

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

2 X 660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER

TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM


DOC. NO. PE-TS-412-558-E001

REVISION 01

VOLUME II



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**

	TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM	SPECIFICATION NO. PE-TS- 412-558-E001	
		VOLUME II B	
		SECTION	
		REVISION 01	DATE: 1.06.2015
		SHEET 1 OF 1	

CONTENTS:

<u>S. NO.</u>	<u>CONTENTS</u>	<u>NO. OF SHEETS</u>
01	PREAMBLE	01
02	INSTRUCTIONS TO BIDDERS	01
03	DEVIATION SCHEDULE	01
04	SECTION – 'A' (SCOPE OF ENQUIRY)	02
05	SECTION – 'B' (PROJECT INFORMATION)	04
06	SECTION – 'C' (SPECIFIC TECHNICAL REQUIREMENTS)	1 to 13 of 30
07	ANNEXURE-A OF SECTION-C (AVERAGE LUX LEVEL & TYPE OF FIXTURES)	14 to 18 of 30
08	ANNEXURE-B OF SECTION-C (LIGHTING & LV POWER DISTRIBUTION IN DIFFERENT AREA)	19 of 30
09	ANNEXURE-C OF SECTION-C (LIST OF APPROVED SUB VENDOR'S)	20 to 30 of 30
10	ANNEXURE-D OF SECTION-C (CUSTOMER SPECIFICATION)	36
11	ANNEXURE-1 TO SECTION C (BOQ CUM PRICE SCHEDULE) FOR MAIN ITEMS OF STATION LIGHTING SYSTEM	3
12	ANNEXURE-2 TO SECTION C (BOQ CUM PRICE SCHEDULE) FOR E&C OF MAIN ITEMS OF STATION LIGHTING SYSTEM	3
13	SECTION – 'D' (STANDARD TECHNICAL SPECIFICATION)	88
14	DATA SHEET-A TO SECTION – 'D'	11
15	DATA SHEET-C TO SECTION – 'D'	13
16	QAP	4

17	MEMORANDUM OF UNDERSTANDING(ANNEXURE-IX)	2
18	DOCUMENT SUBMISSION SCHEDULE	1

	TITLE PREAMBLE	SPECIFICATION NO. PE-SS-999-100-Q-001	
		VOLUME II B	
		SECTION - PREAMBLE	
		REVISION 01	DATE: 1.06.2015
		SHEET 1 OF 1	

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

Section – A: This section outlines the Intent of Specification.

Section – B: This section provides "Projection Information".

Section – C: This section indicates Technical Requirements specific to Contract, not covered in Section – D.

Section – D: This section comprises of Technical Specifications of equipment complete with Data Sheets A and C.


Data Sheet-A: Specific data and other requirements pertaining to the equipments.

Data sheet-C: Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

1.4 **VOLUME – III** **TECHNICAL SCHEDULES (NOT APPLICABLE)**

This volume contains Technical Schedule and Data Sheets–B, which are to be duly filled by bidder and the same shall be furnished with the technical bid.

2.0 This requirements mentioned in Section–C / Data Sheet–A of Section–D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section–D.

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM	SPECIFICATION NO. PE-TS-412-558-E001	
		VOLUME II B	
		SECTION	
		REVISION 01	DATE: 1.06.2015
		SHEET 1	OF 1

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer :
 - a. Unpriced Price Schedule (Annexure-1, 2: of Section-C : BOQ , as enclosed with the specification) with bidder's signature and company stamp.
 - b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
 - c. A copy of previous sheet ("List of Contents"), with bidder's signature and company stamp.

2. In case, bidder is not a manufacturer of lighting fixtures then bidder to submit MOU (as per the format enclosed in the specification – annexure IX) with anyone of the BHEL approved lighting fixtures manufacturers for support for design of lighting system and supply of lighting fixtures material.

3. Signed and stamped copies of the following shall be furnished by the bidders who meets the criteria of PQR and are not registered with PEM-Noida for station lighting package along with the technical offer:
 - a. Documents as listed in Note-1 above.
 - b. Filled in Data Sheet – C
 - c. Catalogue for the items manufactured by the bidder.
 - d. Quality documents
 - e. Type test procedures
 - f. Reference list of the executed projects with order value
 - g. ISO certificate
 - h. Organisational chart/set up


4. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage for the bidders who are already approved with BHEL-PEM. Any such submission, even if made, shall not be considered as part of offer.

5. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.

6. 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.

7. Any changes made by the bidder in the price schedule with respect to the STATION LIGHTING SYSTEM description/ quantities, notes etc. from those given in Annexure-1, 2 to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

	TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM	SPECIFICATION NO. PE-TS- 412-558-E001	
		VOLUME II B	
		SECTION	
		REVISION 01	DATE: 1.06.2015
		SHEET 1 OF 1	

DEVIATION SCHEDULE

SL. NO.	CLAUSE NO.	DEVIATION	REASONS FOR DEVIATION

It is certified that the offer is fully in conformance to the specification requirements except for the deviations, which are specifically brought out in the above prescribed Deviation Schedule.

Signature & seal of Bidder's authorized representative



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION A

REVISION 01

DATE : 1.06.2015

SHEET

1 of 2

SECTION - 'A'

SCOPE OF ENQUIRY



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION A

REVISION 01

DATE : 1.06.2015

SHEET

2 of 2

SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/subvendor's works, proper packing and despatch to site, site unloading & handling, site storage including storage facility (only graded land shall be provided by purchaser), erection and commissioning of **STATION LIGHTING SYSTEM** as mentioned in different sections of this specification for 2x660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER.
- 2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated.
- 6.0 The documents shall be in English language and MKS system of units.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION B

REVISION 01


DATE : 1.06.2015

SHEET

1 of 4

SECTION - 'B'

PROJECT INFORMATION

	<p style="text-align: center;">DOCUMENT TITLE</p> <p style="text-align: center;">TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM</p>	DOC. NO. PE-TS-412-558-E001	
		VOLUME II B	
		SECTION B	
		REVISION 01	DATE : 1.06.2015
		SHEET	2 of 4

PROJECT INFORMATION

INTRODUCTION

1. INTRODUCTION

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1320 MW (2 units of 660 MW each) Coal Based Thermal Power Station at Katupalli. This is an expansion of North Chennai Thermal Power Station (NCTPS) and located on some portion of the ashdyke of NCTPS.

2. OWNER

Tamilnadu Generation and Distribution Corporation

3. CONTRACT SPECIFICATIONS

TNEB specification No. SE/E/T&H(P)/OT.No.175/2007-08

4. LOCATION

The proposed site for main power plant is located near Ennore port (approx 5 kms).
The nearest Railway station is at Athipattu Pudunagar (approx 5 kms.)
All weather road from Pattamandri on the Thiruvottiyur-Ponneri district highway is the nearest road access.
The nearest airport is at Chennai at a distance of 60 km.

5. SITE CONDITION

The site is located near Vayalur Village, Ennore
Latitude : 13°17' N to 13°18' N
Longitude : 80°18' E to 80°19' E
Distance from Chennai City : 35 km
Nearest Airport is at Chennai at a
Distance of : 60 km

6. AVAILABILITY OF LAND

About 500 acres of land has been earmarked to locate all the facilities of the proposed plant and the land is in possession of TANGEDCO.

7. SITE DEVELOPMENT

Generally, level and rough graded land will be made available by the owner.

8. SOIL CONDITION

As indicated by soil consultants, the present site is located in a coastal region with sub-surface consisting of sedimentary deposits. Soil investigation has been carried out at the proposed site. From bore logs it is observed that sub soil in this strata is generally comprising of medium coarse sand up to 5 m followed by silty clay, and compacted clay layers below.



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION B

REVISION 01

DATE : 1.06.2015

SHEET

3 of 4

9. PLANT FOUNDATIONS

All major buildings like Turbine Building, Mill Building, Chimney, Boiler, etc. will be on piles. Major equipment foundations like TG foundations, Boiler Feed Pumps, ID Fan, FD Fan, PA Fan, Coal Mills will be on pile foundations. Other buildings can be supported on spread or raft foundations.

10. MAJOR DISTANCES TO PROJECT SITE

Plant located in Athipattu, Ponneri Taluk of Thiruvallur district, Tamil Nadu.

Distance from Chennai	-	35 km North of Chennai
Distance from Manali	-	20 km
Nearest road	-	All weather road from Pattamandiri, 5 km from Site on Chennai – Ponneri district highway
Nearest Railway Station	-	Athipattu Pudunagar on Chennai Howrah mainline, 3 km from Site
Nearest Sea Port	-	Ennore Port – 3 km and Chennai Port – 20 km from Site
Nearest Air Port	-	Chennai

11. ACTUAL DESTINATION FOR MATERIALS

ENNORE Thermal Power Station

12. MODE OF DESPATCH

Road / Rail / Sea / Air (as per project requirement)

Ambient temperature for Design of electrical equipment in non-air conditioned area	:	50°C
Relative humidity for design of electrical equipment	:	85%
AC Voltage Level For Aux Power Distribution	:	11 KV, 3 phase, 3 wire
	:	3.3 KV, 3 phase, 3 wire
	:	415 V, 3 phase, 4 wire
Rated frequency	:	50 Hz.
Voltage & Frequency variation	:	All equipment shall be suitable for Voltage variation of $\pm 10\%$, frequency variation of (+) 3% to (-) 5% and 10% combined variation (sum of absolute values) of voltage and frequency.

The voltage level for motor shall be as follows:



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION B

REVISION 01

DATE : 1.06.2015

SHEET

4 of 4

- Above 1500 KW : 11 KV
- Above 160 KW & upto 1500 KW : 3.3 KV
- Upto 160 KW : 415 V

AC control voltage : 240 V, 1ph, 50 HZ

UPS Voltage : 240 V, 1ph, 50 Hz

DC Voltage for motor, protection, control and emergency lighting : 220 V

DC Voltage for control & instrumentation : 24 V

AC Voltage for lighting, Space heating : 240 V, 1ph, 50 Hz

AC emergency supply : 415V; 3 Ph; 3 wire

DC Voltage variation : 187 V - 242 V for 220 V DC

Fault levels:

400KV System : 63 kA for 1 sec

33kV System : 25 kA for 3 sec

11KV System : 50 kA for 3 sec

3.3KV System : 40 kA for 3 sec

415V System : 50 kA for 1 sec

220V DC System : 25 kA

Grounding:

- a). 400KV System : Solidly grounded
- b). Generator : High resistance grounded through distribution Transformer, transformer secondary loaded with resistor.
- c). 11KV System : Low Resistance Grounded with Earth-Fault Current limited to 300A
- d). 3.3KV System : Low Resistance Grounded with Earth-Fault Current limited to 300A
- e). 415V System : Solidly grounded
- f). 220V DC System : Ungrounded
- g). Diesel Generator : Ungrounded



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION C

REVISION 01

DATE : 1.06.2015

SHEET

1 of 1

SECTION - 'C'

SPECIFIC TECHNICAL REQUIREMENTS



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 1 OF 30

1.0 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing and despatch to site, site unloading & handling, site storage including storage facility (only graded land shall be provided by purchaser), erection and commissioning of lighting system as described in the various sections of this specification. Lighting system shall generally conform to IS. It is not the intent to completely specify all details of design and construction herein. However, the equipment shall conform to acceptable standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to Contractor, who shall be entitled to reject any work or materials, which in his opinion is not in conformity with the duty requirements.

2.0 SCOPE OF SUPPLY AND SERVICES

The scope of supply and services covers the complete supply of equipment and services for lighting and low voltage power services in accordance with the requirements of various sections of this specification.

2.1 The scope of supply shall be as per BOQ cum Price Schedule for Station Lighting System (Annexure- 1, 2). The complete installation, testing, commissioning and performance testing of lighting and low voltage power services as per Schedule of Equipment & Services enclosed shall be in bidder scope.

2.2 Consumable such as conduit accessories, conduit boxes, saddles, clamps, screws, switch boxes, supports, down rods, ball and sockets, fixing hardware etc, as described in various clause shall deemed to be included by the bidders.

2.3 Adequate number of steel containers are to be supplied for storing of material at site. The same can be taken back by the vendor after completion of work.

3.0 TERMINAL POINTS

Terminal point shall be incoming power supply to lighting distribution boards.

4.0 EXCLUSIONS

4.1 Civil foundations of lighting distribution boards.

4.2 Supply and laying of incoming cables to LDBs and welding sockets (fed from MCC).

4.3 Supply of power cables:

- a) From LDBs to LPs
- b) From LDBs to street lighting panels
- c) From street lighting panels to poles JB.

4.4 Supply of control cables from DC LDB to AC normal board.

4.5 Supply of 2.5 mm² Cu PVC armoured cables for sockets & fixtures in hazardous area, outdoor lighting on buildings, buried cables for floodlight and high mast



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 2 OF 30

4.6 Supply & erection of cable trays.

5.0 Review of the sub-contractor's documents by the contractor shall not relieve the sub-contractor from his responsibility for the design, supply and construction/ installation.

6.0 LIGHTING SYSTEM DESIGN CRITERIA

6.1 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/common control room, particular attention will be given to ensure that illumination is proper and control room lighting will be such as to prevent any glare/ luminous patch on control board/ VDUs when viewed from an angle.

6.2 All fluorescent fixtures will be energy efficient type (28W T5 fluorescent cool day light tube) with electronic ballast, housing acrylic prismatic lenses. All outdoor fixtures will be weatherproof type with DOP-IPW55.

6.3 All high bay fixtures will have vibration damper. **In general, the type of fixtures and illumination levels to be achieved for different areas will be as per enclosed Annexure-A.**

6.4 The lighting fixtures in the plant area will be group controlled from lighting panel by miniature circuit breakers. The lighting fixtures in office areas, control rooms etc. will be controlled by switches. Lighting panels feeding transformer yard and boiler platforms will have contactors for control from remote point.

6.5 Indoor & outdoor lighting system will have electronic type timer arrangement in lighting panel (LP) for controlling lights with a provision for manual control also. Electronic timer will be clock switch type with ON / OFF time setting facility.

