VOLUME II

1 X 660 MW SAGARDIGHI THERMAL POWER PROJECT

TECHNICAL SPECIFICATION

FOR

LIGHTING FIXTURES, LAMPS AND MISCELLANEOUS ITEMS

SPECIFICATION NO: ***PE-TS-445-558-E006***

REVISION: **0**

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301

	TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS & MISCELLANEOUS ITEMS	SPECIFICATION NO. PE-TS-445-558-E006
		VOLUME II
		SECTION - I
	1 X 660 MW SAGARDIGHI THERMAL POWER PROJECT	REVISION 0 | DATE: 06.09.2022
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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 is no deviation with respect to technical specification.

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).

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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.

It is not the intent to specify completely herein all details of the equipment, nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

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 & other misc. items etc. including consumables and erection hardwares.

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. However same shall be subject to end customer approval without any commercial implication.

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

b) Duly filled in signed & stamped copy of scope matrix for broad activities (Annexure-D to Section-I)

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 NIT (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	4.2.3(c), Page-7 of 38	The supply to the DC lighting panels shall be **ALWAYS ON**.
2	Additional requirement in Clause no. 5.11, Page 21 of 38	Junction boxes shall be of 16 SWG sheet steel hot-dip galvanised, dust and damp proof, generally conforming to IP-55. Junction boxes shall be complete with gasketed inspection cover, conduit knock out/threaded hub and terminal blocks. Junction boxes for outdoor use shall be weatherproof IPW-55 and those for hazardous location shall be flame-proof type. Junction boxes shall have following indelible markings: Circuit nos. on top Circuit nos. with ferrules (inside) as per drawing DANGER sign in case of 415V circuit
3	Clause no. 5.12 g), Page 22-23 of 38 I) i II) i III) i & iv IV) i	Referred clause shall be read as: I) i: RA: 20A, 240V, 2 pole, 3 pin with third pin earthed, wall/ column mounted, metal clad gasketed construction, 20mm conduit entry, screwed metal cover tied to it by a metal chain, weatherproof suitable for indoor/outdoor installation. Degree of Protection shall be IP-52 (for indoor) / IP 65 (for outdoor). II) i: RB: 5A & 15A to be replaced with 6A & 16A respectively in standard specification. RB: 6A / 16A, 240V, 2 pole, 3 pin with third pin earthed, Suitable for flush mounting in office areas and control room. The switch shall be also flush mounted piano type. Degree of Protection shall be IP-52 (for indoor) / IP 65 (for outdoor).

		III) i & iv: RC: 63A, 415 V, 3 phase, 4 pin interlocked plug and switch with earthing contact, wall/column mounted, metal clad gasketed construction, weatherproof, suitable for entry and exit of upto 3.5C-95 Sq.mm XLPE 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. Suitable lugs and double compression cable glands shall also be supplied by the bidder. These shall be fed from Welding DB. IV) i: 125 A, 415 V, 3 phase 5 pin interlocked plug & switch with fifth pin earthed, wall/column mounted metal clad gasketed construction, weatherproof, suitable for loop in and loop out connection of 3-1/2C -95 Sq.mm XLPE cable (final cable shall be informed during detail engineering). Degree of protection shall be IP 65.
4	5.14(a) : Page-24 of 38	Referred clause shall be read as: All switch boards/boxes shall be of bent steel construction, fabricated of 14 SWG M.S. sheet with 6 mm thick bakelite cover with brass fixing screws.
5	5.14(b), Page-24 of 38	They shall be flush mounted in the walls in the office areas where false ceiling is provided. **Also, switch control shall be provided for controlling lighting fixtures located indoor.**
6	5.14(f) : Page-25 of 38	Referred clause shall be read as: 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. Flush type receptacles where provided shall be so located that only the plug projects outside. i. Type SWB1 - Switch board with 1 no. 6A switch, JB type SW1. ii. Type SWB2 - 3 nos. 6A switches and 1 no. 6A Socket, JB type SW2. iii. Type SWB2a - 3 nos. 6A switches and 2 no. fan regulator, JB type SW2. iv. Type SWB3 - 6 nos. 6A switches and 1 no. 6A Socket, JB type SW3. v. Type SWB3a - 5 nos. 6A switches and 2 no. fan regulator, 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 up to two nos. of 10 mm2 stranded aluminium/copper 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

7	5.2.1(n), 4: Page-17 of 38	**Referred clause shall be read as:** The luminaire efficacy shall be not less than **90 Lm/W** for LED luminaries.
8	5.2.1(n), 5: Page-17 of 38	The LED used in the luminaires shall have colour rendering index (CRI) of Min **70**. Colour designation of LED shall be "cool day light" (min 5500K) type **for indoor areas. However, for outdoor areas, the colour temperature of LED shall be min. 4000K, including rough & dust prone areas. LED shall conform to the LM 79 & LM 80 requirements.**
9	5.2.1(n), 15: Page-17 of 38	Following protection to be added under clause 15: ➢ Surge Protection
10	Add new clause 7.2.1 after clause 7.2 in Section-II: Page 27 of 38	New Clause 7.2.1: Materials like Concrete Blocks of Paved surface required for installation and placing of container shall be made available by BHEL. Other supporting material like Rails etc. shall be part of Container only.
11	12.4, Page 30 of 38	Referred clause shall be read as: Preparation of as-built drawings shall be in BHEL Scope. However, vendor shall be furnishing the Final Auto Cad dwgs to BHEL.
12	-	For recessed type fixtures provided in Aluminium Frame type false ceiling, suitable provision for removing the fixture and accessing the driver for maintenance from bottom shall be provided.
13	-	Please note that following items are excluded from the supply of this package: Poles, Mast, LDB, WDB, Lighting Panels, Rigid conduit, Wire & Mini truck.
14	New Clause	Pedestal Fan will have 400mm Sweep (50-65 Wattage).
15	Additional clause	Portable Emergency Lighting Unit The portable emergency lighting unit shall be complete with 6 volt storage battery (rechargeable), inverter, automatic charger, twin 6 watts lamp and test switch. Vendor shall furnish make, type and catalogue out sub vendor list.
16	Additional clause	24 V Supply Module Each 24V A.C. supply module shall have one (1) no air cooled two winding transformer and necessary terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module shall be fed from lighting panels. Details of 24V A.C. supply modules shall be as given below: Module type: Portable type/ Fixed type with receptacle distribution panel

		Transformer rating: 500 VA Transformer voltage ratio: 240/24 Volt Primary side isolation: DP MCB with HRC fuse Isolation rating: 16A HRC fuse rating: 6A Secondary side isolation: SPN MCB with HRC fuse Isolation rating: 6A HRC fuse rating: 16A
17	Additional clause	Supply of lighting erection hardware & consumable are in contractor's scope (refer BOQ for list & quantity). Hardware & consumable are of GI and shall be suitable for fixing with GI conduits. Further, contractor shall furnish list of all erection materials, hardware and consumables required for the complete installation. The list materials shall include but shall not be limited to the following: a) Hardware: Bolts, nuts, washers, screws, brackets, supports, clamps, hangers, saddles, cleats, sills, shims etc. b) Materials: Junction boxes, terminal blocks, connectors, ferrules, lugs, brass glands, rigid/flexible conduits, cables, ground wires etc.
18	Additional clause	1. Voltage drop at the fixture from the MLDB bus will not exceed 3%. 2. Sub circuit loading of each lighting panel will be restricted to 1400 Watts. 3. Circuit loading of each lighting Panel will be done in such a way that almost balanced loading in all the phases is achieved.
19	Additional clause	Suitable numbers of 24V portable halogen lamp unit along with flexible copper cable shall be supplied as per details below: Lamp wattage: 40 W Cable size: 2.5 sq. mm Stranded copper Cable length: 20 meter
20	Additional clause	Free standing shall be aluminium ladder, adjustable from 5M to 10M & wheel mounted adjustable aluminium ladder shall be 10M high aluminium ladder.
21	Additional clause	Packing specification as per Annexure-E to be followed by vendor.
22	Additional clause	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.
23	Additional Clause No. 6.0 to be added under Annexure-I of Section-II as below: -	

