भारत हेवी इलेक्ट्रिकल्स लिमिटेड

(भारत सरकार का उपक्रम)

Bharat Heavy Electricals Limited

Industry Sector, Transmission Business Group

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ADDENDUM-01

Dated 18.06.07

SUB : ADDENDUM- 01 To NIT 2871 For ETC Works

REF: TENDER SPECIFICATION. No. –TBSM/BARH/ETC/TENDER, DATED: 24.05.07

With reference to above tender for ETC Works for 400/132kV S/S at Barh in Bihar, following amendments/addendum may be noted.

1. Following new items has been added to Main Scope of ETC BOQ as enclosed.

(i) Sl. No. H (BOQ for outdoor lighting items)

(ii) Sl. No. I (BOQ for control room lighting items)

(iii) Sl. No. J (Miscellaneous items for indoor lighting for control room)

(iv) Sl. No. K (Laying of Cables in Outdoor Switchyard)

- Technical Specification, Customer Specification for Lighting, Project Detail & General Specification & BOQ are enclosed.
- All other terms & conditions of the NIT 2871 dtd 24.05.07 shall remain unchanged.
- Above addendum shall be the part of the NIT 2871. Bidders shall quote for new items (Sl. No. 1(i) - 1(iv) mentioned above).
- Please enclose a copy of the addendum-01 alongwith all the enclosures duly signed by your authorized signatory and stamped with your Technical Bid.

(R.LODWAL)
DGM /TBSM

H. BOQ FOR OUTDOOR LIGHTING ITEMS

(Erection & Commissioning)

Sl. NO.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1.a	Heavy duty Flood light Luminaries with 1x400W HPSV lamps and with necessary control gear box (Type SF_3).	Nos	148		
1b.	Heavy duty Flood light Luminaries with 2x400W HPSV lamps and with necessary control gear box.	Nos	20		
2	415V AC outdoor Lighting panel with 415V, 63A, 3-Phase 4 wire Bus and 1 No. 63A TP&N switch unit as incomer and having the	Nos	8		
a)	12 Nos. 20A outgoing single Pole MCB				
b)	Synchronous timer for light control with bypass toggle switch				
c)	63A, 3-Phase Power Contactor				
3	Junction box with one row of 16 nos. 63A terminals suitable to receive conductor upto 16 sq. mm.	Nos	20		
4	Lighting Mast (30 M Height)	Nos	6		
5	Lighting Poles (11-meter height) with 250 W lighting fixture, junction box, cabling between junction box and fixture, etc.	Nos	10		
6	Receptacles				
	i) Type R_0 (15A)-2 nos.	Nos	2		
	ii) Type Rp (63A)-2 nos.	Nos	2		
	TOTAL AMOUNT				

I. BOQ FOR CONTROL ROOM LIGHTING ITEMS

(Erection & Commissioning)

LIGHTING FIXTURES (WITH ACCESSORIES & LAMPS)

Sl. No.	Type No.	DESCRIPTION	Type of Installation	Type of fixtures	Qty. (No.)	Rate	Amount
1	**FC**	Twin 36 watts totally enclosed , corrosion proof, florescent fixture comprising fibre glass reinforced polyster canopy, CRCA sheet steel gear tray finished stove enameled white acrylic clear cover, stainless steel toggle clips & neoprene/synthetic gasket, lamp, etc complying to IP65 class of protection	Surface/ pendent mounting	Philips type TDC 10/236 or equivalent	30		
2	**FI**	Twin 36 watts industrial trough type, fluorescent fixture comprising CRCA channel power coated grey outside, CRCA cover plate powder coated white & with MS reflector power coated white inside & grey outside, fitted with lamp, electronic ballast, etc.	Surface/ pendent mounting	Philips type TKC 22/236 or equivalent	90		
3	**FR1/ FR2**	Twin 36 W mirror optics anti glare type florescent fixture comprising CRCA sheet housing powder coated white inside, grey outside, high purity aluminium parabolic reflectors, etc fitted with lamp, electronic ballast , starter, capacitor and with anti glare louvers.	Surface/Pendent(FR1)/ Recess(FR2) mounting (false ceiling)	Philips type TBS 285/236 (M5) or equivalent	150		
4	**FB**	Double 36 watts rail type, florescent fixture comprising CRCA channel power coated grey outside, CRCA cover plate power coated white, fitted with lamp, electronic ballast, etc.	Surface/ pendent mounting	Philips type TMC 55/236 or equivalent	30		
5	**FB1**	Single 36 watts rail type, florescent fixture comprising CRCA channel power coated grey outside, CRCA cover plate power coated white, fitted with lamp, electronic ballast, etc.	Surface/ pendent mounting	Philips type TMC 55/236 or equivalent	25		
6	**IR**	100 W, incandescent, down light fixtures electrochemically brightened anodized high purity aluminum reflector comprising of lamp, galvanised mounting bracket, etc.	Recessed mounting in false ceiling areas	Philips type DN 203 or equivalent	20		
7	**IB**	100w, incandescent industrial bulk head fixtures comprising die cast aluminium body finished powder coated white inside, grey outside, heat resistant toughened glass, neoprene/synthetic gasket, MS powder coated wire guard lamp, etc. complying to IP 54 class of protection.	Surface mounting on column/wall /ceiling	Philips type NXC-101 or equivalent	5		
8	**PF**	Self contained emergency lighting fixture with 2x10W Fluorescent lamp with nickel cadmium battery, charger etc.	Wall /column mounting		5		
		TOTAL AMOUNT					

J. MISCELLANEOUS ITEMS FOR INDOOR LIGHTING FOR CONTROL ROOM

(Erection & Commissioning)

