this system will be available whenever normal supply is available in the plant and also when DG set supplies power to 415V A.C emergency bus.

At least 25% of the fixtures shall be fed from AC emergency source.

6.03.00 Emergency D.C. Lighting

During station emergency involving total AC failure, incandescent lamp A.C/ DC lighting fixtures shall be provided for movement of personnel in important areas/buildings at strategic locations in critical operating areas and emergency exits. Emergency DC lighting will be catered by DC emergency lighting distribution (DCELDB) boards. These DCELDBs will feed the DC emergency lighting fixtures directly and through a numbers of DC emergency lighting panels (DCELP) located suitably in respective areas.

The DC Emergency Lighting Distribution Boards will be fed from two power sources, namely –

- i. Main Lighting Distribution Board (MLDB)
- ii. 220V DC distribution boards (DCDB)

These lights will be ON all the time - normally from A.C supply, but on its failure from D.C. supply through automatic switching.

Lighted Exit signs shall be provided and installed in the control room, switchgear room, relay room, maintenance areas.

Underground conveyor tunnels & buildings (ex- Switchgear room and control room etc) located in other distant areas like coal handling, Ash handling plants, WT plants, Water system plants etc., the fixtures shall be 'Instalite' type which is permanently connected to normal supply charging a battery. These will switch "ON" automatically when AC power supply goes "OFF". Further, in underground areas flameproof fixtures shall be provided.

6.04.00 Remote Emergency Lighting

This will be provided in isolated building/area/mobile equipments viz. Stacker-Reclaimer where D.C. supply is not available by self-contained battery/automatic charger/inverter/flood light units. These portable emergency light units will be energised automatically on loss of normal A.C. supply.

6.05.00 Street/Area Lighting

Time switch and photocell will be used for controlling streetlights with provision for manual override and also have the provision of latest Energy Saving Systems.

Same arrangement will also be used for controlling boiler gallery, ESP area , turbine floor (high bay), coal yard and railway marshalling yard lighting.

6.06.00 Receptacles

To cater to welding and other low voltage power requirement of the plant 63A TPN welding socket fed separate Welding receptacle distribution board shall be provided. For other services 15A, 3 pin socket shall be provided.

7.00.00 Not Used**8.00.00 RATING & REQUIREMENT**

- 8.01.00 The lighting system will be supplied from 415 V/415 V \pm 5%, indoor, dry type lighting transformers. Rating of each transformer shall be decided to limit the fault level within 9kA.
- 8.02.00 All equipment and accessories shall be designed for continuous operation under site conditions without exceeding permissible temperature rise as stipulated in relevant standards.
- 8.03.00 Switch, miniature circuit breakers (MCB), MCCB, bus bars shall be fully rated for short circuit level at the point of application. MCB shall have back-up HRC fuse if its rating is less than the available short circuit current.
- 8.04.00 All equipment and accessories shall have proper enclosure to suit the site conditions. Hazardous areas shall have flame-proof enclosure.
- 8.05.00 All wiring from lighting panels to fixtures and receptacles shall be carried out by PVC wires in G.I. Conduits.
- 8.06.00 Heavy duty XLPE FRLS cables will be used only for connections :
- i. From main lighting distribution boards to area lighting panels.
 - ii. From street/area lighting panel to street light poles/towers. From 415V MCCs to receptacles of 63A and above.
 - iii. From Emergency Main Lighting Distribution Board (ACEMLDB) to Emergency Lighting Panels (ELP).
 - iv. From DC Emergency Lighting Distribution Board (DCEMLDB) to DC Lighting Panels (DCLP).
 - v. From 415V PMCC /ACDB to receptacles of 63A and above.
- 8.07.00 Suitable number of Flood Lighting Towers / Lighting Masts with adequate HPSV Flood Light will be provided for crushed coal pile, entire railway marshalling yard and other necessary outdoor areas.
- 8.08.00 Lighting of all main streets, approach roads to various buildings shall be included.
- 8.09.00 Each lighting panel shall be provided with adequate number of outgoing miniature circuit breaker for controlling fixtures. 5A, 3Pin sockets shall be fed from the lighting panel through separate circuits.
- 8.10.00 All A.C. Normal and Emergency A.C. lighting shall be provided with Energy Saving System.
- 9.00.00 METHOD OF CALCULATION**
- 9.01.00 Standard Lumen method shall be adopted for interior & exterior lighting in order to determine the number of lighting fixtures for obtaining the desired average level of illumination.
- 9.02.00 The coefficient of utilization shall be considered to take care of Lumen loss due to:

- a. Effect of room dimensions
- b. Absorption of light in luminaries
- c. Absorption of light at various room surfaces in ceiling, wall etc.
- d. Floor cavity, ceiling cavity
- e. Mounting height

9.03.00 Additionally, a maintenance factor shall also be considered to account for the fall of illumination due to ageing, pollution like dust deposit etc.

Maintenance factors to be considered for various areas shall be as follows :

Area	Maintenance factor
Air conditioned offices/control rooms with false ceiling	0.75
Switchgear/MCC Rooms in TG Building/Service Building	0.65
Other indoor areas	0.6
Boiler area and other areas prone to chemical/dust pollution	0.55

9.04.00 **Utilisation Factor**

- Dusty area such as conveyor galleries/tunnels, TPs/ Crusher House etc. = 50% ceiling, 30% wall, 10% floor.
- Clear areas such as switchgear room / control room etc. = 70% ceiling, 50% wall, 10% floor.
- Working plain = a) At conveyor walkway level. B) At building floor level.

9.05.00 Voltage drop at the fixture from the MLDB bus shall not exceed 3%.

9.06.00 Circuit loading of each lighting panel shall be done in such a way that almost balanced loading in all the phases i.e. R, Y and B is achieved.

9.07.00 At least two sub circuits shall be used for illumination of a particular area.

9.08.00 Sub circuit loading of each lighting panel shall be restricted to 2000W or 12 Nos. fixtures whichever ever is lower.

The working plane shall be considered at 0.85 m from the floor level.

The value of the ratio of spacing (S) to mounting height (H) shall be commensurate with the type of fittings selected, uniformity of illumination. The suspension height for suspended fixtures shall not exceed 1 meter.

10.00.00 **SPECIFIC REQUIREMENTS - SUPPLY**

EQUIPMENT AND MATERIAL



1 x 660 MW - Panki Thermal Power Station

Bidding Doc. No. : 14A14-SPC-G-0001



- 10.01.00 Equipment and material shall comply with description, rating, type and size as detailed in this Specification, drawings, Datasheet and Annexures.
- 10.02.00 Equipment and materials furnished shall be complete and operative in all details.
- 10.03.00 All accessories, control devices, internal wiring, fittings, supports, hangers, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.
- 10.04.00 All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable.

10.05.00 Lighting Transformers

- 10.05.01 Lighting transformers shall be dry type, indoor type dusty vermin proof having ~~415 V/433 V~~ $\pm 2 \times 2.5\%$ with off load tap-changer on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral bushing exclusively used for grounding.). Rating of each lighting transformer shall be selected to cater to the maximum connected lighting. The casing of the transformer shall be grounded at least at two (2) points.