6.0

S.No.	FIXTURE TYPE	NOMENCLATURE	DESCRIPTION	AREA OF USE	Total Luminous flux (Lumen) of luminaire-Minimum value	Measured Electrical Input Power(Watt)-Maximum value
1.1	ILD-1	FC06(LED)	Commercial/decorative type, Surface/pendant mounted LED Batten [min 5500K color temperature, CRI ≥ 75, Chip efficacy > 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PC glossy diffuser. The luminaire shall be made up of CRCA sheet steel **/Aluminium** (IP 20) with THD < 10% and PF > 0.9. Industrial type LED fixture suitable for conduit/surface/ suspended mounting, with integral driver aesthetically designed.	Swgr room / MCC room / Workshop / Main. Shop / Office / Toilet / Corridor / Pantry / Stores/ Toilet / Wash basin / staircase	3780	42
1.2	ILD-2	FC32(LED)	Decorative type, Surface/ pendant mounted LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) . The luminaire shall be made up of CRCA sheet steel/**Aluminium** (IP20) with THD < 10% and PF > 0.9. LED fixture having integral driver.	Office rooms / Corridor / Conference room / Engineer's room	3780	42
1.3	ILD-3	FC26(LED)	Decorative type, recess mounted LED [min 5500K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with glossy diffuser. The luminaire shall be made up of CRCA sheet steel /**Aluminium** (IP20) with THD < 10% and PF > 0.9. 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 etc.	False Ceiling areas (Control room / Electronic Eqpt. Room / Office / Conference room / Engineer's room / Corridor)	3780	42
1.4		FC30(LED)	Decorative type, recess mounted LED [min 5500K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with glossy diffuser. The luminaire shall be made up of CRCA sheet steel /**Aluminium** (IP20) with THD < 10% and PF > 0.9. Panel 600 mm X 600 mm LED luminaire suitable for recess mounting in false ceiling with integral driver aesthetically designed for Control Room/ Office etc.	False Ceiling areas (Control room / Electronic Eqpt. Room / Office / Conference room / Engineer's room / Corridor)	3780	42

1.5	ILD-4	FC81(LED)	Indoor, industrial, corrosion resistant type, ceiling or suspension mounting, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with diffuser. The luminaire shall be made up of Polycarbonate with silicone gasket material (IP65) with THD < 10% and PF > 0.9 Corrosion proof, totally enclosed type LED fixture having integral driver.	Battery room / Chemical Plant / Area with corrosive atmosphere	3780	42
1.6	ILD-5	SB11 (LED)	Pressure Die cast aluminium frame (IP 65), heat resistance toughened clear glass , Medium and High bay, dust free type, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PMMA material lenses for effective light distribution. The luminaire shall have inbuilt surge protection with THD < 10% and PF > 0.9. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. Medium bay, Industrial type LED fixture with integral driver	General Indoor equipment area / Pump House / Workshop / TG Hall	10080	112
1.7	ILD-6	SB02 (LED)	Pressure Die cast aluminium frame (IP 65), heat resistance toughened clear glass , Medium and High bay, dust free type, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PMMA material lenses for effective light distribution. The luminaire shall have inbuilt surge protection with THD < 10% and PF > 0.9.LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory.High Bay Industrial type LED fixture with integral driver	General Indoor equipment area / Pump House / Workshop / TG Hall	16920	188
1.8	ILD-7	SB03 (LED)	Pressure Die cast aluminium frame (IP 65), heat resistance toughened clear glass , Medium and High bay, dust free type, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PMMA material lenses for effective light distribution. The luminaire shall have inbuilt surge protection with THD < 10% and PF > 0.9. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. High Bay Industrial type LED fixture suitable for turbine hall operating floor (mounting height > 10 m)	General Indoor equipment area / Pump House / Workshop / TG Hall	24750	275

1.9	ILD-8	SW41	Integral, higher ingress protection, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 40,000 burning hours (at L70). The luminaire shall be made up of High pressure die cast Aluminium/ extruded Aluminium with polycarbonate front diffuser with THD < 10% and PF > 0.9. Well glass type, vapour proof LED fixture suitable for Boiler / ESP platforms	Boiler Platform / ESP Platform / Dust & Vapour laden areas	4680	52
1.10	ILD-9	SW42	Integral, higher ingress protection, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 40,000 burning hours (at L70). The luminaire shall be made up of High pressure die cast Aluminium/ extruded Aluminium with polycarbonate front diffuser with THD < 10% and PF > 0.9. Well glass type, vapour proof LED fixture suitable for Boiler / ESP platforms	Boiler Platform / ESP Platform / Dust & Vapour laden areas	7380	82
1.11	JA	MW96	Flame proof, weatherproof, LED [min 5500K color temperature, CRI ≥ 80, Chip efficacy > 120 lm/W] having minimum lifetime of 40,000 burning hours (at L70), integral / non-integral well glass luminaire for indoor / outdoor applications. Well glass, flame proof increased safety luminaire LED fixture having an integral driver suitable for division-2, Group IIA/IIB of hazardous areas	Fuel Oil Pump House / Area with explosive atmosphere	8460	94
1.12	IA	FC07 (LED)	Weatherproof bulkhead, suspended/wall mounted luminaire shall operate on 220V DC +10%/-15% variation, Watt: 9 W (min) LED. Industrial type LED fixture suitable for conduit /surface/ suspended/ column mounting having integral driver. Fixture shall operate on 220VDC input supply. Necessary accessories to be included	DC Emergency lighting / staircase / exit point	1260	14
1.13	OLD-1 / OLD-4	SF63 (LED)	Pressure Die cast aluminium frame / Extruded Aluminium, (IP 66), compact, sturdy, dust free type, LED [min 4000K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70).The luminaire shall have inbuilt surge protection (> 2KV) with THD < 20% and PF > 0.95. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. Flood light, heavy duty type LED fixture	Building exterior lighting / Outdoor area lighting / Outdoor eqpt. Area /Area lighting / Yard lighting / Floodlighting purpose	16920	188