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

The nominal standard lamp operation for photoelectric controllers will be ON at 10 lux and OFF at 75 lux, with a time delay built into each controller to prevent false turned off by transient light.

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

6.7 In all the air filtration units and air handling units, one marine type lamp(of 100W approx) shall be supplied.

6.8 All LDBs,LPs to be provided with 20% spare feeders.

7.0 ILLUMINATION DESIGN CALCULATION



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 3 OF 30

7.1 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

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 Room Index is calculated by the following formula:

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

Where MH = Mounting height of luminaire.

Utilization will be considered as given below:

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

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

Boiler area	0.55	
Control room & air conditioned area	0.75	
Indoor area non-AC (except fluorescent fixture)	0.6	
Indoor area non-AC (fluorescent fixture)	0.57	\$
\$: (0.65 x 0.87 = 0.57)		
Ambient temperature considered for above correction factor	40	deg C
Correction factor at above ambient temp. in	0.87	



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 4 OF 30

motionless air:

7.2 For indoor area, the working plan will be considered at 850mm from the floor level. The suspended height of fixtures will not exceed 1000mm. The luminaries will be designed for indoor applications:

- a) High bay above 8 meters
- b) Medium bay 6-8 meters
- c) Low bay below 6 meters

7.3 For outdoor lighting and road lighting of minimum to average illumination will not be less than 0.3 and for minimum to maximum will not be less than 0.05. The maintenance factor will be 0.6 under average condition.

7.4 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.

8.0 LIGHTING SYSTEM DESCRIPTION

a) Lighting system will be provided with AC Normal, AC Emergency and DC Emergency lighting as listed against various areas as per **Annexure- B** enclosed. The average lux level & type of fixtures shall be as per **Annexure-A**.

b) The sources of power supply are as below:

- i) 415V AC Normal (ACN) Supply from different station PMCCs /MCCs/ACDBs
- 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 (80% on ACN and 20% on ACE) and DC luminaries will be in service on AC supply. Even under failure of AC normal supply DC luminaries will be 'ON' through 220V DC supply. On restoration of AC Emergency supply through DG, ACE luminaries will be put-on.

For other auxiliary areas Normal AC 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, 100% AC emergency lighting will be provided.

10% of Lighting Fixtures will be supplied through DC in TG Building, Control rooms, ESP, Boiler area etc. For details of areas please refer to **Annexure-B**.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 5 OF 30

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.

8.1 A.C 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). Each LDB, consists of two nos. 50kVA(min.) / 100kVA(min.), 415/433V, taps of $\pm 5\%$ in steps of 2.5%, epoxy cast resin insulated (encapsulated winding), air-cooled dry type isolation transformers housed in LDB with proper separation from distribution panels. LDB will have two incomers and a bus-coupler with TPN MCCB. The LDB outgoing feeders (12 nos.) will have 63A MCCB.

The ACLPs will be provided with 63A MCCB for incoming and 20A MCBs for outgoing. The short circuit level of LDB shall be at 50 KA. The outgoing MCB of LP will be suitable for short circuit current of 10kA. ACLPs will have 6, 12 & 18 outgoing.

8.2 AC Emergency Lighting System:

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 (ACELDB). Each ACELDB, consists of two nos. 50kVA, 415/433V, taps of $\pm 5\%$ in steps of 2.5%, epoxy cast resin insulated (encapsulated winding), air-cooled dry type isolation transformers housed in ACELDB with proper separation from distribution panels. ACELDB will have two incomers and a bus-coupler with MCCB. The ACELDB outgoing feeders (12 nos.) will have 63A MCCB.

The ACLPs will be provided with 63A MCCB for incoming and 20A MCBs for outgoing. The short circuit level of ELDB shall be at 50 KA. The outgoing MCBs of LP will be suitable for short circuit current of 10kA. ACLPs will have 6, 12 & 18 outgoing.

8.3 220V DC Emergency Lighting System:

This will be provided by emergency A.C. /D.C. lighting fixtures located strategically in critical operating areas and emergency exits.

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). Each DCLDB will have 125A, 2-pole switch fuse and contactor for incoming and 32A, 2-pole switch fuse for 6 nos. outgoing.

Each DCLP will have 32A, 2-pole switch fuse for incoming and 20A, 2-pole MCB for 6 nos. outgoing.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 6 OF 30

8.4 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 for indoor and IPW-55 for outdoor . The DOP for transformer cubicle will be IP-42. The DOP for LP will be IP-54 for indoor and IPW-55 with canopy for outdoors. The thickness of sheet steel enclosures shall be 2 mm minimum for load bearing and 1.6 mm for other members.LDB/LP shall be FRP type.

8.5 Lighting circuit for main plant will be developed to ensure that no two consecutive fixtures will be fed from same phase/circuit and feeding of different LPs will be from separate LDBs. However, for remote areas (auxiliary areas) the lighting will be provided only from one LDB located in that area. Fixtures on each boiler platform shall be fed from minimum two LP, which in turn are fed from different LDB. The circuit loading on each circuit will be restricted to 80% of the MCB rating. The voltage drop from LDB and any fixture will not exceed 3%.

8.6 24V AC Supply modules System:

Each 24V AC supply module will have one no. air-cooled two winding, 500VA, 1-phase, 50HZ, 240/26.5V transformer with 6A (240V side) DP MCB with HRC fuse and 16A (26.5V side) SPN MCB with HRC fuse and necessary 240V and 24V terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module will be fed from respective lighting panels (LP). A group of 5A, 24V AC sockets identified with colour coding in order to distinguish them from the normal 240V sockets will be envisaged in following areas:

- i) Boiler area: Near inspection manholes on boiler platforms and boiler drum.
- ii) TG building: Near HP & LP heaters, turbine flash tank, blow down tank, near condenser water box and near bus duct termination of generator end.
- iii) ESP columns: Near inspection manholes.
- iv) Near Deaerator

8.7 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 0.5 hours backup capacity.

For auxiliary plants and other strategic location, for safe personnel movement during emergency, self-contained Ni-Cd battery operated emergency lighting units (ELU) with 2 hours duration backup capacity will be provided. Each battery will have battery charger and 2X9W fluorescent lamp. The material for JB, switch boxes, saddles, clamps etc will be galvanised steel.

8.8 24V Halogen lamps:



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 7 OF 30

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

9.0 STREET LIGHTING / OUTDOOR LIGHTING

9.1 The roads within BHEL scope as per contract will be considered for lighting.

9.2 Street lights / outdoor lighting will be fed from street lighting panels (SLP) having timer switch, photocell & contactor arrangement with manual control facility. For poles, On/Off facility shall be provided with auto/manual. These street lighting panels will be fed from nearest AC normal LDB.

9.3 For street lighting 11 meter (for secondary roads upto 4M width) and 13 meter (for primary roads more than 4M width) high lighting pole will be used. For outdoor area lighting if required, flood light pole will be used. The technical details of poles will be as per IS-2713. The poles shall be equipped with junction boxes and all other accessories.

9.4 Street Light Poles :

a) Street light poles shall be swaged and welded steel pole, complete with fixing brackets, weather-proof junction box and all other accessories.

b) The pole shall be coated with bituminous preservative paint on inside as well as embedded outside surface. Exposed surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in synthetic medium).

Flood Light Tower :

a) Flood light tower shall be a lattice structure with maintenance platform and approach ladder. All structural members and hardware shall be hot-dip galvanized.

b) Structures shall be designed for an additional load of 1500kg for maintenance crew. Deflection under maximum wind pressure shall not exceed 1 in 360. Structural design shall be as per IS-800 and subject to Owner's approval.

9.5 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.

9.6 15 Nos. Lighting mast shall be considered for General area lighting. High mast tower will be 30 meter high, hot dip galvanized and polygonal shaped at least 20 sided . Each high mast will have 6nos. of 2x400W metal halide non-integral type flood light fittings, 1 no. of twin dome aviation obstruction light and raise/lower arrangement with electrical as well as manual winch for lantern carriage. The electrical controls for winch motor, light fittings



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 8 OF 30

and aviation lights will be mounted in separate control panel, which will have double door arrangement. Two nos. 1-phase 5-pin 20A socket with fuse will be provided in control panel. The location of high mast will be decided during detailed engineering.

10.0 LOW VOLTAGE POWER SERVICES

- 10.1 Light switches will be piano type rated 5A, 240V. Light switches will be installed at 1200mm above floor.
- 10.2 At least one number 240V AC, 6/16A, 5-pin duplex type decorative socket will be provided in office, store, cabin etc. At least one number 20A, 3-pin, 240V AC industrial type receptacles will be provided at suitable location in generation building so that it will be accessible from 15M extension cord from any point. The receptacles shall be provided at interval of 20m or part thereof . All receptacles will be controlled with a switch. In fuel oil area receptacles will be of flameproof type. Receptacles with weatherproof snap action covers and ground fault interrupter will be used for outdoor and wet area application.
- 10.3 63 A, 3-phase, 415V welding receptacles with isolating switch will be provided near all the major equipment and at an average distance of 50m throughout areas within lighting scope. Maximum three (3) nos. 63A receptacles will be fed through one feeder. In hazardous areas these receptacle will be located in MCC rooms. Additionally, two numbers of 400A, 3-phase, 415V welding receptacles (one for each unit) shall be provided in Transformer Yard Area for Oil Filtration Unit. In Boiler area, 2 no's 63A receptacles shall be provided on diagonally opposite corners at every alternate platform.
- 10.4 One nos. Welding Distribution Board (WDB) for each unit will be used to feed 63/100A welding receptacles located in SG & TG areas. Each WDB shall consist of one no. 100kVA, 415/433V, taps of $\pm 5\%$ in steps of 2.5%, epoxy cast resin insulated (encapsulated winding), aircooled dry type isolation transformers housed in WDB with proper separation from distribution panels. The WDB outgoing feeders (12 nos) will have 63/100A MCCB.
- 10.5 On boiler platform there is no functional requirement of 5/15A receptacles. However, 20A industrial type receptacles will be provided only on feeder floor, operating floors and boiler drum level. In addition this, welding receptacles (63A) will also be used at an average distance of 50M.
- 10.6 Receptacles in false ceiling area are generally installed 200mm above floor, whereas in area without false ceiling, installed at 900mm from floor.
- 10.7 Based on room size, suitable nos. of ceiling fans (1200 mm sweep) with stepped electronic regulator flush mounted on switchboard shall be provided in manned office or control room areas not covered by A/C and ventilation system. In the office premises, one fan per 10 sq. metres shall be provided. 20 nos. pedestal fans for both units shall be provided for customer use.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 9 OF 30

10.8 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 mini truck mounted adjustable hydraulic lift shall be provided, 3 nos portable aluminium ladder of various sizes suitable for main control room, switchyard control room etc.

11.0 WIRING / CONDUITS

11.1 Wiring of lighting system will be done as follows:

- i) Wiring installation will be done by multi-stranded, PVC insulated, colour coded wires laid in GI conduits of 20mm dia size (minimum) conforming to IS-9537. The thickness of conduits upto & including 25 mm dia will be 16SWG 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 three number of 1-phase receptacles will be loop in & loop out in a circuit.

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

Lighting Panel to Fixtures: 2.5 sq. mm (Cu)

Lighting Panel to JB's/
Switches: 10 sq. mm (Al)

JB's/ switches to Fixtures: 2.5 sq. mm (Cu)



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 10 OF 30

Panel to First receptacles: 4.0 sq. mm (Cu)

First receptacles to looping
other receptacles: 4.0 sq. mm (Cu)

In case of only one receptacles
in ckt., Panel to receptacles: 4.0 sq. mm (Cu)

Panel/ JB's to flood light
fixtures: 2 x 2.5 sq. mm
(Cu)

The above shall be in the vendor scope of supply. Please refer BOQ for details.

Heavy duty AXWY FRLS XLPE cables will be used for following connections(BHEL scope of supply):

- From main lighting board to area lighting panel/LDB.
- From street/area lighting panel/LDB to street lighting poles/towers.
- From 415V DBs to 125A welding receptacles.

11.3 Wiring in hazardous area and transformer yard will be done using 3C-2.5 mm² copper conductor, PVC insulated, FRLS PVC sheathed armoured cable (BHEL scope of supply).

11.4 For poles, the cable connections (loop-in-loop-out) will be through through 3.5C-25 sq mm Al armoured buried cables(BHEL scope of supply). The mechanical protection of exposed cable near pole will be done through 50 mm dia GI conduit. Wherever, cable is crossing the road, 100mm dia hume pipe will be used.

12.0 EARTHING

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

Lighting Distribution Board: GI Flat 50x6 mm

Lighting Panels: GI Flat 35x6 mm

Lighting fixtures, receptacles,
conduits, junction boxes &
switch boxes: 8 SWG GI wire

Welding receptacles: GS Flat 50x6 mm

Street light pole/ flood light pole
and High mast: GI Flat 50x6 mm



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 11 OF 30

- 12.2 A continuous ground conductor of 8 SWG GI wire will be run all along each conduit run and bonded to it every 600 mm by not less than two turns of the same size of wire. This conductor will be connected to each lighting panel ground bus.
- 12.3 Each street lighting pole/flood light pole will be grounded by 50x6 mm GI flat, which will be connected to two no. 40 mm dia & 3m long MS rod earthing spike, directly driven into ground at a depth of 1 meter from ground level.

The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 8 SWG GI wire. One 8 SWG GI wire shall be taken upto the junction box from lighting fixtures and connected to grounding point.

- 13.0 All steel fabrication shall be given two coats of red oxide primer followed by powder-coated shade RAL 7032.
- 14.0 STATUTORY & REGULATORY REQUIREMENTS

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. During execution of the contract, bidder to ensure compliance to all statutory/regulatory requirements as and when notified by concerned authorities without any implication to BHEL.

- 15.0 The areas for which lighting design engineering is to be done are listed in **Annexure-B**.
- 16.0 Design engineering includes submission of data sheets, GA drawings of equipment, mounting details, various schedules, lighting design calculation sheets, lighting distribution scheme, lighting layout drawings and bill of material drawings. Conduit layout drawings shall be submitted to meet the E&C schedule.
- 17.0 Basic Design Documents covers: Drawings/ documents schedule, technical data sheets, GA drawings of equipment, quality plan, type test reports & type test proposal (as required) for Station Lighting System.
- 18.0 Bidder after award of contract shall prepare all GA, schemes and lighting layout drawings in AUTOCAD 2008. Both hard as well soft copies of dwg/documents will be required for the purchaser's review/ approval.