415V/415V

REFER
AMMENDMENT-1
ELECTRICAL

- 10.05.02 If necessary, apart from the main lighting transformers, separate small additional lighting transformers may be used at distance lighting points.

10.06.00 Lighting Fixtures

- 10.06.01 Lighting fixtures shall be designed for minimum glare. The surface finish shall be smooth, unobtrusive and scratch resistant.
- 10.06.02 Reflector shall be of sheet steel or aluminium, minimum 20 SWG thick, securely fixed by fastening device of captive type.
- 10.06.03 Fixture shall be suitable for 20 mm conduit entry and 16 SWG G.I. earth-wire connections. Fixture shall also be suitable for case coupling entry wherever required.
- 10.06.04 High bay fixtures shall have provision for vibration damper to ensure rated lamp life.
- 10.06.05 Fixture shall be furnished complete with lamps and integrally/non-integrally or separately mounted control gear & accessories or applicable for different types of fixtures. These shall include holders, ballast, capacitor, starter, igniters (separate type) etc.
- 10.06.06 Fixtures shall be fully wired up to respective terminal blocks, suitable for loop in and loop one connection of PVC wires of following sizes:-
- b) Lighting fixture : 2.5 Sq.mm Copper
 - c) Flood Light fixture : 2x2.5 Sq.mm Copper

10.07.01 Lamps

1 x 660 MW - Panki Thermal Power Station

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- 10.07.01 General lighting service (GLS) lamps shall be with clear glass and screwed caps. However, it is preferred to replace GLS lamp by CFL or other energy efficient lamps.
- 10.07.02 All fluorescent lamp shall be bi-pin rotary type and cool daylight. Lamp holder shall be spring loaded, low contact resistance type and shall have resistance to wear and tear.
- 10.07.03 Mercury/Sodium vapour lamp shall be colour corrected type with screwed cap.
- 10.07.04 Lamps shall be suitable for use in position and capable of withstanding small vibrations. Restrictions and special features, if any, shall be clearly indicated in the bid.
- 10.07.05 CFL and T5 fluorescent tube with electronic ballast or tri phosphorous tube.
- 10.07.06 Latest energy saving LED type lighting fixture/ lamps suitable for street light and other non critical areas.

REFER TABLE-1 OF
AMMENDMENT-1 ELECTRICAL

10.08.01 Ballast/Electronic Ballast

- 10.08.01 Ballasts shall be heavy duty, low loss, polyester-filled type with copper winding.
- 10.08.02 Ballast for Mercury/Sodium vapour lamp shall be provided with suitable tappings to set the voltage within range specified.
- 10.08.03 Ballasts shall be free from hum. Ballasts which produce humming sound shall be replaced without any implication by the Contractor.
- 10.08.04 In multi-lamp fixture, each lamp shall be provided with individual ballast.
- 10.08.05 Ballast windings shall have maximum operating temperature of 120 Deg.C without rated temperature rise marking.
- 10.08.06 Ballast for Control Room Area shall be heavy duty, low loss, high-grade silicon steel stampings, vacuum impregnated polyester resin filled with copper winding.

Ballast for other area shall be electronic type, flicker free pre heat lamp start type having power consumption less than 3-watts per ballast, power factor less than 0.98 and THD less than 10%. Ballast shall operate at operating frequency of more than 40 kHz. Power consumption of ballast for 36W Fluorescent Tube shall be less than 9.5W.

Electronic Ballast shall be suitable for 220V DC and also 240V AC.

Electronic Ballast shall be of such design that minimum 25% reduction in energy consumption at constant luminous flux compared with conventional gear.

Electronic Ballast shall provide constant light independent of mains voltage fluctuation.

10.09.01 Lighting Panel/Distribution Boards



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- 10.09.01 Lighting Distribution Boards/panels shall be metal-enclosed, cabinet type, fabricated, fully drawout type from CRCA sheet steel minimum 2.5 mm thick for load bearing members and 2.0mm for non-load bearing members, suitable for either wall/column mounting on brackets or floor mounting on channel sills. The panel shall be provided with lifting hooks. The LPs will be connected to LDB only.
- 10.09.02 Indoor Lighting Distribution Boards & Lighting Panels shall be dust and vermin-proof, IP-54 or better. Outdoor panels shall be weather-proof with canopy, IPW-55 or better. The cubicle housing transformer shall be minimum IP-42.
- 10.09.03 Lighting Distribution Boards and Lighting Panels shall be so constructed as to permit free access to the terminal connections and easy replacement of parts. Front access doors shall have padlocking arrangements. The LDB shall be fixed on a bottom channel 75mm.
- 10.09.04 Lighting Distribution Boards shall have provision of cable entry from bottom and, panels shall have provision of cable entry from top and bottom, as required, with removable gland plates. Necessary double compression type brass cable glands, tinned copper/Aluminium cable lugs are to be furnished.
- 10.09.05 Two ground pads with M10 G.I. bolts and nuts shall be provided on each Lighting Distribution Board and Lighting Panel for connection to ground conductor.
- 10.09.06 Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed on front cover and a directory plate fixed on inside of the front cover. This directory Plate shall contain details of the Lighting Panels being fed from the Distribution Board including their designation, location, loading etc.
- Each Lighting Panel shall be complete with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of each circuit. The plates shall be of anodized aluminium with inscriptions indelibly etched on it.
- 10.09.07 Bus bar shall be electrolytic grade hard drawn aluminium, colour coded for easy identification and designed for a maximum temperature of 85°C. Minimum size shall be 25 x 6 mm. The current density of Aluminium bus bar should not be below 0.8 Amp/Sq.mm. The bus bar shall be provided with heat-shrunk/cold-shrunk PVC sleeve.
- 10.09.08 Board / Panel shall be fitted with phase barriers such that it is not readily possible for personnel to touch the phase busbars. Insulation barriers shall preferably be fitted around the circuit breakers such that only the surface and the toggle of the circuit breaker is available on the front.
- 10.09.09 Incoming and outgoing circuits shall be terminated in suitable terminal blocks.
- 10.09.10 In lighting and receptacle panel 3-phase and 1-phase MCB should not be mixed.
- 10.09.11 In high bays, walkway shall be provided for maintaining light fittings. At other

places suitable ladder / platform / approach shall be provided for maintaining / replacement of light fittings.

10.10.00 **Board/Panel Equipment**

10.10.01 Each board shall consist of one dry type transformer housed in the different cubicles one (1) V.T operated voltmeter with selector switch, one (1) C.T operated ammeter selector switch, VTs, CTs, three (3) nos. phase energized indication lamps backed up by fuses and incoming triple pole MCCB. Proper discrimination between outgoing MCCB of lighting distribution board and downstream MCCB of lighting panel shall be ensured.

10.10.02 Each lighting panel shall have an incoming triple pole MCCB with neutral link and a number of outgoing miniature circuit breakers (MCB).

10.10.03 Board/Panel access door shall be interlocked with incoming MCCB such that the door can be opened only when the switch is in OFF position. Means shall be provided to defeat this interlock.

10.10.04 All MCCB shall be single throw, air break and heavy duty type having quick-make quick-break contacts. Fuses shall be HRC link type.

Contactors shall be air-break electromagnetic type. Push buttons shall be push to actuate type.

