

UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM LTD

1 X 660 MW PANKI THERMAL POWER EXTENSION PROJECT

VOLUME – II

**TECHNICAL SPECIFICATION FOR
LIGHTING FIXTURES, LAMPS AND MISCELLANEOUS ITEMS**

SPECIFICATION NO : PE-TS-426-558-E001, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UTTAR PRADESH, INDIA – 201301**



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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'.
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in BOQ-Cum-Price schedule of the specification shall not be considered (i.e. technical description & quantities as per specification shall prevail).



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SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE OF SUPPLY AND SERVICES

1.1 SUPPLY:

Design, manufacture, assembly, inspection & testing at vendor's/ sub-vendor's works, proper packing and delivery to site of **LIGHTING FIXTURES, LAMPS & MISCELLANEOUS ITEMS** as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation.

1.2 SYSTEM DESIGN ENGINEERING:

System Design Engineering is included in vendor's scope, which includes design of complete lighting system for indoor and outdoor areas of the power plant. Please refer the list of LLO/LDC/CLO/PDS drawings as per Annexure-B for the tentative areas to be covered by the lighting system. The aspect of engineering covers preparation of electrical distribution and control schemes, quantity estimation, luminaire layout drawings, conduit layout drawings, wiring schemes upto luminaires, cable schedules and all associated design work not specifically mentioned in the specification. The quantity estimation to include all items required for the complete lighting system viz. lighting fixtures, lamps, Lighting DBs, Welding DBs, lighting panels, conduits, PVC wires etc.

1.3 Supervision of Erection & Commissioning (as required by site) of lighting system is included in vendor's scope.

1.4 Although Erection and Commissioning is not included in vendor's scope, the vendor shall still not be absolved of his responsibility of establishing the correctness of engineering and equipment at site.

1.5 Standard technical requirements of the lighting fixtures, lamps & miscellaneous items and lighting system design requirements are indicated in Section-II. Project specific requirements/changes are listed in Section-I.

1.6 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail and govern in case of conflict between the corresponding requirements of Section-I and Section-II.

1.7 Review of sub-vendor's documents by the purchaser shall not relieve the vendor from the responsibility of design & supply.

1.8 The documents shall be in English language and MKS system of units.

1.9 Make of all equipment and components shall be as per attached Sub-Vendor List enclosed as per Annexure-A to section- I.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per BOQ-cum-price schedule as part of NIT.

3.0 STATUTORY AND REGULATORY REGULATION

3.1 Statutory and regulatory regulation shall be applicable as per Indian Electricity Rule, 1956 with amendment-3 Rule no. 35, 48, 49, 50, 61 & 64 for illumination & low voltage power services.

4.0 DOCUMENTATION

4.1 Documents required along with the technical offer: -

a) Signed & Stamped copy of Compliance certificate



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- b) Duly filled in signed & stamped copy of scope matrix for broad activities
- c) Signed & stamped copy of unpriced price schedule with “quoted” word indicated against all items.
- d) Duly filled in signed & stamped copy of Datasheet-B.

4.2 Documents required after award of LOI/PO shall be as per Annexure -B (to be submitted by successful bidder).

5.0 SPECIFIC TECHNICAL REQUIREMENTS

5.1

S.No.	Reference clause No. of Section-II	Specific requirement/Change
1	5.2.1(n), Page-17	“The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70Lm/W” shall be read as “The LED chip efficacy shall be min 120 Lm/W”
2	Additional Clause no.6 to be added under annexure-I of section-II as below:-	

6.0

SL. No.	Type of Luminaire	Description	Total Luminous flux (Lumen) of luminaire- Minimum value	Measured Electrical Input Power(Watt)- Maximum value
1	FC02(LED)	Industrial type LED fixture suitable for conduit /surface/ suspended mounting, with integral driver aesthetically designed for Switchgear / Equipment room/stair case/ corridors	3780	42
2	FC06(LED)	Industrial type LED fixture suitable for conduit /surface/ suspended mounting, with integral driver aesthetically designed for Switchgear / Equipment room	3780	42
3	FC07(LED)	Industrial type LED fixture suitable for conduit/ surface/ suspended/ column mounting, having integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc to be included accordingly, if required.	1260	14



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4	FC26(LED)	Panel (approx. 1200 mm X 300 mm) LED luminaire suitable for recess mounting in false ceiling with integral driver aesthetically designed for Control Room/ Office	3780	42
5	FC30 (LED)	Panel 600 mm X 600 mm LED luminaire suitable for recess mounting in false ceiling with integral driver aesthetically designed for Control Room/ Office	3780	42
6	FC32 (LED)	Decorative, surface mounted LED fixture having integral driver	3780	42
7	FC33 (LED)	Decorative, recessed type LED fixture having integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc. to be included accordingly, if required	1260	14
8	FC34 (LED)	Well glass, dust proof type LED fixture having integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc. to be included accordingly, if required	1260	14
9	FC81(LED)	Corrosion proof, totally enclosed type LED fixture having integral driver.	3780	42
10	SB11 (LED)	Medium bay, Industrial type LED fixture	10080	112
11	SB02 (LED)	High Bay Industrial type LED fixture	16920	188
12	SB03 (LED)	High Bay Industrial type LED fixture suitable for turbine hall operating floor (mounting height >10 m)	24750	275
13	SF63 (LED)	Flood light, heavy duty type LED fixture	16920	188
14	SF64 (LED)	Flood light, heavy duty type LED fixture	27000	300
15	SF66 (LED)	Flood light, heavy duty type LED fixture	45000	500
16	SS61 (LED)	Street light LED fixture	6500	73
17	SS62 (LED)	Street light LED fixture	10080	112



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18	SS63(LED)	Street light LED fixture	16920	188
19	SW41(LED)	Well glass type, vapour proof LED fixture suitable for Boiler / ESP platforms	4680	52
20	SW42(LED)	Well glass type, vapour proof LED fixture suitable for Boiler / ESP platforms	7380	82
21	MW96(LED)	Well glass, flame proof increased safety luminaire LED fixture having an integral driver suitable for division-2, Group IIA/IIB of hazardous areas.	8460	94
22	FC30 (LED) DIMMABLE	Panel 600 mm X 600 mm LED luminaire suitable for recess mounting in false ceiling dimmable type with driver aesthetically designed for Control Room/ Office	8460	94
23	Downlighter(LED)	Recessed Mounted Downlighter with Integral driver aesthetically designed for Control Room/ Office	1500	18
24	Downlighter(LED) DIMMABLE	Recessed Mounted Downlighter Dimmable type with driver aesthetically designed for Control Room/ Office	1500	18

Notes:

- 1) LED must comply all the parameters of IS 16105 or IESNA LM-80-08.
- 2) The Luminaire must comply all the parameters of IS 16106 or IESNA LM-79-08.
- 3) The LED driver should comply to IEC 61347-2-13, IS 15885: Part 2: Sec 13, IEC 62384, IS 16104 and CISPR 15.
- 4) The luminaire complete with all accessories shall comply to relevant specified standards.
- 5) The values of minimum luminous flux & maximum measured electrical input power are specified above for the luminaire (including any accessories like driver module etc). These values shall be measured as per IS 16106 & shall not be subject to any further tolerance.
- 6) All parameters mentioned in Section-II, Clause 5.2.1 are to be complied in totality.

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5.0 SPECIFIC TECHNICAL REQUIREMENTS (Continued)

5.2 LIGHTING SYSTEM DESIGN:

- 5.2.1 Lighting system will be designed to ensure adequate uniform visual performance, safety & reliability and will be free from excessive glare and flicker from discharge lamp. In main control room, particular attention will be given to ensure that illumination is proper and aesthetic. Control room lighting will be such as to prevent any glare/ luminous patch on control board /panel/ VDUs when viewed from an angle.
- 5.2.2 All fixtures shall be of a proven design for applications in power plant environment. All outdoor fixtures shall be weatherproof type.
All outdoor fixtures shall be with DOP IP-55.
Type of fixtures/ lux level shall be as per annexure-I
- 5.2.3 LED medium bay fixtures will be installed in areas with sufficient minimum headroom of 5 meter.
However, above minimum headroom may or may not be feasible in boiler/ HRSG area and fixture will be mounted on columns/bottom of platform as per site requirement. Separate mounting arrangement shall be provided that shall be supported from handrails provided on boiler platform walkway, if mounting structure is not available.
- 5.2.4 Flame proof LED lighting fixtures will be installed in Fuel Oil areas and hazardous area as per area classifications. All highbay fixtures will have vibration damper.
- 5.2.5 In general, the type of fixtures, type of luminaries and illumination levels to be achieved will be as per enclosed Annexure-I.
- 5.2.6 The lighting fixtures in the plant area will be group controlled from lighting panel. The lighting fixtures in office areas, control rooms, AC areas/Service building etc. will be controlled by switches.
- 5.2.7 Lighting panel (LP) for controlling lights with additional provision for manual control shall be provided:

Indoor lighting panel: With Timer
Outdoor lighting panel: With Timer
- 5.2.8 Outdoor areas like Fuel oil tank area, open store etc. shall have flood light fixtures mounted on flood light poles.
- 5.2.9 Type of luminaries used for lighting of all indoor & Outdoor areas as per Annexure-I. For DC lighting & Hazardous areas LED type luminaries shall be used.
- 5.2.10 **Service building, admin building and Training Centre shall be ECBC Compliant.**

5.3 ILLUMINATION DESIGN CALCULATION:

- 5.3.1 Lighting design for indoor areas will be done by LUMEN method only.
For a given indoor area, number of luminaires is calculated as follows:

$$\text{Number of luminaires} = \frac{L \times W \times \text{LUX LEVEL (Average)}}{\text{LUMEN} \times \text{COU} \times \text{MF}}$$

where,

L= Length of room (Restricted to Max. 5 times of width)

W= Width of room

LUMEN= Lumen output of each lamp

COU= Coefficient of Utilisation

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MF= Maintenance Factor

Coefficient of Utilisation (COU) is determined from the COU chart for a particular luminaire of the manufacturer, corresponding to selected reflection factors and calculated Room Index.

The working plane from the floor level considered at : 0.85 meter

The Room Index is calculated by the following formula:

$$\text{Room Index} = \frac{L \times W}{(L + W) \times MH}$$

where, MH = Mounting height of luminaire.

The Reflection Factor (RF) will be considered as given below:

	Ceiling (rc)	Wall (rw)	Floor (rf)
For clear areas such as switchgear room/ control room etc	70	50	10
For Dusty area such as conveyor galleries/tunnels, TPs/ Crusher House etc	50	30	10

Values of Maintenance Factor (MF), which includes the luminaire depreciation factor also as per IS-3646, will be considered as given below:

Boiler area and area prone to chemical/ dust pollution=	0.55
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

- 5.3.2 Lighting design for outdoor area, open area shall be done by computer programme as per standard norms for lighting design to meet the specified lux level.

Average maintenance factor for outdoor and road lighting : 0.55

For outdoor lighting and road lighting ratio of minimum to average illumination will not be less than 0.3 and for minimum to maximum will not be less than 0.05.

5.4 LIGHTING SYSTEM DESCRIPTION

Lighting system will be provided with AC normal, AC emergency and DC emergency as listed against various areas as per Annexure-II enclosed.

The sources of power lighting are as below :

- (i) 415V AC Normal (ACN) Supply from different station PMCCs /MCCs
- (ii) 415V AC Emergency (ACE) Supply from Emergency Board
- (iii) 220V DC Emergency Supply from DC Distribution Board
- (iv) 24V AC Supply for maintenance

For main plant area normally all AC luminaries will be in service on normal AC supply.

Approximately distribution of AC Luminaries on AC normal and AC emergency shall as below:

AC Normal (ACN) supply: 75 %

AC Emergency (ACE) supply: 25 %

Normally all DC luminaries shall be 'ON'. Upon failure of AC supply, DC luminaries will be 'ON' through DC supply. On restoration of AC Emergency supply through DG, ACE luminaries will be put-on.

For other auxiliary areas AC Normal lighting will provide 100% illumination level and normally all AC lighting

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fixture shall remain "ON" as long as normal AC supply is available. In DG room, in addition to DC emergency lighting, 100% AC emergency lighting will be provided.

Lighting level by DC emergency lighting will be provided to meet functional/operational requirements. DC fixtures will be located at strategic locations such as near entrance, staircase, landings etc. for safe personnel movement during emergency.

In off-site areas/odd locations (BHEL scope), for safe movement of personal during emergency, self contained battery operated emergency lighting units (ELUs) is envisaged.

Floor Mounted Main Lighting Distribution Board with lighting transformer shall be of MS type. However other area wise lighting DBs shall be of FRP type.

Junction boxes shall be of 16SWG sheet steel hot-dip galvanized, dust and damp proof, generally conforming to IP-66 and for outdoor use shall be of weather proof IP-66, for Battery and Chemical Room shall be corrosion proof. For hazardous area JB shall be part of flame-proof fixture itself.

5.4.1 AC Normal Lighting Systems:

AC Normal lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from Lighting Distribution Board (LDB).

LDBs consisting of dry type isolation transformer housed in LDB with proper separation from distribution panels as per details indicated below is envisaged:

Transformer rating:	50 / 100 kVA
Transformer voltage ratio:	415 / 433 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type:	Non Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	One incomer
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer rating
Outgoing feeder type:	TPN MCCB
Outgoing feeder rating:	63A

AC normal lighting panel as per details given below is envisaged:

Incomer type:	TPN MCB
Incomer rating:	63A
Outgoing feeder type:	SPN MCB
Outgoing feeder rating:	20A
Short circuit rating:	9kA

Street lighting panel as per details given below is envisaged:

Incomer type:	TPN MCCB
Incomer rating:	100A
Outgoing feeder type:	TPN MCB
Outgoing feeder rating:	20A
Short circuit rating:	9kA
ON/ OFF control	With Timer & photocell

5.4.2 AC Emergency Lighting Systems:

AC Emergency lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP)

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which are fed from AC Emergency Lighting Distribution Board (ELDB).

ELDBs consisting of non-encapsulated, dry type isolation transformer housed in ELDB with proper separation from distribution panels as per details indicated below is envisaged:

Transformer rating:	50 / 100 kVA
Transformer voltage ratio:	415 / 433 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	One incomer
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer rating
Outgoing feeder type:	TPN MCCB
Outgoing feeder rating:	63A

AC emergency lighting panel as per details given below is envisaged:

Incomer type:	TPN MCB
Incomer rating:	63A
Outgoing feeder type:	SPN MCB
Outgoing feeder rating:	20A
Short circuit rating:	9kA
	Yes

5.4.3 DC Emergency Lighting Systems:

DC Emergency lighting fixtures fed through suitable numbers of conveniently located DC Emergency Lighting panel (DCELP) which are fed through DC Lighting Distribution Board (DCLDB).

The DCLDB shall be fed from two sources i.e. AC emergency lighting distribution board (ELDB) and DCDB. The emergency lighting fixtures connected to this system shall remain normally 'ON' all the time from AC supply & on failure of AC supply they will automatically switch over to DC supply system. DCLDB shall be equipped with AC under voltage relay and contactor for emergency auto changeover scheme.