ITEM NO.	ITEM DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1	**LIGHTING PANELS (LPs)**				
1.1	LP-1	Nos	3		
1.2	LP-D	Nos	1		
2	LIGHTING CONTROL SWITCH BOXES	Nos			
2.1	TYPE-SWB1	Nos	15		
2.2	TYPE-SWB2	Nos	20		
2.3	TYPE- SWB3	Nos	20		
3	RECEPTACLE BOXES	Nos			
3.1	TYPE-RA	Nos	30		
3.2	TYPE-RB	Nos	40		
4	**CONDUITS**				
4.1	Galvanised Steel Rigid, 20mm	Mtrs	500		
4.2	Galvanised Steel Rigid, 25mm	Mtrs	2000		
4.3	Galvanised Steel Rigid, 40mm	Mtrs	500		
4.4	Epoxy Coated Steel Rigid, 20mm	Mtrs	50		
4.5	Epoxy Coated Steel Rigid, 25mm	Mtrs	200		
4.6	Lead Coated Steel Flexible, 16mm	Mtrs	1000		
5	1.5mm2, Cu. PVC wires (Red, Yellow, Blue, Black, Grey, White)	Mtrs	3100		
6	4mm2, Al.. PVC wires (Red, Yellow, Blue, Black, Grey, White)	Mtrs	6200		
7	6mm2, Al.. PVC wires (Red, Yellow, Blue, Black, Grey, White)	Mtrs	2500		
8	10mm2, Al.. PVC wires(Red, Yellow, Blue, Black)	Mtrs	1800		
9	**JUNCTION BOXES**				
9.1	Type-F	Nos	350		
9.2	Type-FE	Nos	40		
10	**EARTHING WIRES, FLATS & RODS**				
10.1	14 SWG GI Earth wire	Nos	3500		
10.2	CF1-1200 mm sweep	Nos	50		
	TOTAL AMOUNT				

K. Laying of Cables in Outdoor Switchyard

Sl. No.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1	3 ½ C X 35/70/95 sqmm				
(a)	Laying in trench /tray/structure/wall	Mtr.	**2000**		
(b)	Laying in suitable size of GI pipe & buried.	Mtr	**2000**		
2	3 ½ C/ 4C X 16 sqmm				
(a)	Laying in trench /tray/structure/wall	Mtr.	**2000**		
(b)	Laying in suitable size of GI pipe & buried.	Mtr	**2000**		
3	1C/ 2CX2.5 Sqmm				
(a)	Laying in trench /tray/structure/wall	Mtr.	**2000**		
(b)	Laying in suitable size of GI pipe & buried.	Mtr	**2000**		
4	2C/ 4C x 6 Sqmm				
(a)	Laying in trench /tray/structure/wall				
(b)	Laying in suitable size of GI pipe & buried.	Mtr.	**2000**		
		Mtr	**2000**		
	TOTAL AMOUNT				

SCOPE, SPECIFICE TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 The illumination System is required for the following project.

Name of customer: **NTPC Limited**

Name of the project: **3x660MW BARH STPP STAGE- I (400/132 Switchyard Package)**

Refer Section – 3 for Project Details and General Specifications.

2.0 SCOPE

This specification covers the erection, testing and commissioning of Illumination system at site.

The Bidder shall have deemed to have understood completely all the tender drawings and documents and quoted accordingly.

In case of any deviation, the bidder shall indicate separately the clause wise deviation with respect to the specification in the " Schedule of deviations".

It is the responsibility of the successful Bidder to obtain necessary approval/ clearance from statutory organizations wherever applicable for the equipment/ system under the scope specified.

2.1 SCOPE OF SUPPLIES & SERVICES

The equipment / services to be installed for substations under this contract are detailed hereunder under Annexures. In case any minor item, which is not included but is required for completion and successful operation of the system, same shall be brought out by bidder at tender stage itself.

2.1.1 Laying & termination of power/ control cables & earth strip will be in bidder's scope. The quantities of 50x6 galvanized strip shall be worked out by the successful Bidder and shall be intimated to BHEL for procurement.

2.1.2 The sizes of cables indicated are tentative. Actual size required shall be decided at detailed engineering stage. ETC rate quoted shall remain same even if size changes.

2.1.3 Where cables to be laid in GI Pipe, excavation, filling etc. deemed to be included in erection cost quoted.

2.1.4 Since the termination of cables is in Bidder's scope, supply of cable accessories such as lugs, glands, cable tags & markers etc. are deemed to be included in erection cost quoted.

2.1.5 Commissioning Spares:

Contractor shall supply commissioning spares required at site to commission the system without delay. The Contractor shall finalize the list with BHEL during detailed engineering stage.

CHAPTER – E 7 : LIGHTING

1.00.00 **GENERAL**

1.01.00 This specification covers the general description of design, manufacture and construction features, testing, supply installation and Commissioning of the Station Lighting system equipments for switchyard and control room building.

2.00.00 **CODES AND STANDARDS**

2.01.00 All standards and codes of practice referred to herein under Part-I, Section-III 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 relevant standards & codes.

3.00.00 **LIGHTING SYSTEM DESCRIPTION**

3.01.00 The Lighting system covers the illumination of various indoor and outdoor areas in the 400 kV switchyard and switchyard control room. The lighting system of various areas shall comprise of one or more of the following systems:

a) Normal AC Lighting System
b) DC Lighting System

3.02.00 **Normal AC Lighting System**

Normal AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels (LPs) which in turn will be fed from the lighting distribution boards (LDBs)/Switch board/MCC.

3.03.00 **DC Lighting System**

At strategic locations, a few lighting fixtures fed from 220V DC supply, shall be to enable safe movement of operating personnel and access to important control points during an emergency, when the normal AC system fails. These lighting fixtures will be fed from 220V DC LDBs which in turn will be fed from DC lighting panels.

3.03.01 The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply . The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC lighting system.

3.03.02 In addition, emergency DC lighting is to be provided through self contained DC emergency fixture at strategic locations. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.

4.00.00 **EQUIPMENT DESCRIPTION**

4.01.00 **Lighting Fixture, Lamps & Accessories**

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

4.01.02	AC lighting fixtures and accessories shall be suitable for operation on 240 V,AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/-5% and combined voltage and frequency variation (absolute sum) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V & 240 V.
4.01.03	Power factor of fluorescent lamp fixtures shall be not less than 0.90 and that of High Pressure Sodium Vapour and Mercury Vapour (HPSV & HPMV) lamp fixtures shall not be less than 0.85. Suitable power factor improvement capacitors shall be provided for this purpose. Capacitors shall be hermetically sealed to prevent seepage of moisture.
4.01.04	All lighting fixtures shall be complete with lamp(s), lamp holder (s), terminal blocks, clamps, locking arrangements, fixing brackets etc. Control gears shall be provided as applicable / specified. The fixtures shall be fully wired upto terminal block. The internal wiring of the fixtures shall be done with suitable thermo-plastic or silicon rubber insulated copper conductor wires of suitable size and type. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.
4.01.05	All fluorescent fixtures shall be provided with terminal blocks of ELMEX-EP/or Equivalent make inside the fixture for loop in loop out at Fixture. The terminal block shall be suitable for 4 sq. mm. wire termination.
4.01.06	All lighting fixtures shall be provided with an external, brass/GI earthing terminal suitable for connecting 14 SWG, GI earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity through out the fixture.
4.01.07	The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.
4.01.08	Generally all lighting fixtures (except for street light & post top lantern type fixture) shall be provided with 20 mm dia. conduit knock-out for connection to the incoming supply.
4.01.09	The diffusers/louvers used in fluorescent fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period.
4.01.10	Twin fluorescent lamp fixtures shall be wired in lead lag circuit to minimise stroboscopic effect.
4.01.11	High bay fixtures shall be suitable for pendant mounting and provided with safety chain. Flood lights shall have suitable base plate/frame for mounting on structural steel members.
4.01.12	The reflectors shall be manufactured from CRCA sheet steel or aluminium as specified. The aluminium reflectors shall be made of high purity aluminium sheet,