10.10.05 MCB shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.

10.10.06 Time switch in street lighting panels shall be photocell type with automatic voltage stabilizer and necessary electronic unit with provision for sensitivity adjustment depending on external light intensity. When the exterior illumination level shall fall below a preset value for a considerable period of time (adjustable 30 sec. to 180 secs.) the electronic unit shall generate signal for the output relay to pick-up and potential-free contact of the same shall be used for control of contactor for lighting system. Sustained normal illumination level being restored (adjustable 30 sec. to 180 sec.) the lights shall switch off.

10.10.07 Voltmeter / Ammeter shall be of accuracy class 2.0 or better as per IS:1248 Voltmeter / Ammeter selector switch shall be of reputed make.

10.11.00 **Receptacles**

10.11.01 Receptacles shall be heavy duty, complete with individual plug and switch.

10.11.02 The conduit box of the receptacle shall be provided with earthing screws with washer and nuts welded on the surface for grounding with 16 SWG G.I. wire. Arrangement shall be provided inside the conduit box for grounding of third pin.

10.11.03 Shrouded type plug shall be provided with corresponding matching arrangement at sockets to prevent accidental contact with finger during plug insertion.

10.11.04 Receptacles shall be of following types:



1. Type RA-6A, 240V, 2 pole, 3 pin type with third pin grounded, suitable for flush mounting in MCC Room, office areas, control rooms, store rooms, cabins etc. The switch shall be of piano-key type, also flush mounted and decorative non-industrial type.
2. Type RB-16A, 240V, 2 pole, 3 pin Industrial type with third pin grounded, metal clad with gasket having 19mm conduit entry and a metallic screwed cover tied to it with a metallic chain and suitable for installation in clean/dusty areas. The receptacles located in switchgear rooms, MCC rooms and control room shall have IP-42 degree of protection and those located in other dusty areas shall have IP-62 degree of protection. These receptacles shall be located at an interval of 50M along length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper. Minimum one (1) no shall be provided in all equipment floor, feeder floor, boiler drum level, TPs Crusher House, Control Room, Pump House, Transformer Room and at suitable location in all other areas as required. In fuel oil area receptacles will be of flameproof type.
3. Type RC-63A, 415V, 3 phase, 4 pin Industrial type interlocked plug and switch with earthing contact. Other requirements shall be same as Type RB. Interlocking shall be so selected that the switch can be put to 'ON' position only when all the four (4) pins of the plug are housed with complete alignment. In 'OFF' position of the switch the socket outlet shall be completely dead and outgoing terminals isolated. Welding receptacles shall be connected with each other in loop-in loop-out connection to the extent of 3 Nos., located at an interval of 50 M. along the length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper. and minimum one (1) no. shall be provided in all equipment floor, T.Ps, crusher house, wagon tippler, pump house, Cable spreader room, transformer room, boiler platform etc. Separate distribution board shall be used to feed these welding receptacles coming in TG building and boiler areas. At least one (1) no. shall also be provided in each offsite building, which will be fed from 415V MCC. In hazardous areas these receptacle shall be located in MCC rooms.

10.12.00 Fans & Regulators

- 10.12.01 The fan shall have three well balanced blades. And shall be reasonably free from noise. Pedestal fans shall also be provided as per Owner's requirement.
- 10.12.02 Fan motor shall be totally enclosed type with copper winding & class E insulation.
- 10.12.03 Regulator shall have minimum five steps. Electronic regulator with smooth control is preferred.

10.13.00 Switch & Switch Board

- 10.13.01 All switch boards/boxes shall be of bent steel construction, fabricated of 14 SWG M.S. sheet with 6 mm thick Bakelite cover with brass fixing screws.
- 10.13.02 Switch boards/boxes located in control room and office areas shall be flush mounted type on brick wall with only the switch knob projecting outside.
- 10.13.03 Switch boards / boxes shall have conduit knock outs on the sides. Adequate



provision shall be made for ventilation of these boxes.

10.13.04 Flush type receptacles where provided shall be so located that only the plug projects outside.

10.13.05 Switches shall have quick-make and quick-break mechanism operated by a suitable external handle complete with position indicator.

10.14.00 **Lighting Poles/Towers**

10.14.01 **Street Light Poles**

- i. Street light poles shall be swaged and welded steel pole, complete with fixing brackets, weather-proof junction box and all other accessories.
- ii. The pole shall be coated with bituminous preservative paint on inside as well as embedded outside surface. Exposed surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in synthetic medium).

10.14.02 **Flood Light Tower**

- 13 Flood light tower shall be a lattice structure with maintenance platform and approach ladder. All structural members and hardware shall be hot-dip galvanized.
- 14 Structures shall be designed for an additional load of 1500kg for maintenance crew. Deflection under maximum wind pressure shall not exceed 1 in 360. Structural design shall be as per IS-800 and subject to Owner's approval.

10.14.03 **Lighting High Masts**

Applicable standards

IS-875 (Part-III) 1987	-	Code and practice for design loads for Structures.
BSEN 10025/DIN 17100	-	Grade of M.S. Plates.
BS-5135/AWS	-	Welding
BS.ISO 1461	-	Galvanizing
TR. No. 7200 of ILE	-	UK Specification for Mast and foundation.

Structure

Lighting High Mast shall be of continuously tapered polygonal cross section, at least 20 sided, hot dip galvanized and presenting a good and pleasing appearance and shall be based on proven In-Tension design confirming to the standards referred to above, to give an assured performance, and reliable service. The structure shall be suitable for wind loading as per IS-875 Part-III, 1987. The masts dimensions shall be as per standards.

The Mast shall be of 30M height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame,

Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaries, suitable aviation warning light, lightning along with necessary power cables within the mast. The mast shall be delivered only in three sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast.

High mast shall be complete with feeder pillar panel for power distribution to lighting fixtures and winch motor. Feeder pillar panel shall be outdoor type stand mounting with dust and vermin proof, IP 55 and constructed of 14 swg sheet steel.

10.15.00 **Maintenance Equipment**

10.15.01 The Contractor shall supply one (1) no. of wheel mounted adjustable aluminium ladder for the maintenance of street lights.

10.15.02 For the maintenance of lighting fixtures within the power house, the contractor shall also supply two (4) nos. free standing adjustable aluminium ladder, adjustable from 5m. to 10m.

10.15.03 . For the maintenance of lighting fixtures within the CHP area, the Bidder shall supply two (2) nos. free standing adjustable aluminium ladder, adjustable from 5m. to 10m.

10.16.00 **Special Requirement**

10.16.01 All outdoor illumination fixtures, unless it is fed from photocell/time switch controlled lighting panel, has to be provided with outdoor type local switches.

10.16.02 In all the air filtration units and air handling units, one marine type lamp (of 100 Watt approx.) shall be supplied the wiring and fixing of the same has to be done by the contractor.

10.17.00 **Conduits and Accessories**

10.17.01 Conduits shall be rigid steel, hot-dip galvanised, furnished in standard length of 3 metres, threaded at both ends.

10.17.02 Conduits upto and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 20 mm.

10.17.03 Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushings at both ends.

10.17.04 Flexible conduits shall be made with bright, cold rolled annealed and electro-galvanized mild steel strips and coated with PVC.