DCLDBs as per details given below is envisaged:

Distribution Panel type:	Single front fixed type
DC Incomer type:	DP Switchfuse unit with contactor
DC Incomer rating:	125A
AC Incomer type:	TPN MCB with contactor
AC Incomer rating:	63A
Outgoing feeder type:	DP Switchfuse unit
Outgoing feeder rating:	32A

DCLPs as per details given below is envisaged:

Incomer type:	DP Switchfuse unit
Incomer rating:	32A
Outgoing feeder type:	DP MCB
Outgoing feeder rating:	20A

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5.4.4	The LDBs will be provided with voltmeter and ammeter along with selector switch, supply ON indicating lamps etc. All indicating lamps will be cluster LED type. The DOP for LDB will be IP-54 and for transformer cubicle IP-42. Where as the DOP for LP will be IP-54 for indoor and IPW-55 with canopy for outdoor.			
5.4.5	24V AC Supply system: Each 24V AC supply module will have one no. dry type two winding, 1 phase transformer and necessary terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module will be fed from AC emergency lighting panels (ACELP). Details of 24V supply modules shall be as given below:			
	Module type:	Portable type / Fixed type		
	Enclosure:	Steel sheet of 2MM Thickness with louvers		
	Transformer rating:	500 VA		
	Transformer voltage ratio:	240 / 24 Volt		
	Primary side isolation:	DP MCB with HRC fuse		
	Isolator rating:	15A		
	HRC fuse rating:	5A		
	Secondary side isolation:	SPN MCB with HRC fuse		
	Isolator rating:	5A		
	HRC fuse rating:	15A		
	Fixed type 24V supply modules shall be provided in following areas:			
	Boiler/ HRSG area:	Near inspection manholes on boiler platforms and boiler drum.		
	TG Building:	Near HP & LP heaters, turbine flash tank, blow down tank, near condenser water box and near bus duct termination of generator end.		
	ESP area:	Near inspection manholes.		
	other area:	Near Deaerator		
	Suitable numbers of 24V portable halogen lamp unit along with flexible copper cable shall also be supplied as per details below:			
	Lamp wattage:	40 W		
	Cable size:	2.5 sq. mm		
	Cable length:	20 meter		
5.5	Emergency EXIT lamps: Emergency exit lamps backed up by battery shall be provided at strategic locations of the building for safe exit of personnel. These exit lamps will remain ON all the time and normally received power supply from ACELP.			
	Exit lamp unit shall contain maintenance free Ni-Cd battery with 4 hours backup capacity.			
5.5.1	ELUs shall contain maintenance free Ni-Cd battery with 4 hours backup capacity. Each ELU will have battery charger and 2x10W fluorescent lamp with test switch.			
5.6	STREET LIGHTING / OUTDOOR LIGHTING SYSTEM			
5.6.1	The design for roads within BHEL scope as per contract will be considered for lighting.			
5.6.2	Street lights / outdoor lighting will be fed from separate panel located at suitable places. Automatic switching ON/OFF of these circuits shall be done from street light panel.			
5.6.3	For street lighting, street light pole will be used. For outdoor area lighting lighting if required flood light pole will be used. Pole type shall be as below:			

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	Pole height:	11m Street Lighting Pole (PS1) for 1 Luminaire with 1.2m Bracket for Road Width upto 4m (Single Road) with mounting height (MH) from road level 9.5m approx. 11m/13m Street Lighting Pole (PS2) for 1 Luminaire with 1.2/1.8m bracket respectively for Road Width> 4m (single road) with MH 9.5m/11.5m approx. respectively. 13m Street Lighting Pole (PS4) for two Luminaire with 1.8m bracket each for Road Width> 7m (Bi Directional road) with MH 11.5m approx. 11m Flood Lighting Pole (PF1) for one Luminaire 13m Flood Lighting Pole (PF2) for two luminaire		
	Pole construction type:	Fabricated, swaged, steel tubular poles with swan neck arrangement		
	Pole type:	Painted		
	The technical details of poles will be as per IS-2713. The poles shall be equipped with junction boxes and all other required accessories.			
	The poles will be located 1.5 M away from the road edge. The buried cable will run in hume pipe (100 mm dia) wherever it is crossing the roads.			
5.6.4	High mast will be used, if required. High mast will be 30 meter high, hot dip galvanised and polygonal shaped. The location of high mast will be decided during detailed engineering.			
5.7	LOW VOLTAGE POWER SERVICES			
5.7.1	Different type of receptacles as per details below will be provided:			
	(i) Decorative receptacle (RB Type Receptacle)			
	At least 01 number 5/15A, 3-Pin, 230V AC decorative socket will be provided in office, store, cabin etc.			
	For charging of 5A switch sockets, concealed type fixed wiring shall be provided for powering the switch/sockets units in the BHEL supplied modular furnitures.			
	(ii) Industrial receptacle: (RA Type Receptacle)			
	At least 01 number 20A, 5-Pin, 240V AC industrial type receptacles will be provided at suitable location in plant building like switchgear room, MCC room (loacton will be decided during detailed Engineering. The receptacles shall be provided at interval of 20m or part thereof. All receptacles will be controlled with a switch. In hazardous area receptacles will be of flameproof type.			
	(iii) Welding receptacle: (RC Type Receptacle)			
	63A, 3-phase, 415V AC welding receptacles with isolating switch will be provided at specific points (location will be decided during detailed engineering). Maximum 03 nos. receptacles will be fed through one feeder. In hazardous areas these receptacle will be located in MCC room. Each welding receptacle shall be provided with ELCB.			
	(iv) 400 Amp Welding receptacle: (RD Type Receptacle)			
	400A, 3-phase, 415V AC welding receptacles with isolating switch will be provided with MCCB & earthing for transformer oil filtration unit. The general construction of receptacle shall be similar to 63A welding receptacle.			

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5.7.2 Transformer rating for welding distribution board shall be 100kVA. Other construction details shall be identical to AC LDB.

5.7.3 Based on room size, suitable nos. of ceiling fans (1200mm sweep) with Stepped electronic regulator with minimum five steps shall be provided in office rooms, store rooms and social buildings which are not covered by air-conditioned and ventilation system. In the office premises, one fan per 10 sq. metres shall be provided. Pedestal fans shall also be provided, if required.

5.7.4 For the maintenance of lighting fixtures within the power house, 4 nos. free standing adjustable aluminium ladder, adjustable from 05M to 10M shall be provided. For the maintenance of street lights, 01 no. of wheel mounted adjustable aluminium ladder shall be provided.

5.8 WIRING / CONDUITS/ EARTHING (For Design Purpose Only)

5.8.1 Wiring of lighting system will be done as follows:

(i) **Wiring in Boiler areas, TG Hall Floors, Cable Vaults and hazardous area like transformer yard, outdoor area (like Tank area, GT area) will be done using Cu/Al, PVC insulated, FRLS PVC sheathed armoured cable which shall be laid in cable tray running in these areas.**

Wiring installation in CCR Room, ESP Control Room, Switchgear Rooms, Pump Houses, DG Room, Compressor House will be done by multi-stranded, PVC insulated, colour coded wires laid in GI conduits of 20 mm dia size (minimum) conforming to IS-9537 for areas like . The thickness of conduits upto & including 25 mm dia will be 16 SWG and conduits above 25 mm will be 14SWG.

(ii) Conduits will be heavy-duty type hot dip galvanised steel conforming to IS-9537. Conduit accessories will be hot dip galvanised. In corrosive area, conduits will have suitable epoxy coating additionally.

(iii) Flexible conduits made with bright, cold rolled annealed and electro galvanised mild steel strips and coated with PVC will be used where required.

(iv) Conduits in control room, service building, laboratory building and other air-conditioned areas will be surface mounted on the roof above false ceiling, however vertical drops of conduits will be concealed along walls and finally plastered for better aesthetics.

(v) Filling area of wires in conduit shall not exceed 40% of the conduit area.

(vi) Wiring for AC Normal, AC Emergency, and DC Emergency services will run in separate conduits.

(vii) Lighting and receptacles will be fed from separate circuits. No two different phase circuits will be run in the same conduit. However, different circuits of same phase may be laid in the same conduit.

(viii) Maximum 03 numbers of 1-phase receptacles will be loop in & loop out in a circuit.

5.8.2 **Following sizes of 1100 V grade, PVC insulated single core stranded copper conductor wires/ PVC insulated Standed 2 Core copper/aluminium conductor cable will be used:**

	Wire	Cable
Lighting Panel to Fixtures:	2.5 sq. mm (Cu)	2.5 sq. mm (Cu)
Lighting Panel to JB's/ Switches:	2.5 sq. mm (Cu)	2.5 sq. mm (Cu)
JB's/ switches to Fixtures:	2.5 sq. mm (Cu)	2.5 sq. mm (Cu)
Panel to First receptacles:	4.0 sq. mm (Cu)	10 sq.mm (Al)

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	First receptacles to looping other receptacles:	4.0 sq. mm (Cu)	10 sq.mm (Al)	
	In case of only one receptacles in ckt., Panel to receptacles:	4.0 sq. mm (Cu)	10 sq.mm (Al)	
	Panel/ JB's to flood light fixtures:	2 x 2.5 sq. mm (Cu)	2.5 sq. mm (Cu)	
5.8.3	The earthing terminal for junction boxes, receptacles, fixtures, conduit etc.shall be suitable for 8 SWG GI wire. however, The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 16 SWG GI wire. One 16 SWG G.I wire shall be taken upto the junction box from lighting fixtures and connected to grounding point. All junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. Rules. Junction boxes shall have following indelible markings : 1. Circuit nos. on top 2. Circuit nos. with ferrules (inside) as per drawing 3. DANGER sign in case of 415V circuit			
5.8.4	The conduits & wires are excluded from bidder's scope of supply			
5.9	SWITCH & SWITCH BOARD a) Modular Switches, miniature circuit breakers (MCB), 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. b) All switch boards/boxes shall be of bent steel construction, fabricated of 14 SWG M.S. sheet with 6 mm thick Bakelite cover. c) 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. d) Switch boards / boxes shall have conduit knock outs on the sides. Adequate provision shall be made for ventilation of these boxes. e) Flush type receptacles where provided shall be so located that only the plug projects outside. f) Switches shall have quick-make and quick-break mechanism operated by a suitable external handle complete with position indicator. g) Occupancy switches shall be provided in service building.			
5.10	EARTHING Earthing of lighting system will be done by using of following sizes of wire / flat: Lighting Distribution Board: GS Flat 35x6 mm Lighting Panels: Not Applicable Lighting fixtures, receptacles, conduits, junction boxes & switch boxes: 14 SWG GI wire Welding receptacles: GS Flat 35x6 mm Street light pole/ flood light pole: Not Applicable High mast: GS Flat 50x6 mm Electrode for Pole : Not Applicable High mast earthing: 40 mm dia MS rod, 3 mtr long Street lighting panel: GS Flat 35x6 mm			

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5.11 PAINTINGS All sheet steel enclosures shall be chemically cleaned, rinsed, phosphated, rinsed and dried. After the treatment, steel surfaces shall be given undercoats of primer and finished with two coats of sprayed-on enamel or lacquer of approved shade. All steel fabrication shall be given two coats of red-oxide primer followed by two coats of Siemens gray (RAL-7032). All equipment shall be given touch-up paint as required after installation. 5.12 STATUTORY & REGULATORY REQUIREMENT Statutory and regulatory regulation shall be applicable as per Indian Electricity Rule, 1956 with amendment-3 Rule no. 35, 48, 49, 50, 61 & 64 for illumination & low voltage power services.				

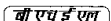
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ANNEXURE-I

AVERAGE LUX LEVEL & TYPE OF FIXTURES

S. No.	LOCATION	AVERAGE LUX LEVEL	TYPE OF LIGHTING FIXTURES
01	TG Hall operating floors	200	High bay LED Luminaire
02	TG hall ground, mezzanine floor	200	LED High/ Medium bay, LED well glass fixture
03	Switchgear/ Charger rooms	250	Energy Efficient LED TL
04	Main control room, Computer room	500	LED luminaire equivalent to Mirror optics with anti glare features type/ downlighter
05	Office areas, Conference rooms	300	Decorative mirror optics LED Luminaire/ LED Downlighter
06	UPS/Operator Room	200	Energy Efficient LED TL
06	Battery rooms	200	Industrial corrosion proof energy efficient FTL.
07	Cable Vault	100	Energy Efficient LED TL
08	Transformer yard	50	Flood light/dust proof integral well glass type LED.
09	Boiler Platforms	100	LED, well glass luminaire
09	Boiler Burner Platforms	100	LED, well glass luminaire
10	ESP area & platforms	100	LED, well glass luminaire
11	ESP control room	300	Decorative recessed mounted type LED.
12	DG room	200	LED medium bay/ industrial type LED luminaire.
13	Mill Reject Compressor room/ CST Pump House	200	LED medium bay/ industrial type LED luminaire.
14	AC plant/ Air washer room	200	LED luminaire, Totally enclosed vapour proof clear acrylic
15	Service/ Technical Building	300	LED, medium bay, industrial type/ Decorative recessed/ surface mounted type LED.
16	Pump house	150	LED, medium bay, industrial type/ surface mounted type LED.
16	Fuel Oil Pump house	250	Flame proof LED type luminaire
16	Fuel Oil Unloading	25-50	Flood light/dust proof integral well glass type LED.
17	Coal Bunker & Mill bay area, feeder floor, Trippler floor	50	LED, well glass luminaire, Dust proof type
18	Street lighting	15-20	LED street lights
19	Corridors walk ways, staircase, toilets, wash rooms etc	100	LED Luminaire, industrial type
20	Toilet Wash room etc.	70	LED Luminaire, industrial type
21	Garage/ Car Parking	50	LED luminaire.
22	Unloading and maintenance bay	300	LED high bay/ industrial type LED luminaire.
23	Elevator	100	Energy Efficient LED TL
24	Aux. Boiler area	100	LED, well glass luminaire
25	CPU Regeneration Building	250	LED, high bay, industrial type.

- Note:**
- 1) The fixture will be suitable for Division-2, Group IIA/IIB of hazardous area as per IS-2148.
 - 2) Decorative type fixtures will be provided for false ceiling areas.
 - 3) For DC lighting & Hazardous areas LED type luminaries shall be used.
 - 4) Medium bay light shall be used if mounting height vary from 5Mtr to 8Mtr

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ANNEXURE-II

LIGHTING & LV POWER SERVICES IN DIFFERENT AREAS

S. No.	AREA	ACN	ACE	DCE	5/15A Socket	20A Socket	63/125A Socket	ELU \$
01	TG building	Y	Y	Y	Y*	Y	Y	-
02	Boiler platforms & boiler area	Y	Y	Y	-	Y	Y	-
03	ESP platforms & Mill area	Y	Y	Y	-	Y	Y	-
04	ID, FD & PA FAN area	Y	-	-	-	Y		-
05	Transformer Yard	Y	Y	-	-	-	Y	-
06	ESP control room	Y	Y	Y	Y*	Y		-
07	DG room	Y	Y	-	-	Y	Y	Y
08	Compressor house	Y	-	-	-	Y	Y	-
09	Fuel oil area	Y	-	-	Y*	Y	Y	Y
10	Outdoor area	Y	-	-	-	Y	-	-
11	Admin Building	Y	-	-	Y*	Y	-	Y
12	Service building	Y	-	-	Y*	Y	-	Y

<u>LEGEND:</u>	ACN:	AC Normal Lighting
	ACE:	AC Emergency Lighting
	DCE:	DC Emergency Lighting (CFL shall be used)
	Y:	YES
	Y*:	YES, Only in control room, offices & toilets
	\$:	Emergency Lighting Unit (ELU) & 5/15A Switch socket for ELU



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DATA SHEET –A

S. No.	Description	Unit	Value
1.0	SYSTEM DESIGN DATA		
1.1	Design ambient	⁰ C	50
1.2	AC Supply		
a)	Rated voltage	V	415
b)	Rated frequency	Hz	50
c)	Voltage variation (permissible)	%	+10% to -10%
d)	Frequency variation (permissible)	%	+5% to -5%
e)	Combined voltage & frequency variation (sum of absolutes permissible)	%	10%
f)	System fault level & duration	kA, sec.	50kA for 1 sec.
1.3	DC Supply		
a)	Rated voltage	V	220
b)	Voltage variation (permissible)	%	+10% to -15%
c)	System fault level & duration	kA, sec.	25kA for 1 sec.
2.0	SCOPE OF SYSTEM DESIGN ENGINEERING		Included in vendor's scope
3.0	Lighting Concept		
3.1	Types of supplies considered (other than AC Normal)		
a)	AC emergency		☒ Yes ☐ No
b)	DC emergency		☒ Yes ☐ No
c)	DC Normal		☒ Yes ☐ No
3.2	Diversity Factor for Sockets	%	25%
4.0	LUMINAIRES, LAMPS & ACCESSORIES		
4.1	Type of false ceiling for recessed fluorescent luminaire		Grid False ceiling (600mm X 600mm) / Aluminium false ceiling (for Control Room).
4.2	Degree of protection for drip proof luminaires		IP55