	polished electrochemically brightened and anodized. Alternately ALGLASS finish is also acceptable.
4.01.13	Lamp holders for fluorescent tubes shall be of spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for holding in normal position under condition of shock and vibration. Live parts of the lamp holder shall not be exposed during insertion or removal of the lamp or after the lamp has been taken out. Lamp holders for incandescent, HPMV & HPSV lamps shall be of porcelain, screwed type.
4.01.14	Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without use of any tool. Starter shall have brass contacts and radio interference suppressing capacitor.
4.01.15	**Lamps** a) Incandescent, HPMV & HPSV lamps shall be provided with screwed (G.E.S) type caps. b) The lamps shall be capable of withstanding small vibrations and theconnections at lead-in wires and filaments/electrodes shall not break under such circumstances. c) Incandescent (GLS) lamps shall be of 'clear' type unless otherwise specified. d) The fluorescent lamps shall be 36 watts slim tube type having 'cool day light' colour designation. e) High pressure mercury vapour (HPMV) lamps shall be of elliptical shape, colour corrected type with special fluorescent coating to increase lumen out put and improve colour rendition. f) High pressure sodium vapour (HPSV) lamps shall be of elliptical shape and provided with external ignitor for rapid restart facility. Halogen lamps shall be of tungsten filament, quartz glass type with ceramic base.
4.01.16	**Ballasts** (a) All HPSV and HPMV lamp fixtures shall be provided with wire-wound ballasts. All fluorescent fixtures except type'FR2 shall be provided with electronic ballasts. Type FR2 fixtures shall be provided with wire-wound ballasts. (b) Wire-wound Ballasts shall have annealed copper wire wound coil, electrical grade silicon sheet steel laminations and hermetically sealed with suitable insulating compound housed in sheet steel enclosure finished stove enamelled grey outside outside. Class of insulation shall be suitable for temp. rise of winding. End connnections and taps shall be brought out in a suitable terminal block rigidly fixed to the ballast enclosure. Ballast shall be suitable for use on nominal voltage of 240 V +/- 10%, 50 Hz supply. Ballast for HPSV and HPMV lamps shall be provided with tap settings of 220 & 240 V. Separate ballast shall be provided for each lamp in case of multi-lamp fixtures. Ballasts shall be free from hum. (c) Electronic ballasts shall be capable of satisfactory performance in adverse environment like that of thermal power station. Electronic ballasts shall consists of AC/DC Convertor, high frequency power oscillator and low pass filter. The ballast shall be suitable for use on nominal voltage of 240 V+ 10%, 50 Hz supply. The filter circuit shall suppress the feed back of high frequency signals to the mains. The ballast shall be rated for 36W fluorescent fixtures.

4.01.17	Ignitors for HPSV lamps shall be of solid state electronic type.
4.01.18	Controlgear box compartment for HPSV & HPMV fixtures shall be complete with ballast, capacitor, electronic ignitor (for HPSV lamps only) etc. fully wired upto terminal block, housed in cast aluminium or CRCA sheet steel enclosures as specified, finished powder coated grey of shade 631 of IS:5. The box shall be provided with hinged door and neoprene/synthetic rubber gasket to achieve IP-54 degree of protection.
4.01.19	Lighting fixtures of Philips/Bajaj/Crompton Greaves make shall be acceptable. Fixtures of any other make shall be subject to Employer's approval.
4.01.20	Neoprene/synthetic rubber gasket shall be provided to achieve specified degree of protection. All outdoor fixtures shall be weather proof type (IP-55 as per IS:2147).
4.01.21	Flood light fixtures shall be provided with graduated disc facilities for aiming angle of luminaire.
4.01.22	Self Contained Emergency lighting fixtures (Type PF) shall be automatic, totally enclosed single unit suitable to receive 240 V+10% AC, 50 Hz supply. The fixtures shall switch 'ON' automatically in the event of failure of AC supply. The unit shall comprise of 1.6 mm thick CRCA M.S. sheet enclosure, finished stove enamelled grey outside, accommodating 6 Volt Nickel-Cadmium batteries, battery charger, 2 x 10W fluorescent lamps, reflector etc. The unit shall be complete with mounting brackets suitable for mounting on wall/column. Battery shall be rated for operation of 2 x 10W fluorescent lamps continuously for 4 hours. Nickel-Cadmium Battery shall be of NTPC approved make.
4.01.23	Brief descriptions of various types of lighting fixtures, alongwith type of installation, make & type and areas of application etc. are indicated in the Bill of Quantity in this specification.
4.01.24	**Fans & Regulator** Ceiling Fans shall be suitable for operation on 240 V, 50 Hz, AC supply comprising of class 'F' insulated copper wound single phase motor, 1200mm sweep, aerodynamically designed well balanced MS blades (3 Nos.), down rod, die cast aluminium housing, capacitor, suspension hook, canopies etc. finished in stove enameled white. Power factor of fans shall not be less than 0.9.
4.01.25	Fan regulators shall be conventional wire-wound type suitable for operation on 240 V AC supply. Cost of regulator shall be included in cost of ceiling fan.
4.01.26	Fan & regulators shall have ISI mark and shall be of NTPC approved make.
4.02.00	**Lighting Panels (LPs)**
4.02.01	Lighting panels shall be constructed out of 2 mm thick CRCA sheet steel. The door shall be hinged and the panel shall be gasketted to achieve specified degree of protection. The panel shall be provided with terminal blocks for incoming and outgoing circuits, earthing terminals, M.S. mounting brackets suitable for surface mounting on wall/column/structure, allen keys with bolts as locking arrangements, circuit directory plate & circuit diagram fitted on the inside of the door etc.