1.14		SF64(LED)	Pressure Die cast aluminium frame / Extruded Aluminium, (IP 66), compact, sturdy, dust free type, LED [min 4000K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70).The luminaire shall have inbuilt surge protection (> 2KV) with THD < 20% and PF > 0.95. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory.Flood light, heavy duty type LED fixture	Building exterior lighting / Outdoor area lighting / Outdoor eqpt. Area /Area lighting / Yard lighting / Floodlighting purpose	27000	300
1.15		SF66 (LED)	Pressure Die cast aluminium frame / Extruded Aluminium, (IP 66), compact, sturdy, dust free type, LED [min 4000K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70).The luminaire shall have inbuilt surge protection (> 2KV) with THD < 20% and PF > 0.95. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. Flood light, heavy duty type LED fixture	Building exterior lighting / Outdoor area lighting / Outdoor eqpt. Area /Area lighting / Yard lighting / Floodlighting purpose	45000	500
1.16	OLD-2	SS62 (LED)	Pressure Die cast aluminium frame / Extruded Aluminium, (IP 65), heat resistance toughened clear glass dust free type, LED [min 4000K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PMMA material lenses for effective light distribution.The luminaire shall have inbuilt surge protection (> 2KV) with THD < 20% and PF > 0.95. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. Street light LED fixture	Street lighting / boundary lighting	10080	112
1.17	OLD-3	SS63 (LED)	Pressure Die cast aluminium frame / Extruded Aluminium, (IP 65), heat resistance toughened clear glass dust free type, LED [min 4000K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 50,000 burning hours (at L70) with PMMA material lenses for effective light distribution.The luminaire shall have inbuilt surge protection (> 2KV) with THD < 20% and PF > 0.95. LM 79 and LM80 reports need to be submitted from a NABL/UL Approved Laboratory. Street light LED fixture	Street lighting / boundary lighting	16920	188
1.18	ILD-10	Downlighter(LED)	Recess, decorative vertical mounting downlighter, LED [min 5500K color temperature, CRI ≥ 70, Chip efficacy ≥ 120 lm/W] having minimum lifetime of 40,000 burning hours (at L70). The luminaire shall be made up of pressure die cast aluminium with a high efficiency diffuser with THD < 10% and PF > 0.9	Control Room / Electronic Eqpt. Room / Conference room / Office / Engineer's Room	1500	18

1.19	EX		Escape lighting luminaire with "EXIT" sign. with LED. Each luminaire shall be self contained battery, battery charger unit. Normally the luminaire shall be ON continuously through 240V AC supply. When AC supply goes OFF the in built battery & inverter system automatically takes on to ignite luminaire for duration of four (4) hours. The battery shall be maintenance free and shall be trickle charged when 240 V AC mains supply is available.	Control Room / Electronic Eqpt. Room / Conference room / Office / Engineer's Room as UPS	REFER TECHNICAL SPECIFICATION	
1.20		FC33 (LED)	Decorative, recessed type LED fixture having integral driver. Fixture shall operate on 220V DC input supply +10%/-15% variation Necessary accessories to be included accordingly, if required	DC Emergency lighting in Control Room / Electronic Eqpt. Room / Conference room / Office.	1260	14
1.21		FC34 (LED)	Well glass, dust proof type LED fixture having integral driver. Fixture shall operate on 220V DC input supply +10%/-15% variation. Necessary accessories like DC to AC convertor etc. to be included accordingly, if required	DC Emergency lighting in Boiler/ ESP Platform.	1260	14
1.22		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	Control Room / Electronic Eqpt. Room / Conference room / Office.	8460	94
1.23		Downlighter (LED) - DIMMABLE	Recessed Mounted Downlighter Dimmable type with driver aesthetically designed for Control Room/ Office	Control Room / Electronic Eqpt. Room / Conference room / Office.	1500	18

Notes:

1. Lens, if required shall be part of LED luminaire.
2. The marking of luminaries and safety requirements of luminaries shall be as per IS standards.
3. LED must comply all the parameters of IS 16105 or IESNA LM-80-08.
4. The Luminaire must comply all the parameters of IS 16106 or IESNA LM-79-08.
5. The LED driver should comply to IEC 61347-2-13, IS 15885: Part 2: Sec 13, IEC 62384, IS 16104 and CISPR 15.
6. The luminaire complete with all accessories shall comply to relevant specified standards.
7. 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.
8. All parameters mentioned in Section-II, Clause 5.2.1 are to be complied in totality.
9. COVE LIGHT(LED)# shall be 5 MTR strip per piece. Cove lighting, if required shall be provided for better aesthetics in false ceiling of common control room (CCR) and ESP Control room.

   # For COVE LIGHT (LED), nomenclature FC36 (LED) to be used in drawing.
   For Downlighter* (LED), nomenclature FC35 (LED) to be used in drawing.

10. LED Drivers shall have the following for Control & Protection:
    a. Suitable precision current control of LED.
    b. Open Circuit Protection
    c. Short Circuit Protection

d. Over Temperation Protection
e. O/V Protection
f. Surge Protection
(For other details refer Technical Specification)

7.0 TESTS

7.1 Vendor shall submit the type test reports of LED Luminaires conducted within last five years as on date of bid opening i.e. 01.07.20 during detailed engineering for customer approval. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

7.2 Type test of LED luminaries: -:
1) All equipments to be supplied shall be of type tested design.
2) All acceptance and routine tests as per the specification and relevant standards shall be carried out. In case of non-acceptance of type test during contract, same shall be done without any commercial implication.

Following type test reports for LED as per standards shall be submitted for approval.
1. Visual and Dimension check
2. Proof of procurement of LEDs
3. Safety tests
a) Marking
b) Construction
c) Provision for Earthing
d) External and Internal wiring
e) Protection against electrical shock
f) Endurance and Thermal
g) Insulation resistance & electrical strength
h) Resistance to heat fire & tracking
i) Resistance to Humidity
4. Fire Retardant test
5. Performance tests (electrical, Photometric color and Life)
6. Burn-in Test
7. Power Cycling
8. Temperature rise test
9. Emission Tests
a) Radiated & conducted emission
b) Harmonics & flickers
10. Immunity tests
In addition, following test reports to be submitted for LED chip/LED luminaire:
a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.
b) LM 80/IS: 16105 report.
c) LM 79/IS: 16106 report.
However, if the vendor is not able to submit the valid type test reports, vendor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval.

7.2 Acceptance Test and Routine Test

7.2.1 All lighting fixtures, lamps and other items shall be subjected to acceptance and routine test, as per relevant specified standards.

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

1.0 SCOPE

The purpose of this design document is to cover basic approach for designing lighting system for power plant. The document covers various types of lighting system, lighting system design, illumination levels, luminaries type & Low Voltage power services for various areas of the power plant as per Annexure-II. The lighting system of chimney, NDCT, CHP area, AHP area & Switchyard shall be under the scope of chimney package, NDCT package, CHP package, AHP Package & Switchyard respectively. All other areas as per contract shall be under the scope main lighting package.

2.0 LIGHTING SYSTEM DESIGN

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 when viewed from an angle.

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-IP65.

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 area and fixture will be mounted on columns/bottom of platform as per site requirement. On boiler platform walkway, fixtures will be installed on handrails only if mounting structure is not available.

2.4 Flame proof LED lighting fixtures will be installed in hazardous area as per area classifications. All highbay fixtures will have vibration damper.

2.5 In general, the type of fixtures, type of luminaries and illumination levels to be achieved will be as per enclosed Annexure-I.

2.6 The lighting fixtures in the plant area will be group controlled from lighting panel. The lighting fixtures in office areas, control rooms etc. will be controlled by switches.
To implement Automatic Lighting Control Solutions, Occupancy based Passive Infra-Red Sensors shall be provided in Conference Room of Power House Building and offices with false ceiling.

2.7 Lighting panel (LP) for controlling lights with additional provision for manual control shall be provided:
Indoor lighting panel: Without Timer
Street/Area/Outdoor lighting panel: With Timer & photocell arrangement
For area/outdoor lighting including boiler gallery, ESP area, turbine floor (high bay), transformer yard area, absorber tower, FGD area Lighting panels shall have timer and photocell arrangement for automatic control with provision for manual override.