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4.3	Flame proof luminaires		
a)	Hazardous area classification		IS-2148 Zone II Group-IIA & IIB
b)	Degree of protection		IP55
c)	Mounting type for well glass		☒ Eye-bolt ☐ MS Galvanised Strap
4.4	Non-integral control gear box for HPMV/HPSV lamps		
a)	Material		☐ CRCA sheet steel ☒ Cast Aluminium LM6
b)	Sheet thickness	mm	☐ 2 for CRCA sheet ☒ 3 for Cast Aluminium LM6
c)	Degree of protection		IP55
d)	Surface treatment		☒ Painted ☐ Galvanized
e)	If galvanized		NOT APPLICABLE
	Process		-
	Weight of zinc	g/m ²	-
f)	If painted		
	Paint shade		RAL 7032
	Minimum paint thickness (DFT)	micron	50
4.5	Lamps		
a)	Type of Fluorescent Lamps (If Applicable)		☒ Cool Daylight ☒ White Light
4.6	Emergency Lighting Unit		
a)	Lamp type		☐ FLT ☒ CFL ☐ LED
b)	Nos. of Lamp		2
c)	Lamp wattage	W	10
d)	Lumen output of lamp at rated voltage	Lumen	To furnished by Vendor.
e)	Type of battery (Rechargeable type)		☒ Ni-Cd ☐ Lead-Acid ☐ Li-Ion
f)	AH capacity of battery	AH	To furnished by Vendor.
g)	Battery voltage	V	9
h)	Battery backup time	Hr	4



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i)	In built charger		Yes
4.7	Exit Sign		
a)	Lamp type		FLT/ CFL/ LED
b)	Nos. of Lamp		1
c)	Lamp wattage	W	20
d)	Lumen output of lamp at rated voltage	Lumen	To furnished by Vendor.
e)	Type of battery		☒ Ni-Cd ☐ Lead-Acid ☐ Li-Ion
f)	AH capacity of battery	AH	To furnished by Vendor.
g)	Battery voltage	V	To furnished by Vendor.
h)	Battery backup time	Hr	4
4.8	24V AC Supply Module (Fixed type & portable type)		
a)	Enclosure		
	Enclosure material		☐ Cast aluminium alloy ☒ CRCA sheet steel
	Enclosure thickness	mm	☐ 3 for Cast aluminium alloy ☒ 2 for CRCA sheet steel
	Louvers provided		☒ Yes ☐ No
b)	Surface treatment		☐ Painted ☒ Galvanized
c)	If galvanized		
	Process		Hot dip
	Weight of zinc	g/m ²	460 gm / mm ² (65 microns)
d)	If painted		
	Paint shade		
	Minimum paint thickness (DFT)	micron	
e)	Transformer		
	Rating	VA	500
	Voltage ratio & Current Rating	V	240 V/24V [5A/15A]
	Class of insulation		Class F, temperature rise limited to Class-B
f)	24V Hand lamp unit		
	Lamp type		☒ Halogen ☐ LED



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	Lamp wattage	W	40
g)	No. of outgoing sockets		4
h)	Whether cord coiling arrangement provided		☒ Yes air cooled ☐ No
5.0	Junction Box		
a)	Enclosure material		CRCA/ Steel
b)	Enclosure thickness	mm	16 SWG
c)	Galvanized (applicable for CRCA sheet)		☒ Yes ☐ No
d)	Degree of protection		IP-66(indoor) / FRP Weather proof IPW-66 for outdoor area & Flameproof for hazardous area)
6.0	Industrial/ Welding Receptacle		
a)	Enclosure material		☐ Heavy duty cast aluminium alloy ☒ CRCA sheet steel
b)	Enclosure thickness	mm	☐ 3 for cast aluminium alloy ☒ 2 for CRCA sheet steel
c)	Surface treatment		☐ Painted ☒ Galvanized
d)	If galvanized		
	Process		Hot dip
	Weight of zinc	g/m ²	460 gm / mm ² (65 microns)
e)	If painted		NOT APPLICABLE
	Paint shade		
	Minimum paint thickness (DFT)	micron	
f)	Degree of protection		IP-42 / IP 62(dusty area)
7.0	Decorative Receptacle		
a)	Enclosure material		☐ Cast aluminium alloy ☒ MS Sheet
b)	Enclosure thickness	mm	☐ 2 for cast aluminium alloy ☒ 1 for MS sheet
c)	Surface treatment		☐ Painted ☒ Galvanized/ Electro-plated
d)	If galvanized		
	Process		Hot dip



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	Weight of zinc	g/m ²	460 gm / mm ² (65 microns)
e)	If painted		NOT APPLICABLE
	Paint shade		
	Minimum paint thickness	micron	
f)	Degree of protection		IP-42 / IP 62(dusty area)
9.0	Switch Box		
a)	Enclosure material		[] FRP [✓] CRCA Sheet.
b)	Enclosure thickness	mm	14 SWG M.S sheet with 6mm thick Bakelite cover
c)	Galvanized		[✓] Yes [] No
d)	Painted		[] Yes [✓] No
d)	Degree of protection		IP-55
10.0	Conduit (Flexible)		
a)	Type		[✓] Electrogalvanized cold rolled annealed & coated with PVC [] Lead coated
b)	Size	mm	20
c)	Standard length	m	25 to 50
d)	Thickness of Galvanization	microns	
5.13	Cable Glands		By vendor for all incoming and outgoing cables
a)	Type		[✓] Double compression [] Single compression
b)	Material		Brass
c)	Nickel Plating provided		[✓] Yes [] No
d)	Flameproof glands with flameproof equipment		[✓] Yes [] No
5.14	Cable Lugs		By vendor for all incoming and outgoing cables
a)	Type		Crimping type/ ring type
b)	Material		Tinned copper
12.0	LADDERS		
a)	Type		[✓] Free standing [] wheel mounted [] both
b)	Material		[] Steel [✓] Aluminium



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c)	Duty		☐ Heavy ☒ Medium
d)	Surface treatment		☒ Galvanised ☐ Painted
e)	Reference Standard		IS: 4571, 3696

Note:

1. Detailed luminaire and lamp data shall be placed by vendor after award of contract.
2. Galvanization wherever applicable shall be hot dip galvanized with weight of Zinc as 460g/m² (65micron).



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LIST OF APPLICABLE STANDARDS

ILLUMINATION

Code of practice for interior illumination	IS 3646
Code of practice for industrial lighting	IS 6665
Code of practice for lighting of public thoroughfare	IS 1944

LUMINAIRES

Luminaires	IS 10322
Industrial luminaires with metal reflector	IS 1777
Industrial lighting fittings with plastic reflectors	IS 3287
Decorative lighting outfits	IS 5077
Waterproof electric lighting fittings	IS 3528
Watertight electric lighting fittings	IS 3553
Dust-proof electric lighting fittings	IS 4012
Dust-tight electric lighting fittings	IS 4013
Flameproof electric lighting fittings - well glass & bulk head types	IS 2206
Electric lighting fittings for division 2 areas	IS 8224
General & Safety requirement of Luminaire	IS 1913
General Lighting. LEDs and LED modules Terms and definitions	IS 16101
Self Ballasted LED Lamps for General Lighting Services.	IS 16102
LED modules for General lighting Safety Requirements.	IS 16103
Lamp control gear Part 2 particular	IS 15885(Part 2)
Requirements d.c. or a.c. Supplied Electronic control gear for LED modules	IS 16104

LAMPS

Tungsten filament lamps for domestic and similar general lighting purpose	IS 418
Tubular fluorescent lamps for general lighting service	IS 2418
High pressure mercury vapour lamps	IS 9900
High pressure sodium vapour lamps	IS 9974



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LUMINAIRE COMPONENTS

Ballast for fluorescent lamps for switch start circuits	IS 1534
Ballast for high pressure mercury vapour lamps	IS 15882
Capacitors for use in tubular fluorescent high pressure mercury and low pressure sodium vapour discharge lamp circuits	IS 1569
Bi-pin lamp holders for tubular fluorescent lamps	IS 3323
Methods of measurement of lamp cap temperature rise	IS 8913
Starters for fluorescent lamps	IS 2215
Holders for starters for tubular fluorescent lamps	IS 3324
Cast acrylic sheets for use in luminaires	IS 7569

ASSEMBLED EQUIPMENT AND COMPONENTS

Low voltage switchgear and controlgear.	IS 60947
Code of practice for selection, installation & maintenance of switchgear & control gear	IS 10118
Explosive atmospheres	IS 60079
Classification of hazardous areas for electrical installations	IS 5572
Dry type transformers	IS 11171
Electrical Accessories - circuit breakers for over protection for household and similar installations	IS 60898
Low voltage Fuses for voltages not exceeding 1000 V ac or 1500 V dc	IS 13703
Indicator lamps (visual)	IS 1901

POLES, SOCKETS AND OTHER MISCELLANEOUS

Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes	IS 1293
Interlocking switch socket outlet	IS 4160
Electric ceiling type fans and regulators	IS 374
Structural steel (Standard quality)	IS 2062
Danger notice plates	IS 2551
Enclosures for accessories for household and similar fixed electrical installations	IS 14772
General construction in steel - Code of practice	IS 800
Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes	IS 5082



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Code of practice for phosphating of iron and steel	IS 6005
Colour for ready mixed paints & enamels	IS 5
Recommended practice for hot dip galvanising of iron & steel	IS 2629
Method of testing uniformity of coating on zinc coated articles	IS 2603
Flexible steel conduits for electrical wiring	IS 3480
Conduits for electrical installations	IS: 9537
Scaffolds & ladders - Code of safety	IS: 3696
Aluminium extension ladders	IS: 4571
General Requirement for enclosures for accessories for household & similar fixed electrical installations	IS: 5133

1 X 660 MW PANKI THERMAL POWER EXTENSION PROJECT

DATA SHEET - B

SL. NO.	DESCRIPTION	LUMINAIRE MAKE AND MODEL	MEASURED ELECTRICAL INPUT POWER (W) MAX. VALUE	TOTAL LUMINOUS FLUX (LUMEN) OF LUMINAIRE - MIN. VALUE
	MAIN SUPPLY ITEMS			
1.0	Lighting Luminaires (complete with accessories)			
1.1	Luminaire Type FC02 (LED)			
1.2	Luminaire Type FC06 (LED)			
1.3	Luminaire Type FC07 (LED)			
1.4	Luminaire Type FC26 (LED)			
1.5	Luminaire Type FC30 (LED)			
1.6	Luminaire Type FC32 (LED)			
1.7	Luminaire Type FC33 (LED)			
1.8	Luminaire Type FC34 (LED)			
1.9	Luminaire Type FC81 (LED)			
1.10	Luminaire Type SB11 (LED)			
1.11	Luminaire Type SB02 (LED)			
1.12	Luminaire Type SB03 (LED)			
1.13	Luminaire Type SF63 (LED)			
1.14	Luminaire Type SF64 (LED)			
1.15	Luminaire Type SF66 (LED)			
1.16	Luminaire Type SS61 (LED)			
1.17	Luminaire Type SS62 (LED)			
1.18	Luminaire Type SS63 (LED)			
1.19	Luminaire Type SW41 (LED)			
1.20	Luminaire Type SW42 (LED)			
1.21	Luminaire Type MW96 (LED)			
1.22	Luminaire Type Downlighter (LED)			
1.23	Luminaire Type FC30 Dimmable (LED)			
1.24	Luminaire Type Downlighter Dimmable(LED)			

NOTE :

- Bidder to fill details of luminaires as per parameters mentioned above and furnish Data Sheet - B along with technical offer



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ANNEXURE – A

LIST OF MAKES (SUB-VENDOR ITEMS)

S. NO.	ITEM	VENDOR
1	24V SUPPLY MODULE WITH COMPLETE ACCESSORIES	POWER PACK ENTERPRISES
	24V SUPPLY MODULE WITH COMPLETE ACCESSORIES	INDCOIL
	24V SUPPLY MODULE WITH COMPLETE ACCESSORIES	Ames Impex Electricals Pvt. Ltd
2	AC CONTACTORS	SIEMENS
	AC CONTACTORS	GE-POWER
	AC CONTACTORS	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
	AC CONTACTORS	L&T
	AC CONTACTORS	BCH
3	AC MCCB	C&S ELECTRIC LTD.
	AC MCCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	AC MCCB	SIEMENS
	AC MCCB	GE-POWER
	AC MCCB	L&T
	AC MCCB	CROMPTON GREAVES
4	AMMETER	AUTOMATIC ELECTRIC LTD.
	AMMETER	RISABH INST. PVT LTD
5	CABLE GLANDS	ALLIED TRADERS & EXPORTERS
	CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS
	CABLE GLANDS	BALIGA LIGHTING EQPT PVT LTD
	CABLE GLANDS	COMMET BRASS PRODUCTS
	CABLE GLANDS	DOWELLS
	CABLE GLANDS	ELECTROMAC INDUSTRIES
	CABLE GLANDS	INCAB
6	CABLE LUGS	DOWELLS
	CABLE LUGS	UNIVERSAL MACHINES LTD.
7	CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE
	CONTROL SWITCHES/ SELECTOR SWITCH	GE-POWER
	CONTROL SWITCHES/ SELECTOR SWITCH	ALSTOM LTD
	CONTROL SWITCHES/ SELECTOR SWITCH	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	CONTROL SWITCHES/ SELECTOR SWITCH	Shrenik & Co.
	CONTROL SWITCHES/ SELECTOR SWITCH	RECOM PVT. LTD.
8	DICHORIC SPOT LIGHTING FIXTURE	REPUTED MAKE
9	EMER. PORTABLE LTG. SET	BAJAJ ELECTRICALS
10	EMERGENCY LIGHTING UNIT (FIXED &	BAJAJ ELECTRICALS



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	PORTABLE TYPE)- NON FLAME PROOF EMERGENCY LIGHTING UNIT (FIXED & PORTABLE TYPE)- NON FLAME PROOF	PROLITE AUTOGLO LIMITED,
11	EXIT SIGN (FLAME PROOF)	REPUTED MAKE
	EXIT SIGN (NON FLAME PROOF)	REPUTED MAKE
12	FLEXIBLE CONDUITS (LEAD COATED)	PLICA INDIA PVT. LTD.
	FLEXIBLE CONDUIT (PVC COATED)	REPUTED MAKE
13	FUSE BASE	INDO ASIAN
	FUSE BASE	GE-POWER
	FUSE BASE	L&T
	FUSE BASE	C&S ELECTRIC LTD.
	FUSE BASE	SIEMENS
	FUSE BASE	ABB
	FUSE BASE	SPACEAGE SWITCHGEARS LTD.
	FUSE BASE	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	FUSE BASE	ALSTOM LTD
	FUSE BASE	ESSEN DEINKI
14	GI CONDUIT (EPOXY PAINTED)	BIS APPROVED MAKE
15	GI CONDUITS	BIS APPROVED MAKE
16	HAND LAMP UNIT	REPUTED MAKE
17	HRC FUSES	INDO ASIAN
	HRC FUSES	GE-POWER
	HRC FUSES	L&T
	HRC FUSES	C&S ELECTRIC LTD.
	HRC FUSES	SIEMENS
	HRC FUSES	ABB
	HRC FUSES	SPACEAGE SWITCHGEARS LTD.
	HRC FUSES	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	HRC FUSES	ALSTOM LTD
	HRC FUSES	ESSEN DEINKI
18	IND.POWER & WLDG SOCKETS	CROMPTON GREAVES
	IND.POWER & WLDG SOCKETS	CYCLO ELECTRIC DEVICE & SERV.CO.
	IND.POWER & WLDG SOCKETS	BCH
	IND.POWER & WLDG SOCKETS	BEST & CROMPTON
	IND.POWER & WLDG SOCKETS	AJMERA INDUSTRIES & ENGG. WORKS
19	INDICATING LAMPS	BCH
	INDICATING LAMPS	C&S ELECTRIC LTD.
	INDICATING LAMPS	ESSEN DEINKI
	INDICATING LAMPS	VAISHNO(HOTLINE SWGR.& CONTROL)
	INDICATING LAMPS	GE-POWER
	INDICATING LAMPS	SIEMENS
	INDICATING LAMPS	SCHNEIDER ELECTRIC INDIA PVT. LTD.