19.0 INSPECTION & TESTING

- 19.1 Standard quality plan of various items are enclosed as Annexure-E. For non-SQP items, bidder shall furnish their QP after award of contract. Inspection shall be carried out as per Quality Plan (QP) approved by TANGEDCO/BHEL without any implication on cost and delivery.

All material used for the construction of the equipment shall new and shall be in accordance with the requirements of this specification. Materials utilized shall be those which have established themselves for use in such applications.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 12 OF 30

19.2 All acceptance and routine tests as per relevant standards and specification shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

19.3 Valid Type test certificate on any equipment (within last 5 years) shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

19.4 Type test reports shall be furnished by the bidder. Such Type tests should have been carried out within last five years, as on the 31.10.2013, on identical components / materials. In absence of such type tests reports or in case such reports are not found to be meeting the specification/standards requirements, bidder shall conduct, free of cost to the purchaser, all such type tests according to the relevant standards and reports shall be submitted to the owner for approval.

All the components and completely assembled switchboards shall be tested as per the latest edition of standards.

20.0 Makes of sub-vendor and equipment/components shall be subject to TANGEDCO/BHEL approval during detailed engineering without any implication on cost and delivery. For BHEL approved sub-vendor list, refer enclosed **Annexure-C**.

21.0 Bidder shall furnish Field QP after award of contract for purchaser's approval.

22.0 Bidder shall furnish various schedules/data sheets completely filled and duly stamped and signed as per various sections of this specification

23.0 Number of copies of documents/data to be submitted by the successful bidder shall be as per enclosed Document Submission Schedule.

24.0 PRICES

24.1 The bidder shall quote prices for supply, erection, testing & commissioning of complete lighting system as per format attached with the specification.

24.2 Unit price quoted for erection, testing & commissioning of items listed under BOM shall be deemed to have been included the prices for erection material as described in clause 1.4 section-D of standard specification of lighting system (installation) of this specification and other relevant clauses of this specification for various lighting equipment.

24.3 The unit rates of supply & installation(E&C) for all equipment and services quoted by the bidder shall be firm for a variation of quantities limited to **±30% of total order value** till completion of works at site.

24.4 Purchaser reserves the right to delete/add any equipment or services from the bidders scope, and for price adjustment in such cases, unit prices quoted by the bidder will be



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 13 OF 30

considered.

- 24.5 The bidder shall furnish unpriced price schedule of all equipment and services inclusive of commissioning spares, O&M spares and special tools & tackles along with the technical bid.
- 24.6 Bidder to note that the price quoted for System Engineering Design for lighting system shall be fixed for the project and will not vary with the change in scope of supply of equipment.
- 24.7 Bidder shall quote unit price of all the equipment and the components like MCB's, switches, lamps etc. in the unit price schedule enclosed.
- 25.0 Bidder after award of contract shall prepare and submit the area drawings as per various sections of this specification within 4 weeks of the input given by the purchaser. The total engineering along with freezing of BOM shall be completed in line with specification requirement.
- After completion of work at site, bidder shall prepare 'AS BUILT' drawings and furnish the same in floppy as well as in CD ROM.
- 26.0 Vendor to furnish area wise commissioning protocol during contract stage sequentially as per site progress.
- 27.0 Structural steel requirement shall be informed to the bidder at contract stage and drawing approval for the same shall be subject to BHEL approval without any commercial implication.
- 28.0 The winch of the high mast shall be type tested in presence of a reputed Institution and the test certificates shall be furnished before supply of materials. A test certificate shall be furnished by the Tenderer from the original equipment manufacturer, for each winch in support of the maximum load operated by the winch.
- 29.0 Engineering, Supply and E&C schedule:
As per NIT (Notice Inviting Tender).
- 30.0 Annexures:
Annexure-A: Average lux level & type of fixtures
Annexure-B: lighting and LV power distribution in different area
Annexure-C: List of approved sub-vendor's
Annexure-D: Customer specification



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 14 OF 30

ANNEXURE-A**AVERAGE LUX LEVEL & TYPE OF FIXTURES**

S. No.	LOCATION	AVERAGE LUX LEVEL	TYPE OF LUMINAIRE	TYPE OF LAMP
1	Turbine generator building			
1.1	General Auxiliary Equipment Areas	200	Industrial Well Glass	metal halide lamp
1.2	Cable Spreader Room	100	Industrial type fluorescent lamp with vitreous enamel reflectors	T5 fluorescent tube with electronic ballast
1.3	All Switchgear Room Area	200	Industrial type fluorescent lamp with vitreous enamel reflectors	LED lamp fixtures
1.4	TG Building Operating Floor	200	Industrial integral high bay	250/400W metal halide lamp
1.5	Main Control Rooms, Computer Rooms	400	Decorative recessed mounted with mirror optic (Dark Lighter)	LED lamp fixtures
1.6	Battery Rooms	200	Industrial Corrosion proof luminaire	2x28W T5
1.7	Unloading and Maintenance bay	250	Industrial integral high bay	250W/400W HPMV lamp
1.8	Service Building	300	Industrial type fluorescent lamp with vitreous enamel reflectors/ Industrial integral high bay	2x28W T5
2	Boiler Area			
2.1	Boiler area and platforms	100	Dust proof/dust tight integral well glass luminaire.	metal halide lamp
2.2	Coal Bunker and Mill bay area, feeder floor, tripler floor	150	Dust proof/dust tight integral well glass luminaire	metal halide lamp
2.3	ESP areas and Platforms	120	Dust proof/dust tight integral well glass luminaire	metal halide lamp



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 15 OF 30

2.4	ESP Control room	400	Decorative recessed mounted with mirror optic for clean room areas	LED lamp fixtures
3	Transformer Yard			
3.1	General	50	General purpose flood light	250W/400W metal halide lamp
3.2	Near equipment	70	Dust proof/dust light integral well glass	1 x 70 W metal halide Lamp
4	Various Off-site building			
4.1	Equipment / Switchgear Room	200	Industrial type fluorescent lamp with vitreous enamel reflectors upto mounting height of 3.5M or industrial medium bay integral luminaire for mounting heights between 3.5 to 8.0 M	LED lamp fixtures
4.2	Pump House	200	Industrial Well glass	70W metal halide/125W metal halide lamp
5	Cooling Water Pump House area			
5.1	Cooling tower area	50	Industrial well glass	metal halide lamp
5.2	CWPH	200	Industrial medium bay integral luminaire for mounting heights between 3.5 to 8M	metal halide lamp
6	DM Plant area			
6.1	Control room	300	Decorative recessed mounted with mirror optic for clean room areas.	LED lamp fixtures
6.2	Pump House.	200	Industrial well glass.	metal halide lamp
7	Chemical House			



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 16 OF 30

7.1	Control room	300	Decorative recessed mounted with mirror optic for clean room areas.	LED lamp fixtures
7.2	Equipment rooms and Pump rooms	150	Industrial Corrosion proof luminaire	2x28W T5
8	Fuel Oil Tank Area			
8.1	Tank Area	50	Non-integral flood light	metal halide lamp
8.2	Fuel oil area pump house	100	Flame proof well glass	Metal halide lamp
9	Road & Yard Lighting			
9.1	Main Roads	25	Integral type street lighting luminaire with aluminium reflector	LED lamp fixtures
9.2	Secondary roads	15	-do-	LED lamp fixtures
9.3	Perimeter (compound lighting)	15	-do-	LED lamp fixtures
9.4	Yard Lighting	20	Flood light	LEP or metal halide
10	Diesel Generator			
10.1	DG Room	150	Industrial trough type	metal halide lamp
10.2	Compressor Room	150	Industrial trough type	metal halide lamp



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 17 OF 30

11	Stores			
11.1	Cement stores	100	Industrial trough type fluorescent dust proof	metal halide lamp
11.2	Chemical stores	150	Corrosion proof	metal halide lamp
11.3	Permanent stores	150	Industrial trough type/ metal halide	HPMV lamp
12	Hydrogen Plant			
12.1	Hydrogen Plant Building	150	Explosion proof metal halide / Fluorescent fittings suitable for class-I and Division –II	metal halide lamp
13	Laboratory			
13.1	Electrical Laboratory	250	Mirror optics fluorescent	LED lamp fixtures
13.2	Chemical laboratory	300	Corrosion resistant, fluorescent	CFL
14	Cable Galleries			
14.1	Cable galleries	100	Industrial trough Type fluorescent	metal halide lamp
15	General			
15.1	Offices, conference rooms, etc.	300	Decorative mirror optics type	LED lamp fixtures



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 18 OF 30

15.2	Corridors, Walkways, Staircase, Lockers etc	70	Industrial Type CFL with vitreous enamel reflectors	LED lamp fixtures
15.3	Toilet Wash room etc	70	Industrial Type CFL with vitreous enamel reflectors	LED lamp fixtures
15.4	Garage/Car Parking	50	Industrial trough type fluorescent	LED lamp fixtures
15.5	Facility building, canteen	150	Industrial trough type fluorescent	LED lamp fixtures
16	Administration Building			
16.1	Main office areas (air conditioned)	300	Decorative recessed type with mirror optic reflector	LED lamp fixtures
16.2	Main office areas (non A/c)	300	Decorative with wide mirror optic reflector	LED lamp fixtures
17	DC Lights Fittings			
17.1	Control Room (with false ceiling)	50	Recess mounted Down lighter	GLS lamp
17.2	Other areas (without false ceiling)	20	Industrial bulk head	GLS lamp

Note: * The fixture will be suitable for Division-2, Group IIA/IIB of hazardous area as per IS-2148.
Decorative type fixtures will be provided for false ceiling areas.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 19 OF 30

ANNEXURE – B

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	Y	-	Y	Y	-
05	Transformer Yard	Y	Y	Y	-	Y	Y	-
06	ESP control room	Y	Y	Y	Y*	Y	Y	-
07	DG room	-	Y	Y	Y*	Y	Y	-
08	Compressor house	Y	Y	Y	Y*	Y	Y	-
09	Fuel oil area	Y	-	-	Y*	Y	Y	Y
10	Outdoor area	Y	-	-	-	-	-	-
10	Administrative building	Y	-	-	Y*	Y	Y	Y
12	Service building	Y	-	-	Y*	Y	Y	Y

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



DOCUMENT TITLE
**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 20 OF 30

ANNEXURE-C

LIST OF APPROVED SUB-VENDORS

The bidder shall select the make of components of lighting system from the list below. However, the bidder may propose name of additional sub-vendors (including for FRP type LDBs, LPs & JBs) based on their experience, which will be subject to BHEL/ TANGEDCO approval at contract stage. The details of manufacturing facility, experience, customer certificates etc for any such proposed sub-vendor shall be submitted at contract stage. Acceptance /non-acceptance of additional sub -vendor proposed by the vendor shall have no commercial implication to BHEL.

All Makes shall be subject to BHEL/TANGEDCO approval without any commercial implication to BHEL.

ITEM CODE	ITEM DESCRIPTION	VENDOR NAME
ES1	AC CONTACTORS	SIEMENS
		GE-POWER
		TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
		L&T
		BCH
ES3	AC MCCB	C&S ELECTRIC LTD.
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
		SIEMENS
		GE-POWER
		L&T
		CROMPTON GREAVES
ES5	ACDB/ DCDB FIXED TYPE	ELECTRO CONTROLS & DEVICES
		JASPER ENGINEERS PVT. LTD.
		JACKSON ENGINEERS
		SPACEAGE SWITCHGEARS LTD.
		KMG ATOZ SYSTEMS
		ASIATIC
		UNILEC ENGINEERS PVT. LTD.
		C&S ELECTRIC LTD.
		ENPRO ENGG.
		ASSOCIATED SWGR & PROJ. LTD.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 21 OF 30

		BCH
		ECS PRIVATE LTD
		L&T
		GE-POWER
		SIEMENS
		KHOKHAR ELECT. PVT LTD.
		VIDHYUT CONTROLS (INDIA) PVT. LTD.
ES7	AUXILIARY RELAYS	ABB
		ALSTOM LTD
		JYOTI LTD.
		OEN INDIA LTD
		SIEMENS
ES8	BIMETAL RELAYS	L&T
		GE-POWER
		SIEMENS
		TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
ES10	CABLE CLAMPS & CABLE TIES	ELECTROMAC IND.CORPN.
		INCAB
		NOVOFLEX MARKETING PVT. LTD.
ES11	CABLE GLANDS	ALLIED TRADERS & EXPORTERS
		ARUP ENGG & FOUNDRY WORKS
		BALIGA LIGHTING EQPT.PVT.LTD.
		COMMET BRASS PRODUCTS
		DOWELLS
		ELECTROMAC INDUSTRIES
		INCAB
ES12	CABLE LUGS	DOWELLS
		UNIVERSAL MACHINES LTD.
ES13	D.C. MCCB	CROMPTON GREAVES
		L&T
		GE-POWER
		SIEMENS
ES14	EARTH LEAKAGE CB	L&T



DOCUMENT TITLE
**TECHNICAL SPECIFICATION FOR
 STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 22 OF 30

		SIEMENS
		GE-POWER
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
		C&S ELECTRIC LTD.
		ABB
		INDO ASIAN
		MDS SWITCHGEAR LTD
		S&S POWER SWITCHGEAR LTD,
ES16	GI CONDUITS	M. CHANDRA & CO
		BEC INDUSTRIES
		S.N. SEN & CO.
ES17	GI CONDUIT (EPOXY PAINTED)	BIS APPROVED MAKE
ES18	FLEXIBLE CONDUITS (LEAD COATED)	PLICA INDIA PVT. LTD.
ES19	FLEXIBLE CONDUIT (PVC COATED)	REPUTED MAKE
ES20	DC CONTACTORS	SCHNEIDER ELECTRIC INDIA PVT. LTD.
		BHEL (BHOPAL)
		ELECTROMAC INDUSTRIES
		L&T
		SIEMENS
		TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
		GE-POWER
ES21	CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE
		GE-POWER
		ALSTOM LTD
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
		M/s Shrenik & Co.
		RECOM PVT. LTD.
ES22	CONTROL TRANSFORMER/ WINDING HEATING TRANSFORMER	AUTOMATIC ELECTRIC LTD.
		INDCOIL
		KAPPA ELECTRICALS
		LOGICSTAT
		PRECISE ELECTRICALS
		UNILEC ENGINEERS PVT. LTD.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 23 OF 30