	Removable gland plates shall be provided for entry of cables/conduits. For outdoor type panel a canopy shall be provided slope towards the rear side of the panel.
4.02.02	Wiring inside the panel shall be carried out with 1100 V grade. PVC insulated stranded copper wires of adequate size. On both ends of each wire engraved identification ferrules shall be provided.
4.02.03	All MCBs/Isolators/Switches/Contactors etc. shall be mounted inside the panel and a bakelite/ fibre glass sheet shall be provided inside the main door such that the operating knobs of MCBs etc., shall project out of it for safe operation against accidental contact.
4.02.04	Equipment mounted inside the panel shall be provided with individual labels with equipment designation/rating. Front of the panel shall be provided with label engraved with designation of the panel as furnished by the employer. Labels shall be made of 3 ply lamicoid/engraved PVC having white letters on black background.
4.02.05	Terminal bocks shall be 750 V grade, clip-on stud type, moulded in melamine, suitable for terminating multicore 35 or 70 Sq. mm. stranded aluminium conductor incoming cable and 10 Sq. mm. stranded aluminium conductor for each outgoing circuits voltage. All terminals shall be shrouded, numbered and provided with identification strip for the feeders.
4.02.06	MCB's shall be current limiting type with magnetic and thermal release suitable for manual closing and automatic tripping under fault condition. MCB's shall have short circuit interrupting capacity of 9 KA rms. MCB knob shall be marked with ON/OFF indication. A trip free release shall be provided to ensure tripping on fault even if the knob is held in ON position. MCB terminal shall be shrouded to avoid accidental contact.
4.02.07	Isolators of AC lighting panels shall be of TPN, 63 A, continuous duty, load make-break type suitable for 415 V, 3 phase 4 wire system. Isolator knob shall be marked with ON/OFF indication. Terminals shall be shrouded to avoid accidental contact. The isolator shall be suitable for withstanding let through energy of 125 A HRC fuse.
4.02.08	DC switches shall be rotary type, 2 pole, continuous duty, load break type, quick make quick break, suitable for 220 V DC, 2 wire system. Switch knob shall be provided with ON/OFF indication.
4.02.09	Fuses shall be of HRC plug in type complete with fuse fittings. Fuse fittings shall incorporate fully insulated shrouded contacts. Visible indication of operation of fuse shall be provided.
4.02.10	Contactors shall be triple pole, air break, electromagnetic type, provided with 2 NO and 2 NC auxiliary contacts. The coil shall be suitable for 240 V AC/ 220 V DC supply as required. The main contacts shall be silver plated.
4.02.11	Synchronous timers shall be quartz controlled electronic type, complete with rechargeable nickel cadmium cell, 24 hours range day dial, NO/NC contacts etc. and suitable for operation on 240 AC supply.

4.02.12 The exterier side of panel, shall be powder coated with smoke grey, shade 692 of IS:5 and the interior side of the panels shall be white.

4.02.13 Lighting Panels shall be of following types:

TYPE	INCOMER FEEDER	OUTGOING FEEDERS	DETAIL OF CONTENTS
LP-1	1No. 415V,63A, TPN Isolator (31/2Cx70sq.mm cable)	18Nos.,20A, 240V MCB	415V,63A AC2 duty contactor and Synchronous timer of 24 hour range 10A, 240V selector switch, fuse, etc. outdoor type and IP:55 degree of protection
LP-2	1No. 415V,63A, TPN Isolator (31/2Cx35sq.mm cable)	9Nos.,20A, 240V MCB	415V,63A AC2 duty contactor and Synchronous timer of 24 hour Range 10A, 240V selector switch, Fuse, etc. outdoor type and IP:55 degree of protection
LP-D1	1No. 220V, 32A, DP isolator	6Nos.,16 220V DP Switch & Fuse	220V,32A DC contactor, Fuse, etc. outdoor type and IP:55 degree of protection

4.03.00 **Switch Boxes**

4.03.01 Switch boxes shall be made of 1.6 mm thick, MS sheet with 3 mm. thick decorative, bakelite/perspex cover. Switchbox shall be hot dip galvanised, provided with earthing terminal, mounting holes and screws, specified number of conduit knockouts on both the top and the bottom sides etc. The switch boxes shall be suitable for surface/flush mounting.

4.03.02 Switches shall be Piano Key Type single pole, quick make quick break, suitable for operation on 240 V AC supply and shall be of reputed make subject to employer's approval.

4.03.03 Sockets shall be of 3 pin type, suitable for 240 V AC supply.

4.03.04 Switch box shall be adequately sized to accommodate switch/fan regulators/sockets and terminal blocks. All switch box mounted items shall be fully wired upto terminal blocks located inside the box by 650 V grade PVC insulated flexible copper wire.

4.03.05 Terminal blocks provided for all incoming and outgoing wires shall be of 650 V grade, moulded in melamine, suitable for loop-in loop-out of 10 sq. mm. stranded aluminium wire and tap off of 1.5 sq.mm. copper wire.

4.03.06 Switch boxes shall be of following types :

NTPC TYPE No.	Switch	Fan Regulator*	Socket
SWB 1	5 A - 3 Nos.	-	5A - 1.No.
SWB 2*	5 A - 5 Nos.	1	5A - 1.No.
SWB 3*	5 A - 7 Nos.	3	5A - 1.No

* Space provision shall be kept for fan regulator in switch boxes.

4.04.00 **Receptacles**

4.04.01 Receptacles boxes shall be fabricated out of MS sheet of 2mm thick and hot dip galvanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, and gasket to achieve degree of protection, terminal block for loop-in loop-out, of wire/cable of specified size, mounting brackets suitable for surface mounting on wall/column/structure, conduit entry/gland plate etc.

4.04.02 The On/Off switches shall be rotary type, heavy duty, double break, AC 23 category, suitable for AC supply.

4.04.03 Plug & socket shall be of shrouded die-cast aluminium. Socket shall be provided with lid safety cover.

4.04.04 Robust mechanical interlock shall be provided for receptacles type RA such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in Off position.

4.04.05 Wiring inside the box shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size.

4.04.06 Terminal block shall be of 750 V grade, clip on stud type, moulded in Malamine, suitable for terminating specified cable size. All the terminals shall be shrouded.