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20	JUNCTION BOXES (FLAME PROOF)	SUDHIR SWITCHGEAR
21	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGNIREES PVT. LTD.
	JUNCTION BOXES (NON FLAME PROOF)	Electro Controls & Devices
	JUNCTION BOXES (NON FLAME PROOF)	Shrenik & Co.
	JUNCTION BOXES (NON FLAME PROOF)	PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	Adroit Control Engineers Pvt.Ltd.
	JUNCTION BOXES (NON FLAME PROOF)	PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	MIKA ENGINEERS
	JUNCTION BOXES (NON FLAME PROOF)	PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	BAJAJ ELECTRICALS
	JUNCTION BOXES (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS
	JUNCTION BOXES (NON FLAME PROOF)	S.B. ELECTRICAL ENGINEERING CORPORATION
22	LADDER	REPUTED MAKE
23	LIGHTING FIXTURES (LED)	Neev Luminaries
	LIGHTING FIXTURES (LED)	HAVELLS INDIA LIMITED
	LIGHTING FIXTURES (LED)	BAJAJ ELECTRICALS
	LIGHTING FIXTURES (LED)	SURYA ROSHNI LIMITED
	LIGHTING FIXTURES (LED)	PHILIPS
	LIGHTING FIXTURES (LED)	HPL ELECTRIC & POWER PVT. LTD
	LIGHTING FIXTURES (LED)	INSTA POWER
	LIGHTING FIXTURES (LED)	PYROTECH ELECTRONICS PVT. LTD.
	LIGHTING FIXTURES (LED)	HALONIX TECHNOLOGIES LIMITED
24	LIGHTING FIXTURES (NON LED)	BALIGA LIGHTING EQPT PVT LTD
	LIGHTING FIXTURES (NON LED)	ELEXPRO ELECTRICALS PVT/ LTD.
	LIGHTING FIXTURES (NON LED)	BAJAJ ELECTRICALS
	LIGHTING FIXTURES (NON LED)	CROMPTON GREAVES
	LIGHTING FIXTURES (NON LED)	EVERGREEN ENGG. CO.
	LIGHTING FIXTURES (NON LED)	PHILIPS
	LIGHTING FIXTURES (NON LED)	WIPRO LTD.
	LIGHTING FIXTURES (NON LED)	HPL ELECTRIC & POWER PVT. LTD
	LIGHTING FIXTURES (NON LED)	SURYA ROSHNI LIMITED
	LIGHTING FIXTURES (NON LED)	HAVELLS INDIA LIMITED
	LIGHTING FIXTURES (NON LED)	HALONIX TECHNOLOGIES LIMITED
25	LIGHTING FIXTURES (FLAME PROOF)	HAVELLS INDIA LIMITED
	LIGHTING FIXTURES (FLAME PROOF)	BAJAJ ELECTRICALS
	LIGHTING FIXTURES (FLAME PROOF)	BALIGA LIGHTING EQPT PVT LTD
26	LIGHTING LAMP (LED)	HAVELLS INDIA LIMITED
	LIGHTING LAMP (LED)	NEEV LUMINARIES
	LIGHTING LAMP (LED)	SURYA ROSHNI LIMITED
	LIGHTING LAMP (LED)	BAJAJ ELECTRICALS
	LIGHTING LAMP (LED)	PHILIPS



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	LIGHTING LAMP (LED)	HPL ELECTRIC & POWER PVT. LTD
	LIGHTING LAMP (LED)	INSTA POWER
	LIGHTING LAMP (LED)	PYROTECH ELECTRONICS PVT. LTD.
	LIGHTING LAMP (LED)	HALONIX TECHNOLOGIES LIMITED
27	LIGHTING LAMP (NON LED)	WIPRO LTD.
	LIGHTING LAMP (NON LED)	ESSEN DEINKI
	LIGHTING LAMP (NON LED)	BAJAJ ELECTRICALS
	LIGHTING LAMP (NON LED)	INSTA POWER
	LIGHTING LAMP (NON LED)	PHILIPS
	LIGHTING LAMP (NON LED)	HAVELLS INDIA LIMITED
	LIGHTING LAMP (NON LED)	HPL
	LIGHTING LAMP (NON LED)	SURYA ROSHNI LIMITED
	LIGHTING LAMP (NON LED)	HALONIX TECHNOLOGIES LIMITED
28	LIGHTING SWITCH , SOCKET & S/F UNIT	ELEXPRO ELECTRICALS PVT/ LTD.
	LIGHTING SWITCH , SOCKET & S/F UNIT	ANCHOR
	LIGHTING SWITCH , SOCKET & S/F UNIT	KAYCEE
	LIGHTING SWITCH , SOCKET & S/F UNIT	L&T
	LIGHTING SWITCH , SOCKET & S/F UNIT	SIEMENS
	LIGHTING SWITCH , SOCKET & S/F UNIT	INDO ASIAN
29	MCB	MDS SWITCHGEAR LTD
	MCB	INDO ASIAN
	MCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	MCB	S&S POWER SWITCHGEAR LTD,
30	MODULAR SWITCH BOARD	ANCHOR
	MODULAR SWITCH BOARD	ELEXPRO ELECTRICALS PVT/ LTD.
	MODULAR SWITCH BOARD	HAVELLS INDIA LIMITED
31	PEDESTAL FAN & CEILING FAN	REPUTED MAKE
32	PHOTOELECTRIC SWITCH	REPUTED MAKE
33	PVC WIRES	BIS APPROVED MAKE
34	RECEPTACLE (FLAME PROOF)	BALIGA LIGHTING EQPT PVT LTD
	RECEPTACLE (FLAME PROOF)	SUDHIR SWITCHGEAR
	RECEPTACLE (FLAME PROOF)	FCG FLAME PROOF CONTROL GEAR
35	RECEPTACLE (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS
	RECEPTACLE (NON FLAME PROOF)	CROMPTON GREAVES
	RECEPTACLE (NON FLAME PROOF)	CYCLO ELECTRIC DEVICE & SERV.CO.
	RECEPTACLE (NON FLAME PROOF)	BCH
	RECEPTACLE (NON FLAME PROOF)	BEST & CROMPTON
36	RECEPTACLES - DECORATIVE	ANCHOR
	RECEPTACLES - DECORATIVE	ELEXPRO ELECTRICALS PVT/ LTD.
	RECEPTACLES - DECORATIVE	BAJAJ ELECTRICALS
	RECEPTACLES - DECORATIVE	AJMERA INDUSTRIES & ENGG. WORKS
37	SWITCH BOX	ANCHOR



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	SWITCH BOX	ELEXPLO ELECTRICALS PVT/ LTD.
	SWITCH BOX	BAJAJ ELECTRICALS
	SWITCH BOX	AJMERA INDUSTRIES & ENGG. WORKS
	SWITCH BOX	S.B. ELECTRICAL ENGINEERING CORPORATION
38	TERMINAL BLOCKS	WAGO-CONTROLS
	TERMINAL BLOCKS	CONNECT WELL
	TERMINAL BLOCKS	ELMEX CONTROLS PVT. LTD.
	TERMINAL BLOCKS	ESSEN DEINKI
	TERMINAL BLOCKS	TECHNOPLAST
	TERMINAL BLOCKS	PHOENIX MECANO LTD.,
39	TIMERS - ELECTRONIC	ESSEN DEINKI
	TIMERS - PNEUMATIC	BCH
	TIMERS - PNEUMATIC	ALSTOM LTD
	TIMERS - PNEUMATIC	L&T
	TIMERS - PNEUMATIC	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
	TIMERS - PNEUMATIC	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	TIMERS - PNEUMATIC	ELECTRONIC AUTOMATION PVT. LTD.
40	HAND LAMP UNIT	REPUTED MAKE
41	VOLTMETER	AUTOMATIC ELECTRIC LTD.
	VOLTMETER	RISHABH INST.PVT LTD

NOTE: Make of all the equipment / instrument under this specification shall be subjected to owner's approval in the event of order. Owner reserves the right to accept/ reject any make or sub-vendor and to add new sub-vendors for the project after award of contract. Approval, rejection or addition of makes shall not have any price implication to the owner after award of contract.



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**ANNEXURE – B
DOCUMENTS REQUIRED AFTER AWARD OF LOI**

PE-V0-426-558-E101	OGA of equipments such as fixture, SBs, JBs, Receptacles, free standing ladder, Emergency exit sign, wheel mounted ladder, ceiling fans, ELU, etc.	Primary	R-0 within 14 days from lot clearance of released items & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.
PE-V0-426-558-E102	Datasheet of lamps, CFL, Fluorescent tube, PVC coated conduit	Primary	
PE-V0-426-558-E901	MQP FOR LUMINARIES	Primary	
PE-V0-426-558-E905	MQP FOR MISCELLANEOUS ITEMS	Primary	
PE-V0-426-558-E201	Lighting design Calculation	Secondary	Within 3 weeks from the date of BHEL input drawing & re- submission within 10 days of BHEL comments. BHEL shall furnish comments / approval on each submission within 18 days from receipt.
PE-V0-426-558-E301	Lighting Layout	Secondary	
PE-V0-426-558-E401	Conduit Layout	Secondary	Within 10 days from the approval of respective LLOs
PE-V0-426-558-E103	MOUNTING ARRANGEMENT OF BULK HEAD FIXTURE	Secondary	Along with respective OGA
PE-V0-426-558-E104	TYPE TEST REPORTS FOR LIGHTING FIXTURES	Secondary	Within 2 months from lot clearance for applicable items
PE-V0-426-558-E105	FIELD QUALITY PLAN OF LIGHTING FIXTURES	Secondary	Within 3 months from PO
PE-V0-426-558-E106	MOUNTING ARRANGEMENT drgs.	Secondary	Along with respective OGA

Note: The above list of drawings and documents is indicative. Number of drawings may vary as per project requirements.



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ANNEXURE – C

SCOPE MATRIX FOR BROAD ACTIVITIES

SCOPE MATRIX FOR BROAD ACTIVITIES				
Sl. No.	Activities	Contractor	Associate	Remark (if any)
1	System Design			
2	Supply: - (a) Fixtures & Lamps (b) Other Items (as required for System completion)			
3	Supervision of Erection & commissioning			
4	Design review & changes based on site feedback for establishing correctness of the system at site			

Notes: -

1. Bidder to indicate Division of work (DOW)/ scope matrix between contractor & associate by indicating “Yes”/ “No” against each activity in the appropriate column, same to be furnished duly signed & stamped along with technical offer.



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 - 4.1 ENGINEERING INPUTS
 - 4.2 DESIGN CRITERIA
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 - 7.0 PACKING
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1.0 INTENT OF SPECIFICATION

- 1.1 The requirements given in specification for supply of equipment and system design engineering shall be fully complied with.
- 1.2 For the equipment of supply in vendor's scope, the "design" shall broadly cover the selection of components, materials, sizes etc. and complete responsibility of establishing the correctness of equipment design rests with the vendor.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing required function in a manner acceptable to Purchaser, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgement is not in full accordance herewith.
- 1.4 Make of all equipment and components shall be to the approval of Purchaser. Bidder to comply to Sub-vendor list enclosed as Annexure to Section I, however same shall be subjected to end client approval without any commercial implication.

2.0 CODES & STANDARDS

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The material, construction, manufacture, inspection and testing shall conform to the latest revisions of standards as specified in Data Sheet-A.
- 2.3 In case of conflict between the applicable reference standard and this specification, stringent requirement shall govern.

3.0 LIGHTING SYSTEM DESCRIPTION (CONCEPTUAL VIEW)

- 3.1 All areas of plant (indoor and outdoor) shall be provided with suitable lighting arrangement to meet the functional requirements by use of various types of luminaires so as to achieve the desired quality and level of illumination.
- 3.2 Lighting system shall also cover the low voltage power services such as power receptacles and single phase feeders.
- 3.3 Lighting system shall be fed through various power sources such as AC Normal, AC Emergency and DC Emergency supply to achieve the desired reliability.
- 3.4 Power tapped from various sources shall be distributed through lighting distribution boards and lighting panels upto the various luminaires and power outlet sockets / feeders.



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4.0 SYSTEM DESIGN ENGINEERING

Engineering shall be done by the vendor only during the contract engineering stage as the same is covered in his scope. During tender stage, bidder shall make his quotation on the basis of BOQ furnished by the purchaser with the tender document.

- 4.1 ENGINEERING INPUTS :** Complete engineering shall be done by the vendor on the basis of documents listed below. The engineering inputs shall be furnished by purchaser. However, furnishing of these inputs shall not absolve the vendor of responsibility to visit site and get acquainted with actual site conditions.

4.1.1 Indoor Areas

- a) Room dimensions (details as covered in various layout drawings)
- b) Lighting System Design Data (LSDD) covering typical values for various types of indoor areas, indicating :
 - i. Required average illumination level
 - ii. Reflection factors for walls, ceiling and floor
 - iii. Maintenance factor
 - iv. Type of luminaire
 - v. Mounting height of luminaire
 - vi. Height of working plane
- c) AC Emergency lighting requirements
- d) DC lighting requirements
- e) Requirement of sockets
- f) Requirement of exhaust fans and fan points

4.1.2 Outdoor Areas

- a) Area geometry (details as covered in various layout drawings)
- b) Lighting System Design Data (LSDD) covering typical values for various types of outdoor areas, indicating:
 - i. Average illumination level
 - ii. Type of luminaire
 - iii. Pole heights / mounting height
 - iv. AC Emergency lighting requirement



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- v. DC lighting requirements
- vi. Maintenance factor
- c) Requirement of sockets

4.1.3 Other inputs

- a) Plot plan, Main equipment plan and TG hall floor plans (to assess quantum of area lighting drawings)
- b) Suggestive location of LDBs
- c) Suggestive power distribution scheme (SLDs)
- d) Control schemes
- e) Single phase feeder details
- f) No. of sockets / criteria for computation of no. of sockets / location of sockets etc.
- g) LDB/WDB details
- h) LP details
- i) Poles & Masts details
- j) Conduit sizes
- k) Wire sizes
- l) Earthing material sizes

4.2 DESIGN CRITERIA:

4.2.1 General Requirements of Design

- a) Lighting system shall be provided to ensure adequate visual performance, safety and reliability and shall be free from excessive glare and flicker from discharge lamps. Particular attention shall be paid to ensure that level of illumination is satisfactory in all respects including viewing of all instruments, alarms, annunciators and indicating lamps.
- b) Complete system design shall be done on the basis of inputs provided by the purchaser and in line with the laid down criteria.
- c) Requirements of sockets shall be as per the criteria / number of sockets given by the purchaser during detailed engineering stage.
- d) Complete power distribution system shall be designed keeping following criteria in view :



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- Simplicity
- Controlled voltage drop
- Cost effectiveness

4.2.2 Sources of Power Supply

- a) The illumination of various indoor and outdoor areas in the main plant and off site areas shall comprise of one or more of the following systems:
 - Normal AC Lighting System
 - Emergency AC Lighting System
 - DC Lighting System
- b) Arrangement and distribution of power shall depend upon the functional requirements of areas and therefore supply from all types of power sources shall not be made available to all areas. Lighting & LV power services in different areas shall be provided as per Annexure-B enclosed.
- c) 24V AC lighting for maintenance purposes (for hand lamps and/or hand operated tools) shall be supplied from 240/24V fixed/ portable lighting module.