ES23	LT- CURRENT TRANSFORMER	SIEMENS
		AUTOMATIC ELECTRIC LTD.
		INDCOIL
		KAPPA ELECTRICALS
		PRAGATI ELECTRICALS
		PRECISE ELECTRICALS
		SILKAANS ELECT.MFG.CO.PVT.LTD
		PRAYOG ELECTRICALS PVT. LTD.
		C&S ELECTRIC LTD.
ES24	LT- POTENTIAL TRANSFORMER	SIEMENS
		AUTOMATIC ELECTRIC LTD.
		INDCOIL
		KAPPA ELECTRICALS
		PRAGATI ELECTRICALS
		PRECISE ELECTRICALS
		SILKAANS ELECT.MFG.CO.PVT.LTD
		PRAYOG ELECTRICALS PVT. LTD.
ES25	DC SWITCH	GE-POWER
		KAYCEE
		SIEMENS
ES26	DISTRIBUTION BOX	M/S SHRENIK & CO.
ES27	EMER. PORTABLE LTG. SET	BAJAJ ELECTRICALS
		BAJAJ ELECTRICALS
ES28	FUSE BASE	INDO ASIAN
		GE-POWER
		L&T
		C&S ELECTRIC LTD.
		SIEMENS
		ABB
		SPACEAGE SWITCHGEARS LTD.
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
		ALSTOM LTD
ESSEN DEINKI		



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 24 OF 30

ES29	HRC FUSES	INDO ASIAN
		GE-POWER
		L&T
		C&S ELECTRIC LTD.
		SIEMENS
		ABB
		SPACEAGE SWITCHGEARS LTD.
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
		ALSTOM LTD
		ESSEN DEINKI
ES30	GALVANISING	JENCO INDUSTRIAL CORPORATION
		NATIONAL GALVANISING COMPANY
		SIGMA GALVANISING PVT.LTD
		B.P. PROJECTS PVT LTD
		STANDARD GALVANISERS
		STEEL PRODUCTS
		UNITECH FABRICATORS & ENGINEERS PVT. LTD.
		M/s Shivam Engineers & Fabricators
		M/s B.G. Shirke Construction Technology Pvt. Ltd.
		M/s Galbro Ispat Galvanizers Pvt. Ltd.
ES31	GI WIRE & FLAT	EROS METELS
		APT ENGINEERING WORKS
		ARUN ENGG WORKS
		GRAM ENGINEERING
		INDIANA CABLE TRAYS CORPORATION
		JAMNA METAL COMPANY
		M.J. WORKS
		METTALITE INDUSTRIES
		NATIONAL GALVANISING CO.
		PRESS METAL CORPORATION
SYSTEM ENCL.ENTERPRISES		



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 25 OF 30

ES32	HIGH MAST	BAJAJ ELECTRICALS
		TLL
ES33	IND.POWER & WLDG SOCKETS	CROMPTON GREAVES
		CYCLO ELECTRIC DEVICE & SERV.CO.
		BCH
		BEST & CROMPTON
		AJMERA INDUSTRIES & ENGG. WORKS
ES35	INDICATING LAMPS	BCH
		C&S ELECTRIC LTD.
		ESSEN DEINKI
		VAISHNO(HOTLINE SWGR.& CONTROL)
		GE-POWER
		SIEMENS
		SCHNEIDER ELECTRIC INDIA PVT. LTD.
ES36	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGINEERS PVT. LTD.
		Electro Controls & Devices
		M/s Shrenik & Co.
		M/s PHOENIX MECANO LTD.,
		Adroit Control Engineers Pvt.Ltd.
		M/s PHOENIX MECANO LTD.,
		MIKA ENGINEERS
M/s PHOENIX MECANO LTD.,		
ES37	JUNCTION BOXES (FLAME PROOF)	
ES38	LIGHTING DISTRIBUTION BOARDS	ADVANCE ENGG. COMPANY
		Sterling Generators Pvt. Ltd.
		MIKA ENGINEERS
		ELEXPLO ELECTRICALS PVT/ LTD.
		KMG ATOZ SYSTEMS
		UNILEC ENGINEERS PVT. LTD.
		AVAIODS TECHNOVATORS LTD.
		Adroit Control Engineers Pvt.Ltd.
		JACKSON ENGINEERS
		Adlec Systems Private Limited



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 26 OF 30

		Popular Switchgears Pvt Ltd
		CANDS
		Pyrotech Electronics Pvt. Ltd.
		Positronics Control Systems Pvt Ltd
		Industrial Switchgears & Control Pvt Ltd
		M/s Vidhyut Control (I) Pvt.Ltd.
		MILESTONE SWITCHGEARS PVT. LTD.
ES39	LIGHTING FIXTURES (NON LED)	BALIGA LIGHTING EQPT PVT LTD
		ELEXPLO ELECTRICALS PVT/ LTD.
		BAJAJ ELECTRICALS
		CROMPTON GREAVES
		EVERGREEN ENGG. CO.
		PHILIPS
		WIPRO LTD.
		HPL
		SURYA ROSHNI LIMITED
		HAVELLS INDIA LIMITED
ES40	LIGHTING FIXTURES (LED)	Neev Luminaries
		HAVELLS INDIA LIMITED
ES41	LIGHTING FIXTURES (FLAME PROOF)	HAVELLS INDIA LIMITED
ES42	LIGHTING LAMP (NON LED)	WIPRO LTD.
		ESSEN DEINKI
		HAVELLS INDIA LIMITED
		INSTA POWER
ES43	LIGHTING LAMP (LED)	HPL
		HAVELLS INDIA LIMITED
		SURYA ROSHNI LIMITED
ES44	LIGHTING POLES	INSTA POWER
		BOMBAY TUBE & POLES CO.
		RIDHDHI POLES
		MIKA ENGINEERS
		KL INDUSTRIES



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 27 OF 30

		BAJAJ ELECTRICALS
		TLL
ES45	LIGHTING SWITCH , SOCKET & S/F UNIT	ELEXPLO ELECTRICALS PVT/ LTD.
		ANCHOR KENWOOD ELECTRICAL
		KAYCEE
		L&T
		SIEMENS
		INDO ASIAN
ES46	LIGHTING TRANSFORMER	AUTOMATIC ELECTRIC LTD.
		INDCOIL
		POWER PACK ENTERPRISES
		VIJAY ELECTRICALS LTD.
		GILBERT & MAXWELL
		KAPPA ELECTRICALS
Ames Impex Electricals Pvt. Ltd		
ES47	LOCAL PUSH BUTTON STATION (NON FLAME PROOF)	GE-POWER
		ASIATIC
		C&S ELECTRIC LTD.
		EVERGREEN ENGG. CO.
		TECKNIC CONTROLS
		EX-PROTECTA LIGHTING EQUIPMENT
		BALIGA ELECTRICALS
		ENPRO ENGG.
		STERLING SWGR CONTROL PVT.LTD.
		ELEXPLO ELECTRICALS PVT/ LTD.
		VAISHNO(HOTLINE SWGR & CONTROL)
		JASPER ENGINEERS PVT. LTD.
		KMG ATOZ SYSTEMS
		UNILEC ENGINEERS PVT. LTD.
BCH		
CANDS		
SIEMENS		
SCHNEIDER ELECTRIC INDIA PVT. LTD.		



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 28 OF 30

		TECKNIC CONTROLS
		UNITED ELECTRIC
		M/s Shrenik & Co.
ES48	LOCAL PUSH BUTTON STATION (FLAME PROOF)	
ES49	LIGHTING PANEL (FLAME PROOF)	BALIGA ELECTRICALS SUDHIR SWITCHGEAR
ES50	LIGHTING PANEL (NON FLAME PROOF)	MIKA ENGINEERS ELEXPRO ELECTRICALS PVT/ LTD. Vidhyut Controls (India) Pvt. Ltd. KMG ATOZ SYSTEMS UNILEC ENGINEERS PVT. LTD. AVAIODS TECHNOVATORS LTD. Adroit Control Engineers Pvt.Ltd. JACKSON ENGINNEERS MILESTONE SWITCHGEARS PVT. LTD.
ES51	MCB	MDS SWITCHGEAR LTD INDO ASIAN SCHNEIDER ELECTRIC INDIA PVT. LTD. S&S POWER SWITCHGEAR LTD, BHARAT BIJLEE LTD. CROMPTON GREAVES GE-POWER KIRLOSKAR ELECTRIC CO LTD. LAXMI HYDRAULICS PVT. LTD MARATHON NGEF RAJINDRA ELECT INDUSTRIES SIEMENS
ES55	MODULAR SWITCH BOARD	ANCHOR KENWOOD ELECTRICAL ELEXPRO ELECTRICALS PVT/ LTD. HAVELLS INDIA LIMITED
ES59	RECEPTACLES - DECORATIVE	ANCHOR KENWOOD ELECTRICAL



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 29 OF 30

		ELEXPLO ELECTRICALS PVT/ LTD.
		BAJAJ ELECTRICALS
		AJMERA INDUSTRIES & ENGG. WORKS C&S ELECTRIC LTD.
		RSI
		SPEED-O-CONTROL
		SUSHIL ENGG CORP.
ES61	SWITCH BOX	ANCHOR KENWOOD ELECTRICAL ELEXPLO ELECTRICALS PVT/ LTD. BAJAJ ELECTRICALS AJMERA INDUSTRIES & ENGG. WORKS
ES62	TERMINAL BLOCKS	WAGO-CONTROLS CONNECT WELL ELMEX CONTROLS PVT. LTD. ESSEN DEINKI TECHNOPLAST M/s PHOENIX MECANO LTD., ESSEN DEINKI
ES64	TIMERS - ELECTRONIC	ESSEN DEINKI
ES67	RECEPTACLE (FLAME PROOF)	BALIGA ELECTRICALS SUDHIR SWITCHGEAR FCG FLAME PROOF CONTROL GEAR
ES68	RECEPTACLE (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS CROMPTON GREAVES CYCLO ELECTRIC DEVICE & SERV.CO. BCH BEST & CROMPTON
ES69	EMERGENCY LIGHTING UNIT (FIXED & PORTABLE TYPE)- NON FLAME PROOF	BAJAJ ELECTRICALS PROLITE ENGINEERS PRIVATE LIMITED,
ES70	EMERGENCY LIGHTING UNIT (FIXED & PORTABLE TYPE)- FLAME PROOF	
ES71	24V SUPPLY MODULE WITH COMPLETE ACCESSORIES & HAND LAMP UNIT	POWER PACK ENTERPRISES INDCOIL Ames Impex Electricals Pvt. Ltd



DOCUMENT TITLE
**TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM**

SPECIFICATION NO. PE-TS-412-558-E001

VOLUME II-B

SECTION C

REVISION 01

DATE: 1.06.2015

SHEET 30 OF 30

ES72	ENERGY METER (ANALOG)	BHEL (EDN)	
		SIMCO ENGG. LTD	
		RISHABH INST.PVT LTD	
		AUTOMATIC ELECTRIC LTD.	
		CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	
ES73	ENERGY METER (DIGITAL)	CONZERVE SYSTEMS PVT. LTD.(SCHNEIDER)	
ES74	AMMETER	AUTOMATIC ELECTRIC LTD.	
		RISHABH INST.PVT LTD	
ES75	VOLTMETER	AUTOMATIC ELECTRIC LTD.	
		RISHABH INST.PVT LTD	
ES80	PVC WIRES	BIS APPROVED MAKE	
ES81	PEDESTAL FAN & CEILING FAN	REPUTED MAKE	Vendor to furnish Make of item along with the offer which shall be subject to BHEL/TANGEDCO approval during contract stage without any commercial implication to BHEL.
ES82	EXIT SIGN (FLAME PROOF)	REPUTED MAKE	
ES83	EXIT SIGN (NON FLAME PROOF)	REPUTED MAKE	
ES84	LADDER	REPUTED MAKE	
ES85	HUME PIPE	REPUTED MAKE	
ES86	PHOTOELECTRIC SWITCH	REPUTED MAKE	
ES87	DICHORIC SPOT LIGHTING FIXTURE	REPUTED MAKE	
	MINI TRUCK MOUNTED HYDRALIC LIFT	REPUTED MAKE	
	MARINE TYPE LAMP WITH LUMINAIRE	REPUTED MAKE	

CHAPTER-19

ILLUMINATION SYSTEM

1.00.00 SCOPE OF WORK

The scope of work shall include complete supply, installation, testing, commissioning and putting into successful commercial operation of the lighting system for the entire plant covering all indoor & outdoor areas including street, area, periphery and yard lighting and offsite buildings like ICHS Stage I, Sea water intake plant at NCTPP Stage II etc.

The equipment and materials within the scope of supply shall include but not limited to:

- a) Lighting transformer.
- b) Lighting fixtures with lamps and accessories/LED type fixtures.
- c) Lighting panels/boards: Main lighting distribution boards, emergency lighting distribution boards, emergency DC lighting panels, lighting panels, street lighting panels etc. All panels shall be provided with Energy Saving System.
- d) Street lighting poles, flood lighting towers and high masts.
- e) Receptacles, switches, switchboards, portable emergency lighting unit, maintenance equipment etc.
- f) Cables, wires, splicing/termination kits/connection accessories.
- g) Conduit and accessories, junction and pull boxes, terminal blocks.
- h) Grounding materials and connections.
- i) All fittings, supports, brackets, anchors, clamps and connections.
- j) Steel for field fabrication of supports and brackets

Carrying out of detail engineering including detail design calculations, preparation of lighting layouts showing location of fixtures, cable wires and conduit, preparation of cable schedule, and other related drawings as detailed in subsequent clauses and also consider the Energy Saving System.