4.04.07 Receptacles shall be of following types :

NTPC Type No.	Item Description: Switch rating	Socket & plug rating	Type & make of plug & Socket	Terminal Block size
RA	20 A, SP 240V AC	20A, 3 pin 240 V AC (Industrial)	NTPC appd. make	1-4 way, suitable for loop-in loop-out of 10 sq.mm. alu. Conductor
RB	15-A, S.P 240V AC	5A+15A, 6 Pin decorative Piano-key Type Switch	NTPC appd.make	

4.05.00 **Junction Boxes**

4.05.01 Junction box for lighting fixtures shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanised, provided with terminal blocks, earthing terminals, mounting bracket and screws, conduit knockouts on three sides etc. conforming to class of protection IP:55. The J.B. shall be of following types suitable for surface/flush mounting on wall/ceilings/structures. The J.B. cover shall be hinged and bolted with captive nuts and bolts. Terminal block shall be stud type.

NTPC Type No.	**Terminal block size**	**Remarks**
JB-F	1.No-2 way, suitable for loop-in Loop-out upto 2 numbers 10 sq. mm. aluminium conductor and tap off of 1.5 Sq. mm. copper conductor	
JB-FE	-DO-	Epoxy coated Instead of Galvanised, 50 Microns Shall be coated on surface

4.05.02 Fuses shall be HRC, plug in type, complete with bakelite fuse fittings.

ON/OFF switch shall be TPN, rotary type, load break suit able for 415V AC system.

4.05.03 Terminal blocks shall be of 750 V grade clip-on, stud type molded in melamine. The terminals shall be shrouded and numbered.

4.06.00 **Conduits, Fittings & Accessories**

4.06.01 Conduits offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, couplings caps, nipples, etc.).

4.06.02 **Rigid Steel Conduits**

i) Rigid steel conduits conforming to IS : 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside . It shall be possible to pass wooden ball in a straight length of conduit. Diameter of ball shall be 2 mm less than the internal dia of conduit. Conduit shall be plugged by PVC caps for storage and transportation.

ii) Outside and inside surfaces of conduits shall be hot dip galvanized and shall have high protection against corrosive and polluting substances.

iii) For installation in corrosive areas, conduits shall be of epoxy coated MS.

	iv) Fittings and accessories for conduits shall also be hot dip galvanised. However for corrosive areas accessories & fittings shall have additional epoxy coating. v) Salient Dimensional parameters of conduit fittings and accessories shall be as follows with symbolic alphabets bearing the meaning as given in respective IS.
4.06.03	**Flexible Steel Conduits** Flexible conduit shall be 16mm dia. water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free form burrs and sharp edges. Conduit shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures. Conduits shall be of PLICA make or approved equivalent.
4.06.04	**Pull-out Boxes** Pull out boxes shall be provided at approximately 4 (four) metre interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, Structures, etc. The bolts, nuts, screws, etc. required for the installation shall be included in the installation rates. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP :55 degree of protection and those used indoor shall be suitable for IP :52 degree of protection. Pull out box & its cover shall be hot dip galvanised. Bidder shall include the cost of pull out boxes in the installation rates for conduits & accessories.
4.07.00	**Lighting Wires** Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. Colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases & neutral, respectively and white & gray for DC positive & DC negative circuits, respectively.
4.08.00	**Lighting Poles**
4.08.01	The various lighting fixtures complete with lamps and accessories for the outdoor of switchyard shall be installed on the gantries and lighting poles along the road.
4.08.02	The poles shall be of ERW tubes of specified lengths, stepped tubular or swaged tubular and joined together. Poles shall be smooth cylindrical and swan neck or straight as specified. Poles shall be complete with base plates & taper plugs, and necessary pipe reducer/fixing brackets for fixing the light fixture as per drawing enclosed. Lighting poles shall be of following types.

	NTPC Type No.	Overall Pole Height	Overhang projection	Application
	A1	13m	1.2m	For single street Light fixture.
	C1	11m	-	For flood light fixture
	C2	13m	-	For flood light fixture
	E1	4m	-	For post top lanterns.

4.08.03 Lighting poles shall be painted with two coats of red Oxide and Zinc chromate in Synthetic compound primer on the exposed outside surface and with Bituminous paint all along the inside of the pole and outside portion which shall be embedded in foundation at manufacturing stage.

4.09.00 **Lighting Mast**

Lighting Mast shall be of continuously tapered polygonal cross section hot dip galvanised presenting a pleasing appearance. 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, luminaires, suitable aviation warning light, lightning alongwith necessary power cables within the mast. The mast shall be delivered only in three/ four sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast.

a) The Mast together with the fixtures shall be capable of withstanding the appropriate wind loads as per IS:875. The Mast shall be fabricated from special steel plates conforming to BS-EN10-025 and folded to form a polygonal section.

b)Lantern Carriage shall be fabricated suitably and hot dip galvanised for fixing and holding flood light fixtures and their control gear boxes. Lantern carriage shall be provided with 16 nos. twin 400W HPSV flood light fixtures.

c)Junction box shall be whether proof conforming to IP:55 made of cast aluminium and mounted on the carriage to facilitate interconnection to lighting fixtures. A suitable winch arrangement shall be provided to lower & raise the Lantern Carriage Assembly.

d) Winch shall be of completely self sustaining type without the need for brake shoe, springs or clutches. The min. working load shall not be less than 750 kg. The winch drum shall be grooved to ensure perfect seat for stable and tidy rope lay with no chances for slippage. Winch shall be operated by an internally mounted three phase motor/power tool with necessary reduction gear mechanism. A handle for manual operation of winch shall also be provided. An adequate door opening shall be provided at the base of the Mast.

e) A timer shall be provided in the Mast for switching ON & OFF the luminaires.

f) A finial (heavy duty, hot dip galvanized) with a height of 1.2M shall be provided at the centre of the head frame for providing lighting protection. It shall be solidly bolted with the mast body to provide a conducting path. Earthing terminals shall be provided for earthing the mast.