10.17.05 Conduit Wiring for Chimney

- a) Complete C.I. conduits, PVC insulated wires, G.I. grounding conductor, weather proof outdoor junction box and all accessories viz. supports, clamps, junction boxes, etc. to make the installation complete in all respects. Conduit wiring shall be from the lighting fixtures to the junction box located at the bottom of the chimney.

- b) All the obstruction lights shall be uniformly distributed over three single phase circuits. Conduit wiring for lighting installation shall be done with PVC cables drawn through the G.I. conduit of proper size. The GI conduits shall be terminated to a fuse box mounted on the chimney shell, at an accessible height from the ground. The cables shall be 1100/650 V Grade, 1/c, 10mm², PVC insulated and sheathed Stranded Aluminium conductor. The conduits shall be clamped at interval not greater than 600 mm. by means of approved type of saddles, clamps, etc. securely fixed on the shell/ladder. PVC bush shall be used at either end of the conduit. The minimum size of conduit to be used for the installations shall be 65mm. Pull boxes, at intervals of not more than 10 meters, inspection bends, etc. are to be provided at suitable locations to facilitate laying of wires. 8 SWG G.I. wire shall be run along the conduit for grounding purpose. All conduit accessories and junction boxes shall be hot-dip galvanized and of approved type. Wiring shall be done as per the relevant IS specification.

10.18.00 **Junction Box**

- 10.18.01 Junction boxes shall be of 16 SWG sheet steel hot-dip galvanized, dust and damp proof, generally conforming to IP-66.
- 10.18.02 Junction boxes shall be complete with gasketed inspection cover, conduit knock out/threaded hub and terminal blocks.
- 10.18.03 Junction boxes for outdoor use shall weatherproof IPW-66 and those for hazardous location shall be flame-proof type suitable for a particular zone / gas group in compliance with IS: 2148 / IS: 13346 and shall have certification from CIMFR, Dhanbad.
- 10.18.04 Junction boxes shall have following indelible markings :
- Circuit nos. on top
 - Circuit nos. with ferrules (inside) as per drawing
 - DANGER sign in case of 415V circuit

10.18.05 **Junction Box for Chimney**

The junction box at the chimney bottom shall be weather proof and suitable for flue laden atmosphere and provided with suitable terminal blocks and conduit knockouts for incoming cables and outgoing conduits. Double compression type cable gland shall be used for incoming cables.

10.19.00 **Lighting Cables & Wires**

- 10.19.01 Lighting Cable shall be heavy duty, 1100 Volt grade, multi-core stranded aluminium conductor, XLPE insulated, extruded PVC inner sheath, single round G.I. wire armoured and overall PVC sheathed with FRLSH conforming to IS 1554.
- 10.19.02 Lighting wires shall be 1100 Volt grade, PVC insulated, stranded conductor, single core cable conforming to IS 694, colour coded as below :
- RED for R-Phase BLACK for Neutral
- YELLOW for Y-Phase WHITE for + 'Ve D.C.

BLUE for B-Phase GREY for -'Ve D.C.

10.19.03 Wire size shall be as follows :

For point wiring beyond lighting panel : 10 Sq.mm. Aluminium.
i.e. from lighting Panel to junction Stranded conductor
box (main run)

From Junction box to lighting fixture : 2.5 Sq.mm. Copper.
Stranded conductor.

Receptacle : 4 Sq.mm. Copper

10.20.00 **Terminals**

10.20.01 Multi way terminal blocks of approved type, complete with screws, nuts, washers and marking strips shall be furnished for connection of incoming/outgoing wires.

10.20.02 Each terminal shall be suitable for connection upto 2 nos. 10 Sq.mm stranded aluminium conductors without any damage to the conductor or looseness of connectors.

10.21.00 **Portable Emergency Lighting Unit**

The portable emergency lighting unit shall be complete with storage battery (rechargeable), inverter, automatic charger, twin 6W fluorescent tube lamp and test switch. Contractor shall furnish make, type and catalogue.

10.22.00 **24V Supply Module**

10.22.01 Each 24V A.C. supply module shall have one(1) no. air-cooled two winding, 500VA, 1-phase, 50HZ, 240/24V transformer with 6A (240V side) and 16A (24V side) HRC fuse in primary and secondary side and necessary 240V and 24V terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module shall be fed from respective lighting panels. A group of 6A, 24V AC receptacles located near Boiler access doors and condenser area shall be wired up to 24V side of each 24V A.C supply module.

The 24V A.C. supply modules shall be sheet steel enclosed with louvers and shall be suitable for outdoor use. The 24V A.C. supply modules shall be suitable for wall/steel structure/column mounting. Switches shall be mounted at the front on sheet steel enclosure.

10.22.02 Portable 24 V AC Supply modules having sheet steel enclosure with louvers as per above shall be supplied at entry and exit point of all room/ building. 24V halogen automobile lamp with reflector alongwith 1100 V twin core PVC sheathed 2.5 mm² stranded copper wire of 20 M length as handset.

10.23.00 **Indication Lamp**

Lamps shall be clustered of LED type. LED lamp shall be made in accordance with InP Technology (Aluminium Indium Gallium Phosphide Technology). The



body shall be made of Poly Carbonate Unbreakable Lens. LED shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. LED circuit shall be PCB mounted. Intensity shall be greater than 200 mcd. All Push Button lamps shall be as per LED indicating lamp.

10.24.00 **Contactors**

10.24.01 Contactors shall be three pole, air break type, with non_bouncing silver/silver alloy contacts. Contactor duty shall be class III _ category AC3 for unidirectional drives and AC4 for bi_directional and inching drives/class I _ category DC2.

10.24.02 Each contactor shall be provided with minimum two (2) N/O and two (2) N/C auxiliary contacts rated 10 A at operating voltage. The exact requirement of contacts shall be decided by the Vendors taking into account the scheme requirements and spares.

10.24.03 Contactor starters shall comply with the requirements of IS_8544 (Part _ 1) in respect of co_ordination of the characteristics of contactor, overload relay, and fuse. The type of co_ordination shall be Type _ C as per IS_8544.

10.25.00 **Remote Stop Push Button Station (RPB)**

10.25.01 Remote Push button shall be utilised for manual ON/OFF for group of lights is approved selected zone. RPB's shall be metal enclosed, fabricated from CRCA sheet steel minimum 2 mm thick and shall be provided with a STOP Push Button only wired up to terminal block. RPB's shall be suitable for wall / column mounting on brackets. RPB shall be dust & vermin proof, IP-54 or better. In case of outdoor it shall have IPW 65 with additional weatherproof protection RPB shall have provision of cable entry both from top & bottom, as required with removable gland plates, minimum 2 mm thick.

10.25.02 Push button shall be heavy duty, oiltight, push to actuate type with integral escutcheon plate marked with its function.

10.25.03 Each push button shall have one (1) normally open and one (1) normally closed contacts rated 10 A at 240V.

10.26.00 **Nameplate**

Nameplates shall be furnished for identification of devices and circuits. All switches, controls and indications shall be permanently and legibly marked in English as to their functions.

All lighting fixtures, receptacles, fans, junction boxes etc. shall be properly marked up indelibly with corresponding circuit numbers.

10.27.00 **Samples**

Owner reserves the right to call for samples if considered necessary and the same shall be submitted by the Bidder free and without any obligation.