Furnishing of all labour, skilled and unskilled, supervisory personnel, erection tools and tackles, testing equipments, implements, supplies, consumables & hardware, and transportation for timely and efficient execution of the contract work.



Preparation of **AS-BUILT** drawings showing field modifications (if any).

2.00.00 CODES AND STANDARDS

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

2.02.00 Equipment/components conforming to the latest editions of Standards of the International Standard Institutions, Institution of Electrical & Electronic Engineers, USA (IEEE), National Elect. Manufactures Association, USA (NEMA) or International Electro-Technical Commission (IEC) will also be acceptable provided these are either equivalent or more stringent.

IS-1913	IS-1977	IS-10322	IS-8623	IS-6064
IS-8828	IEC-598	IS-9224	IS-2959	IS-1248
IS-2705	IS-4160	IS-2713	IS-800	IS-2026
IS-2099	IS-694	IS-1554	IS-9537	IS-5133

3.00.00 DESIGN CRITERIA

3.01.00 The lighting layout shall be designed to provide uniform illumination with minimum glare. The layout design shall meet all the statutory requirements, etc.

3.02.00 The system provides lighting and electric power supply to all plant areas covering both BTG, BOP, Outdoor areas (also including lighting of all main streets, approach roads to various buildings) and Offsite buildings and areas. In addition, it also provides lighting to selected areas during plant emergency conditions.

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

3.04.00 The circuit loading on each circuit shall be restricted to 80% of the MCB rating.

3.05.00 All A.C. Normal and Emergency A.C. lighting shall be provided with Energy Saving System



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

i) Normal A.C. Lighting

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

ii) Emergency A.C. Lighting

- a) On failure of normal A.C. Supply, emergency A.C. lighting will be provided in service building, areas of the powerhouse, boiler area, boiler galleries etc for general visibility, safe movements and operation of important auxiliaries.
- b) The emergency LDBs (ELDB) are similar to the MLDB except that lighting transformers in this case are fed from station A.C. Emergency bus having D.G. System backup. Thus power for A.C. emergency lighting is 415V-3ph-4W, 50HZ, effectively grounded.
- c) At least 20% of the fixtures shall be fed from AC emergency source.

iii) Emergency D.C. Lighting

- a) This will be provided by emergency A.C. /D.C. lighting fixtures located strategically in critical operating areas and emergency exits. About 10% of the fixtures that are fed from normal AC supply and upon its failure, be fed from 220 V DC supply. Emergency DC lighting will be catered by DC emergency lighting distribution (DCELDB) boards. These DCELDBs will feed the DC emergency lighting fixtures directly and through a numbers of DC emergency lighting panels (DCELP) located suitably in respective areas.



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

1. Emergency Main Lighting Distribution Board (EMLDB)
2. 220V DC distribution boards (DCDB)

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

iv) Remote Emergency Lighting

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

v) Street/Area Lighting

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

vi) Receptacles

To cater to welding and other low voltage power requirement of the plant 63A TPN welding socket fed from MCC/A.C. distribution board of respective area shall be provided. For other services 15A, 3pin socket shall be provided.

4.00.00 SYSTEM PARTICULARS

System particulars are as follows:

		415V AC System Incoming	415V AC System Outgoing	240V AC System	220VDC System
4.01.00	Nominal Voltage	415V	415 V	240V	220V



4.02.00	Highest system Voltage	457V	457 V	264V	242 V
4.03.00	Number of phases	Three (3)	Three (3)	Single	NA
4.04.00	Frequency	50 Hertz	50 Hertz	50 Hertz	NA
4.05.00	Voltage variation	±10%	±10%	±10%	-15% to +10%
4.06.00	Frequency variation	±5%	±5%	±5%	NA
4.07.00	Combined voltage & frequency variation	10%	10%	10%	NA
4.08.00	Neutral earthing	Effectively	Solidly grounded	Solidly grounded	Un grounded grounded
4.09.00	Fault level	50 kA	9 kA	9 kA	25 kA

5.00.00 METHOD OF CALCULATION

- a) Standard Lumen method shall be adopted for interior & exterior lighting in order to determine the number of lighting fixtures for obtaining the desired average level of illumination.
- b) The coefficient of utilization shall be considered to take care of Lumen loss due to:
1. Effect of room dimensions
 2. Absorption of light in luminaries
 3. Absorption of light at various room surfaces in ceiling, wall etc.
 4. Floor cavity, ceiling cavity
 5. Mounting height
- c) Additionally, a maintenance factor shall also be considered to account for the fall of illumination due to ageing, pollution like dust deposit etc. Maintenance factors to be considered for various areas shall be as follows :



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

d) Utilization Factor

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

e) Lux levels and types of fittings to be considered for various areas are given in Annexure-1.

f) Voltage drop at the fixture from the LDB bus shall not exceed 3%.

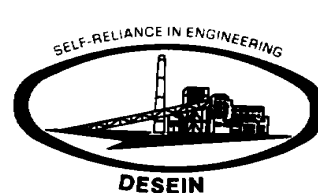
g) Circuit loading of each lighting panel shall be done in such a way that almost balanced loading in all the phases i.e. R, Y and B is achieved.

h) At least two phases shall be used for illumination of a particular area. All control rooms & power house area like operating floor, Switchgear room, boiler area etc.

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

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

k) The suspension height for suspended fixtures shall not exceed 1 m.



6.00.00 GENERAL REQUIREMENTS

- 6.00.01 Equipment and material shall comply with description, rating, type and size as detailed in this Specification. All equipment and accessories shall be designed for continuous operation under site conditions without exceeding permissible temperature rise as stipulated in relevant standards.
- 6.00.02 Equipment and materials furnished shall be complete and operative in all details.
- 6.00.03 All accessories, control devices, internal wiring, fittings, supports, hangers, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.
- 6.00.04 All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable.
- 6.00.05 All equipment and accessories shall have proper enclosure to suit the site conditions. Hazardous areas shall have flame-proof enclosure

6.01.00 Lighting Transformers

- a) Lighting transformers shall be dry type, indoor type dust and vermin proof having single phase, 415 V/433 V, off load tap-changer with $\pm 2 \times 2.5\%$ on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral bushing exclusively used for grounding.) Rating of each lighting transformer shall be selected to cater to the maximum connected lighting and receptacle load on that transformer. The casing of the transformer shall be grounded at least at two (2) points. Rating of each transformer shall be decided to limit the fault level within 9kA.
- b) Lighting Transformer shall be 2 x 100% for TG Building , Service building , Water treatment plant, ESP and Fuel oil pump house
- c) If necessary, apart from the main lighting transformers, separate small additional lighting transformers may be used at distance lighting points.

6.02.00 Lighting Fixtures

- a) Lighting fixtures shall be designed for minimum glare. The surface finish shall be smooth, unobtrusive and scratch resistant.
- b) Reflector shall be of sheet steel or aluminium, minimum 20 SWG thick, securely fixed by fastening device of captive type.
- c) Fixture shall be suitable for 20 mm conduit entry and 16 SWG G.I. earth-wire connections. Fixture shall also be suitable for case coupling entry wherever required.
- d) High bay fixtures shall have provision for vibration damper to ensure rated lamp life.
- e) Fixture shall be furnished complete with lamps and integrally/non-integrally or separately mounted control gear & accessories or applicable for different types of fixtures. These shall include holders, ballast, capacitor, starter, igniters (separate type) etc.
- f) Fixtures shall be fully wired up to respective terminal blocks, suitable for loop in and loop one connection of PVC wires of following sizes:-
 1. Lighting fixture : 2.5 Sq.mm Copper
 2. Flood Light fixture : 2x2.5 Sq.mm Copper
- g) The distribution of lighting fixtures/receptacles shall be such that the loading on each phase of the LDB is approx. equal.
- h) In indoor areas fixtures with suitable mounting accessories shall be used and shall not be directly mounted on walls.
- i) Search lights having adequate coverage shall be provided in watch towers

6.03.00**Lamps**

- a) General lighting service (GLS) lamps shall be with clear glass and screwed caps.
- b) All fluorescent lamp shall be bi-pin rotary type and cool daylight.
- c) Lamps shall be suitable for use in position and capable of withstanding small vibrations. Restrictions and special features, if any, shall be clearly indicated in the bid.
- d) CFL and T5 fluorescent tube with electronic ballast or tri phosphorous tube.



- e) Latest energy saving LED type lighting fixture/ lamps
- f) Light Emitting Plasma (LEP)

6.04.00 Ballast

- a) Ballasts shall be heavy duty, low loss, and polyester-filled type with copper winding.
- b) Ballasts shall be free from hum. Ballasts which produce humming sound shall be replaced without any implication.
- c) In multi-lamp fixture, each lamp shall be provided with individual ballast.
- d) Ballast windings shall have maximum operating temperature of 120 Deg.C without rated temperature rise marking.
- e) Ballast for Control Room Area shall be heavy duty, low loss, high-grade silicon steel stampings; vacuum impregnated polyester resin filled with copper winding. Ballast for other area shall be electronic type, flicker free pre heat lamp start type having power consumption less than 3-watts per ballast, power factor less than 0.98 and THD less than 10%. Ballast shall operate at operating frequency of more than 40 kHz. Power consumption of ballast for 36W Fluorescent Tube shall be less than 9.5W.

6.05.00 Lighting Panel/Distribution Boards

- a) Lighting Distribution Boards/panels shall be Fibre reinforced plastic (FRP) type, suitable for either wall/column mounting on brackets or floor mounting on channel sills.
- b) Indoor Lighting Distribution Boards & Lighting Panels shall be dust and vermin-proof, IP-54. Outdoor panels shall be weather-proof with canopy, IPW-55 or better. The cubicle housing transformer shall be minimum IP-42.
- c) Lighting Distribution Boards and Lighting Panels shall be so constructed as to permit free access to the terminal connections and easy replacement of parts. Front access doors shall have padlocking arrangements.



- d) Lighting Distribution Boards shall have provision of cable entry from bottom and, panels shall have provision of cable entry from top and bottom, as required, with removable gland plates. Necessary double compression type brass cable glands, tinned copper/Aluminium cable lugs are to be furnished.
- e) Two ground pads with M10 G.I. bolts and nuts shall be provided on each Lighting Distribution Board and Lighting Panel for connection to 25 x 3 mm G.I. flat.
- f) Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed on front cover and a directory plate fixed on inside of the front cover. This directory Plate shall contain details of the Lighting Panels being fed from the Distribution Board including their designation, location, loading etc. Each Lighting Panel shall be complete with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of each circuit. The plates shall be of anodized aluminium with inscriptions indelibly etched on it.
- g) Bus bar shall be electrolytic grade hard drawn aluminium, colour coded for easy identification and designed for a maximum temperature of 85°C. Minimum size shall be 25 x 6 mm.
- h) Board / Panel shall be fitted with phase barriers such that it is not readily possible for personnel to touch the phase busbars. Insulation barriers shall preferably be fitted around the circuit breakers such that only the surface and the toggle of the circuit breaker are available on the front.
- i) Incoming and outgoing circuits shall be terminated in suitable terminal blocks.
- j) In lighting and receptacle panel 3-phase and 1-phase MCB should not be mixed.

6.06.00**Receptacles**

- a) Receptacles shall be heavy duty, complete with individual plug and switch.
- 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 G.I. 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.
- d) Receptacles shall be of following types:
 - 1. Type RA-5A, 240V, 2 pole, 3 pin type with third pin grounded, suitable for flush mounting in MCC Room, office areas, control rooms, store rooms, cabins etc. The switch shall be of piano-key type, also flush mounted and decorative non-industrial type.

In service building and administration building all the occupants shall be provided with 4 nos. of 5A, switches and telephone point in the modular furniture.

- 2. Type RB-15A, 240V, 2 pole, 3 pin Industrial type with third pin grounded, metal clad with gasket having 19mm conduit entry and a metallic screwed cover tied to it with a metallic chain and suitable for installation in clean/dusty areas. The receptacles located in switchgear rooms, MCC rooms and control room shall have IP-42 degree of protection and those located in other dusty areas shall have IP-62 degree of protection. These receptacles shall be located at an interval of 50M along length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper. Minimum one (1) no shall be provided in all equipment floor, feeder floor, boiler drum level, TPs Crusher House, Sub-station, Control Room, Pump House, Transformer Room, various levels of service building, RO plant, and at suitable location in all other areas as required. In fuel oil area receptacles will be of flameproof type.
- 3. Type RC-63A, 415V, 3 phase, 4 pin Industrial type interlocked plug and switch with earthing contact. Other requirements shall be same as Type RB. Interlocking shall be so selected that the switch can be put to 'ON' position only when all the four (4) pins of the plug are housed with complete alignment. In 'OFF' position of the switch the socket outlet shall be completely dead and outgoing terminals isolated. Welding receptacles shall be connected with each other in loop-in loop-out connection to the extent of 4 Nos., located at an interval of 50 M. along the length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper and minimum one (1) no. shall be provided in all equipment floor, T.Ps, crusher house (2 nos. on each floor of crusher house) , wagon tippler, stacker



reclaimer machines, pump houses, substation buildings & Cable spreader room, transformer room, boiler platform, switchgear/ MCC rooms, Transformer yard, cooling tower, etc. Separate distribution boards with isolating transformers shall be used to feed these welding receptacles. At least one (1) no. shall also be provided in each offsite building, which will be fed from 415V MCC. In hazardous areas these receptacle shall be located in MCC rooms.

4. 400A, 415 V, 3 phase, 4 wire receptacles for Transformer filtration unit shall also be provided with MCCB and earthing arrangement.

6.07.00 Fans & Regulators

- a) Ceiling fans shall be provided in non-air conditioned cabins and in various areas inside the administration building canteen, security building etc. The number of such fans shall be decided based on room size.
- b) The fan shall have three well balanced blades and shall be reasonably free from noise. Pedestal fans shall also be provided as per Owner's requirement.
- c) Fan motor shall be totally enclosed type with copper winding & class E insulation.
- d) Regulator shall have minimum five steps. Electronic regulator with smooth control is preferred.
- e) Fans and accessories shall be provided for the Local control rooms in addition to the Air Conditioning

6.08.00 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.