4.10.00	**PAINTING**
4.10.01	All sheet steel work for lighting panels, lighting fixtures etc. shall be treated in tanks in accordance with IS 6005. Degreasing shall be done by alkaline cleaning. Rust and scale shall be removed by pickling with acid. After pickling, the parts shall be washed in running water and rinsed in slightly alkaline hot water and dried. After phosphating the surfaces shall be rinsed and passivated. Treatment as per IS:6005 shall be provided. Two coats of lead oxide primer followed by powder painting with final shade of 692 of IS:5 shall be done.
4.10.02	All welds, bolt holders, conduit/cable entry holes etc. made during installation shall be wire brushed and touched up with metal primer of lead oxide and zinc chromate in synthetic medium..
4.11.00	**GALVANISING**
4.11.01	Galvanising of switch boxes, junction boxes, conduits, other steel components and accessories shall conform to IS: 2629 and IS: 2633. Galvanising shall be uniform, clean, smooth, continuous and free form acid spots. Should the galvanising of the samples be found defective, the entire batch of steel shall have to be regalvanised at Contractor's cost after pickling.
4.11.02	The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS: 1367 (Part-13). The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them.
5.00.00	**INSTALLATION**
5.01.00	**Lighting Fixture Installation**
5.01.01	Lighting fixture of appropriate type as per lighting layout drawings shall be installed the by Contractor. The type of mounting arrangement of fixtures shall be selected from the typical arrangement shown in the attached drawings. The type of mounting will generally be indicated on the layout drawings. The exact mounting will be decided at site depending upon the actual space/other facilities available at site. Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.
5.01.02	Wooden plugs in walls and ceilings for fixing of lighting fixtures and accessories are not acceptable. A suitable fool-proof method preferably using nylon rawl plug for fixing these shall be offered and this shall be subject to the Employer's approval.
5.01.03	Lighting fixtures installed on/under platforms in boiler area/pedestals (such as TG pedestals) and other structures which are subject to vibrations shall be provided with suitable vibration dampers/rubber cushions to minimise the variations reaching the lighting fixtures. The arrangement shall be subject to Employer's approval.
5.01.04	Flood lights shall be mounted on steel base of structures/walls. Fixing slots shall be provided to turn the fixture by about 5 deg. on both sides. Bolts shall be tightened with spring washers. Terminal connection to the flood lights shall be made through flexible-conduits.

5.01.05	In the rooms where false ceiling is provided the lighting fixtures shall be supported separately by false ceiling grid or roof over false ceiling and not by the ceiling board.
5.01.06	The installation of lighting fixtures shall include the supply of all steel brackets, channels, angles, supporting, & anchoring material and hardware, steel brackets/hangers for bridging the gap above false ceiling and other accessories.
5.01.07	The self contained emergency lighting fixtures shall generally be installed in off site areas on walls/columns/structure as required at site.
5.01.08	Fan clamps shall be rigid enough and shall be made to suit the position suitable for reinforced concrete roofs or steel structures as required. Suspension rod shall be of adequate strength to withstand the dead and impact forces imposed on it.
5.01.09	Ballasts which, produce humming sound after commissioning at site shall be replaced at free of cost by the contractor.
5.01.10	All steel installation accessories shall be brushed-up and shall be painted with red lead primer followed by two coats of aluminium paint/enamel paint to the satisfaction of Project manager.
5.02.00	**Lighting Panel Installation**
5.02.01	Lighting panel shall be mounted at a height of 1200 mm from floor level unless otherwise specifically mentioned on walls/columns/steel structures as indicated in the drawings by fastening to suitable studs.
5.03.00	**Installation of Switch Boxes, Receptacles and Junction Boxes**
5.03.01	Switch boxes, Receptacles and Junction boxes shall be adequately supported/mounted on wall/column by means of anchor fasteners/expandable bolts or shall be mounted on angle/plate or other structural supports fixed to floor/wall/ceiling.
5.03.02	In office areas and control rooms, switch boxes shall be flush mounted in wall and junction boxes shall be recess mounted.
5.03.03	Mounting height of switch boxes and receptacles from floor level shall be as follows :

S.No.	**Item**	**Mounting Height**	**Location**
1.	Light control switch box	1500 mm	-
2.	20 A Receptacles	900 mm	Outdoor location
3.	5/15 A Receptacles	500 mm	Indoor location

5.03.04	Necessary conduit /cable entry shall be made by drilling/punching during installation depending on the requirement. No gas cutting shall be used.
5.04.00	**Conduit Installation**
5.04.01	In corrosive areas like Battery room, water treatment plant, etc. only epoxy coated

	MS conduit and accessories shall be installed for wiring purpose.
5.04.02	All accessories/fittings required for making the installation complete shall include tees, elbows, check nuts, brass or galvanised steel end caps, pull boxes, saddles, spacers and required supporting steel work.
5.04.03	Exposed conduits shall run in straight lines parallel to building columns/beams and walls. Conduits shall be fixed by using metallic saddles/clamp secured to suitable nylon rawl plugs with screws or secured to the building steel at an interval of not more than 1 metre, but either side of couplers or bends or similar fittings. Saddles/clamps shall be fixed at a distance of 30 cm from the centre of such fittings.
5.04.04	In rooms with false ceiling, conduits shall be embedded in the wall. Embedded conduits shall be securely fixed in position to preclude any movement. For embedded conduits fixing of standard bends or elbows shall be avoided and all curves shall be made bending the conduits itself. Spacing of embedded conduit shall be such as to permit flow of mortar between them and in no case shall be less than 40 mm. Embedded conduits shall have a minimum mortar cover of 50 mm. Positioning and ensuring proper alignment during concreting by other agencies shall be the responsibility of the contractor.
5.04.05	All openings in the floor/wall/ceiling etc, made for conduit installation shall be sealed and made water proof.
5.04.06	Size of conduit shall be selected considering no. of wires drawn in line with IS : 732 and as indicated below.