10.28.00 **Energy Saving System**

Panels



The energy saving system panel shall consists of loss less reactance coils with voltage tapping, contactor to select the tap, Micro-processor based TIMER along with real time clock for activating the contactor at a pre-set time. The unit shall be programmable so that at a pre-set time contactor on the lower voltage tap can be selected and reduced voltage can be applied across the circuit. It shall also be possible to modify the setting at site, if required.

The capacity of panels shall be 25/30 kVA or more as required. This system shall be incorporated in normal AC panels and Emergency AC panels.

Lamps

CFL and T5 fluorescent tube with electronic ballast or tri-phosphorous tube.

11.00.00 **SPECIFIC REQUIREMENTS-SERVICES**

11.01.00 **Consumables and Hardware**

11.01.01 The Contractor shall furnish all erection materials, hardware and consumables required for the completed installation.

11.01.02 The materials shall include but not limited to the following:-

- | | | | |
|----|-------------|---|---|
| a. | Consumables | : | Welding rods & gas, oil and grease, cleaning fluids, paints, electrical tape, soldering materials etc. |
| b. | Hardware | : | Bolts, nuts, washers, screws, brackets, supports, clamps, hangers, saddles, cleats, sills, shims etc. |
| c. | Materials | : | Junction boxes, terminal blocks, connectors, ferrules, lugs, brass glands, rigid/flexible conduits, cables, ground wires etc. |

11.01.03 Supply of cement, sand, stone etc. required for the execution of the contract shall be the responsibility of the Contractor.

12.00.00 **ERECTION TOOLS & TACKLES**

12.01.00 The Contractor shall provide all tools, tackle, implements, scaffoldings, ladders, etc. which are required for handling and erection of the equipment and materials.

Installation work shall be carried out in accordance with good engineering practices and also manufacturer's instructions/ recommendations where the same are available.

Equipment shall be installed in a neat workmanlike manner so that it is level, plumb, square and properly aligned and oriented

12.02.00 **Street Lighting Poles**



Erection of Street Lighting poles together with all its accessories including civil foundation work, installing lighting fixture, wiring and cabling work are included within scope of contractor.

12.03.00 **Flood Lighting Tower**

12.03.01 Erection of Flood Lighting Towers including civil foundation work shall be done by Contractor.

12.03.02 Contractor shall also mount assembled fixtures, outdoor & lockable type isolating switch cubicle install necessary cabling and wiring make connections.

Floodlights shall be mounted on steel base facing the tentative direction shown on the drawing. Fixing holes shall be provided with slot to turn the fixture about 5° on both sides. Bolts shall be finally tightened with spring washer.

The contractor shall supply and install the steel base for fixing the flood light on the flood light towers.

Terminal connections to the floodlight shall be made through PVC coated flexible metallic conduits.

12.04.00 **Receptacles**

Receptacles shall be installed at locations shown in the approved drawings.

12.05.00 **MLDB, EMLDB, DCELDB and Lighting Panel**

MLDB, EMLDB, DCELDB and Lighting Panels shall be erected at the locations indicated in approved drawings.

12.06.00 **Lighting High Masts**

Erection of Lighting Masts together with all its accessories including civil foundation work, installing lighting fixture, wiring and cabling work are included within scope of contractor.

12.07.00 **Lighting Fixtures**

12.07.01 Continuous rows of fluorescent tubes shall be mounted on a continuous M.S. angle for each row of lights.

12.07.02 In turbine hall, fixtures shall be mounted to maintain sufficient clearance from the overhead travelling crane trolley.

12.07.03 In boiler galleries, mounting height of fixtures shall be about 2500 mm from platforms except shown otherwise.

12.07.04 Bracket for fixture mounting shall be fabricated at site from 40 mm conduits with a reducing socket to suit the fixtures and clamped on to the handrails. The fixing shall be strong enough to withstand vibration and high wind velocity.

If a roof over platform is available, the fixture can be pendant mounted.

- 12.07.05 Fixtures shall be mounted on sub_station structures with suitable clamps. No cutting or drilling of sub_station structures is permitted. It is preferable to provide separate structures in Switchyard and Substation.
12. 07.06 The fixtures after erection shall be marked up indelibly with corresponding circuit number for easy identification of lamp circuit.
12. 08.00 **Wiring**
12. 08.01 Wiring shall be generally carried out by PVC wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.
12. 08.02 Wire shall not be pulled through more than two equivalent 90° bends in a single conduit run.
12. 08.03 Wiring shall be spliced only at junction boxes with approved type connections or terminal strips. Maximum two wires can be connected to each way of the terminal block. Splicing of only one phase shall be done in a junction box.
12. 08.04 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.
12. 08.05 For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/ junction box.
12. 08.06 A.C. and D.C. circuits shall not be run in the same conduit and junction boxes. Circuits fed from different transformers shall be run through different conduits and Junction boxes.
12. 08.07 Receptacle circuits shall be kept separate and distinct from lighting and fan circuits.
12. 08.08 Separate neutral wire shall be provided for each circuit. Wiring throughout the installation shall be such that there is no break in the neutral wire in form of switch or fuse.
- 13.00.00 **CONDUIT SYSTEM**
- 13.00.01 In case of unarmoured cable, all conduits shall originate from the respective lighting panel and terminate in lighting fixtures, receptacles etc.
- 13.00.02 Exposed conduits shall be run in straight lines parallel to building columns, beams and walls as far as practicable. Unnecessary bends and crossings shall be avoided to present a neat appearance.
- 13.00.03 Conduit supports shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.
- 13.00.04 Conduits shall be clamped on to approved type space plates or brackets by saddle or U-bolt. The spacer plates or brackets in turn, shall be fixed to the building by welding and to concrete or brick work by grouting as shown on drawing.
- 13.00.05 Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.

- 13.00.06 Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.
- 13.00.07 Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less than 40 mm.
- 13.00.08 Where conduits are run on cable trays they shall be clamped to supporting steel at an interval of 600 mm.
- 13.00.09 For directly embedding in soil, the conduits shall be coated with an asphalt base compound. Concrete pier or anchor shall be provided where necessary to support the conduit rigidly and to hold it in place.
- 13.00.10 Conduits shall be installed in such a way as to ensure against trouble from trapped condensation.
- 13.00.11 Running threads shall be avoided as far as practicable. Where it is unavoidable, check nuts shall be used.
- 13.00.12 Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating device etc. when it is evident that such proximity may impair the service life of cables.
- 13.00.13 Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run.
- 13.00.14 For long run, junction/pull boxes shall be provided at suitable intervals to facilitate wiring.
- 13.00.15 Conduits shall be securely fastened to junction box or cabinets, each with a locknut and insulated bushing inside the box and locknut outside.
- 13.00.16. Conduit lengths shall be joined by screwed couplers. Couplers shall be clearly cut.
- 13.00.17 Conduit joints and connections shall be made thoroughly water tight and rust proof by application of a thread compound which will not insulate the joints.
- 13.00.18. White lead is suitable for application on embedded conduit and red lead for exposed conduit.
- 13.00.19. The battery Room installation shall be made with acid fume proof conduits.
- 13.00.20 Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations or flattened surfaces. Heat shall not be applied in making any conduit bend.
- 13.00.21 The entire metallic conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded.
- 13.00.22 Lighting fixture shall not be suspended directly from junction box in the main conduit run.