2.8 Outdoor areas like Fuel oil tank area, open store etc. shall have flood light fixtures mounted on flood light poles.

2.9 All LP's and LDB's shall be painted outside with shade Siemens Grey RAL 7032.

2.10 Fuel Oil areas and hazardous areas shall have Flameproof type fixtures.

2.11 With respect to S.No.1 titled "Lighting Fixture & Lamps" of the Annexure-C titled "Type of Fittings/Fixtures and Other Auxiliary Areas" of Volume: II-F/2 of the Customer Technical Specification, While finalizing lighting fixtures, following four parameters shall be followed:

a. The LED chip efficacy shall be min 120 Lm/Watt.

b. The LED used in The LED used in the luminaires shall have colour rendering index (CRI) of Min **70**.

c. Colour designation of LED shall be "cool day light" (min 5500K) type for indoor areas. However, for outdoor areas, the colour temperature of LED shall be min. 4000K, including rough & dust prone areas. LED shall conform to the LM 79 & LM 80 requirements."

d. Regarding burning hours, NIT specification shall be followed.

For detailed description of the type of fittings, kindly refer S.No.5 of Clause 5.0 of Section-I

3.0 ILLUMINATION DESIGN CALCULATION

3.1 Lighting design for indoor areas will be done by LUMEN method only.

For a given indoor area, number of luminaries is calculated as follows:

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

Where

L	= Length of room (Restricted to Max. 5 times of width)
W	= Width of room
COU	= Coefficient of utilisation
LUMEN	= Lumen output of each lamp
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 shall be considered at 0.85m from the floor level. 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 air-conditioned area, switchgear room, control room, office area, TG Hall, equipment rooms.	80-90	40-60	20

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

a) Control Room : 0.75

b) Switchgear/MCC Room : 0.65

c) General Indoor Area : 0.6

d) Dusty area (Boiler area and area prone to dust pollution) : 0.55

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: 0.6
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.

4.0 LIGHTING SYSTEM DESCRIPTION

a) Lighting system will be provided with AC Normal, AC Emergency and DC Emergency as listed against various areas as per Annexure-II enclosed.

b) The sources of power lighting are as below:

i) Normal AC Lighting (ACN) (415V) Supply from different station PMCCs/MCCs.

ii) Emergency AC lighting (ACE) (415V) Supply from Emergency Board.

iii) Emergency DC Lighting (220V) Supply from DC Distribution Board.

iv) 24V AC lighting (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: 80 %
AC Emergency (ACE) supply: 20 %
In Main Control room, 30% emergency lighting shall be provided.

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

For other auxiliary areas AC Normal lighting will provide 100% illumination level and normally all AC lighting fixture shall remain "ON" as long as normal AC supply is available. In DG room, in addition to DC emergency lighting, 30% 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, connecting passages etc. for safe personnel movement during emergency.

One no. (1) DC emergency lighting fixture shall be provided at entry, exit and staircase landing of stair cases of Control Rooms of TG Buildings, Control Rooms of ESP/FGD, Control Rooms of CW Switchgear Cum Control Room building & TPs in boiler area.
DC emergency lighting shall be provided in critical operating areas including Main Control room, near Turbine Drain Valve area, MV & LV Switchgear room and Boiler Burner floor.

In off-site areas/odd locations (BHEL scope), for safe movement of personal during emergency, The Remote Emergency light unit (ELU) shall be provided with self-contained battery, automatic charger, inverter with LED lamp.

4.1 Normal AC Lighting:

AC Normal lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACNLP) 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:
Generally, AC, ACE & DC Lighting panels shall be provided with 20% spare outlets.

LDB TYPE-I (100/150KVA)

Transformer rating:	100/150 kVA
Transformer voltage ratio:	415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.

Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	Two incomer and Bus coupler
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer design
Outgoing feeder type:	TPN MCCB with earth leakage current protection
Outgoing feeder rating:	63A
Vector group	Dyn11
Outgoing feeder quantity:	12 / 18 / 20 nos.(typical)

LDB TYPE-II (50KVA)

Transformer rating:	50 kVA
Transformer voltage ratio:	415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	Two incomer and Bus coupler
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer design
Outgoing feeder type:	TPN MCCB with earth leakage current protection
Outgoing feeder rating:	63A
Vector group	Dyn11
Outgoing feeder quantity:	8 nos.

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

Incomer type:	TPN SFU /MCCB
Incomer rating:	63A
Outgoing feeder type:	SPN MCB
Outgoing feeder rating:	20A
Outgoing feeder quantity:	18 nos. / 12 nos./ 6 nos.
Short circuit rating:	9kA

Street/Area/Outdoor AC normal lighting panel as per details given below is envisaged:

Incomer type:	TPN SFU / MCCB
Incomer rating:	63A
Outgoing feeder type:	TPN MCB
Outgoing feeder rating:	20A
Outgoing feeder quantity:	6 nos.

Short circuit rating:	9kA
ON/ OFF control	With Timer and photocell

Photocell and Timer shall be provided in Street Lighting Panel for all Main and Branch Roads.

4.2 Emergency AC lighting:

AC Emergency lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from AC Emergency Lighting Distribution Board (ELDB).
ELDBs consisting of dry type isolation transformer housed in ELDB with proper separation from distribution panels as per details indicated below is envisaged:

ELDB TYPE-I (100 /150 KVA)

Transformer rating:	100 / 150 kVA
Transformer voltage ratio:	415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	Two incomer (Both from Emergency MCC) and Bus coupler
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer design
Outgoing feeder type:	TPN MCCB with earth leakage current protection
Outgoing feeder rating:	63A
Vector group	Dyn11
Outgoing feeder quantity:	12 /18 / 20 nos.(typical)

ELDB TYPE-II (50KVA)

Transformer rating:	50 kVA
Transformer voltage ratio:	415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
LDB Configuration:	Two incomer (Both from Emergency MCC) and Bus coupler
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer design

Outgoing feeder type:	TPN MCCB with earth leakage current protection
Outgoing feeder rating:	63A
Vector group	Dyn11
Outgoing feeder quantity:	8 nos.

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

Incomer type:	MCCB
Incomer rating:	63A
Outgoing feeder type:	SPN MCB
Outgoing feeder rating:	20A
Outgoing feeder quantity:	18 nos. / 12 nos./ 6 nos.
Short circuit rating:	9kA

Street/Area/Outdoor Emergency lighting panel as per details given below is envisaged:

Incomer type:	TPN SFU / MCCB
Incomer rating:	63A
Outgoing feeder type:	TPN MCB
Outgoing feeder rating:	20A
Outgoing feeder quantity:	6 nos.
Short circuit rating:	9kA
ON/ OFF control	With Timer and photocell

4.3 Emergency DC Lighting:

This will be provided by D.C. lighting fixtures located strategically in critical operating areas. Emergency D.C. lighting fixtures will be fed from respective area D.C. Lighting Panel either through Cable Junction Box or direct which in turn shall be connected to DC Emergency Lighting Distribution Board (DCELDB).
These lights will be ON all the time. These emergency lighting fixtures shall account for 10% of the total fixtures provided in critical operating areas.

DCLDBs as per details given below is envisaged:

Distribution Panel type:	Single front fixed type
LDB Configuration:	Two incomer (both from DCDB)
DC Incomer type:	DP Switch fuse unit with contactor
DC Incomer rating:	125A
AC Incomer type:	Not Applicable
AC Incomer rating:	Not Applicable
Outgoing feeder type:	Switch fuse unit
Outgoing feeder rating:	32A

Outgoing feeder quantity: 12 nos.

DCLPs as per details given below is envisaged:
Incomer type: SPN Switch fuse unit
Incomer rating: 32A
Outgoing feeder type: DP MCB
Outgoing feeder rating: 20A
Outgoing feeder quantity: 6 nos.

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-55 for indoor and IPW-55 with canopy for outdoor.