Size of the Wire	**Size of the Conduit (in mm)**		
	20	**25**	**40**
	Maximum Number of Wire		
1.5 Sq.mm.	5	10	21
2.5 Sq.mm.	5	8	19
4 Sq.mm.	3	6	16
6 Sq.mm.	2	5	12
10 Sq.mm.	-	4	8

5.04.07	For long conduit runs pull out boxes shall be provided at suitable intervals not exceeding 4 m to faciliate wiring. However pull out boxes need not to be provided wherever junction box exists in circuit.
5.04.08	Conduits shall be securely terminated at lighting panels, switch boxes, junction boxes/lighting fixtures by proper fasterning with a lock nut on insde and outside. The number of conduit s terminating at lightin g panel shall not exceed the permissible number considering the glanding area of lighting panel. Conduit termination shall be made water and vermin proof.
5.04.09	Conduit lengths shall be jointed by screwed couplers. Running thread equal to twice the length of coupling shall be provided on any one length to facilitate easy dismantling. The contractor shall have at site die for threading conduit. All field threaded ends shall be reamed after threading and anti-corrosive paint applied. Conduits shall be cleanly cut. The cut ends shall be within three (3) degree of square with a conduit axis. Cut ends shall be reamed and all burrs and sharp edges removed. Conduit joints and connections shall be made thoroughly water-tight and

	rust-proof by application of the thread compound which will not insulate the joints.
5.04.10	Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating device etc.
5.04.11	Slip joint 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 contracton of conduit run.
5.04.12	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. For bending of conduits, bending machine shall be arranged at site by the Contractor to facilitate cold bend. The bends formed shall be smooth.
5.04.13	The entire metallic conduit system whether embedded or exposed shall be electrically continuous and thoroughly grounded. When slip joints are used, suitable bonding shall be provided among the joint to ensure a continuous ground circuit. G.I. Pull wire of adequate size shall be laid in all conduits before installation.
5.04.14	All conduits installed outdoor shall be sloped towards pull boxes, hand holes/manholes for drainage. Low points of conduits not terminating in pull boxes, hand holes/manholes shall be provided with weep holes for drainage. Care shall be taken to see that no rough edge is left around the weep holes. Where no provision for drainage can be made, both ends of conduit shall be sealed after cable is laid through. Minimum slope of 1 in 400 shall be provided.
5.04.15	Each conduit run shall be marked with its designation as indicated on the drawings. Identifications shall be by means of painting so located that each run of conduit is readily identified at each end. Where conduits terminate at panels, switch boxes, junction boxes, or other enclosures, the designations shall also be painted on the inside of the enclosure adjacent to the conduits.
5.05.00	**Lighting Pole**
5.05.01	Installation of poles shall include construction of required foundation.
5.05.02	For lighting Poles M 15 PCC foundation shall be made a for planting depth of minimum 1/6TH of the pole height.
5.05.03	Junction box shall be fixed to the pole with 'U' clamps for wiring lighting terminating the cables. 25 mm dia holes shall be made on poles for wiring of lighting fixtures from junction box.
5.05.04	Flood light fixtures shall be mounted on galvanised M.S base making use of shop drilled holes or by suitable clamps. No cutting or drilling of galvanised structure is permitted. For mounting flood light fixtures on poles, required supporting frame work shall be made.
5.05.05	For loop-in loop out of the cables, 50 mm dia G.I. conduits with minimum 500 mm radius shall be laid along pole mast embedding in PCC foundation. The 50 dia G.I.

	conduit shall be part of installation.
5.05.06	G.S. Earthing bolt (Size M6) shall be welded to pole/mast for earthing pole/mast. Fixture and junction box shall be inter connected by earthing wire to pole/mast earthing bolt. Earth connection between pole/mast and earth electrode shall be made by 25x3 mm GS flat. Welding between GS flat and electrode shall be provided with protective coating.
5.05.07	2 C X 2.5 mm2 cable from street lighting pole JB to the lighting fixture, 4 CX 16 mm2 cable from the lighting mast JB-M to JB-M1 and 2 C X 2.5 mm2 cable for wiring of fixtures on top of the mast shall be supplied by the employer. The same shall be laid and terminated by the Contractor. The cost of this work shall be included in the installation price of lighting pole/mast.
5.05.08	Lighting poles shall be painted with two coats of aluminium paint after completion of installation.
5.06.00	**Wiring Installation**
5.06.01	Wiring installation of various areas between lighting panels, switch boxes, junction boxes, fixtures, fans, receptacles etc. shall be done in G.I. conduits.
5.06.02	Lighting fixtures shall generally be group controlled directly from lighting panel. However, in office areas, control shall be provided through switch boxes.
5.06.03	A junction box with two way terminal block of suitable size shall be provided near the fixture except the fluorescent fixtures and last fixture in a circuit for loop -in-loop-out and T-off connection.
5.06.04	All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible. Call bell wiring in office area shall also be done by the Contractor.
5.06.05	Wires shall not be pulled through more than two equivalent 90^0 bends in a single circuit run. Wherever required, suitable conduit junction boxes/pull boxes shall be provided. All types of wiring, concealed or unconcealed shall be capable of easy inspection.
5.06.06	Receptacles and lighting circuit shall be fed from different circuits. The switch controlling these circuits shall be on the phase wire of the circuits.
5.06.07	A.C. normal and DC system wiring shall run throughout in separate conduits.
5.06.08	Wiring shall be spliced only at junction boxes/terminal blocks. Maximum two wires shall be connected at each terminal. In vertical run of conduit the wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.
5.06.09	For group controlled of lighting fixtures, single phase receptacles and switch boxes, aluminium wire of 4/6/10 sq. mm. shall be used from lighting panel as circuit wiring, as applicable. However, T-off connection to the lighting fixture shall be done by 1.5 sq.mm. copper.

5.06.10	The wiring between switch box and lighting fixtures and fans shall be done by 1.5 sq.mm. copper wire.
5.06.11	All lighting wires shall be crimped using solderless crimping type tinned copper lugs suitable for the specified type of terminal block.
5.07.00	**Ceiling Fans and Regulators**
5.07.01	The contractor shall install the ceiling fans and regulators at the locations shown in the relevant drawings. The exact locations will however, be decided at site in consultation with Project manager.
5.07.02	The fan regulator shall be mounted on the lighting control switch box provided in that area.
5.07.03	Hook along with rubber bush shall be supplied and grouted in ceiling for mounting the fan. All necessary, material and hardware for installation shall be supplied by the Contractor.
6.00.00	**EARTHING OF LIGHTING SYSTEM**
6.01.01	Lighting panels, etc. shall be earthed by two separate and distinct connections with main earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run alongwith each conduit run. Cable armours shall be connected to earthing system at both the ends.
6.01.02	Earthing conductors shall be free from pitting laminations, rust scale and other mechanical defects.
6.01.03	Connection between earth leads and equipment shall normally be bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.
6.01.04	Earthing conductors along their run on column, walls, etc. shall be supported by suitable welding/cleating at an interval of 1000 mm.
6.01.05	20 mm dia M.S. electrode of 3 meter long shall be embedded below permanent moisture level for earthing every lighting pole and mast.
6.01.06	On completion of installation, continuity of earth conductors shall be checked.
7.00.00	**QUALITY ASSURANCE PROGRAM**
7.01.00	Bidder shall furnish detailed Quality Assurance Programme and Quality Plans for all materials and accessories to be supplied and installed under the scope of the specification as per General Technical Conditions of technical specification. The Quality Plans shall include all tests/checks as per relevant National/International Standards and the requirements of this specification including tests listed under clause 8.0.0 of this Section.