6.09.00 Maintenance Equipment

- a) The Contractor shall supply one (1) no. mini truck mounted adjustable hydraulic lift for the maintenance of street lights.
- b) For the maintenance of lighting fixtures within the high bay areas, the contractor shall also supply four (4) nos. free standing adjustable aluminium ladder, adjustable from 5m. To 10m.
- c) Three (3) nos. portable aluminium ladders of various sizes suitable for main control room, switchyard control room, etc

6.10.00 Special Requirement

- a) All outdoor illumination fixtures, unless it is fed from photo cell time switch controlled lighting panel, has to be provided with outdoor type local switches.
- b) In all the air filtration units and air handling units, one marine type lamp (of 100 Watt approx.) shall be supplied the wiring and fixing of the same has to be done by the contractor.

6.11.00 Conduits and Accessories

- a) Conduits shall be rigid steel, hot-dip galvanized, furnished in standard length of 3 metres, threaded at both ends.
- b) Conduits upto and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
- c) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushings at both ends.



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

6.12.00 Junction Box

- a) Junction boxes shall be of 16 SWG sheet steel hot-dip galvanized, dust and damp proof, generally conforming to IP-66.
- b) Junction boxes shall be complete with gasket inspection cover, conduit knock out/threaded hub and terminal blocks.
- c) Junction boxes for outdoor use shall be FRP weatherproof IPW-66 and those for hazardous location shall be flame-proof type.
- d) 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

6.13.00 Lighting Cables & Wires

6.13.01 All wiring from lighting panels to fixtures and receptacles shall be carried out by PVC wires in G.I. Conduits.

6.13.02 Heavy duty AYWY FRLS cables will be used only for connections:

1. From main lighting distribution boards to area lighting panels
2. From street/area lighting panel to street light poles/towers.
3. From 415V MCCs to receptacles of 63A and above.

6.13.03 Lighting Cable shall be heavy duty, 1100 Volt grade, multi-core stranded aluminium conductor, PVC insulated, extruded PVC inner sheath, single round G.I. wire armoured and overall PVC sheathed conforming to IS 1554.

6.13.04 Lighting wires shall be 1100 Volt grade, PVC insulated, stranded conductor, single core cable conforming to IS 694, colour coded as below :

RED for	R-Phase	BLACK for	Neutral
YELLOW for	Y-Phase	WHITE for	+ 'Ve D.C.



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

6.13.05 Wire size shall be as follows:

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

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

6.14.00 Terminals

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

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

7.00.00 ENERGY SAVING SYSTEM

7.01.00 Panels

The energy saving system panel shall consists of loss less reactance coils with voltage tapping, contactor to select the tap, Micro-processor based TIMER along with real time clock for activating the contactor at a pre-set time. The unit shall be programmable so that at a pre-set time contactor on the lower voltage tap can be selected and reduced voltage can be applied across the circuit. It shall also be possible to modify the setting at site, if required. The capacity of panels shall be 25/30 kVA or more as required. This system shall be incorporated in normal AC panels and Emergency AC panels.

7.02.00 Lamps

Latest energy saving LED type lighting fixture/ lamps and/or CFL and T5 fluorescent tubes with electronic ballast or tri-phosphorous tubes or Light Emitting Plasma.

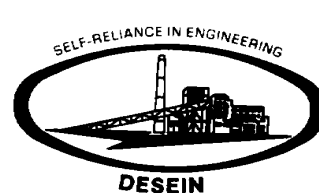
7.03.00 Board/Panel Equipment



- a) Each board shall consist of 2 x 100% dry type transformer housed in the different cubicles voltmeter with selector switch, C.T. operated ammeter and incoming triple pole switch. Outgoing feeder from the Lighting Distribution Board shall have MCCB.
- b) Each lighting panel shall have an incoming triple pole switch with neutral link and a number of outgoing miniature circuit breakers (MCB).
- c) Board/Panel access door shall be interlocked with incoming switch unit such that the door can be opened only when the switch is in OFF position. Means shall be provided to defeat this interlock.
- d) Contactors shall be air-break electromagnetic type. Push buttons shall be push to actuate type.
- e) MCB shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.
- f) Time switch in street lighting panels shall be photocell type with automatic voltage stabilizer and necessary electronic unit with provision for sensitivity adjustment depending on external light intensity. When the exterior illumination level shall fall below a preset value for a considerable period of time (adjustable 30 sec. to 180 secs.) the electronic unit shall generate signal for the output relay to pick-up and potential-free contact of the same shall be used for control of contactor for lighting system. Sustained normal illumination level being restored (adjustable 30 sec. to 180 sec.) the lights shall switch off.
- g) Voltmeter / Ammeter shall be of accuracy class 2.0 or better as per IS: 1248 Voltmeter / Ammeter selector switch shall be of reputed make.
- h) Each lighting panel shall be provided with adequate number of outgoing LCBs/MCBs for controlling fixtures. 5A, 3Pin sockets shall be fed from the lighting panel through separate circuits.

8.00.00**LIGHTING POLES/TOWERS**

Suitable number of Flood Lighting Towers / Lighting Masts with adequate metal halide Flood Light or LEP (Light Emitting Plasma) will be provided for crushed coal



pile, and other necessary outdoor areas.

The fixtures shall not be fixed to gantry structures in outdoor areas.

8.01.00 Street Light Poles

a) Street light poles shall be swaged and welded steel pole, complete with fixing brackets, weather-proof junction box and all other accessories.

b) The pole shall be coated with bituminous preservative paint on inside as well as embedded outside surface. Exposed surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in synthetic medium).

8.02.00 Flood Light Tower

a) Flood light tower shall be a lattice structure with maintenance platform and approach ladder. All structural members and hardware shall be hot-dip galvanized.

b) Structures shall be designed for an additional load of 1500kg for maintenance crew. Deflection under maximum wind pressure shall not exceed 1 in 360. Structural design shall be as per IS-800 and subject to Owner's approval.

8.03.00 Lighting High Masts

a) Applicable standards

- | | | |
|---------------------------|---|--|
| 1. IS-875 (Part-III) 1987 | - | Code and practice for design loads for Structures. |
| 2. BSEN 10025/DIN 17100 | - | Grade of M.S. Plates. |
| 3. BS-5135/AWS | - | Welding |
| 4. BS.ISO 1461 | - | Galvanizing |
| a) TR. No. 7200 of ILE | - | UK Specification for Mast and foundation. |

b) Structure

- Lighting High Mast shall be of continuously tapered polygonal cross section, at least 20 sided, hot dip galvanized and presenting a good and pleasing



appearance and shall be based on proven In-Tension design confirming to the standards referred to above, to give an assured performance, and reliable service. The structure shall be suitable for wind loading as per IS-875 Part-III, 1987. The masts dimensions shall be as per standards.

2. The Mast shall be of 30M height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame, Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaries, suitable aviation warning light, lightning along with necessary power cables within the mast. The mast shall be delivered only in three sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast.

9.00.00 CHIMNEY LIGHTING

9.01.00 Electrical System

415V, normal and emergency AC power supply for chimney shall be derived from main plant power supply system. Emergency supply shall feed 20% of platform lighting, 50% of staircase lighting, aviation obstruction lighting and elevator load. All other loads shall be connected on normal power supply.

Ambient temperature for design of all equipment shall be considered as 55°C, which is likely to be encountered inside the chimney.

The distribution boards of chimney shall comprise switch fuse units of appropriate ratings. Emergency board shall have two incomers, one from emergency supply and other from normal AC distribution board itself. Auto changeover scheme shall be provided in emergency board to enable changeover to healthy source on failure of any source.

Dry type isolating transformer of Dyn11 connection shall be provided in emergency board to obtain neutral lead, in case 3 – phase 3- wire, emergency supply is derived from main plant.

9.02.00 Lighting system

Various platforms shall be illuminated by 70/150W metal halide well glass lighting fixtures. Staircase lighting shall be with 70W metal halide well glass fixtures. Average



illuminations level of 150 lux shall be maintained on equipment and 50 lux on platforms/staircases. Lighting system shall be controlled through MCB provided in lighting panel. Six numbers of metal halide flood lights focused towards chimney shall be provided on each external platform for aesthetics view during night times.

Lighting and power panel each shall be located at grade level and at other in between levels as required. All distribution boards, aviation lighting controls, etc. shall be located at grade level only. At each platform, 1 No. 63A, 415V welding receptacle and 1 No. 15A, 240V receptacle shall be provided and shall be fed from power panel. Wiring installation for lighting fixture shall be of PVC insulated copper/aluminum wires through galvanized steel conduits. a

Aviations obstruction lighting system shall conform to the requirements of the latest rules and regulations of the International Civil Aviation Organization (ICAO), National Airports Authority (NAA) and Directorate of Air Routes and Aerodromes (DARA) or any other statutory body and also to conform to IS: 4998. The obstruction lighting shall be done as per Appendix 6 figure 6.2 of ICAO i.e. Combination of Low intensity (Multi LED type- B) & Medium intensity (Multi LED type- B). The life of light fittings shall be 20 years maintenance free. Minimum Low intensity fittings 12 nos. (1/6, 1/2 & 5/6 level) & Medium intensity fittings 12 nos. (1/3, 2/3 & top level) and marking/painting shall be done as per ICAO. A minimum of six levels will be provided with aviation obstruction lights and there will be four light units per level. Each aviation warning light shall be of neon type having two lamps. Only one (1) lamp in a given fitting would be ON at a time and if the lamp fails, its failure would initiate an alarm and the next lamp in that particular fitting would be switched on automatically. Necessary control panel for control and annunciation shall be supplied. The control scheme of the control panel shall be to the approved of OWNER/Consultant.

One (1) photo controller along with suitable controller arrangement to be supplied by the contractor to switch ON and OFF the aviation warning light automatically based on the intensity of natural light during day/night.

The top light or lights shall be so arranged as to mark the point or edge of the obstruction marking surface. The lights shall be placed between 1.5 meter and 3 meter below the top. The number and arrangements of lights at each level or platform be such that the obstruction is indicated from every angle in azimuths.



Aviation obstruction lighting shall be complete with lights, photocell, controller, special cables, etc. and IP65 shall be followed for all panels.

The warning lights shall be adequately secured to the chimney against the wind forces. The low intensity shall be of fixed red colour, medium intensity shall be flashing red and high intensity shall be of flashing white. Temporary aviation lights with infrared bulbs shall be installed at each of the levels as instructed by OWNER as the construction work progresses and also above the top most point of the obstruction as construction progresses. These lights need to be installed only after the level of obstruction is greater than 45 meter above grade level. The lights shall continue to exist till permanent arrangement to provide such lights are completed.

10.00.00 Portable Emergency Lighting Unit

The portable emergency lighting unit shall be complete with storage battery (rechargeable), inverter, automatic charger, twin 9W CFL lamp and test switch. Contractor shall furnish make, type and catalogue.

11.00.00 24V AC Maintenance Lighting System

11.01.00 Each 24V A.C. supply module for maintenance purposes (for hand lamps and for hand operated tools) shall have one(1) no. double wound dry types, 1-phase, 50HZ, 240/24V transformer with HRC fuse in primary and secondary side and necessary 240V and 24V terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module shall be fed from respective lighting panels.

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

12.00.00 Nameplate

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



13.00.00 Painting

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.

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

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

14.00.00 Samples

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

15.00.00 SPECIFIC REQUIREMENTS-SERVICES**15.01.00 Consumables and Hardware**

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

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

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



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

15.02.00 Erection Tools & Tackles

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

15.03.00 Street Lighting Poles

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

15.04.00 Flood Lighting Tower

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

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

15.05.00 Lighting High Masts (winch operated)

Erection of Lighting Masts together with all its accessories including civil foundation work, installing lighting fixture, wiring and cabling work are included within scope of contractor. Min. 30 Nos. shall be provided, locations shall be decided during detailed engineering.

15.06.00 Wiring

15.06.01 Wiring shall be generally carried out by PVC wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.

15.06.02 Wire shall not be pulled through more than two equivalent 90° bends in a single conduit run.



- 15.06.03 Wiring shall be spliced only at junction boxes with approved type connections or terminal strips. Maximum two wires can be connected to each way of the terminal block. Splicing of only one phase shall be done in a junction box.
- 15.06.04 For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.
- 15.06.05 For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/ junction box.
- 15.06.06 A.C. and D.C. circuits shall not be run in the same conduit and junction boxes. Circuits fed from different transformers shall be run through different conduits and Junction boxes.
- 15.06.07 Receptacle circuits shall be kept separate and distinct from lighting and fan circuits.
- 15.06.08 Separate neutral wire shall be provided for each circuit. Wiring throughout the installation shall be such that there is no break in the neutral wire in form of switch or fuse.
- 15.06.09 Wires of different phases shall run in separate conduits wires of lighting and power receptacles shall be run in separate conduits and on separate circuits.
- 15.07.00 Cabling**
- 15.07.01 In outdoor areas, main runs from lighting panels shall be by means of cables, directly buried in ground or laid in trenches for the underground portion and through conduit for the above ground portion.
- 15.07.02 Buried cables shall be laid and covered with sand/riddled earth, and protected from damage by bricks at sides and precast concrete slab at top. Buried cables shall have cable markers at 50M interval and projecting 150 mm above ground. At cable bends and joints markers shall be provided.
- 15.07.03 When buried cables cross road/railway track, additional protection to be provided in form of G.I. pipe.
- 15.08.00 Grounding**



- 15.08.01 All lighting panels, junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. Rules.
- 15.08.02 Ground connections shall be made from nearest available ground grid. All connections to ground grid shall be done by arc welding.
- 15.08.03 Panels/Boards shall be directly connected to ground grid by two nos.35 x 6 mm G.I. flats. (for panels/two nos. 50x6 mm G.I. flats (for distribution boards).
- 15.08.04 All junction boxes, receptacles, lighting fixtures etc. shall be grounded with 8 SWG G.I. wire.
- 15.08.05 Each street lighting Pole shall be grounded at two points by two nos. 50x6 mm G.I flat risers from two (2) nos. earthing spike 40 mm dia & 3m long directly driven into ground at a depth of 1m from ground level. The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 16 SWG GI wire. One 16 SWG G.I wire shall be taken upto the junction box from lighting fixtures and connected to grounding point.
- 15.08.06 Two (2) nos. earthing spike 3m long & 40 mm dia directly driven into ground at a depth of 1m from ground level shall be provided for each flood lighting tower.
- The sheet steel cubicle housing the power supply Isolator at base of flood lighting tower shall be connected at two (2) points from these earthing risers by 16 SWG G.I. wire – The flood lighting fixtures shall be grounded by one (1) 16 SWG G.I wire running through the lighting conduct upto the distribution box.
- Two (2) nos. separate spike of 3m long & 40 mm dia directly driven into ground at a depth of one (1) m from ground level shall be provided for connection of the lighting must on top of flood lighting tower through two (2) nos. 50x6 mm G. I. flat down conductor.
- 15.08.07 A continuous ground conductor of 12 SWG G.I. wire shall be run all along each conduit run and bonded to it every 600 mm by not less than two turns of the same size of wire. This conductor shall be connected to each panel ground bus.