4.5 24V AC lighting:

Each 24 V AC supply module shall have one (1) no. dry type two winding, 500VA, 1-phase, 50Hz, 240/24V transformer with 6A (240 side) and 16A (24V side) HRC fuse and necessary 240V and 24V terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module shall be fed from respective lighting panels. Details of 24V supply modules shall be as given below:

Module type:	Portable type / Fixed type
Transformer rating:	500 VA
Transformer voltage ratio:	240 / 24 Volt
Primary side isolation:	DP MCB with HRC fuse
Isolator rating:	16A
HRC fuse rating:	6A
Secondary side isolation:	SPN MCB with HRC fuse
Isolator rating:	6A
HRC fuse rating:	16A
Fixed type 24V supply modules shall be provided in following areas:	
Boiler 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 Portable 24 V AC supply modules along with 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

4.6 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 ACLP.
Exit lamp unit shall contain maintenance free Lead Acid/Ni-Cd battery with 2.5 hours backup capacity.

4.7 Portable Emergency Lighting Unit
ELUs shall contain maintenance free Lead Acid/Ni-Cd battery with 4 hours backup capacity. Each ELU will have battery charger and 2x6W fluorescent lamp.

5.0 STREET/ AREA / OUTDOOR LIGHTING

5.1 The roads within the station plant boundary and as per contract will be considered for lighting.

5.2 Street lights / outdoor lighting will be fed from separate boards located at suitable places. Automatic switching ON/OFF of these circuits shall be done through timers and photocell with manual control facility.
For area/outdoor lighting including boiler gallery, ESP area, turbine floor (high bay), transformer yard area, absorber tower, FGD area Lighting panels shall have timer and photocell arrangement for automatic control with provision for manual override.

5.3 For street lighting, street light pole will be used. For outdoor area lighting if required flood light pole will be used. Pole type shall be as below:

Pole height: 13 metres for primary roads / 11 meter for secondary roads.
Pole construction type: Fabricated, swaged, Steel Tubular Poles
Pole type: Hot Dip Galvanised
All lighting poles shall be made from Steel of Ultimate Tensile Strength 410MPA as per IS 2713. For height of 11m, 410SP51 and for height of 13m, 410SP67 pole shall be supplied.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.

5.4 The technical details of poles will be as per IS-2713. The poles shall be equipped with junction boxes and all other required accessories.

5.5 The poles will be located 1.5m away from the road edge. The buried cable will run in Hume pipe wherever it is crossing the roads.

5.6 High mast tower will be used, if required. High mast tower will be 30-meter-high, hot dip galvanised and polygonal shaped.

6.0 LOW VOLTAGE POWER SERVICES

6.1 Different type of receptacles as per details below will be provided:

(i) Decorative receptacle:
At least 02 numbers 5/15A, 3-Pin, 240V AC decorative socket will be provided in office, store, cabin etc.

(ii) Industrial receptacle:
At least 01 number 20A, 5-Pin, 240V AC industrial type receptacles will be provided at suitable location in plant building. 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:
63A, 3-phase 4-wire, 5 pin, 415V AC welding receptacles with isolating switch will be provided at each major plant maintenance area at an average distance of 50m. Minimum 1 no welding receptacle shall be provided at each floor of TG building, each boiler platform, each pump house, each ESP, Transformer yard, battery room, Mill Area, PA/FD area, ID area and other major plant maintenance area. Exact quantity and location shall be shown in illumination layout drawings during detailed engineering. However exact requirement will be finalized during finalization of illumination layout drawing of individual area/ building. Maximum three (3) nos. welding receptacles shall be fed through one feeder. In hazardous areas these receptacles will be located in MCC room. Welding receptacles in TG Building, Boiler area, ESP area, FGD area & CW pump house area shall be fed from 415V Welding Distribution Board. Welding receptacles in off-site areas shall be fed from nearest 415V MCC/ PMCC.

(iv) Two (02) nos. of 125A, 415 V TPN with Earth surface mounting 5 pin industrial type shall be provided at Transformer yard.
One (01) no. of 125A, 415 V TPN with Earth surface mounting 5 pin industrial type shall be provided at FGD area.
One (01) no of 125A, 415 V TPN with Earth surface mounting 5 pin industrial type for each ESP i.e. total six (06) nos for ESP area.

6.3 Transformer rating for Welding Distribution Board shall be 100KVA. Constructional details shall be as.

WDB (100KVA)

Transformer rating:	100 kVA
Transformer voltage ratio:	415 / 415 Volt, taps of +5% to -5% in steps of 2.5%
Transformer type:	Non-Encapsulated
Distribution Panel type:	Single front fixed type
WDB Configuration:	One incomer
Incomer type:	TPN MCCB
Incomer rating:	As per lighting transformer design
Outgoing feeder type:	TPN MCCB with earth leakage current protection
Outgoing feeder rating:	63A
Vector group	Dyn11
Outgoing feeder quantity:	12 nos.

WDB's shall be provided in following areas:

a) Main Power House: 2 nos.
b) Boiler area: 2 no.
c) ESP area: 1 no.
d) CW PH area: 1 no.
e) FGD area: 1 no.

6.4 Based on room size, suitable number of 1200mm or 1400mm sweep ceiling fans with stepped electronic regulator shall be provided for office rooms, store rooms and other social buildings which are not covered by air-conditioned and ventilation system.

6.5 Receptacles:
a) Receptacles shall be heavy duty, complete with individual plug and switch as detailed in the annexure.
b) The conduit box of the receptacle shall be provided with earthing screws with washer and nuts welded on the surface for grounding with 16 SWG GI wire. Arrangement shall be provided inside the conduit box for grounding of third pin.
c) Shrouded type plug shall be provided with corresponding matching arrangement at sockets to prevent accidental contact with finger during plug insertion.

6.6 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. 10m high car wheel mounted adjustable aluminium ladder adjustable up to 10m high shall be provided.
For the maintenance of lighting fixtures within the FGD, 2 nos. free standing adjustable aluminium ladder, adjustable from 05M to 10M shall be provided.

7.0 WIRING / CONDUITS

7.1 Wiring of lighting system will be done as follows:

i) Wiring installation will be by multi-stranded, PVC insulated, colour coded wires laid in GI conduits of 20mm dia min size conforming to IS-9537. The thickness of conduits upto & including 25 mm dia will be 1.6 mm and conduits above 25 mm will be 2.0 mm. Wires shall be conforming to IS-694.

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. Conduit installed in concrete shall be a minimum 20mm dia.

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 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) Wiring for ACN, ACE and DC lighting system shall be carried out in separate conduits.

vi) 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.

vii) Maximum three number of receptacles will be loop in & loop out in a circuit.

viii) Separate neutral wire shall be provided for each circuit. Wiring throughout the installation shall be such that there is no break in the neutral wire in form of switch or fuse.

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

x) Wiring shall be spliced only at junction boxes with approved type connections or terminal strips. Maximum two wires can be connected to each way of the terminal block. Splicing of only one phase shall be done in a junction box.

xi) For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.

xii) For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/ junction box.

7.2 Wiring in hazardous area will be done using 2.5 sq m PVC armoured cable.

7.3 In outdoor areas like transformer yard and road lighting, connection through cable shall be adopted.

7.4 Following sizes of 1100 V grade, PVC insulated, single core, stranded copper conductor wires will be used:

Lighting Panel to JBs:	2.5 sq. mm (Cu)
JBs/ switches to JBs/ Fixtures:	2.5 sq. mm (Cu)
Panel to First receptacles:	4.0 sq. mm (Cu)
First receptacles to looping other receptacles:	4 sq. mm (Cu)
Panel/ JBs to flood light fixtures:	2 x 2.5 sq. mm (Cu)

8.0 EARTHING

Earthing of lighting system will be done by using of following sizes of wire / flat:

Lighting Distribution Board:	GI Flat 50x6 mm
Lighting Panels:	GI Flat 35x6 mm
Lighting fixtures, receptacles, conduits, junction boxes & switch boxes:	16 SWG GI wire
Street light pole/ flood light pole and High mast:	GI Flat 50x6 mm
Electrode for Pole/ High mast earthing:	2 nos, 40 mm dia MS rod, 3 mtr long

9.0 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.