8.00.00 **TESTS**

8.01.00 All the equipment, device and materials being supplied shall be type tested type as per relevant IS.

8.03.00 **Type Tests**

8.03.01 Lighting Fixtures

List of the types tests on each type of lighting fixtures as per applicable I.S.

S.No.	Test
1.	Visual Examination
2.	Dimensional checking
3.	Insulation Resistance(dry) test
4.	High voltage test
5.	Thermal test
6.	Photometric Test / Luminous output test
7.	Endurance Test
8.	Protection against Electric Shock.
9.	Thermal Shock proof test for glass
10.	Rain proof test
11.	Test for dust tightness
12.	Jet proof test
13.	Splash proof test
14.	Humidity test
15.	Power factor measurement Test
16.	Wind loading test

8.03.02 Type test reports for the following test shall be submitted for Lamps of each rating and type with adequate details / drawings to establish equivalence with the offered type.

8.03.03 Type test reports for the following items, shall be submitted as per relevant standards.

a. Degree of protection test for Lighting panel of each type.
b. Degree of protection test for Junction box of each type.
c. Receptacle of each rating.
d. Miniature circuit breaker of each rating.
e. MCB of each rating.
f. Mechanical strength test for lighting fixtures.

8.04.00 **Acceptance Test and Routine Test**

8.04.01 All lighting fixtures, lamps and items listed under BOQ shall be subjected to acceptance and routine test, as per relevant specified standards.

8.04.02 Junction boxes, switch boxes, receptacle enclosure etc. shall be subjected to physical and dimensional checks.

8.05.00	**Galvanizing Tests**
8.05.01	The quality of galvanizing shall be smooth, continuous, free from flux stains and shall be inspected visually.
8.05.02	In addition following tests shall be conducted as acceptance tests. i) Uniformity of coating - The coating of any article shall withstand for 1minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal. ii) The quality of cadmium/zinc plating on items with screw threads shall be free from visible defects such as unplated areas, blisters and modules and shall be inspected visually. iii) In addition, the plating thickness shall be determined microscopically/chemically or electronically.
9.00.00	**COMMISSIONING CHECKS**
9.01.00	On completion of installation work, the Contractor shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.
9.02.00	The Project manager 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.
9.03.00	The installation shall be then tested and commissioned in presence of the Project manager.
9.04.00	The contractor shall provide all, men material and equipment required to carry out the tests.
9.05.00	All rectifications repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor without any extra cost. The handing over the lighting installation shall be effected only after the receipt of written instruction from the Employer/his authorised representative.
9.06.00	The testing shall be done in accordance with the applicable Indian Standards and codes of practices. The following tests shall be specifically carried out for all lighting installation. a. Insulation Resistance. b. Testing of earth continuity path. c. Polarity test of single phase switches. d. Functional checks.
9.07.00	The lighting circuits shall be tested in the following manner : a. All switches ON and consuming devices in circuit, both poles connected together to obtain resistance to earth. b. Insulation resistance between poles with lamps and other consuming devices removed and switches ON.

10.00.00 **ILLUMINATION LEVELS AND TYPE OF FIXTURE**

Location	**Avg. Lux level**	**Type of Fixture**
Street light	10	HPSV
Switchyard	20 (general)	HPSV
	50 (on strategic eqpt)	HPSV
Control room	300	FR2
Cable Vault	50	FB
Switchgear room	150	FI
Battery room	150	FC
Charger room	100	FR1
Offices	300	FR1
Toilet	-	FB1
Staircase	-	FB1
Emergency DC		
Control room	20	IR
Battery room	20	IB
Staircase	20	IB

SECTION-3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.1 PROJECT INFORMATION

a) Customer : National Thermal Power Corporation Ltd.

b) Project : 400 / 132 kV Switchyard Package for Barh Super Thermal Power Project (3x660 MW)

c) Consultant : None

d) Project Location : The site is approximately 4 KMs from Barh town. The nearest railway station is Barh on the Patna – Calcutta section of main trunk route. Patna is approximately 75 KMs from the site.

3.2 SITE CONDITIONS

3.2.1 Ambient Temp.

			OUTDOOR	INDOOR
a)	Ambient air temp. (max.)	:	+ 45 °C	+ 40 °C
b)	Ambient air temp. (min.)	:	0 °C	0 °C
c)	24 hour average (max.)	:	+ 40 °C	+ 35 °C

All equipment/ systems shall be designed for ambient temperature of 50°C

3.2.2 Relative humidity for design purposes % : 100

3.2.3 Height above mean sea level in meters : <1000 meters

3.2.4 Pollution Severity : High (25 mm/ kV)

3.2.5 Wind data

a) The basic wind speed Vb at 10 meters above mean ground level : 47meter /sec

b) Max. Wind Pressure on steel members. : 1500 N/m^2

3.3 QUALIFYING REQUIREMENT

The sub contractor shall offer type tested equipment as per applicable IEC Standards or as specifically specified. The equipment shall be in successful operation for at least two years and type test has been conducted on it.

3.4 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests / acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested, type test reports of the same shall be submitted for scrutiny. Type test reports more than five years old will not be acceptable. These reports should be for the test conducted on the equipment similar to these proposed to be supplied under this contract and the test should have been either conducted at an independent laboratory or should have been witnessed by a client.

If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the sub contractor will have to carry out the Type Tests without any extra cost and/or delivery implications.

Where specified by the purchaser, type tests will have to be conducted by the sub-contractor on the equipment in the scope of supply. Such tests shall be witnessed by the customer/ consultant and BHEL for which the test charges and delivery implications if any, shall be indicated separately by the sub-contractor.

3.5 SITE SUPERVISION OF EQUIPMENTS

Bidders shall furnish undertaking that erection, testing and commissioning shall be carried out under their supervision.

3.6 ENCLOSURES

A) Chapter G1 – General Technical Requirements (19 pages)
B) Chapter E12 – Requirement of Auxiliary Items (10 pages)
C) Model/ Standard General Technical Conditions (QA&I Portion) (19 pages)