- 13.00.23 Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduits ends shall be plugged or capped to prevent entry of foreign material.
- 13.00.24 After installation the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.
- 13.00.25 In control rooms and office areas provided with false ceiling conduct run shall be concealed type, embedded in the walls.
- 14.00.00 **Cabling**
- 14.00.01 In outdoor areas, main runs from lighting panels shall be by means of XLPE cables, directly buried in ground or laid in trenches for the underground portion and through conduit for the above ground portion.
- 14.00.02 Buried cables shall be laid and covered with sand/riddled earth, and protected from damage by bricks at sides and precast concrete slab at top. Buried cables shall have cable markers at 50M interval and projecting 150 mm above ground. At cable bends and joints markers shall be provided.
- 14.00.03 When buried cables cross road/railway track, additional protection to be provided in form of G.I. pipe.
- 15.00.00 **Grounding**
- 15.00.01 All lighting panels, junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. Rules.
- 15.00.02 Ground connections shall be made from nearest available ground grid. All connections to ground grid shall be done by arc welding.
- 15.00.03 Panels/Boards shall be directly connected to ground grid by two nos. 35 x 6 mm G.S. flats. (for panels/two nos. 50x6 mm G.S. flats (for distribution boards).
- 15.00.04 All junction boxes, receptacles, lighting fixtures etc. shall be grounded with 8 SWG G.S. wire.
- 15.00.05 Each street lighting Pole shall be grounded at two points by two nos. 50x6 mm G.S flat risers from two (2) nos. earthing spike 40 mm dia & 3m long directly driven into ground at a depth of 1m from ground level. The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 16 SWG GS wire. One 16 SWG G.S wire shall be taken upto the junction box from lighting fixtures and connected to grounding point.
- 15.00.06 Two (2) nos. earthing spike 3m long & 40 mm dia directly driven into ground at a depth of 1m from ground level shall be provided for each flood lighting tower.
- The sheet steel cubicle housing the power supply Isolator at base of flood lighting tower shall be connected at two (2) points from these earthing risers by 16 SWG G.S. wire - The flood lighting fixtures shall be grounded by one (1) 16 SWG G.S wire running through the lighting conduct upto the distribution box.

Two (2) nos. separate spike of 3m long & 40 mm dia directly driven into ground at a depth of one (1)m from ground level shall be provided for connection of the lighting must on top of flood lighting tower through two (2) nos. 50x6 mm G.S. flat down conductor.

A continuous ground conductor of 12 SWG G.S. wire shall be run all along each conduit run and bonded to it every 600 mm by not less than two turns of the same size of wire. This conductor shall be connected to each panel ground bus.

16.00.00 **Foundation & Civil Works**

16.00.01 Equipment foundations panel foundations and all other civil work will be provided by the Contractor.

16.00.02 Concrete trenches, cable trays and other civil work will be provided by the Contractor. The Contractor can make use of those trenches, cable trays etc. for conduit installation.

17.00.00 **Excavation and Back Filling**

17.00.01 The Contractor shall perform all excavation and backfilling as required for buried cable and ground connections.

17.00.02 Excavation shall be performed upto the required depth. Such sheeting and shoring shall be done as may be necessary for protection of the work.

17.00.03 The Contractor shall make use his own arrangements for pumping out any water that may be accumulated in the excavation.

17.00.04 All excavation shall be backfilled to the original level with good consolidation.

18.00.00 **Steel Fabrication**

18.00.01 All supports, hangers & brackets shall be fabricated by the Contractor. Necessary steel shall be supplied by the Contractor.

18.00.02 Steel for fabrication shall be straightened and cleaned of rust and grease. All fabrication shall be free of sharp edge.

18.00.03 Every effort shall be made to minimize the wastage of steel as far as practicable during fabrication. The wastage in no case shall exceed 3% of the total quantity of steel fabricated.

19.00.00 **Painting**

19.00.01 Street light poles shall be given two coats of aluminium paints after installation.

19.00.02 All steel fabrication shall be given two coats of red-oxide primer followed by two coats of Siemens gray (RAL-7032).

19.00.03 All equipment shall be given touch-up paint as required after installation.

20.00.00 **Cleaning up of Work Site**



- 20.00.01 The Contractor shall, from time to time, remove all rubbish resulting from execution of his work. No materials shall be stored or placed on passage or drive ways.
- 20.00.02 Upon completion of work, the Contractor shall remove all rubbish, tools, scaffoldings, temporary structures and surplus materials etc. to leave the premises clean and fit for use.
- 21.00.00 **Inspection & Testing**
- 21.00.01 On completion of erection works, the Contractor shall request the Engineer for inspection and tests with minimum fourteen (14) days advance notice.
- 21.00.02 The Engineer shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.
- 21.00.03 The installation shall be then tested and commissioned in presence of the Engineer and put on trial run for stipulated contract period.
- 21.00.04 All rectification, repair or adjustment work found necessary during inspection, testing, commissioning and trial run shall be carried out by the Contractor without any extra cost.
- 22.00.00 **TESTS**
- 22.01.00 **Shop Tests**
- 22.01.01 All equipment shall be completely assembled, wired, adjusted and routine tested as per relevant Indian Standards at manufacturer's works and in the presence of Owner's representatives.
- 22.01.02 Tests on Control gear / Lighting Distribution Boards / Lighting Panels shall include:
- Wiring continuity tests.
 - High voltage and insulation tests.
 - Operational tests.
- 22.01.03 The tests on lighting fixtures shall include:
- All routine tests as per relevant I.S.
 - Rain-proof test for outdoor type luminaries and respective control gearbox as type test.
 - Temperature rise test on ballast/choke as type test. Dust proof test as type test.
- 22.02.00 **Site Tests**
- 22.02.01 Contractor shall thoroughly test and meggar all cables, wires and equipment to prove the same are free from ground and short circuit.
- 22.02.02 If any ground or short circuit is found, the fault shall be rectified or the cable and/or equipment replaced.

- 22.02.03 All equipment shall be demonstrated to operate in accordance with the requirements of this specification.
- 22.02.04 Illumination in different areas are as per designed lux level generally confirming with Indian Standards. The lux level shall be verified by photometer at site location.

Test Certificates:

Certified copies of all tests carried out at works and at site shall be furnished in requisite no. of copies for approval of the Owner.

The equipment shall be dispatched from works only after receipt of Owner's written approval of shop test reports.

Type test certificates on any equipment, if so desired by the owner, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

ANNEXURE-I**ILLUMINATION LEVELS**

Lighting System will provide the following illumination levels. The lighting fixture/clamp type and quantity will be selected to achieve the illumination level at different condition of the plant.