Note-1: As an alternative to energy saving system & automatic day light Control System, Photocells with timer arrangement in street light panels for outdoor road lighting shall be provided.

ANNEXURE-I

AVERAGE LUX LEVEL & TYPE OF FIXTURES

S. No.	LOCATION	AVERAGE LUX LEVEL	TYPE OF LIGHTING FIXTURE	TYPE OF LAMPS
1.0	**Turbine Generator Building :**			
1.1	General Auxiliary Equipment Areas (Turbine hall other Platforms)	200	High/ Medium bay Industrial type LED luminaire	-
1.2	Cable Spreader Room	70	Industrial type LED luminaire	-
1.3	Switchgear Room	250	Industrial type LED luminaire	-
1.4	TG Building Operating Floor	200	High bay Industrial type LED luminaire	-
1.5	Main Control Rooms	400	Recessed type LED luminaire asthetically designed for control room/ offices	-
1.6	Battery Rooms	150	Totally enclosed corrosion proof LED luminaire	-
1.7	Unloading and Maintenance bay	250	High bay Industrial type LED luminaire	-
1.8	UPS Room	250	Recessed type LED luminaire asthetically designed for control room/ offices	
1.9	Oil Room and indoor hazardous areas	150	Flame proof LED type Luminaire	
1.10	General Indoor for Power House and other BOP areas	100	Industrial type LED luminaire	
2.0	**Boiler Area :**			
2.1	Boiler area, platforms and Bunker floor	100	Industrial type LED well glass luminaire	-
2.2	Coal Bunker and Mill bay area	100	Industrial type LED well glass luminaire	-
2.3	ESP areas and Platforms	100	Industrial type LED well glass luminaire	-
2.4	ESP Control Room	400	Recessed type LED luminaire asthetically designed for control room/ offices	-
3.0	**Transformer Yard :**			
3.1	Transformer Yard for Power House & other BOP areas	50	Street/ Flood light LED luminaire	-
4.0	**Various Off-site Buildings :**			
4.1	Equipment Room / Switchgear Rooms	250	Industrial type LED luminaire	-
4.2	DG room	250	Medium bay Industrial type LED luminaire	-
4.3	MRS Compressor, CW treatment plant, GAS Chlorination, ETP,CPU Regeneration Building & CTBD RO Plant.	250	Medium bay Industrial type LED luminaire	
4.4	AC Plant room / Air Washer room / AHU Room	200	Medium bay Industrial type LED luminaire	
5.0	**Cooling Water Pump House Area :**			
5.1	CW PH	250	Medium bay Industrial type LED luminaire	-

6.0	**Road & Yard Lighting:**			
6.1	Main Roads	20	Street lights LED luminaire	-
6.2	Secondary Roads	10	Street lights LED luminaire	-
6.3	Perimeter (Compound) Lighting - (for BHEL scope)	10	Street lights LED luminaire	-
7.0	**Various Other Control Rooms**			
7.1	Other Control Rooms (Without False Ceiling)	400	Recessed type LED luminaire asthetically designed for control room/ offices	-
7.2	Other Control Rooms (Without False Ceiling)	300	Recessed/ Surface/ Suspended type LED luminaire	-
7.3	PLC Rooms/Central Analysers/Shift Charge Engineers room (With False Ceiling)	250	Recessed type LED luminaire asthetically designed for control room/ offices	-
8.0	**Facility building, Canteen etc.**	150	LED luminaire	-
9.0	**General :**			
9.1	Corridors, Walkways, Staircase, Lockers etc.	70	LED luminaire	-
9.2	Toilets, Wash Rooms, etc.	70	LED luminaire	-
10.0	**Fuel Oil Tank area**			
10.1	Tank area	50	Flood light LED luminaire	
11.0	DC Emergency area Main Control room	50	LED luminaire	
12.0	DC Emergency other area	20	LED luminaire	
13.0	Outdoor storage handling and unloading area	20	Industrial type LED Luminaire	-
14.0	a) Chemical Laboratory b) Analysis area	300 300	Industrial type LED Luminaire/ Corrosion proof LED Luminaire	-
15.0	Building periphery Lighting	20	LED Luminaire	-

Note : 1) In false ceiling area LED luminaire shall be recessed mounting type and in non-false ceiling area LED luminaire shall be of surface mounting type.

2) Medium bay light shall be used if mounting height vary from 5Mtr to 8Mtr

3) Additional normal LED fixture shall be provided near transformers in transformer yard for maintenance which shall be 20% of the total fixtures installed in Transformer Yard or minimum 1 number for each transformer.

4) Kindly note that the Lighting of BOP areas wherein already Existing facilities have been used (as per BHEL Plot Plan PE-DG-445-100-M001) is excluded from lighting scope.

ANNEXURE-II

LIGHTING & LV POWER SERVICES IN DIFFERENT AREAS								
S. No.	**AREA**	**ACN**	**ACE**	**DCE**	**5/15A Socket**	**20A Socket**	**63A Socket**	**ELU $**
01	TG building	Y	Y	Y	Y*	Y	Y	-
02	Boiler platforms & boiler area	Y	Y	Y		Y	Y	-
03	ESP platforms, ESP Area & Mill area	Y	Y	-	-	Y	Y	-
04	ID, FD & PA FAN area	Y	Y	-	-	Y	-	-
05	Transformer Yard	Y	Y	-	-	Y	Y	-
06	ESP & FGD control room	Y	Y	Y (Refer Note-1)	Y*	Y	Y	-
07	DG room	Y	Y	Y	-	Y	Y	-
08	Compressor house	Y	-	-	Y*	Y	Y	Y
09	Fuel oil area	Y	-	-	Y*	Y	-	Y
10	CWPH Control Room & Electrical Room	Y	Y	Y	Y*	Y	-	Y
11	FGD AREA (Other than FGD Control room)	Y	-	-	Y*	Y	Y	Y
12	Other Auxiliary Buildings (like CW PH, CW Treatment Plant, CTBD RO Plant Building).	Y	-	-	Y*	Y	Y#	Y
NOTE - 1	DC Lighting (DCE) shall be provided only at selected strategic locations in **ESP & FGD Control room only.**							
NOTE - 2	Emergency Lighting shall be provided only at above indicated locations where Y has been indicated under ACE Column.							

LEGEND:

ACN:	AC Normal Lighting
ACE:	AC Emergency Lighting
DCE:	DC Emergency Lighting
Y:	YES
Y*:	YES, Only in control room, offices & toilets
$:	Emergency Lighting Unit (ELU) & 5/15A Switch socket for ELU
Y#:	Shall be provided at each major plant maintenance area.