All junction boxes, receptacles, fixtures etc. shall be connected to this 12 SWG ground conductor.

15.09.00 Foundation & Civil Works

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

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

15.10.00 Excavation and Back Filling

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

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

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

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

15.11.00 Steel Fabrication

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

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

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

15.12.00 Cleaning up of Work Site



15.12.01 The Contractor shall, from time to time, remove all rubbish resulting from execution of his work. No materials shall be stored or placed on passage or drive ways.

15.12.02 Upon completion of work, the Contractor shall remove all rubbish, tools, scaffoldings, temporary structures and surplus materials etc. to leave the premises clean and fit for use.

16.00.00 INSPECTION & TESTING

16.01.00 The Engineer shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.

16.02.00 The installation shall be then tested and commissioned in presence of the Engineer and put on trial run for stipulated contract period.

16.03.00 All rectification, repair or adjustment work found necessary during inspection, testing, commissioning and trial run shall be carried out by the Contractor without any extra cost.

17.00.00 LIST OF TESTS TO BE CONDUCTED

17.01.00 Shop Tests

17.01.01 All equipment shall be completely assembled, wired, adjusted and routine tested as per relevant Indian Standards at manufacturer's works and in the presence of Owner's representatives.

17.01.02 Tests on Control gear / Lighting Distribution Boards / Lighting Panels shall include:

- a) Wiring continuity tests.
- b) High voltage and insulation tests.
- c) Operational tests.

17.01.03 The tests on lighting fixtures shall include:

- a) All routine tests as per relevant I.S.



- b) Rain-proof test for outdoor type luminaries and respective control gearbox as type test.
- c) Temperature rise test on ballast/choke as type test. Dust proof test as type test.

17.02.00 Site Tests

- 17.02.01 Contractor shall thoroughly test and meggar all cables, wires and equipment to prove the same are free from ground and short circuit.
- 17.02.02 If any ground or short circuit is found, the fault shall be rectified or the cable and/or equipment replaced.
- 17.02.03 All equipment shall be demonstrated to operate in accordance with the requirements of this specification.
- 17.02.04 Illumination in different areas are as per designed lux level generally confirming with Indian Standards. The lux level shall be verified by photometer at site location.

18.00.00 DRAWINGS, DATA & MANUALS**18.01.00 To be submitted with the Bid**

- 18.01.01 Make, type and catalogue number of lighting fixtures, lamps and accessories along with technical leaflets, data sheets, polar curves etc.
- 18.01.02 Typical outline drawings, showing constructional features, cable / conduit entry, fixing arrangements etc. of:
 - a) General Arrangement Drawing of Lighting Transformer.
 - b) Lighting Distribution Board & Panel/receptacles/junction boxes.
 - c) Street light pole.
 - d) Flood light towers.



- 18.01.03 Technical leaflets and data sheet on each piece of equipment/device such as M.C.B., switch fuse, receptacle etc.
- 18.01.04 Technical Particulars Sheets.
- 18.01.05 Type test certificates on lighting fixtures and lighting panels, transformer, ballast, power cables.
- 18.02.00 To be submitted for Approval and Distribution**
- 18.02.01 Detail dimensional drawing showing constructional features, cable/ conduit entry, grounding, fixing arrangement etc. of :
- a) Lighting Transformer.
 - b) Lighting panels & distribution boards.
 - c) Receptacles & Junction boxes.
 - d) Street light poles & towers.
 - e) Lighting fixture complete with lamps and accessories.
 - f) Non-integral/separate type control gear box for lighting fixtures, as applicable.
- 18.02.02 Data sheets for lighting fixture, lamps, accessories with light distribution curves, coefficient of utilization charts etc. Type and routine test certificates of transformer, cables, lighting fixture, lighting panels, ballast, etc.
- 18.02.03 Control schematic and wiring diagram of 415V AC/220V DC lighting panel with automatic changeover from AC to DC and vice-versa, 415V normal AC Street/area lighting panel with automatic ON/OFF feature.
- 18.02.04 Technical Particulars Sheets and Calculations
- 18.02.05 Technical leaflets and data sheet on each piece of equipment/ device such as MCB, switch, fuse, receptacle etc. Type and routine test certificates of transformer and cables.
- 18.02.06 Lighting layouts showing the disposition of fixtures, lighting panels/boards, circuit distributions, conduit & wire rolling.



- 18.02.07 Key Single Line Diagram for lighting distribution, board-wise single line diagram with feeder loading, cable schedule and interconnection chart, design calculation for lighting.
- 18.02.08 AS-BUILT lighting layout and erection drawings, properly incorporating the changes/alterations/field modifications, if any, as carried out at field alongwith circuit distribution schemes of all lighting panels, conduit and cable routing and as acceptable to the Owner.
- 18.02.09 Any other relevant drawings, data and manuals necessary for satisfactory installation, operation and maintenance.
- 18.02.10 The Contractor may note that the drawings, data and manuals listed are minimum requirement only. The Contractor shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.



ANNEXURE – 3

ILLUMINATION LEVELS

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

S.No.	Area/Structure	Average Illumination in Lux	Type of Luminaire	Type of lamp
1.0	Turbine Generator Building			
1.1	General Auxiliary Equipment Areas	200	Industrial Well Glass	70W/150W metal halide /125W metal halide Lamp
1.2	Cable Spreader Room	100	Industrial type fluorescent lamp with vitreous enamel reflectors	T5 fluorescent tube with electronic ballast or tri phosphorous tube.
1.3	All Switchgear Room Area	200	Industrial type fluorescent lamp with vitreous enamel reflectors	LED Lamp Fixtures
1.4	TG Building Operating Floor	200	Industrial integral high bay	250W/400W metal halide Lamp
1.5	Main Control Rooms, Computer Rooms	400	Decorative recessed mounted with mirror optic (Dark Lighter)	LED Lamp Fixtures
1.6	Battery Rooms	200	Industrial Corrosion proof luminaire	2 x 40W/36W FTL
1.7	Unloading and Maintenance bay	250	Industrial integral high bay	250 W/400 W HPMV Lamp
1.8	Service Building	300	Industrial type fluorescent lamp with vitreous enamel reflectors/ Industrial integral high bay	2 x 36W FTL/250W metal halide Lamp
2.0	Boiler Area			



2.1	Boiler area and platforms	100	Dust proof/dust tight integral well glass luminaire.	70W metal halide / 125 W metal halide lamp
2.2	Coal Bunker and Mill bay area, feeder floor, tripler floor	150	Dust proof/dust tight integral well glass luminaire	1 x80 W/125 W metal halide Lamp
2.3	ESP areas and Platforms	120	Dust proof/dust tight integral well glass luminaire	70 W metal halide /125 W metal halide Lamp
2.4	ESP Control room	400	Decorative recessed mounted with mirror optic for clean room areas	LED Lamp Fixtures
3.0	Transformer Yard			
3.1	General	50	General purpose flood light	250W/ 400 W metal halide Lamp or LEP
3.2	Near equipment	70	Dust proof/dust light integral well glass	1 x 70 W metal halide Lamp
4.0	Various Off-site building			
4.1	Equipment / Switchgear Room	200	Industrial type fluorescent lamp with vitreous enamel reflectors upto mounting height of 3.5M or industrial medium bay integral luminaire for mounting heights between 3.5 to 8.0 M	LED Lamp Fixtures.
4.2	Pump House	200	Industrial Well glass	70 W metal halide /125 W metal halide Lamp
5.0	Cooling Water Pump House area.			
5.1	Cooling tower area.	50	Industrial well glass.	70W metal halide /125W metal



				halide lamp.
5.2	CWPH	200	Industrial medium bay integral luminaire for mounting heights between 3.5 to 8M.	70/150W metal halide or 150/250W metal halide lamp.
6.0	DM Plant area.			
6.1	Control room.	300	Decorative recessed mounted with mirror optic for clean room areas.	LED Lamp Fixtures.
6.2	Pump House.	200	Industrial well glass.	70W metal halide /125W metal halide lamp.
7.0	Chemical House.			
7.1	Control room.	300	Decorative recessed mounted with mirror optic for clean room areas.	LED Lamp Fixtures.
7.2	Equipment rooms and Pump rooms.	150	Industrial Corrosion proof luminaire.	2x40W /36 FTL.
8.0	Ash Handling System.			
8.1	AH Pump Houses.	200	Industrial well glass.	70W metal halide /125W metal halide lamp.
8.2	Control room.	300	Decorative recessed mounted with mirror optic for clean room areas.	LED Lamp Fixtures
9.0	Coal Handling Plant			
9.1	Conveyors open/enclosed	70/100	Dust proof / dust tight integral well glass luminaire	1 x 80 W / 125 W metal halide Lamp
9.2	Crusher house, Junction towers	100	Dust proof / dust tight integral well glass luminaire	1 x 80 W/125 W metal halide Lamp
9.3	Coal Stock yard	50	Non-integral flood light	250 W/400 W metal halide Lamp



9.4	SWGR Room	200	Industrial type fluorescent lamp with vitreous enamel reflectors	LED Lamp Fixtures
9.5	Control Room	300	Decorative recessed mounted with mirror optic for clean room areas	LED Lamp Fixtures
9.6	Underground conveyer	100	Flame proof and dust proof well glass	1 x 80 W/125 W metal halide Lamp.
9.7	Pipe Conveyer (ECHS)	70	Dust proof / dust tight integral well glass luminaire	1 x 80 W metal halide Lamp
10.0	Fuel Oil Tank Area			
10.1	Tank Area	50	Non-integral flood light	LEP or 250 W/400 W metal halide Lamp.
10.2	Fuel oil area pump house	100	Flame proof well glass	1 x 80 W/125 W metal halide Lamp.
11.0	Road & Yard Lighting			
11.1	Main Roads	25	Integral type street lighting luminaire with aluminium reflector	LED Lamp Fixtures.
11.2	Secondary roads	15	-do-	LED Lamp Fixtures
11.3	Perimeter (compound lighting)	15	-do-	LED Lamp Fixtures
11.4	Yard Lighting	20	Flood light	LEP or 250 W metal halide
12.0	Diesel Generator			
12.1	DG Room	150	Industrial trough type	1 x 80 W/125 W metal halide Lamp
12.2	Compressor Room	150	-do-	-do-
13.0	Stores			
13.1	Cement stores	100	Industrial trough type fluorescent dust proof	1 x 80 W/125 W metal halide Lamp



13.2	Chemical stores	150	Corrosion proof	
13.3	Permanent stores	150	Industrial trough type/ metal halide	1 x 80 W/125 W HPMV Lamp
14.0	Hydrogen Plant			
14.1	Hydrogen Plant Building	150	Explosion proof metal halide / Fluorescent fittings suitable for class-I and Division –II	1 x 80 W/125 W metal halide Lamp
15.0	Laboratory			
15.1	Electrical Laboratory	250	Mirror optics fluorescent	LED Lamp Fixtures
15.2	Chemical laboratory	300	Corrosion resistant, fluorescent	CFL
16.0	Cable Galleries			
16.1	Cable galleries	100	Industrial trough type fluorescent	
17.0	General			
17.1	Offices, conference rooms, etc.	300	Decorative mirror optics type	LED Lamp Fixtures
17.2	Corridors, Walkways, Staircase, Lockers etc.	70	Industrial Type CFL with vitreous enamel reflectors	LED Lamp Fixtures
17.3	Toilet Wash room etc.	70	Industrial Type CFL with vitreous enamel reflectors	LED Lamp Fixtures
17.4	Garage/Car Parking	50	Industrial trough type fluorescent	LED Lamp Fixtures
17.5	Facility building, canteen	150	Industrial trough type fluorescent	LED Lamp Fixtures



18.0	Administration Building			
18.1	Main office areas (air conditioned)	300	Decorative recessed type with mirror optic reflector	LED Lamp Fixtures
18.2	Main office areas (non A/c)	300	Decorative with wide mirror optic reflector	LED Lamp Fixtures
19.0	DC Lights Fittings			
19.1	Control Room (with false ceiling)	50	Recess mounted Down lighter	1 x 100 W GLS lamp
19.2	Other areas (without false ceiling)	20	Industrial bulk head	1 x 100 W GLS Lamp.

Note:

1. The lux level and type of fitting for any area not specified shall be finalized during detailed engineering without any price implication.
2. N/E AC lighting and DC lighting shall be identified with suitable colour code.

CONTRACTOR may change the type of fixture to be used in different area against indicated above, provided minimum illumination level as indicated above is maintained. Lighting shall appear aesthetically good. CONTRACTOR shall measure the lux levels in the above areas (measured at the working plane) using suitable devices/meters as per relevant standards to prove the specified values.

ANNEXURE B: FITTINGS AND ACCESSORIES OF LIGHTING TRANSFORMER

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

1. 150 mm dia. winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.
2. Handling and lifting lugs both for enclosure and core-coil assembly.
3. Jacking pad for core-coil assembly.



4. Inspection covers for cable and box.
5. Door handle operated safety limit switch with 1NO + 1NC contact.
6. Ground bus.
7. IP-55 junction box.
8. Rating and terminal marking plates.