4.2.3 Lighting philosophy

a) Normal AC Lighting System

Normal AC lighting system 415V, 3 phase, 4 wire, will be fed from lighting panels (LPs) which in turn will be fed from the lighting distribution boards (LDBs). Street lights/ flood lights shall be fed from Street Lighting Panel (SLP), Welding receptacles shall be fed from Welding DB/ MCC in offsite areas.

b) Emergency AC Lighting System

This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These will be fed from emergency lighting panels (ELPs) which in turn will be fed from 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights will go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energized by Diesel generator set.

c) DC Lighting System

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

The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply at station service switchgear as well as Emergency switchgear. The DC supply will be automatically switched OFF after about 3 minutes



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following the restoration of supply to normal AC or emergency AC lighting system.

In auxiliary /off site buildings, 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.

d) Street Lighting/ Flood Lighting

Street lights / flood lights will be fed from Street Lighting Panel (SLP). The number of street lights / flood lights shall be grouped in such a way that they will be fed from the nearest SLP available. Street lights shall have provision of automatic switching ON and OFF in any one of the following modes and as per the purchaser's scheme:

- i. Manual
- ii. Automatic through 00 - 24 hrs time switch
- iii. Automatic through combination of 00 - 24 hrs time switch and a remote sensing device for monitoring external illumination level. Each SLP shall be provided with a time switch and a remote light sensing device.

4.2.4 Number of Luminaires

- a) All calculations shall be done as per the input data covered under "Engineering Inputs".
- b) Total AC luminaires

Total number of AC luminaires for indoor and outdoor areas shall be calculated on the basis of point to point method by an established computer program. Optimisation criteria shall form part of street lighting calculations.

For AC emergency lighting, a specified percentage of total AC luminaires shall be considered as AC emergency luminaires. The percentage shall be informed during detail engineering.

4.2.5 Layout Considerations

a) General Layout Considerations

- i. Layout of equipment such as LDBs and LPs shall be on the basis of following criteria :
 - Ease of operation
 - Maintainability
 - Aesthetics
- ii. Luminaires shall be located to meet the functional requirements of the area. Aesthetics shall form part of layout considerations.
- iii. Due considerations shall be given to the mounting arrangement depending upon location and type of area.
- iv. While preparing lighting system layout drawings for air conditioned control rooms/areas having false ceilings, the vendor shall be required to interface



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with the Air Conditioning / Ventilation Duct layout and false ceiling layout drawings to avoid fouling / interference.

- v. The poles shall be located 1.5m away from the road edge. The buried cable shall run in hume pipe / duct bank wherever it is crossing the roads.
- vi. 240V AC, 5/15A universal socket (at least two number) shall be provided in office, store, cabin etc. The receptacles shall be provided at interval of 20m or part thereof for hand tools etc. One no. 20A, 240V AC industrial type receptacle shall be provided at suitable location in all other area as required. The receptacles shall be controlled through switch/MCBs. In hazardous area, receptacles shall be flame proof.
- vii. Suitable nos. of 63A/125A, 3 phase, 415V industrial receptacle with switch shall be provided at specific points in power plant area for welding purposes. At least one 63A/125A receptacle shall be provided in each off-site building.
- viii. 1200mm/ 1400mm sweep ceiling fans with stepped electronic regulator shall be provided for office room, store rooms and social buildings which are not covered by air-conditioned and ventilation system.
- ix. All fans including pedestal fans shall comply to relevant IS.

b) Conduit System

- i. Unless indicated otherwise, conduits shall originate from respective lighting panels and shall continue upto the luminaires for all indoor areas.
- ii. Conduits shall run in straight runs, parallel to building columns, walls etc. as far as practicable.
- iii. Unnecessary bends and crossings shall be avoided.
- iv. In the corrosive environment, conduit installations shall be made with corrosion proof conduits. Such requirements shall be clearly indicated while preparing BOQ.
- v. Conduits in control room and other air-conditioned areas shall be surface mounted on the roof above false ceiling. However vertical drops of conduits shall be through column flanges or grooved to the wall, finally covered for better aesthetics.

c) Wiring

- i. Each circuit from LP shall be taken in a separate conduit.
- ii. Wiring of AC normal, AC emergency & DC emergency lighting system shall be carried out in separate conduits.



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- iii. Receptacle wiring shall be distinct from lighting conduits. No two phase circuits shall be run in the same conduit. However different circuits of same phase may be laid in the same conduit.
- iv. Maximum three nos. of receptacles shall be loop-in & loop-out in a circuit.
- v. Filling area of wires in conduit shall not exceed 40% of the conduit area.
- vi. Wiring shall be done with following conductor sizes:
 - Luminaires – 2.5 sq. mm
 - 5A plug & socket – 2.5 sq. mm
 - 5/15A and 20A plug & socket – 4 sq.mm
- vii. Wiring shall be designed for the uniformly distributed spread of luminaires on each phase i.e. R,Y,B. Distribution of luminaires on these phases shall be such so that there is generally uniform light intensity in the event of failure of one or two phases.
- viii. Luminaires located in offices, stores, laboratories, toilets etc. shall be individually or group controlled.

d) Cabling

- i. Cables shall be considered wherever it is not desirable to run the insulated wires due to long runs or for any other valid reason.
- ii. Cable Schedule shall be prepared for all cable connections.

4.3 ENGINEERING OUTPUTS:

Vendor shall prepare and submit following documents and drawings for purchaser's approval :

- a) Lighting calculations for indoor areas covering details such as room dimensions (length, width, height), illumination level, reflection factors (walls, ceiling, floor), maintenance factor, type of luminaire, mounting height of luminaire, room index, coefficient of utilisation, no. of luminaires (AC Normal & AC Emergency), lumen output of each luminaire, reference drawings and remarks.
- b) Lighting calculations for outdoor areas covering average illumination level, type of luminaire, chart for illumination level at various points in the area; location (coordinates), number and height of poles; type, number (normal + emergency) and orientation of luminaires etc. Calculated values of average and minimum illumination level as obtained through computer package shall also be furnished. Dot density plots for lux level shall be furnished if available in the computer package.
- c) Single line diagrams of power distribution upto Lighting Panels. Separate drawing for complete lighting distribution shall also be prepared by vendor.



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- d) Loads on each phase of LP and LDB with consideration of diversity factor for sockets.
- e) Layout drawings for each indoor area indicating location of luminaires, sockets, fan points, exhaust fans, LDBs and LPs. Details of type of luminaires, source of power supply (AC Normal, AC Emergency, DC Normal and DC Emergency). Bill of Material shall also be covered which shall include unit wise requirements of luminaires and other items.
- f) Layout drawings for each outdoor area indicating location of poles / towers, orientation of luminaires, sockets and LPs. Details of pole height / mounting height, type of luminaires, source of power supply (AC Normal, AC Emergency, DC Emergency). Bill of Material shall also be covered for various types of luminaires.
- g) Conduit layout drawings with wiring and load distribution details as superimposed on the area layout drawings indicated above. Drawings shall include Bill of Material for conduits, wires etc.
- h) Wiring and load distribution details for outdoor areas.
- i) Master Bill of Material (to be submitted at regular intervals of engineering progress) including all items required for the complete lighting system viz. lighting fixtures, lamps, Lighting DBs, Welding DBs, lighting panels, conduits, PVC wires etc.
- j) In case of revised inputs or site feedback, preparation and submission of revised engineering outputs shall also be in the scope of vendor.
- k) Calculation for selection of number and size of containers
- l) Packing procedures and drawings.

5.0 LUMINAIRES, ACCESSORIES AND LAMPS

5.1 GENERAL REQUIREMENTS OF LUMINAIRES

- a) All luminaires and accessories shall be designed for continuous operation and shall be suitable for the system design data given in Data Sheet A.
- b) Luminaires shall be complete with accessories mounted inside the luminaire assembly. Lamps shall be supplied separately as per BOQ.
- c) All luminaires and accessories shall be suitable for operation in the atmospheric conditions prevailing at site.
- d) Power factor for fluorescent lamp luminaires shall be 0.9 or more and that for HPMV/ HPSV luminaires shall be 0.85 or more. Power factor correction capacitors shall be provided for this purpose.



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- e) Luminaires shall be designed for minimum glare. No bright spots should appear from the lamp or from the reflectors.
- f) All accessories shall be wired upto a terminal block or a separate weather proof metallic terminal box suitable for 2.5 sq. mm. copper wire termination.
- g) All internal wiring shall be of PVC or silicon rubber insulation, capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration.
- h) All luminaires and accessories including the breathing holes shall be vermin proof.
- i) Surface Treatment:
 - All surfaces after manufacture shall be thoroughly cleaned and degreased. Pre-treatment of surfaces shall be as per the applicable standard. Pretreated surfaces shall be free from rust, sharp edges, scales and burrs.
 - Finish of surfaces shall be non-porous, smooth and unfaded.
- j) All metal parts of the luminaires shall be bonded and connected to the earthing terminal. Earthing terminal shall be suitable for connecting 14 SWG GI wire.
- k) Flood lights shall be provided with base frame / base plate for mounting on structural steel members / wall.
- l) All weather proof luminaires shall have the control gear housed in a weather proof enclosure with necessary gaskets, mounting bracket, locking screws etc.

5.2 LUMINAIRE TYPES & OTHER ITEMS

5.2.1 General requirements depending upon type of luminaire are listed below. Specific requirements of each luminaire are indicated in "Luminaire Details" enclosed as Annexure-I.

a) Channel Mounted Luminaires (Fluorescent Luminaires)

- Channel mounted luminaires, except the special purpose luminaires, shall have CRCA sheet steel base plate / rail / channel / box / side panels / housing as per "Luminaire Details". Sheet shall be completely stove enameled unless mentioned vitreous enameled in "Luminaire Details". Colour of enamel shall be grey on all non-reflecting surfaces and white on reflecting surfaces.
- Twin fluorescent luminaires shall be wired in lead-lag circuit to minimise stroboscopic effect.
- Luminaires suitable for surface mounting shall also be suitable for pendant mounting. Knockouts of 20mm ET conduit fixation shall be provided for this purpose.



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b) Decorative Fluorescent Luminaires

- Decorative luminaires shall be provided with one of the following as per “Luminaire Details” :
 - i. Perspex acrylic diffuser.
 - ii. High purity, anodised aluminium, mirror optic reflectors with anodised aluminium matt finish transverse fins to control glare.
 - iii. Opal polystyrene louvers and sheet steel side panels.
 - iv. Vertical metallic louvers finished in stove enamelled white and with sheet steel side panels.
- End plates of decorative luminaires shall be of high impact polystyrene or sheet metal finished in black colour.
- Diffusers and louvers for the fluorescent lamps shall be made of high impact polystyrene sheet and shall have no yellowing property over a prolonged period of use.
- Recessed type decorative luminaires shall be suitable for mounting with gypsum boards / luxalon / plaster of Paris/aluminium frame false ceiling of standard size as per Data Sheet A and “Luminaire details”.

c) Industrial Fluorescent Luminaires (General Purpose)

- Additional reflectors, wherever provided, shall be easily removable type.

d) Industrial Fluorescent Luminaires (Special Purpose)

- Luminaires for chemical vapour (acidic / alkaline) laden environment shall be of cast aluminium controlgear box and end boxes. Controlgear housing shall have detachable, one piece neoprene gasket cover to make it weather proof. Design shall be suitable for chemically charged environment.
- Luminaires for corrosive and dust laden environment shall be made of tray type sheet steel housing and transparent acrylic visor supported by a galvanised sheet steel frame, fitted to the housing with gasket all around. Cable entry shall be from the side of luminaire. Luminaire shall be totally dust and vapour proof.
- Luminaires for highly corrosive environment shall have with sheet aluminium/ polycarbonate housing. controlgear housing, CRCA sheet steel controlgear tray with a stove enamelled white reflector. A clear acrylic cover of dish shape, secured to canopy by stainless steel toggle and neoprene gasket lining, shall be provided at the bottom.



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- Luminaires for drip proof environment such as street lighting fluorescent luminaire shall have sheet aluminium canopy, a detachable reflector-cum-controlgear housing, clear ribbed acrylic cover held in aluminium frame. Luminaire shall have the degree of protection IP:55 unless mentioned otherwise in Data Sheet A. Luminaire shall be suitable for side entry mounting with the pole bracket arm.

e) Bay Type Luminaires

- Luminaires shall be designed for following indoor applications:
 - i) High bay
 - ii) Medium bay
 - iii) Low bay
- Luminaires shall have top mounted, cast aluminium controlgear housing. Housing shall have cooling fins and canopy for easy access to the components. Canopy shall be hinged at one end and wing screw bolted at the other end.
- Controlgear shall be connected to the detachable lamp housing at the bottom such that heat dissipation is proper and distributed.
- Lamp housing-cum-reflector shall be made from spun aluminium, electrochemically brightened and anodised.
- Lamp housing for the dust laden environment shall be totally enclosed type. A clear toughened glass cover shall be attached to the lamp housing with an aluminium frame and neoprene gasket. Luminaire shall be provided with a safety chain for toughened glass.
- Mounting arrangement shall consist of MS brackets with an anti-vibration eye-bolt.
- Side mounted controlgear box shall be provided for low bay luminaires, if mentioned in "Luminaire Details".

f) Well Glass Luminaires

- Well glass luminaires shall be suitable for dust and vapour laden environment.
- Luminaires shall be provided with a die-cast aluminium canopy and heat resistant well glass, fitted with a ring type gasket.
- All well glass luminaires shall be provided with vitreous enamelled reflector.
- Zinc plated MS wire guard shall be provided for protection of well glass.



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- Separate side mounted and top connected control gear box shall be provided for use with HPMV & HPSV lamps.
- Integral control gear box, where applicable, shall be of die cast aluminium material with one piece neoprene gasket between the box and its cover to make it dust and vapour proof.
- Luminaires shall be conduit mounted type for incandescent lamps and surface mounting type for HPMV & HPSV lamps.

g) Flame Proof Well Glass Luminaires

- Housing material shall be cast aluminium alloy LM6. Housing outer surface shall be provided with cooling fins.
- Flame proof luminaires shall be provided with heavy toughened well glass cemented in a retaining ring.
- Zinc-coated / chrome-plated MS chain connected to the main body and glass retaining ring shall be provided.
- A detachable terminal box at the top shall be provided.
- Neoprene gaskets, where needed, shall be provided for weather proof construction and indoor and outdoor application.
- Two cable entries of 20mm ET conduit shall be provided with one flame proof plug.
- Luminaires shall be suitable for the hazardous areas as classified in Data Sheet A. Design of flame proof luminaire shall be supported by the type test report for flame proofness from a government or government approved independent laboratory.

h) Street Lighting Luminaires (Other than Fluorescent Luminaire)

- These luminaires shall be suitable for street lighting and general purpose outdoor area lighting.
- Luminaire housing shall be one piece cast aluminium alloy to accommodate lamp housing and controlgear for lamp wattage upto 150 watts. For lamp wattage above 150 watts, controlgear housing shall be of cast aluminium alloy whereas lamp housing shall be of deep drawn aluminium.
- Inside finish of the lamp housing shall be stove enamelled white. Optical control shall be provided with two high purity, electro brightened and anodised side reflectors.