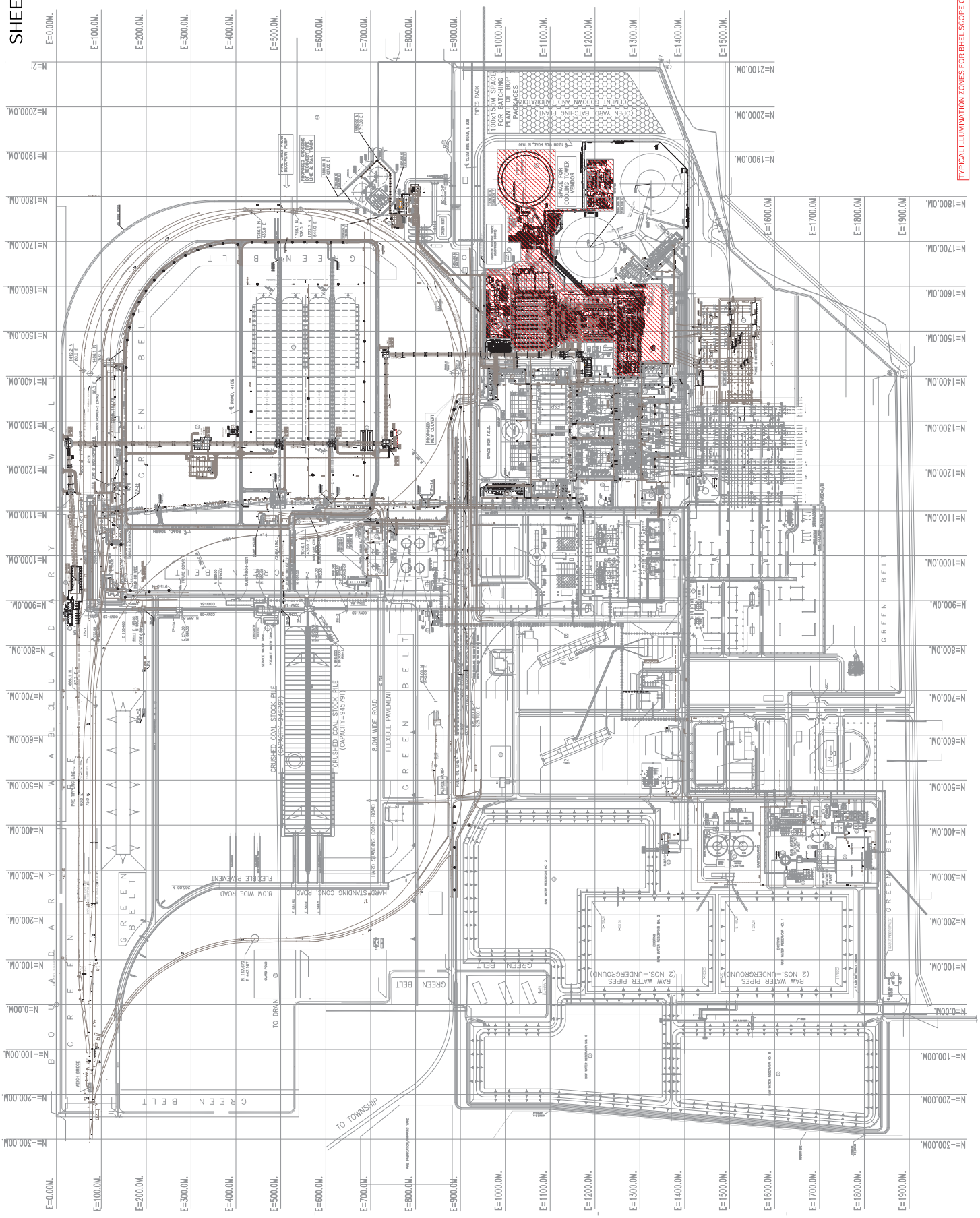
APPLICABLE CODES AND STANDARDS	
ILLUMINATION	
Code of practice for interior illumination	IS 3646
Code of practice for industrial lighting	IS 6665
Code of practice for lighting of public thoroughfare	IS 1944
LUMINAIRES	
Luminaires	IS 10322
Industrial luminaires with metal reflector	IS 1777
Industrial 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
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	IS 1569
and low pressure sodium vapour discharge lamp circuits	
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 control gear.	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	IS 60898
for household and similar installations	
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	IS 1293
and rated current upto and including 16 amperes	
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,	IS 5082
tubes and sections for electrical purposes	
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	IS: 5133
& similar fixed electrical installations	
LED LUMINAIRES	

16101:2012	General Lighting. LEDs and LED modules Terms and definitions
16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.
16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.
16103(Part I):2012	LED modules for General lighting Safety Requirements.
15885(Part 2/Sec. 13) :2012	Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c.
16104:2012	Supplied Electronic control gear for LED modules d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.
16105:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.
16106:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products
16107:2012	Luminaires Performance
16108:2012	Photo-biological safety of Lamps and Lamp Systems
IS 513	Cold rolled low carbon steel sheets and strips
IS 12063	Classification of degree of protection provided by enclosures.

IS 14700	Electro magnetic compatibility (EMC) – Limits (Part 3/Sec. 2) for Harmonic current emission – THD < 15% (equipment, Input current < 16 Amps. per phase.
IS 9000 (Part 6)	Environment testing: Test Z – AD: composite temperature/humidity cyclic test.
IS 15885 (Part 2/Sec. 13)	Lamp control gear: particular requirements for DC or AC supplied electronic control gear IS 16004 – 1 and 2) for LED modules.
IS 4905	Method for random sampling

IS:1944	Code of practice for lighting of public thorough fare
IS:3646	Code of practice for interior illumination.
IS:5572	Classification of Hazardous areas (other than Mines) having flammable gases and Vapours for electrical installation
S:6665	Code of practice for industrial lighting.
.	National Electrical Code
-	Indian Electricity Rules.
	Indian Electricity Act
IS:5	Colour for ready mixed paints & enamels.
IS:280	Mild steel wires for general engineering purposes.
IS:374	Electric ceiling type fans & regulators.
IS:732	Code of practice for electrical wiring installations.
IS:1255	Code of practice for installation and maintenance of power cables Upto and including 33KV rating.
IS:2062	Steel for general structural purposes
IS:2629	Recommended practice for hot-dip galvanizing of iron and steel.
IS:2633	Methods for testing uniformity of coating of zinc coated articles.
IS:2713	Tubular steel poles for overhead power lines.
IS:3043	Code of practice for earthing
IS:5216	Guide for safety procedures and practices in electrical work.
IS:5571	Guide for selection of electrical equipments for hazardous areas.
BS:6121	Mechanical cable glands


TYPICAL ILLUMINATION ZONES FOR BHEL SCOPE OF BUILDINGS
CRUSHED COAL STOCK PILE (CAPACITY=945791)
8.0M WIDE ROAD
FLEXIBLE PAVEMENT
HARD STANDING CONC. ROAD
RAW WATER PIPES (2 NOS.-UNDERGROUND)
TO DRAIN
TO TOWNSHIP
GREEN BELT