Sl. No.	Area/Structure	Average Illumination Level in Lux	Type of Fixture	Type of Luminarie
1.0	Turbine Generator Building			
1.1	General (auxiliary equipment areas)	200	Industrial well glass fixture, dust & jet proof, die cast aluminium body, stove enamel finish, vitreous enamel reflector integral mounted control gear/industrial bulk head with integral mounted control gear	1x70 W/ 1x150 W HPSV lamp
1.2	Cable vault	100	Industrial type FTL	Energy Efficient FTL
1.3	All switchgear room area	250	Industrial type with vitreous enamel reflector	Energy Efficient FTL
1.4	TG Building operating floor	200	Industrial high bay with anodised aluminium reflector with all accessories including control gear	1x400 W HPSV Lamp
1.5	Unit control room	500	Decorative recessed with wide angle mirror optic antiglare type	Energy Efficient FTL
1.6	Battery rooms	150	Corrosion-proof	Energy Efficient FTL
1.7	TG building ground, mezzanine floor and misc. floors	200	Industrial well glass with integral control gear	1X250W HPSV bulb and 1x70 W HPSV well Glass
1.8	Air washer room and A/C plant room	200	Totally enclosed vapour proof with clear acrylic cover	Energy Efficient FTL
1.9	Unloading and maintenance bay	300	Industrial high bay with anodised aluminium reflector	250 W HPSV lamp (for mounting height >9m)
1.10	Electrical laboratory, chemical laboratory (airconditioned)	250	Decorative recessed with wide angle mirror optic anti-glare type	Energy Efficient FTL
1.11	Chemical laboratory (non-airconditioned)	250	Totally enclosed corrosion proof with clear acrylic cover	2x28W FTL

1.12	Chimney	Qty as per AAAI	As per AAAI	Flood light, Aviation warning lights and bulk head for staircase.
2.0	BOILER AREA			
2.1	Boiler area and platforms, ESP area and platforms	100	Dust proof / dust tight well glass fixture	70 W HPSV Lamp
2.2	Feeder floor areas	50	Dust proof / dust tight increased safety well glass	70 W HPSV Lamp
2.3	ESP control room	300	Decorative recessed with wide angle mirror optic antiglare type	Energy Efficient FTL
3.0	COAL /ASH HANDLING PLANT			
3.1	Conveyors enclosed	100	Dust proof well glass with Reflector wire guard integral mounted control gear box.	1 x 70 W HPSV lamp
3.2	Underground conveyor tunnel	40	Flame proof industrial bulkhead with integral control gear box	1 x 70W HPMV
3.3	Crusher house, Junction towers	100	Dust proof / dust tight well glass with reflector wire guard integral mounted control gear	1 x 70W HPSV
3.4	Coal yard	15-25	Flood light	1 x 400W HPSV
3.5	Coal unloading, Track hopper stacker reclaimers	25-50	Flood light	1 x 400W HPSV
3.6	Control room		Same as in Unit control room.	2 x Energy Efficient FTL
3.7	Ash Pond and Ash bund area	15-25	Flood light	1 x 400W HPSV
4.0	Fuel Oil system & fire hazardous area	250	Flame proof industrial bulkhead with integral control gear box	1x250 HPSV/1x400HPSV
4.1	Fuel unloading area,	25-50	Flood light	1 x 250W/400W HPSV
5.0	ROAD & YARD LIGHTING			
5.1	Roads	15-20	Street light with clear acrylic cover cut-off type with integral mounted control gear. Auto switch ON/ OFF shall be provided.	1 x 125W HPSV
5.2	Perimeter (compound) lighting	10-20	-do-	-do-
5.3	Yard lighting	15-20	General purpose flood light	250W HPSV
5.4	Parking area	50	General purpose flood light, high/medium beam flood light	1 x 250 W HPSV
5.5	Marshalling	25-50	General purpose flood	1 x 250 W

ROAD & YARD LIGHTING REPLACED WITH TABLE-1 OF AMMENDMENT -1 ELECTRICAL



	Yard/Railway line		light, high/medium beam flood light	HPSV	HPSV is also acceptable
6.0	GENERAL				
6.1	Switchyard	50	Flood Light	1X250/400W MH	
6.2	Corridors, walkways, staircase, etc.	100	Industrial type with vitreous enamel reflectors/channel mounted box type	Energy Efficient FTL	
6.3	Lockers, toilets, wash rooms, etc		Channel mounted box type	Energy Efficient FTL	
6.4	Building periphery lighting		Industrial well glass with integral mounted control gear/industrial bulk head with integral mounted control gear/ flood light fittings	70 W HPSV lamp / 400 W HPSV lamp	
6.5	Office Rooms	300	Decorative recessed type FTL	Energy Efficient FTL	
7.0	DC LIGHT FITTINGS				
7.1	Control room	-	Decorative recessed type with cylindrical reflector	1x100 W incandescent lamp	
7.2	Other areas	-	Industrial bulk head or industrial well glass with reflector	1x100 W incandescent lamp	

NOTE:

- a) Energy efficient type FTL-T5 tube light fittings shall be used.
- b) N/E AC lighting and DC lighting shall be identified with suitable colour code.
- c) CONTRACTOR may change the type of fixture to be used in different area against indicated above, provided minimum illumination level as indicated above is maintained. Lighting shall appear aesthetically good. CONTRACTOR shall measure the lux levels in the above areas (measured at the working plane) using suitable devices/meters as per relevant standards to prove the specified values.
- (d) For chimney / Cooling Tower, aviation warning lights as per AAAI's recommendation shall be provided.
 - 1 Medium intensity light should be used alone or in combination of low intensity lights where height is greater than 45 m. High intensity light should be used for heights more than 150 m as required to conform to the standard of Civil Aviation Department, directorate of air route and aerodromes, Government of India, DGCA, ICAO or any other statutory body and also to conform to IS: 4998 and as per the drawing. Each aviation warning light shall be of neon type having two lamps. Only one (1) lamp in a given fitting would be ON at a time and if the lamp fails, its failure would initiate an alarm and the next lamp in that particular fitting would be switched on automatically. Necessary control panel for control and annunciation shall be supplied. The control scheme of the control panel shall be to the approved of OWNER/Consultant
 2. One (1) photo controller along with suitable controller arrangement to be supplied by the bidder to switch ON and OFF the aviation warning light automatically based on the intensity of natural light during day/night. The



aviation warning lights on each of the external platform and three (3) nos. of flood lights (250 W HPSV) at all external platform levels shall be connected to three different phases.

- 3 The warning lights shall be adequately secured to the chimney against the wind forces. The low intensity shall be of fixed red colour, medium intensity shall be flashing red and high intensity shall be of flashing white. In no case the intensity shall be less than 100 candles of light. Blinker rate of Aviation warning lights shall be as per Aviation standards.
- 4 The top light or lights shall be so arranged as to mark the point or edge of the obstruction-marking surface. The lights shall be placed between 1.5 meter and 3 meter below the top. The number and arrangements of lights at each level or platform be such that the obstruction is indicated from every angle in azimuths.
- 5 The lights shall be displayed on the points at each platform of the chimney so as to indicate the general definition and extent of the obstruction.
- 6 The aviation lighting distribution board shall have facility to receive two (2) incoming feeders, one (1) from the main DB of the chimney and the other from the emergency source of the power plant with auto changeover facility.
- 7 Temporary aviation lights with infrared bulbs shall be installed at each of the levels as instructed by OWNER as the construction work progresses and also above the top most point of the obstruction as construction progresses. These lights need to be installed only after the level of obstruction is greater than 45 meter above grade level. The lights shall continue to exist till permanent arrangement to provide such lights are completed.