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- Clear acrylic bowl fitted with a rubber gasket and easily removable type shall be secured to the lamp housing.
- Provision shall be made for adjustment of lamp location for proper focussing.
- Luminaires shall be suitable for mounting with pole bracket arm.

i) Flood Lighting Luminaires

- Flood light lamp housing and reflector shall be separate from controlgear box. Requirements of controlgear box are specified elsewhere.
- Lamp reflectors shall be of high purity spun aluminium attached to the cast aluminium lamp holder housing at the rear. Lamp holder housing shall be provided with cooling fins.
- Reflector shall be closed from the front by heat resistant toughened glass and synthetic "S" type weather proof gasket.
- Luminaire shall be provided with special lamp centering and focussing device ensuring good beam control.
- MS mounting bracket shall allow fixation of the flood light in any position in a horizontal plane and the flood light can be locked in at any set angle in the vertical plane. Cast iron base and / or two protector scales shall also be provided where specified in "Luminaire Details"
- Design shall permit replacement of lamp from the rear without disturbing the previously set aiming angles. Special guide pins shall also be provided for protecting the lamps from damage while replacing.

j) Halogen Flood Lighting Luminaire

- Luminaires shall be compact in design with aluminium alloy housing and three piece highly polished and anodised reflector assembly.
- Toughened glass panel in the front shall be provided with silicon gaskets.
- Lamp replacement from the front is also acceptable.

k) Post Top Lanterns

- Luminaire shall comprise of a spun aluminium canopy, opal acrylic diffuser and a cast aluminium spigot.
- Controlgear shall be integral type and shall be housed in the spigot.
- Luminaire shall be supplied without mounting pole.



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l) Bulk Head (Flame Proof)

- Bulk head luminaires shall be used for the locations where explosion or fire hazard exists.
- Luminaire shall be made of cast iron housing with integral terminal box.
- Front of the luminaire shall be covered with flat toughened glass cemented into a retaining ring.
- Lamp replacement shall be from the front.
- Controlgear box for HPMV lamps shall be integral to the housing.
- MS fixing straps shall be provided for mounting.
- Luminaire shall be stove enameled grey outside and white inside.
- Terminal box shall be provided with 20 mm ET conduit entry.
- Complete luminaire shall be suitable for the hazardous area as classified in Data Sheet A. Type test certificate for flame proofness test from government or government approved independent laboratory shall be submitted.

m) Bulk Head (Weather Proof)

- Luminaire shall be suitable for indoor / outdoor applications having weather proof features.
- The luminaire shall comprise of die cast aluminium alloy body of dish shape.
- Luminaire shall have a heat resistant prismatic cover held in a weather proof gasket.
- Luminaire shall be stove enamelled grey outside and white inside.
- Glass cover shall have a galvanised wire protection.
- Luminaire shall be provided with locking arrangement with Allen key to prevent pilferage.
- Luminaire shall be suitable for use with incandescent lamp upto 100W.
- Provision for 20 mm ET conduit entry shall be provided at the bottom.



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n) LED type Luminaires:

- LED Luminaires shall be used for the lighting if specified in BOQ as part of NIT.
- In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type.
- The individual lamp wattage for LED shall be upto 3 watt.
- The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70Lm/W.
- The LED used in the luminaires shall have colour rendering index (CRI) of Min 65. Colour designation of LED shall be “cool day light” (min 5700K) type.
- The LED luminaire shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.
- The beam angle for LED chip shall be 120 degrees.
- The max. junction temperature of LED shall be 85 deg C, further the lumen maintenance at this temperature shall be min 90%.
- The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9.
- The marking on luminaire & safety requirements of luminaire shall be as per IS standards.
- Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.
- The connecting wires used inside the system, shall be low smoke halogen free, fire retardant PTFE cable.
- Fuse protection shall be provided in input side specifically for LED luminaires.
- Care shall be taken in the design that there is no water stagnation anywhere. The entire housing shall be dust and water proof protection as per IS 12063.
- Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer. LED Drivers may have following control & protections:
 - Suitable precision current control of LED.
 - Open Circuit Protection



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- Short Circuit Protection
- Over Temperature Protection
- Overload Protection

o) Emergency Lighting Luminaires

- The luminaire shall be automatic having in-built battery.
- Battery shall have integral charging unit.
- Charger shall be suitable for operation as per system design data.
- The battery enclosure shall be suitably painted and ventilated for the performance with sealed lead acid battery, as applicable.

5.3 CONTROLGEAR BOX (NON-INTEGRAL TYPE)

- a) Boxes shall have weatherproof construction and shall be provided with one piece neoprene gasket.
- b) Boxes shall be provided with HRC fuse mounted on a removable tray. Boxes shall be provided with all necessary components having a neat layout arrangement such that it is possible to test, inspect or replace any component without difficulty.
- c) Boxes shall be suitable for mounting on structures, walls and columns.
- d) Suitable number of terminals shall be provided for looping-in and looping-out of cable connections and also connections to the luminaire(s).
- e) Cable / conduit knock-outs shall be for each loop-in and loop-out connection and also connection to the luminaire(s).

5.4 REFLECTORS

- a) Reflectors shall be made of sheet steel or aluminium as applicable.
- b) The aluminium reflectors shall be made of high purity aluminium sheet. Sheet will be polished, electrochemically brightened and anodised.
- c) Wherever reflectors are separate from housing, they shall be securely attached to the luminaire by means of easily accessible fastening devices such that they are readily removable from the housing for maintenance.

5.5 LAMP HOLDERS



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- a) Holders shall be resistant to wear and shall be smooth in operation.
- b) Contacts shall be of durable quality.
- c) Holders shall hold the lamp under condition of shock and vibration.
- d) Lamp holders for fluorescent lamp shall be spring loaded, bi-pin, rotor type with low contact resistance.
- e) Live parts of the holder shall not be exposed when the lamp is inserted or removed in case of fluorescent luminaires.
- f) Lamp holders for HPMV & HPSV lamps shall be of porcelain material.
- g) Holders shall be screw type for HPSV & HPMV lamps. Holders for incandescent lamps shall be screw type, unless mentioned otherwise in Data sheet A.
- h) Lamp holders for incandescent lamps shall be of brass or porcelain.

5.6 STARTER HOLDERS

- a) Starter holders shall be designed and manufactured as per the applicable standard.

5.7 BALLASTS

- a) Fluorescent fixtures shall have electronic ballasts. Ballasts shall be totally enclosed type.
- b) Ballasts shall be easily removable type.
- c) Core shall be made of low loss, electrical grading stampings.
- d) End connections shall be made available in a terminal block, rigidly fixed to the ballast enclosure.
- e) Ballasts shall be free from humming.
- f) Ballast shall be provided separately for each lamp in a multi-lamp luminaire.
- g) Tappings shall be provided to set the voltage within range for HPMV & HPSV luminaires.

5.8 STARTERS

- a) Starters shall be made of aluminium material. Plastic or any other material if used shall be subject to purchaser's approval.
- b) Starters shall have bi-metal electrodes.
- c) Starter shall be replaceable without the use of any tool and without disturbing any accessory or lamp.



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- d) Starters shall have high mechanical strength.
- e) Starters shall be provided with radio interference suppressing capacitors.
- f) Starters shall have brass contacts.

5.9 CAPACITORS

- a) Capacitors shall have constant value of capacitance, suitable for operation at supply voltage.
- b) Capacitors shall be hermetically sealed, preferably in a metal enclosure to prevent seepage of impregnant and ingress of moisture.

5.10 LAMPS

- a) Lamps shall be suitable for use in any position.
- b) Lamps shall be capable of withstanding small vibrations without breakage to filaments / electrodes and lead-in wire.

5.10.1 Type of Lamps

- a) Fluorescent Lamp
 - i. Anode rings shall be provided to prevent blackening of the ends.
 - ii. Lamp caps shall be two pin type at each end.
- b) Incandescent (GLS) Lamps
 - i. Incandescent lamps shall be “clear” type.
- c) Mercury Vapour Lamps
 - i. Lamp caps shall be screw type.
- d) Sodium Vapour Lamps
 - i. Lamps shall be ovoid shaped with diffusing powder coating.
 - ii. Lamps shall be provided with external igniters and rapid restart facility.
 - iii. Lamp caps shall be screw type.
- e) Halogen Lamps
 - i. Lamps shall be double ended linear type.



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- ii. Lamps shall be of immediate start type.
- iii. Design of lamps shall ensure high performance and high efficiency.

5.11 JUNCTION BOXES

- a) Junction boxes with terminals shall be supplied for branching and terminating lighting wires/cables whenever required, as specified.

- b) Construction Features

- i. The junction boxes shall be fabricated out of material & thickness as specified in Datasheet-A and shall be of rectangular shape. The cover shall be hinged or bolted with captive nuts and bolts and shall be provided with neoprene gasket lining all over.
- ii. The junction boxes shall be provided with suitable knock outs/ gland plates for conduit/ cable connection. The conduit connection shall be properly sealed. The junction boxes meant for cable connection shall be complete with removable gland plates, glands and cable lugs, as required. The junction boxes shall be provided with two earthing terminals suitable for GI earthing wires.
- iii. The junction boxes shall be weather proof type conforming to IP-55..
- iv. The boxes and cover shall be hot dip galvanised. Junction boxes for corrosive areas like DM Plant, water treatment plant etc. shall have additional epoxy/acrylic coating of thickness not less than 50microns on outer surface.
- v. The junction boxes shall be suitable for mounting on wall, columns, etc. The brackets, bolts, nuts, screws and any other erection accessories required for erection shall be included.

- c) Terminals

- i. Multiway terminal blocks of approved type and make complete with galvanised screws, nuts, washers and marking strips shall be furnished for terminating the lighting wires.
- ii. All the terminals blocks shall be of 650V grade one piece construction with insulating barriers. These terminals shall be made of copper alloy and shall be stud type. Each terminal provided on junction box shall be suitable for terminating two numbers of aluminium conductors of the size as specified without any damage to the conductors or looseness.

- d) The junction boxes shall be of following types:

Type	Description
------	-------------



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- JB-F Provided with four (4) way stud type terminals for terminating upto 2 nos. 10 mm² stranded aluminium conductors on each terminal, suitable for outdoor installations.
- JB-FE Same as above but with an additional epoxy coating of 50 micron thickness.
- JB-S Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of 3.5Cx50 mm² stranded aluminium conductors & with one no.6A HRC fuse and link.

5.12 RECEPTACLES

- a) Receptacle unit shall consist of socket outlet with associated switch and plug. The socket outlet and switch shall be flush mounted on a box which shall be suitable for mounting on wall or steel structures.
- b) Receptacle boxes shall be fabricated from material with thickness mentioned in Data Sheet A.
- c) Steel boxes shall be hot dip galvanised/ painted as specified in Datasheet-A and as per the requirements of applicable standard corresponding to the sheet thickness.
- d) The boxes shall have conduit knock-outs and shall be suitable for cable entry of the size to be specified by purchaser during detailed engineering.
- e) The boxes shall be provided with neoprene rubber gaskets to make them moisture and dust proof.
- f) Suitable loop-in and loop-out terminals shall be provided inside the box. Terminals for incoming and outgoing shall be suitable for the size of conductor of cables.
- g) The receptacle units shall be of the following types:
 - I. Type RA: It shall have the following:
 - i. 20A, 240V, 1-phase, 2 pole, 3-pin (third pin scrapping earth) porcelain, metal clad socket with a metallic cover tied to it.
 - ii. Rotary, heavy duty 20A switch conforming to applicable standard.
 - iii. Shrouded, die-cast aluminium plug.
 - iv. It shall be combined interlocked weather proof industrial unit.
 - v. Mechanical interlock shall be provided as follows :
 - Switch can be put ON only when plug is fully engaged.



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- Plug can be withdrawn only when switch is in OFF position.
- Cover can be opened only when switch is in OFF position.

vi. The arrangement should ensure that water does not enter the plug when socket is ON.

vii. Loop-in loop-out terminals shall be provided inside the box suitable for 10 mm² Al conductor.

II. Type RB: It shall have the following:

- i. Combination of 5A & 15A, 240V, 1-phase, 2 pole, 3-pin, third pin grounded socket with integral piano key type 15A switch, flush mounted on decorative bakelite (6 mm thick)/ perspex (3 mm thick) sheet as cover of the boxes.
- ii. Loop-in loop-out terminals similar to type RA shall be provided. These will be located in office areas.

III. Type RC: It shall have the following:

- i. 63A, 415V, 3-phase-neutral earth, metal clad socket with cover
- ii. Rotary, heavy duty 63A switch conforming to applicable standard.
- iii. Shrouded, die-cast aluminium plug
- iv. It shall be combined, interlocked weather proof industrial unit.
- v. Mechanical interlock shall be same as that are applicable for RA type receptacles
- vi. The receptacle boxes shall be suitable for entry and exit of 3.5CX70 mm² Al conductor PVC cable and loop-in loop-out terminals for the same shall be provided such that not more than one core is terminated at one terminal. Removable, undrilled cable gland plate shall be provided. Tinned copper lugs and double compression cable glands shall also be supplied by the bidder.

IV. Type RD: It shall have the following:

- i. 125A, 415V, 3-phase-neutral earth, metal clad socket with cover.
- ii. Rotary, heavy duty 125A switch conforming to applicable standard.
- iii. Shrouded, die-cast aluminium plug
- iv. It shall be combined, interlocked weather proof industrial unit.
- v. Mechanical interlock shall be same as that are applicable for RC type receptacles



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vi. The receptacle boxes shall be suitable for entry and exit of 3.5CX95 mm² Al conductor PVC cable and loop-in loop-out terminals for the same shall be provided such that not more than one core is terminated at one terminal. Removable, undrilled cable gland plate shall be provided. Tinned copper lugs and double compression cable glands shall also be supplied by the bidder.

V. Type RE: It shall have the following:

- i. 5A, 240V, 1-phase, 2 pole, 3-pin, third pin grounded socket with integral piano key type 5A switch, flush mounted on decorative bakelite (6 mm thick)/ perspex (3 mm thick) sheet as cover of the boxes.
- ii. Loop-in loop-out terminals similar to type RA shall be provided. These will be located in office areas.

5.13 CEILING FAN & REGULATORS

- a) The bidder shall supply the following ceiling fans complete with suspension rod, canopy and accessories and regulators:
 - i. 1200 mm sweep
 - ii. 1400 mm sweep
- b) The fan motor shall be totally enclosed. The motor winding shall be of copper wire provided with double or reinforced class-E insulation.
- c) The fan shall have three (3) well balanced blades. Precaution shall be taken in the manufacture of fan as well as regulators to ensure reasonable degree of silence at all speeds.
- d) The regulator shall be electronic type with stepped/smooth (stepless) control of approved make.

5.14 LIGHTING CONTROL SWITCH-BOXES

- a) The switch-boxes shall be of bent steel construction, fabricated of 1.6 mm thick MS steel with 6 mm thick decorative bakelite or 3 mm thick perspex sheet cover. The boxes shall be hot dip galvanised.
- b) The switch-boxes shall be suitable for surface mounting as well as flush mounting in brick walls. They shall be flush mounted in the walls in the office areas where false ceiling is provided.
- c) Switch-boxes shall have conduit knock-out on two sides. Adequate provision shall be made for ventilation of these boxes. Conduit knock-out sizes shall be as per conduit layout drgs.
- d) Switches shall be of piano-key type having quick-make, quick-break mechanism, provided with position marking, suitable for mounting on insulating plate. The



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switches shall be suitable for 1-phase, 240V, 50 Hz supply. They shall conform to relevant standards. The switches shall be supplied loose and shall be fixed at site according to requirement.

- e) All components housed in the switch-boxes shall be wired to an outgoing junction box by 1.5 mm² Cu wire. The junction box shall have adequate nos. of terminals.
- f) The size of switch-boxes shall be adequately chosen to accommodate the no. of switches and fan regulator boxes specified below. Fan regulators shall be supplied separately.
 - i. Type SWB1 - Switch board with 1 no. 5A switch, JB type SW1.
 - ii. Type SWB2 - 3 nos. 5A switches and 1 no. fan regulator, JB type SW2.
 - iii. Type SWB2a - 4 nos. 5A switches, JB type SW2.
 - iv. Type SWB3 - 7 nos. 5A switches, 3 nos. fan regulator, JB type SW3.
 - v. Type SWB3a - 8 nos. 5A switches, JB type SW3.