1289087/2023/PS-PEM-EL

1 X 660MW SAGARDIGHI TPS UNIT-6
TENTATIVE LOCATION OF LIGHTING DISTRIBUTION BOARDS (REV.02)

S.No.	Location	Type	Rating	Description	Remarks
1.	MV Switchgear Room	ACN	150 KVA	1UA	
2.	MV Switchgear Room	ACN	100 KVA	1UB	
3.	LV Switchgear Room	ACN	100 KVA	1UC	
4.	LV Switchgear Room	ACN	50 KVA	1UD	
5.	Boiler MCC Room	ACN	100 KVA	1UE	
6.	Boiler MCC Room	ACE	50 KVA	1UF	12 O/G
7.	LV Switchgear Room	ACE	50 KVA	1UG	
8.	LV Switchgear Room	ACE	50 KVA	1UH	
9.	LV Switchgear Room	DCE	125 A	1UI	
10.	Boiler MCC Room	DCE	125 A	1UJ	
11.	ESP Cum FGD Switchgear Room (Dedicated for ESP)	ACN	150 KVA	1UK	
12.	ESP Cum FGD Switchgear Room (Dedicated for FGD)	ACN	150 KVA	1UL	
13.	ESP Cum FGD Switchgear Room	ACE	50 KVA	1UM	12 O/G
14.	ESP Cum FGD Switchgear Room	ACE	50 KVA	1UN	
15.	ESP Cum FGD Switchgear Room	DCE	125 A	1UI	
16.	CPU Regeneration Building MCC	ACN	100 KVA	0UA	
17.	AC PLANT ROOM MCC	ACN	100 KVA	0UB	
18.	Ammonia Unloading MCC	ACN	50 KVA	0UC	
19.	Fire Water/CW MCC	ACN	150 KVA	0UD	
20.	Fire Water/CW MCC	ACE	50 KVA	0UE	
21.	Fire Water/CW MCC	DCE	125 VA	0UF	
22.	CWPD PMCC (IN CTBD RO PLANT)	ACN	100 KVA	0UG	
23.	LV Switchgear Room - WDB	ACN	100 KVA	1UM	
24.	LV Switchgear Room - WDB	ACN	100 KVA	1UN	
25.	Boiler MCC Room – WDB	ACN	100 KVA	1UO	
26.	Boiler MCC Room – WDB	ACN	100 KVA	1UP	
27.	ESP Cum FGD Control Room – WDB	ACN	100 KVA	1UQ	
28.	ESP Cum FGD Control Room – WDB	ACN	100 KVA	1UR	
29.	CWPH MCC Room – WDB	ACN	100 KVA	1US	

LEGEND:

ACN : AC Normal LDB , ACE : AC Emergency LDB, DCE : DC LDB

LDB : Lighting Distribution Board, WDB: Welding Distribution Board.

ACB, ACE & DCE LDB's are with two incomer and one bus-coupler scheme.

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)	%	+3% 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		IP65
4.3	Flame proof luminaires		
a)	Hazardous area classification		IS-2148 Zone II Group-IIA, IIB & IIC
b)	Degree of protection		IP65

c)	Mounting type for well glass		[√] Eye-bolt [ ] MS Galvanised Strap
4.4	Non-integral control gear box for HPMV lamps		Not Applicable
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 painted		
	Paint shade		during detailed engineering
	Minimum paint thickness (DFT)	micron	50
4.5	Lamps		
a)	Type of LED Lamps		[√] Cool Daylight [√] White Light
b)	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	6
d)	Lumen output of lamp at rated voltage	Lumen	To furnished by Vendor
e)	Type of battery (Rechargeable type)		Ni-Cd / Lead Acid
f)	AH capacity of battery	AH	To furnished by Vendor
g)	Battery voltage	V	To furnished by Vendor (min. 6V)
h)	Battery backup time	Hr	4
i)	In built charger		Yes
4.7	**Exit Sign**		
a)	Lamp type		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

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		CRCA sheet steel
	Enclosure thickness	mm	2 mm 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)	Transformer		
	Rating	VA	500
	Voltage ratio & Current Rating	V	240V/24V [6A/16A]
	Class of insulation		Class F, temperature rise limited to Class-B
e)	24V Hand lamp unit		
	Lamp type		[√] Halogen [ ] LED
	Lamp wattage	W	40
f)	No. of outgoing sockets		4
g)	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
d)	Degree of protection		IP-55 (indoor) / Weather proof IPW-65 with canopy for outdoor area
6.0	**Industrial/ Welding Receptacle**		
a)	Enclosure material		CRCA Sheet Steel
b)	Enclosure thickness	mm	2
c)	Surface treatment		Galvanised
d)	If galvanized		

	Process		Hot Dip
	Weight of zinc	g/m^2	460 gm/ mm2 (65 microns)
e)	Degree of protection		IP-55 for indoor / IP 65 for outdoor
7.0	**Decorative Receptacle**		
a)	Enclosure material		CRCA Sheet Steel
b)	Enclosure thickness	mm	2 mm
c)	Surface treatment		Galvanised
d)	If galvanized		
	Process		Hot Dip
	Weight of zinc	g/m^2	460 gm/mm2 (65 microns)
e)	Degree of protection		IP-55 for indoor / IP 65 for outdoor
8.0	**Switch Box**		
a)	Enclosure material		[ ] FRP [√] CRCA Sheet.
b)	Enclosure thickness		14 SWG MS sheet with 6mm thick Bakelite cover with brass fixing screws
c)	Galvanized		[√] Yes [ ] No
d)	Painted		[ ] Yes [√] No
e)	Degree of protection		IP-55
9.0	**Conduit (Flexible)**		
a)	Type		Cold rolled annealed and electro galvanised mild steel strips and coated with PVC
b)	Size	mm	20
c)	Standard length	m	25 to 50
d)	Thickness of Galvanization	microns	25 (min.)
10.0	**Cable Glands**		**By vendor for all incoming and outgoing cables**
a)	Type		Double compression
b)	Material		Brass
c)	Nickel Plating provided		[√] Yes [ ] No
d)	Flameproof glands with flameproof equipment		[√] Yes [ ] No
11.0	**Cable Lugs**		**By vendor for all incoming & outgoing cable**
a)	Type		Crimping type/ ring type
b)	Material		Tinned copper
12.0	**LADDERS**		
a)	Type		Free standing and wheel mounted both

b)	Material		[ ] Steel [√] Aluminium
c)	Duty		[ ] Heavy [√] Medium
d)	Surface treatment		[√] Galvanised [ ] Painted
e)	Reference Standard		IS: 4571, 3696

Note :

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

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

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 control gear.	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
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

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1 X 660MW SAGARDIGHI TPS

DATA SHEET - B

SL. NO.	DESCRIPTION MAIN SUPPLY ITEMS	MEASURED ELECTRICAL INPUT POWER (W) MAX. VALUE	TOTAL LUMINOUS FLUX (LUMEN) OF LUMINAIRE - MIN. VALUE	MAKE & MODEL OF LUMINAIRE
1.0	**Lighting Luminaires (complete with accessories)**			**REFER BELOW NOTE 2&3**
1.1	Luminaire Type FC06 (LED)			
1.2	Luminaire Type FC07 (LED) - DC			
1.3	Luminaire Type FC33 (LED) - DC			
1.4	Luminaire Type FC34 (LED) - DC			
1.5	Luminaire Type FC30 (LED)			
1.6	Luminaire Type FC32 (LED)			
1.7	Luminaire Type FC81 (LED)			
1.8	Luminaire Type SB11 (LED)			
1.9	Luminaire Type SB02 (LED)			
2	Luminaire Type SB03 (LED)			
2.1	Luminaire Type SF63 (LED)			
2.2	Luminaire Type SF64 (LED)			
2.3	Luminaire Type SF66 (LED)			
2.4	Luminaire Type SS62 (LED)			
2.5	Luminaire Type SS63 (LED)			
2.6	Luminaire Type SW41 (LED)			
2.7	Luminaire Type SW42 (LED)			
2.8	Luminaire Type MW96 (LED)			
2.9	Downlighter (LED)			
3	Cove Light (LED)			
3.1	Luminaire Type 30-40 W (LED) FC 30 with Dimmable ballast			
3.2	Downlighter (LED)-dimmable			

NOTE :

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

2 Lighting designer shall furnish the make of above mentioned luminaires along with MOU as per technical PQR prior to the placement of order.

3 Luminaire manufacturer shall furnish the make of above mentioned luminaires prior to the placement of order.