ANNEXURE-II

LIGHTING & LIGHTING TRANSFORMER

Sr. No.	ITEM	Unit	
1.0	AUXILIARY POWER SUPPLY		
1.1	SYSTEM VOLTAGE		
	Lighting equipment and accessories shall be designed for satisfactory operation from the following power supply sources.		
1.1.1	A.C Supply		415 Volt, 3 phase, 50hz, 3 wire effectively grounded system Fault level 50kA rms symmetrical
1.1.2	DC Supply		Fault level 25kA symmetrical 220V, 2wire, ungrounded system.
1.2	PERMISSIBLE VARIATION		
	Equipment and accessories shall be suitable for operation over the entire range of voltage/frequency variations as listed below:		
1.2.1	A.C Supply		Voltage $\pm 10\%$ Frequency $\pm 5\%$ Combined voltage and frequency 10% (absolute sum)
1.2.2	D.C Supply		Voltage 198 to 242 Volt
3.0	LIGHITNG TRANSFORMER		
3.1	Type		Cast Resin Dry type, non-encapsulated VPI with nomex insulation
3.2	KVA rating		100kVA (Min.)
3.3	Voltage rating		415 V/433 V 415V/415V
3.4	Cooling		AN
3.5	P.U. Impedance		*0.04 $\pm 10\%$
3.6	Voltage control		Off load tap switch/link with change of $\pm 5\%$ in step of 2.5% tapping full capacity
3.7	Vector Group		Dyn11
3.8	Class of Insulation		F (155 Deg.C)
3.9	Maximum Temperature rise over 50 Deg C. ambient in winding by resistance		90 Deg.C
3.10	Neutral		Solidly grounded

REFER
AMMENDMENT-1
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Notes:

The secondary neutral of the transformer shall be brought out for getting a grounded four (4) wire supply. Each transformer shall be routine tested and one transformer shall be type tested in accordance with relevant standard.



The transformer shall be liable for rejection if the tolerance on the quoted values of losses, impedance, temperature rise, etc. exceeds the specified values of relevant standard.

The transformer shall be mounted inside sheet steel enclosure which shall be an integral part of Lighting Distribution Board.

Typical Transformer rating of 100kVA and impedance is indicated in Annexure. However rating of transformer required shall be worked out by the bidder. Calculations for the same shall be submitted with bid.

Each lighting fixture shall be furnished complete with associated lamp, holder and control gear fully wired up. Control should include copper ballast, copper choke, capacitor starter, electronic- igniter (separate type). Fuse connector block etc.

For well glass fittings for HPSV lamps higher wattage (250/400 W) floodlight luminaire, the control gear will be separate/ non integral type whereas for high bay, streetlight and mini flood light fixture, the control gear shall be integral type.

Make, type & catalogue no. of lighting fixtures are indicated herein with the intent to elaborate the physical appearance/ constructional features only pertaining to the particular type of fixture.

The supply also includes associated junction boxes, brackets supports, hangers and wires wherever applicable.

ANNEXURE -III**FITTINGS AND ACCESSORIES OF LIGHTING TRANSFORMER**

Each transformer shall be equipped with fittings and accessories as listed below :

1. 150 mm dia. winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.
2. Handling and lifting lugs both for enclosure and core-coil assembly.
3. Jacking pad for core-coil assembly.
4. Inspection cover for cable and box.
5. Door handle operated safety limit switch with 1NO + 1NC contact.
6. Ground bus.
7. IP-55 junction box.
8. Rating and terminal marking plates.

Note : All indication, alarm, trip contacts provided shall be rated for 0.5A at 220 V D.C. and 5A at 240 V A.C.

ANNEXURE -IV**BROAD LIST OF AREAS TO BE ILLUMINED**

Purpose of this list is to give general guidance on major areas to be illumined. The list is however not exhaustive. Scope of lighting shall cover power house area, railway track, pump houses, different buildings, rooms, crusher house, tanks, transformer area and adjacent area/street, open yards, peripheral road inside boundary wall etc. the responsibility for provision of illumination of all the areas shall lie with the power plant EPC Contractor. Illumination engineering shall be done by the power plant EPC contractor based on the detail layout developed for rooms/areas during detail engineering.

- (a) Transformer Yard for GT, ST & UT extended upto 400 kV switchyard.
- (b) Power House Building.
- (c) Boiler area for units, boiler galleries, platforms, stairs.
- (d) ESP
- (e) ESP control building.
- (f) Service Building (Centralized Control Room).
- (g) C.W. and ACW pump house.
- (h) CW chlorination plant building.
- (i) Mill Bay.
- (j) All roads in the transformer yard including approach roads (as will be finalized during detail engineering), general area, Toilets falling within lighting zone shall be covered under power plant EPC package.
- (k) Chimney along with aviation lighting.
- (l) NDCT.
- (m) DG & compressor building.
- (n) Ash Water P.H. & Elec. Room.
- (o) ASW pump house & Elec. Room.
- (p) Chemical house/Electrical and control room.
- (q) HFO & LDO pressurizing pump house.
- (r) Fly ash conveying Comp. building & elec. Room.
- (s) Open yard, Fuel unloading area,
- (t) Store
- (u) Canteen
- (v) Work shop
- (w) Weight bridge
- (x) DM plant
- (y) Wagon tippler
- (z) Wagon tippler control room along with railway track.
- (aa) Pent house
- (bb) Crusher house
- (cc) CHP MCC and Control room.
- (dd) Fuel oil transfer pump house along with railway track.
- (ee) HCSD pump house and MCC room.
- (ff) Dry ash silo and HCSD system.
- (gg) MCC cum ctrl. Room of HCSD system.
- (hh) Lube oil storage shed.
- (ii) ETP.
- (jj) In plant raw water reservoir & PH.
- (kk) Fire station.
- (ll) Pretreatment & filtration plant.
- (mm) TTW & FW pump house.
- (nn) Plant area STP.

- (oo) Administration building
- (pp) Check post
- (qq) Secondary gate
- (rr) Ash gate
- (ss) CW treatment building.
- (tt) Loco shed
- (uu) Peripheral road inside boundary wall
- (vv) Security office
- (ww) Any other as per plot plan & relevant drawings.

Note: Aviation obstruction lights shall be provided on tall installations as per regulation.



**1 x 660 MW - Panki Thermal Power Station
AMENDMENT ELECTRICAL SYSTEM**

Attachment
Table-01

Sl. No.	Area/ Structure	Average Illumination Level in Lux	Type of Fixture	Type of Luminarie
5.0	ROAD & YARD LIGHTING			
5.1	Roads	15-20	Street light with pressure die cast housing cover glass, best in energy saving having IP66 degree of protection, similar to PHILIPS make : GreenLine Xtra. Auto switch ON/ OFF shall be provided.	125 W LED
5.2	Perimeter (compound) lighting	10-20	-do-	-do-
5.3	Yard lighting	15-20	Flood light with split design to support diffuser combination, die cast aluminium housing, having IP66 degree of protection similar to PHILIPS make : eW Reach Powercore gen2	250 W LED
5.4	Parking area	50	-do-	-do-
5.5	Marshalling Yard/Railway line	25-50	-do-	-do-

Note: If any clarification issued earlier found contrary to the above amendments, the amendment shall supersede the clarification.