JB details for lighting control switch boxes are as below:

JB-SW1 Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of 10 mm² stranded aluminium conductor.

JB-SW2 Similar to the JB-SW1 but provided with ten (10) way terminals.

JB-SW3 Similar to the JB-SW1 but provided with eighteen (18) way terminals.

5.15 CABLE GLANDS

- a) Whether specifically mentioned or not, cable glands of suitable sizes shall be supplied along with each equipment for power and control cables.
- b) Rubber components used in the gland shall be of neoprene.
- c) Name / trade name of manufacturer, type no. and applicable range of outer diameter of cable shall be engraved / indelibly printed on the cable gland.

5.16 CABLE LUGS

- a) All equipment shall be supplied with the power and control cable lugs of suitable size, whether specifically mentioned or not.
- b) Name / trade name and size of lug shall be engraved/ indelibly printed on each cable lug.

5.17 FLEXIBLE METALLIC CONDUITS AND FITTINGS

- a) Flexible metallic conduits shall generally conform to the requirements of IS:3480.



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- b) Flexible conduits shall be made of strip steel, which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.
- c) The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.
- d) The surface of the strip shall be thoroughly cleaned before application of protective coating. Pre-treatment, before galvanization, shall conform to IS:6005.
- e) The strip shall be electro-galvanized to a minimum thickness of 25 microns as per IS 3480.
- f) Flexible conduits shall be lead coated for application in high temperature zones if specifically mentioned in Data Sheet A.
- g) The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be free from burrs and sharp edges and suitable for pulling insulated cables and wires without damage.

5.18 PVC CONDUITS

- a) PVC conduits shall generally conform to the requirements of IS: 9537(Part I & Part III).

6.0 SURFACE TREATMENT

- 6.1 All metal parts and the surfaces (exterior & interior) of equipment, unless stated otherwise in case of reflectors, shall be degreased by dipping in hot alkaline solution and rubbed with wire brush to remove oil & scale from them & then rinsed in water. Alternatively, they may be shot / sand blasted.
- 6.2 Parts shall be pickled by dipping in hydrochloric acid tank to remove the rust from the surfaces formed during storage of sheets & then rinsed to remove traces of the acid. The cleaning and pretreatment of all metal parts shall be as per applicable standard.
- 6.3 The surfaces to be painted shall then be prepared by phosphatizing to protect them from further rusting & to create a good bond with the paint. The pretreatment shall conform to the applicable standard.
- 6.4 All parts shall then be subjected to a coat of red oxide primer paint.
- 6.5 All inside and outside surfaces of panel shall be spray painted with synthetic enamel of the shade as per Data Sheet A.
- 6.6 Electrostatic or powder painting shall be acceptable subject to purchaser's approval.
- 6.7 Wherever possible, finished parts shall be coated with peelable compound by spraying method to protect the finished product from scratches, grease, dirty and oily spots during handling and transportation.



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7.0 PACKING

7.1 A) The material shall be packed to ensure protection against damage during transit, storage for prolonged periods and handling. Lighting Fixtures, Lamps, Receptacles, Switchboards, 24V Supply modules, 24V sockets, Junction Boxes, Exit signs shall be clean and dry prior to packaging.

B) All items specified above at 7.1 shall be supplied in packed cartons. The tapes used for packing shall not bleed, leave residue, or damage the item when removed.

C) Fixtures & other lighting material mentioned above shall be wrapped in weather proof material such as polythene sheets, air bubble sheets/ thermocol etc. The lighting fixtures shall be placed in a corrugated paperboard/ fibreboard container/ mono carton.

D) The mono cartons shall be wrapped or bagged or tied in place in master cartons. The master carton shall be taped and then wrapped with cushioning material.

E) The dimensions of cartons shall be as per manufacturer's recommendations.

F) For items like step ladder, wheel mounted ladder and flexible conduits, packing shall be as per manufacturer standard.

Vendor shall further furnish packing procedure along with packing drawing at contract stage for applicable items for purchaser approval.

7.2 Containers adequate for storing 70% of P.O. quantity material at site are to be supplied. Vendor shall furnish suitable justification to purchaser during detailed engineering for the number and size of containers being supplied.

7.3 Specification for the sea worthy packing, if enclosed, for the export jobs shall form part of the specification.

8.0 GUARANTEED PERFORMANCE REQUIREMENTS

8.1 The vendor shall guarantee satisfactory performance of the equipment supplied under all conditions and requirement as laid down by this specification.

8.2 Vendor shall ensure satisfactory performance for lighting system designed by them at site.

9.0 INSPECTION & TESTING

9.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-558-E006) without any deviations. The equipment which are not covered in the Quality Plan shall be tested as per the QP to be submitted by bidder. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ ultimate customer's approval. There shall



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be no commercial implication to BHEL on account of any changes in QP during contract stage.

- 9.2 All the components and completely assembled equipment shall be tested as per the latest edition of standards. Charges for these tests shall be deemed to be included in equipment price.
- 9.3 All the specified type and routine tests shall be carried out to verify the rating and performance of the equipment. Where valid type test certificates in evidence of equipment performance claimed are available & approved by purchaser, the requirements for conducting type tests may be waived. The general arrangement of object under test shall be to purchaser's approval.
- 9.4 All manufacturing processes viz. machining, sheet forming, electroplating, wire routing, cleating & crimping, assembly, surface preparation shall conform to good manufacturing practices.
- 9.5 Inspection for dimensional & visual checks especially of the following, with respect to contract drawings, documents & standards shall be conducted:
- a) General sturdiness & rigidity of equipment
 - b) Surface finishing
 - c) Gasketting
 - d) Inter-changeability
 - e) Constructional features viz. location, accessibility & marking of components, segregation, accessibility to live parts (shrouding) etc.
 - f) Completeness of scope
- 9.6 Equipment shall be liable for rejection if tolerances on the values of dimensions, power consumption, impedances, temperature rise etc. exceed the specified values by purchaser and / or standards.

10.0 SPARES

- 10.1 Mandatory spares (if applicable) are indicated in BOQ-cum-price schedule.
- 10.2 Erection & commissioning spares are included in the bidder's scope of supply. BE&C spares are indicated in BOQ-cum-price schedule.
- 10.3 A list of recommended O&M spares quantities for a duration of 3 years A shall be filled up in the applicable schedule / format and submitted by bidder along with offer. However, the acceptance of the same shall not be binding on purchaser.

11.0 TOOLS AND TACKLE

- 11.1 Tools & tackle which are essential to facilitate assembly, adjustments, erection, maintenance & dismantling of equipment shall be provided as part of equipment supplied.
- 11.2 The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.



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11.3 Vendor shall also submit a list of recommended tools and tackle. Acceptance of these tools and tackle shall not be a binding on the purchaser.

11.4 Schedule of tools & tackle shall be filled up by bidder.

12.0 DOCUMENTATION

12.1 Documents to be submitted by the vendor immediately after award of contract

a) Bar chart of activities of manufacture, testing, inspection and despatch.

12.2 Documents to be submitted during detailed engineering of contract

12.2.1 Engineering documents (refer clause 4.3) to be generated by the vendor, if applicable.

- a) Lighting calculations for indoor areas.
- b) Lighting calculations for outdoor areas.
- c) SLD of power distribution upto LPs.
- d) Power load on each LP & LDB
- e) Layout drawings for indoor areas
- f) Layout drawings for outdoor areas.
- g) Conduit layout drawings.
- h) Wiring and load distribution details for outdoor areas.
- i) Master Bill of Material.
- j) Packing Procedure & drawing.
- k) Calculation for selection of no. & size of container.

12.2.2 Other documents :

- a) Final Quality Plans
- b) Technical data sheet
- c) Polar curves, zonal flux diagram and CoU charts of luminaires.
- d) Complete design calculations for arriving at number of luminaires.
- e) Fixing / mounting details of luminaires and other items.
- f) General arrangement drawings of following:
 - i. Luminaires
 - ii. Receptacles
 - iii. 24 V Supply module
- g) Field Quality Plan as per General Technical Conditions.
- h) Control Scheme for fluorescent, HPMV and HPSV luminaires.



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- i) Schematic drawings for LDBs / LPs.
- j) Type test certificates.
- k) Catalogues / leaflets

12.3 Operation and Maintenance (O&M) manual :

The document shall comprise of installation, operating and maintenance instructions for various items / components. The O&M manual shall include the following :

- a) Write ups / instructions / procedures for
 - i. Storage at site.
 - ii. Unpacking.
 - iii. Handling at site.
 - iv. Erection.
 - v. Pre-commissioning / commissioning tests.
 - vi. Operating procedures.
 - vii. Maintenance procedures.
 - viii. Precautions to be taken during operation and maintenance work.
 - ix. Trouble shooting charts covering problems, cause and solution.
- b) Approved Technical Data Sheets.
- c) Technical leaflet of various items / components.
- d) Copies of the type, acceptance and routine test certificates in bound volume.
- e) Details of all components liable to be replaced during the life of the equipment.
- f) List of maintenance tools required.
- g) List of testing equipment required.

12.4 AS BUILT DRAWINGS

- a) Preparation of as-built drawings shall be in the scope of vendor.
- b) The as-built drawings shall be prepared on the basis of marked up copies received from the erection contractor.
- c) Entire work of as-built drawings shall be to the satisfaction of purchaser.



1. Flood lighting luminaires to have non-integral control gearbox.
2. All other luminaires shall have integral control gearbox, unless specifically mentioned otherwise in enclosed sheets.
3. For more details of each luminaire, refer specification.



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1.0 Fluorescent Lamp Luminaires

- | | | | |
|------|------|--------|---|
| 1.1 | FC01 | 1 x 28 | Fluorescent, industrial box type base without any cover. |
| 1.2 | FC02 | 2 x 28 | Fluorescent, industrial box type base without any cover. |
| 1.3 | FC03 | 1 x 28 | Fluorescent, industrial box type base and stove enamelled side reflectors. |
| 1.4 | FC04 | 2 x 28 | Fluorescent, industrial box type base and stove enamelled side reflectors. |
| 1.5 | FC05 | 1 x 28 | Fluorescent, industrial box type base and vitreous enamelled side reflectors. |
| 1.6 | FC06 | 2 x 28 | Fluorescent, industrial box type base and vitreous enamelled/ anodized glossy side reflectors. |
| 1.7 | FC07 | 1 x 18 | Fluorescent, industrial box type base and vitreous enamelled side reflectors operating on 220V DC input supply. |
| 1.8 | FC21 | 1 x 28 | Fluorescent, decorative with 3 side perspex acrylic diffuser. |
| 1.9 | FC22 | 2 x 28 | Fluorescent, decorative with 3 side perspex acrylic diffuser. |
| 1.10 | FC23 | 1 x 28 | Fluorescent, decorative, recessed type with perspex acrylic diffuser. |
| 1.11 | FC24 | 2 x 28 | Fluorescent, decorative, recessed type with perspex acrylic diffuser. |
| 1.12 | FC25 | 1 x 28 | Fluorescent, decorative, recessed type with mirror optic reflector. |
| 1.13 | FC26 | 2 x 28 | Fluorescent, decorative, recessed type with mirror optic reflector. |
| 1.14 | FC27 | 2 x 28 | Fluorescent, decorative with opal polystyrene louvers. |
| 1.15 | FC28 | 2 x 28 | Fluorescent, decorative, recessed type with opal polystyrene louvers. |
| 1.16 | FC29 | 2 x 28 | Fluorescent, decorative with vertical metallic louvers. |
| 1.17 | FC30 | 4 x 14 | Fluorescent, decorative, recessed type, 600 x 600 size with perspex acrylic diffuser. |
| 1.18 | FC31 | 4 x 20 | Fluorescent, decorative, recessed type, 600 x 600 size with opal polystyrene louvers. |



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|------|------|--------|---|
| 1.19 | FC32 | 2 x 28 | Fluorescent, decorative, surface mounted with mirror optic reflector. |
| 1.20 | FC33 | 1 x 18 | Fluorescent, decorative, recessed type with mirror optic reflector operating on 220V DC input supply. |
| 1.21 | FC34 | 1 x 18 | Fluorescent, dust proof, totally enclosed type with sheet steel housing operating on 220V DC input supply |
| 1.22 | FC41 | 2 x 28 | Fluorescent, vapour proof with end boxes and controlgear box of cast Al. |
| 1.23 | FC51 | 2 x 28 | Fluorescent, dust proof, totally enclosed type with sheet steel housing. |
| 1.24 | FC61 | 1 x 28 | Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover. |
| 1.25 | FC62 | 2 x 28 | Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover. |
| 1.26 | FC81 | 2 x 28 | Fluorescent, corrosion proof, totally enclosed type with sheet aluminium/ polycarbonate housing. |

2.0 High Pressure Mercury Vapour (HPMV) Lamp Luminaire

- | | | | |
|------|------|----------|--|
| 2.1 | MB01 | 1 x 250 | Mercury, high bay, industrial type. |
| 2.2 | MB02 | 1 x 400 | Mercury, high bay, industrial type. |
| 2.3 | MB03 | 1 x 1000 | Mercury, high bay, industrial type. |
| 2.4 | MB04 | 1 x 250 | Mercury, high bay, totally enclosed industrial type. |
| 2.5 | MB05 | 1 x 400 | Mercury, high bay, totally enclosed industrial type. |
| 2.6 | MB06 | 1 x 250 | Mercury, high bay with non-integral controlgear box. |
| 2.7 | MB07 | 1 x 400 | Mercury, high bay with non-integral controlgear box. |
| 2.8 | MB11 | 1 x 250 | Mercury, medium bay, industrial type. |
| 2.9 | MB12 | 1 x 400 | Mercury, medium bay, industrial type. |
| 2.10 | MB13 | 1 x 250 | Mercury, medium bay, totally enclosed industrial type. |
| 2.11 | MB14 | 1 x 400 | Mercury, medium bay, totally enclosed industrial type. |



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|------|------|---------|--|
| 2.12 | MB17 | 1 x 80 | Mercury, low bay, industrial type. |
| 2.13 | MB18 | 1 x 125 | Mercury, low bay, industrial type. |
| 2.14 | MB19 | 1 x 80 | Mercury, low bay, totally enclosed industrial type. |
| 2.15 | MB20 | 1 x 125 | Mercury, low bay, totally enclosed industrial type. |
| 2.16 | MW41 | 1 x 80 | Mercury, well glass, vapour proof with vitreous enamelled reflector. |
| 2.17 | MW42 | 1 x 125 | Mercury, well glass, vapour proof with vitreous enamelled reflector. |
| 2.18 | MW51 | 1 x 80 | Mercury, well glass, dust proof with vitreous enamelled reflector. |
| 2.19 | MW52 | 1 x 125 | Mercury, well glass, dust proof with vitreous enamelled reflector. |
| 2.20 | MW91 | 1 x 80 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing. |
| 2.21 | MW92 | 1 x 125 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing. |
| 2.22 | MW93 | 1 x 80 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing |
| 2.23 | MW94 | 1 x 125 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing. |
| 2.24 | MW95 | 1 x 80 | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div.-2 areas. |
| 2.25 | MW96 | 1 x 125 | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas. |
| 2.26 | MW98 | 1 x 125 | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing |
| 2.27 | MS61 | 1 x 125 | Mercury, street light with one piece cast aluminium body. |
| 2.28 | MS62 | 1 x 250 | Mercury, street light with two piece cast aluminium body. |
| 2.29 | MS63 | 1 x 400 | Mercury, street light with two piece cast aluminium body. |



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2.30 MF61 1 x 250 Mercury, flood light, general purpose.

2.31 MF62 1 x 400 Mercury, flood light, heavy duty type.

2.32 MF63 2 x 400 Mercury, flood light, heavy duty type.

2.33 MP21 1 x 80 Mercury, post top lantern

2.34 MP22 1 x 125 Mercury, post top lantern

3.0 High Pressure Sodium Vapour (HPSV) Lamp Luminaire

3.1 SB01 1 x 150 Sodium, high bay, industrial type.

3.2 SB02 1 x 250 Sodium, high bay, industrial type.

3.3 SB03 1 x 400 Sodium, high bay, industrial type.

3.4 SB04 1 x 150 Sodium, high bay, totally enclosed industrial type.

3.5 SB05 1 x 250 Sodium, high bay, totally enclosed industrial type.

3.6 SB06 1 x 400 Sodium, high bay, totally enclosed industrial type.

3.7 SB07 1 x 150 Sodium, high bay with non-integral controlgear box.

3.8 SB08 1 x 250 Sodium, high bay with non-integral controlgear box.

3.9 SB09 1 x 400 Sodium, high bay with non-integral controlgear box.

3.10 SB11 1 x 150 Sodium, medium bay, industrial type.

3.11 SB12 1 x 250 Sodium, medium bay, industrial type.

3.12 SB13 1 x 150 Sodium, medium bay, totally enclosed industrial type.

3.13 SB14 1 x 250 Sodium, medium bay, totally enclosed industrial type.

3.14 SB17 1 x 70 Sodium, low bay, industrial type.

3.15 SB18 1 x 150 Sodium, low bay, industrial type.

3.16 SB19 1 x 70 Sodium, low bay, totally enclosed industrial type.

3.17 SB20 1 x 150 Sodium, low bay, totally enclosed industrial type.

3.18 SW41 1 x 70 Sodium, well glass, vapour proof with vitreous enamelled/
powder coated type reflector.



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3.19	SW42	1 x 150	Sodium, well glass, vapour proof with vitreous enamelled/ powder coated type reflector.
3.20	SW51	1 x 70	Sodium, well glass, dust proof with vitreous enamelled reflector.
3.21	SW52	1 x 150	Sodium, well glass, dust proof with vitreous enamelled reflector.
3.22	SW91	1 x 70	Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.
3.23	SW92	1 x 150	Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.
3.24	SW93	1 x 70	Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.
3.26	SW95	1 x 70	Sodium, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas.
3.27	SW96	1 x 150	Sodium, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas.
3.28	SS61	1 x 70	Sodium, street light with one piece cast aluminium body.
3.29	SS62	1 x 150	Sodium, street light with one piece cast aluminium body.
3.30	SS63	1 x 250	Sodium, street light with two piece cast aluminium body.
3.31	SS64	1 x 400	Sodium, street light with two piece cast aluminium body.
3.32	SF61	1 x 250	Sodium, flood light, general purpose.
3.33	SF62	1 x 400	Sodium, flood light, general purpose.
3.34	SF63	1 x 250	Sodium, flood light, heavy duty type.
3.35	SF64	1 x 400	Sodium, flood light, heavy duty type.
3.36	SF65	2 x 250	Sodium, flood light, heavy duty type.
3.37	SF66	2 x 400	Sodium, flood light, heavy duty type.
3.38	SP21	1 x 70	Sodium, post top lantern.



**TECHNICAL SPECIFICATION FOR
LIGHTING FIXTURES, LAMPS &
MISCELLANEOUS ITEMS**

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4.0 Tungsten Lamp Luminaires

- | | | | |
|------|------|---------|--|
| 4.1 | TW41 | 1 x 100 | Tungsten, well glass, vapour proof with vitreous enamelled reflector. |
| 4.2 | TW42 | 1 x 200 | Tungsten, well glass, vapour proof with vitreous enamelled reflector. |
| 4.3 | TW51 | 1 x 100 | Tungsten, well glass, dust proof with vitreous enamelled reflector. |
| 4.4 | TW52 | 1 x 200 | Tungsten, well glass, dust proof with vitreous enamelled reflector. |
| 4.5 | TW91 | 1 x 100 | Tungsten, well glass, flame proof with vitreous enamelled reflector. |
| 4.6 | TW92 | 1 x 200 | Tungsten, well glass, flame proof with vitreous enamelled reflector. |
| 4.7 | TW95 | 1 x 100 | Tungsten, well glass, increased safety (Div. 2) with vitreous enamelled reflector. |
| 4.8 | TW96 | 1 x 200 | Tungsten, well glass, increased safety (Div. 2) with vitreous enamelled reflector. |
| 4.9 | TB21 | 1 x 60 | Tungsten, bulk head, weather proof. |
| 4.10 | TB22 | 1 x 100 | Tungsten, bulk head, weather proof. |
| 4.11 | TB91 | 1 x 100 | Tungsten, bulk head, flame proof. |
| 4.12 | TB92 | 1 x 200 | Tungsten, bulk head, flame proof. |
| 4.13 | TP21 | 1 x 200 | Tungsten, post top lantern. |
| 4.14 | TE02 | 1 x 20 | Tungsten, portable emergency unit with rechargeable battery. |
| 4.15 | TE02 | 1 x 40 | Tungsten, portable emergency unit with rechargeable battery. |
| 4.16 | TX01 | 1 x 60 | Tungsten, dispersive vitreous enamelled reflector. |
| 4.17 | TX02 | 1 x 100 | Tungsten, dispersive vitreous enamelled reflector. |
| 4.18 | TX03 | 1 x 75 | Decorative recessed mounting luminaire suitable for comptalux lamp. |
| 4.19 | TX04 | 1 x 100 | Decorative recessed mounting luminaire suitable for comptalux lamp. |



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4.20 TX05 2 x 100 Double obstruction aviation light of cast Al. alloy with red glass.

5.0 Halogen

5.1 HF61 1 x 300 Halogen, flood light, drip proof.

5.2 HF62 1 x 500 Halogen, flood light, drip proof.

5.3 HF63 1 x 750 Halogen, flood light, drip proof.

5.4 HF64 1 x 1000 Halogen, flood light, drip proof.

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							Rev No.: 00 Date: 02/11/15 VALID UPTO: 01/11/18					
SI No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD			
					6 M	6 C/N						
1	2	3	4	5			7	8	9	D*	**	10
Note: 1): Lighting fixtures supplier to ensure that constructional features of the lighting fixture (conventional & LED type) are as per NTPC specification requirements 2): Lighting fixture supplier to maintain all quality control records identified in this QP whether it is identified for NTPC verification or witness or not.												
Conventional type Lighting Fixture												
A	Bought out items / in-process checks											
1	Lamps	Make, rating & type	Major	Visual	1 sample per type	1 sample per type	NTPC specification requirements for rating & type, Make to be BIS approved with CML number	NTPC specification requirements for rating & type, Make to be BIS approved with CML number		V	-	-
1.1	Electronic Ballast (if applicable)	a Certificate of compliance	Major	Visual	-	-	NTPC specification requirements	Certificate of compliance by ballast manufacturer / lighting fixture supplier that ballst meets all NTPC specification requirements	Certificate of compliance	V	-	-
		b THD and pf check	Major	Electrical	Mnfr std.	-	NTPC specification requirements	THD <=10% , pf >= 0.9 for FH type and pf >= 0.95 for other type of florescent lighting fixtures	Inspection report	P/V *	-	-
												P/V * - means test will be performed either by lighting fi supplier or their sub-vendor as Verified by lighting fixture suj
1.2	Castings	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	Castings shall be free from any defects such as blow holes, surface blisters, cracks and cavities etc.	Inspection report	P/V *	-	-
												P/V * - means test will be performed either by lighting fi supplier or their sub-vendor as Verified by lighting fixture suj
1.3	Sheet metal forming and fabrication	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	sheet metal fabrication / forming etc should be as per manufacturer drgs	Inspection report	P/V *	-	-
												P/V * - means test will be performed either by lighting fi supplier or their sub-vendor as Verified by lighting fixture suj
1.4	Pre-treatment and powder coating	Pre-treatment process checks, Powder coating finish, thickness, uniformity of coating and adhesion	major	Visual, chemical & mech	Mnfr std.	-	Mnfr standard , NTPC specification requirements	Nominal coating thickness 50 microns or more	Inspection report	P/V *	-	-
												P/V * - means test will be performed either by lighting fi supplier or their sub-vendor as Verified by lighting fixture suj

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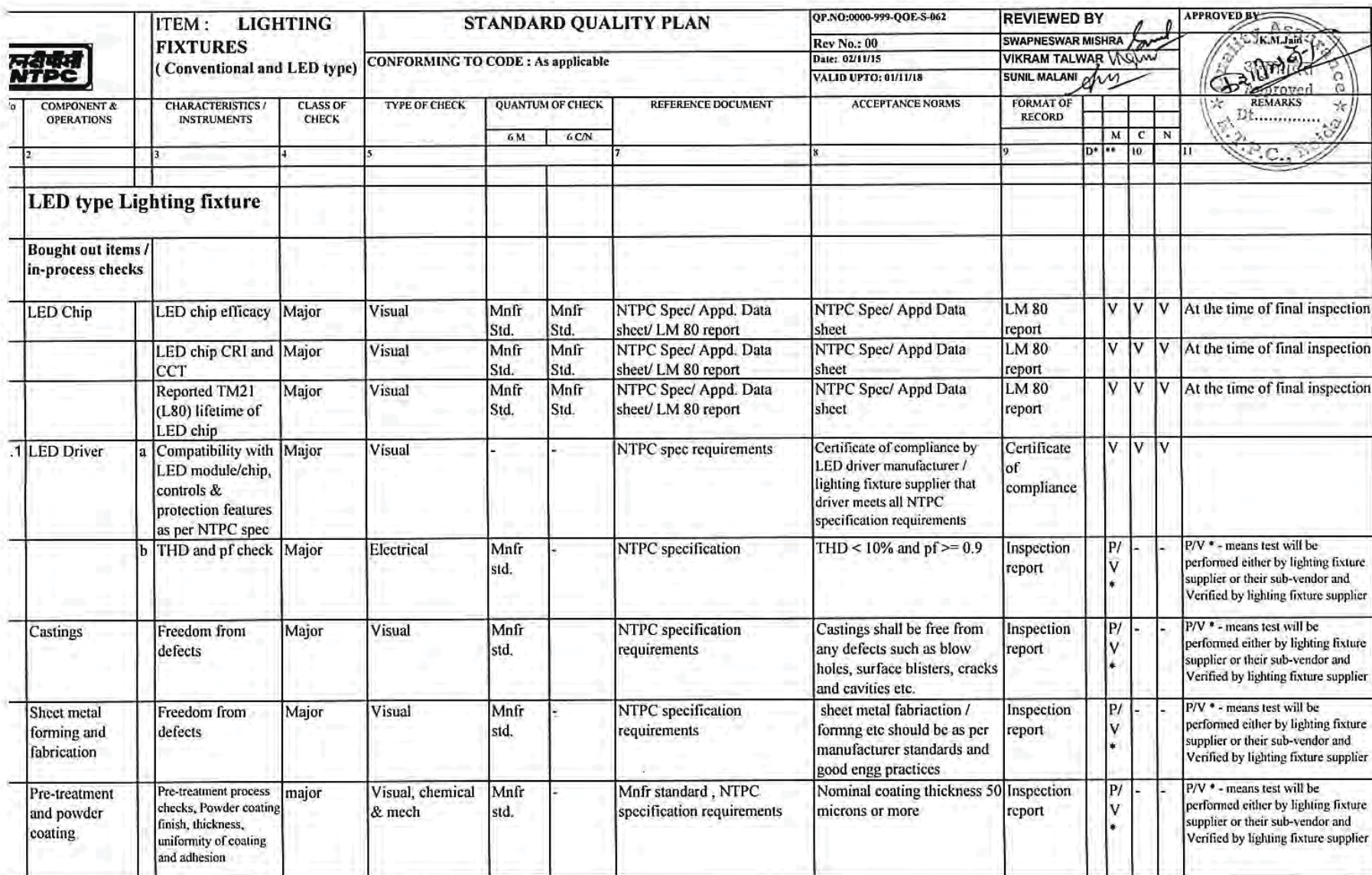
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				CONFORMING TO CODE : As applicable			Rev No.: 00	SWAPNESWAR MISHRA	 K.M. Jain REMARKS D:.....					
							Date: 02/11/15	VIKRAM TALWAR						
							VALID UPTO: 01/11/18	SUNIL MALAN						
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD					
					6 M	6 CN								
										D*	**	10		
3	Acceptance Tests on conventional Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard.	Major	Visual	-	-	lighting fixture supplier to submit the details of lot offered for NTPC inspection (Type of lighting fixtures, their batch number, sub-vendor name, quantity)	COC	List	P	V	V		The list may be used by NTPC for sample selection
		b Lamp make	Major	Visual	100%	100%	Make to be BIS approved with CML number	Make to be BIS approved with CML number	Certificate of compliance	V	V	V		
		c Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W		
		d Electronic Ballast (if applicable for offered lighting fixtures) THD and pf check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	THD <=10% , pf >= 0.9 for FH type and pf >= 0.95 for other type of florescent lighting fixtures	Inspection report	P	W	W		At lighting fixture supplier test lab
		e Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	1 sample per type	NTPC approved data Sheet	IS 10322 Part 1	Inspection report	P	W	W		
		f Resistance to dust (applicable if IP5X and above)	Major	optical	Mnfr std.	Mnfr std	NTPC approved Data sheet and accepted type test reports	Certificate of compliance	Certificate of compliance	P/V *	V	V		P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		f Photometry check	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports	Certificate of compliance for the batch : that offered lighting fixture LOR is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/V *	V	V		P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		g Dimensions	Major	Visual	1 sample per type	1 sample per type	NTPC specification and approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W		
		h HV & IR test	Major	Visual	#	#	IS 10322 part 1	IS 10322 part 1	Inspection report	P	W	W		# As per Table 1 (inspection Level S2) and Table 2C AQL 2.5 of IS 2500

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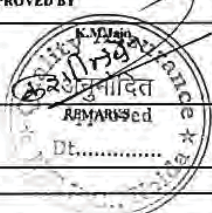
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							Rev No.: 00		VIKRAM TALWAR				
							Date: 02/11/15		SUNIL MALAN				
							VALID UPTO: 01/11/18						
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
					6 M	6 CN				D*	**	M	C
1	2	3	4	5	6	7	8	9	10	11	12	13	14
B	Acceptance Tests on LED Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard	Major	Visual	-	-	lighting fixture supplier to submit the details of lot offered for NTPC inspection (Type of lighting fixtures, their batch number, sub-vendor name, quantity)	-	List	P	V	V	The list may be used by NTPC for sample selection
		b LED chip make	Major	Visual	-	-	NTPC accepted type test reports (LM80/LM79) report	Certificate of compliance	Certificate of compliance	V	V	V	
		c Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W	
		e Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	1 sample per type	NTPC approved data Sheet	IS 10322 Part 1	Inspection report	P	W	W	
		f Resistance to dust (applicable if IP5X and above)	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports	Certificate of compliance	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		f Photometry check	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports, LM 79, IS 16106, IS 16107	Certificate of compliance for the batch: that offered lighting fixture LOR and lighting fixture efficacy is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier

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					6 M	6 C/N				M	C	N	
1	2	3	4	5			7	8	9	D*	**	10	11
		g	Dimensions	Major	Visual	1 sample per type	1 sample per type	NTPC specification and approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W
		i	LED driver: THD and pf check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	THD < 10% and pf >= 0.9	Inspection report	P	W	W
		j	LED driver: Precision current control check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
		k	LED driver: Open circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
		l	LED driver: Short circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
		m	LED driver: Over temperature protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
		n	LED driver: Overload protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W
		o	LED driver: Surge protection compliance check	Major	Electrical	-	-	NTPC specification	Certificate of compliance that surge protection is provided	Certificate of compliance	V	V	V

4 PACKING Dimensions/ Type/ Finish/ Freedom from Defects Major Visual 100% 100% Tech Spec/ Approved Packing Procedure Tech Spec/ Approved Packing Procedure Inspection Report P W W

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