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



ANNEXURE-1

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for Main items for Station Lighting System

Item No.	DESCRIPTION	P.O.	Unit	SUPPLY	
				QTY.	Unit Ex-works (Rs)
	MAIN EQUIPMENT				
1.0	Lighting Distribution Board (LDB)				
1.1	AC LDB Type LDB-H (12)				
1.1a	AC LDB Type LDB-H (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	19		
1.1b	100kVA transformer for housing in 1.1a	Nos.	38		
1.2	AC LDB Type LDB-F (8)				
1.2a	AC LDB Type LDB-F (8) without transformer (including cubicle suitable for 2 no. 50 kVA transformer)	Nos.	11		
1.2b	50kVA transformer for housing in 1.2a	Nos.	22		
1.3	DC LDB Type LDB-D (6)	Nos.	6		
1.4	AC LDB Type WDB-H (12) with 100 kVA transformer for welding socket				
1.4a	AC LDB Type WDB-H (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	2		
1.4b	100kVA transformer for housing in 1.4a	Nos.	4		
2.0	Lighting Panels (LP)				
2.1	AC Normal /Emergency indoor Type LP – A (6)	Nos.	7		
2.2	AC Normal (Decorative) Type LP – A (6)	Nos.	2		
2.3	AC Normal /Emergency indoor Type LP – A (12)	Nos.	70		
2.4	AC Normal /Emergency outdoor Type LP – A (12)	Nos.	22		
2.5	AC Normal (Decorative) Type LP – A (12)	Nos.	30		
2.6	AC Normal /Emergency indoor Type LP – A (18)	Nos.	16		
2.7	AC Normal /Emergency outdoor Type LP – A (18)	Nos.	25		
2.8	DC indoor Type LP – D (6)	Nos.	25		
2.90	DC outdoor Type LP – D (6)	Nos.	4		
2.10	Street Lighting Type LP – S (6)	Nos.	8		
3.0	Lighting Luminaires (complete with accessories)				
3.1	Luminaires Type FC02 (*) EQ LED TYPE	Nos.	180		
3.2	Luminaires Type FC02	Nos.	35		
3.3	Luminaire Type FC06 (*) EQ LED TYPE	Nos.	1900		
3.4	Luminaire Type FC06	Nos.	135		
3.5	Luminaire Type FC26 (*) EQ LED TYPE	Nos.	1900		
3.6	Luminaire Type FC26	Nos.	450		
3.7	Luminaire Type FC81 (*) EQ LED TYPE	Nos.	240		
3.8	Luminaire Type FC81	Nos.	10		
3.9	Luminaire Type FC32 (*) EQ LED TYPE	Nos.	220		
3.10	Luminaire Type FC32	Nos.	640		
3.11	Luminaire Type TB22	Nos.	340		
3.12	Luminaire Type TX04	Nos.	180		
3.13	Luminaire Type TW41	Nos.	350		
3.14	Luminaire Type SF63	Nos.	75		
3.15	Luminaire Type SF66	Nos.	90		
3.16	Luminaire Type SB11	Nos.	115		
3.17	Luminaire Type SB02	Nos.	350		
3.18	Luminaire Type SB03	Nos.	150		
3.19	Luminaire Type SS61	Nos.	6		
3.20	Luminaire Type SS62	Nos.	550		
3.21	Luminaire Type SS63	Nos.	290		
3.22	Luminaire Type SS62 (*) EQ LED TYPE	Nos.	150		
3.23	Luminaire Type SS63 (*) EQ LED TYPE	Nos.	250		
3.24	Luminaire Type SW41	Nos.	7700		
3.25	Luminaire Type SW42	Nos.	1450		
3.26	Luminaire Type MW96	Nos.	210		
3.27	Luminaire Type MW98	Nos.	70		
3.28	Luminaire Type 4X14 W TL (*) EQ LED TYPE	Nos.	20		
3.29	100W Marine type luminaire with lamp	Nos.	2		

ANNEXURE-1

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for Main items for Station Lighting System

Item No.	DESCRIPTION	P.O.	Unit	SUPPLY	
				QTY.	Total Ex-works (Rs)
	MAIN EQUIPMENT				
4.0	Lighting Lamp				
4.1	28W T5 fluorescent tube	Nos.	1130		
4.2	100W Incandescent lamp	Nos.	700		
4.3	100W Comptalux lamp	Nos.	180		
4.4	70W MH lamp (SON-E)	Nos.	8000		
4.5	150W MH lamp (SON-E)	Nos.	2000		
4.6	250W MH lamp (SON-E)	Nos.	400		
4.7	400W MH lamp (SON-E)	Nos.	275		
4.8	125W HPMV lamp(SON-E)	Nos.	210		
4.9	150W MH lamp (SON-T)	Nos.	380		
4.10	250W MH lamp (SON-T)	Nos.	35		
5.0	Switch boxes for individual control of circuits				
	Switchboards consisting of switch boxes, switch plates and fixing accessories.				
5.1	Type SWB1	Nos.	170		
5.2	Type SWB2	Nos.	120		
5.3	Type SWB3	Nos.	65		
5.4	Type SWB1 Decorative	Nos.	50		
5.5	Type SWB2 Decorative	Nos.	200		
5.6	Type SWB3 Decorative	Nos.	70		
6.0	Junction boxes				
6.1	Type JB-F	Nos.	17500		
6.2	Type JB-FE	Nos.	340		
6.3	Type JB-S	Nos.	475		
7.0	Receptacles				
7.1	Type RA	Nos.	960		
7.2	Type RA (Flame proof)	Nos.	25		
7.3	Type RB	Nos.	500		
7.4	Type RC	Nos.	270		
7.5	Type RD	Nos.	3		
8.0	Ceiling fans with electronic regulators				
8.1	1200 mm sweep	Nos.	60		
8.2	Pedestal Fan	Nos.	10		
9.0	Emergency lighting Units	Nos.	60		
	With Ni-Cd battery and 2 X 9W fluorescent lamp				
10.0	Poles Along with fixtures				
10.1	Type PS1 (410 SP51 as per IS-2713)	Nos.	150		
10.2	Type PS2 (410 SP67 as per IS-2713)	Nos.	250		
10.3	Type PF2 (410 SP51 as per IS-2713)	Nos.	55		
10.4	Type PF1 (410 SP51 as per IS-2713)	Nos.	20		
11.0	Wires				
11.1	1x2.5 mm ² Cu PVC	mtrs.	5,14,000		
11.2	1x 4 mm ² Cu PVC	mtrs.	23,500		
11.3	1x 10 mm ² Al PVC	mtrs.	6,800		
12.0	GI wire, flat & MS rod				
12.1	8 SWG GI wire	mtrs.	346000		
12.2	35X6 mm GI flat	mtrs.	5,000		
12.3	50X6mm GI flat	mtrs.	1,000		
12.4	40mm dia MS rod	nos.	700		
13.0	Hot dip Galvanised Rigid Steel Conduits (Heavy Duty)				
13.1	20 mm dia GI conduit, 1.6 mm thick	mtrs.	2,77,000		
13.2	25 mm dia GI conduit, 1.6 mm thick	mtrs.	38,300		
13.3	40 mm dia GI conduit, 2 mm thick	mtrs.	38,500		
13.4	25 mm dia GI conduit with epoxy coating, 1.6 mm thick	mtrs.	6,000		
14.0	Flexible epoxy coated conduit				
14.1	20 mm dia epoxy coated conduit	mtrs.	53,100		

ANNEXURE-1

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for Main items for Station Lighting System

Item No.	DESCRIPTION <u>MAIN EQUIPMENT</u>	P.O. QTY.	Unit	SUPPLY	
				Unit Ex-works (Rs)	Total Ex-works (Rs)
15.0	Structural steel	MT	35		
16.0	Hume pipe				
16.1	Hume pipe 100 mm dia	mtrs.	1000		
17.0	24V supply module & lamp unit complete with all accessories				
17.1	Fixed type 24V supply modules	Nos.	30		
17.2	Portable type 24V supply modules	Nos.	93		
17.3	Portable halogen lamp unit	Nos.	10		
17.4	5A, 24V industrial type sockets	Nos.	275		
18	LIGHTING MAST	Nos.	15		
19.0	Ladder				
19.1	Free standing ladder	Nos.	7		
20	EXIT SIGN	Nos.	30		
21	Mini truck mounted adjustable hydraulic lift	Nos.	1		

NOTES:

- All Fluorescent fixtures shall have energy efficient lamp (T5) and electronic ballast.
- The unit rates of supply and installation (E&C) for all equipment and services quoted by the bidder shall be firm for a variation of quantities limited to $\pm 30\%$ of total order value till completion of works at site.
- 'Basic Design Documents' cover: Drawings/ documents schedule, technical data sheets, GA dwgs. of equipments, quality plan, type test reports for Station Lighting System.
- Erection & commissioning materials (such as double compression cable glands, conduit fittings viz. couplers, elbows, bends, tees, circular boxes etc., conduit accessories viz. clips, saddles, spacing plates, entry bushes, lock nuts, plugs, heavy duty lugs, ferrules, expansion fastners, ball & sockets, earth clips, fan boxes, clamps, screws etc. form part of erection activities) and accessories including commissioning & operational spares upto system handing over to TANGEDCO has to be worked out for complete and successful erection & commissioning of the total supply as per BOQ. The price to be quoted for E & C accordingly for equipment and fittings.
- Design engineering charges are considered to be included in main equipment supply price. No separate charges shall be applicable.
- Fabrication & painting charges of structural steel shall be part of erection charges of those equipment for which the same is being used.
- Installation of lamp shall be part of E&C of respective fixture. The E&C price of fixtures to be quoted accordingly.
- All measuring and testing instruments required during erection, testing, commissioning and performance testing shall be arranged by the bidder and taken back.
- Adequate number of steel containers are to be supplied for storing of material at site. The same can be taken back by the vendor after completion of work.

ANNEXURE-2

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for E&C of Main items for Station Lighting System

Item No.	DESCRIPTION	P.O.	Unit	E&C		
				QTY.	Unit Ex-works (Rs)	Total Ex-works (Rs)
	MAIN EQUIPMENT					
1.0	Lighting Distribution Board (LDB)					
1.1	AC LDB Type LDB-H (12)					
1.1a	AC LDB Type LDB-H (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	19			
1.1b	100kVA transformer for housing in 1.1a	Nos.	38			
1.2	AC LDB Type LDB-F (8)					
1.2a	AC LDB Type LDB-F (8) without transformer (including cubicle suitable for 2 no. 50 kVA transformer)	Nos.	11			
1.2b	50kVA transformer for housing in 1.2a	Nos.	22			
1.3	DC LDB Type LDB-D (6)	Nos.	6			
1.4	AC LDB Type WDB-H (12) with 100 kVA transformer for welding socket					
1.4a	AC LDB Type WDB-H (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	2			
1.4b	100kVA transformer for housing in 1.4a	Nos.	4			
2.0	Lighting Panels (LP)					
2.1	AC Normal /Emergency indoor Type LP – A (6)	Nos.	7			
2.2	AC Normal (Decorative) Type LP – A (6)	Nos.	2			
2.3	AC Normal /Emergency indoor Type LP – A (12)	Nos.	70			
2.4	AC Normal /Emergency outdoor Type LP – A (12)	Nos.	22			
2.5	AC Normal (Decorative) Type LP – A (12)	Nos.	30			
2.6	AC Normal /Emergency indoor Type LP – A (18)	Nos.	16			
2.7	AC Normal /Emergency outdoor Type LP – A (18)	Nos.	25			
2.8	DC indoor Type LP – D (6)	Nos.	25			
2.90	DC outdoor Type LP – D (6)	Nos.	4			
2.10	Street Lighting Type LP – S (6)	Nos.	8			
3.0	Lighting Luminaires (complete with accessories)					
3.1	Luminaires Type FC02 (*) EQ LED TYPE	Nos.	180			
3.2	Luminaires Type FC02	Nos.	35			
3.3	Luminaire Type FC06 (*) EQ LED TYPE	Nos.	1900			
3.4	Luminaire Type FC06	Nos.	135			
3.5	Luminaire Type FC26 (*) EQ LED TYPE	Nos.	1900			
3.6	Luminaire Type FC26	Nos.	450			
3.7	Luminaire Type FC81 (*) EQ LED TYPE	Nos.	240			
3.8	Luminaire Type FC81	Nos.	10			
3.9	Luminaire Type FC32 (*) EQ LED TYPE	Nos.	220			
3.10	Luminaire Type FC32	Nos.	640			
3.11	Luminaire Type TB22	Nos.	340			
3.12	Luminaire Type TX04	Nos.	180			
3.13	Luminaire Type TW41	Nos.	350			
3.14	Luminaire Type SF63	Nos.	75			
3.15	Luminaire Type SF66	Nos.	90			
3.16	Luminaire Type SB11	Nos.	115			
3.17	Luminaire Type SB02	Nos.	350			
3.18	Luminaire Type SB03	Nos.	150			
3.19	Luminaire Type SS61	Nos.	6			
3.20	Luminaire Type SS62	Nos.	550			
3.21	Luminaire Type SS63	Nos.	290			
3.22	Luminaire Type SS62 (*) EQ LED TYPE	Nos.	150			
3.23	Luminaire Type SS63 (*) EQ LED TYPE	Nos.	250			
3.24	Luminaire Type SW41	Nos.	7700			
3.25	Luminaire Type SW42	Nos.	1450			
3.26	Luminaire Type MW96	Nos.	210			
3.27	Luminaire Type MW98	Nos.	70			
3.28	Luminaire Type 4X14 W TL (*) EQ LED TYPE	Nos.	20			
3.29	100W Marine type luminaire with lamp	Nos.	2			
4.0	Switch boxes for individual control of circuits					
	Switchboards consisting of switch boxes, switches, switch plates and fixing accessories.					
4.1	Type SWB1	Nos.	170			
4.2	Type SWB2	Nos.	120			
4.3	Type SWB3	Nos.	65			
4.4	Type SWB1 Decorative	Nos.	50			
4.5	Type SWB2 Decorative	Nos.	200			
4.6	Type SWB3 Decorative	Nos.	70			

ANNEXURE-2

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for E&C of Main items for Station Lighting System

Item No.	DESCRIPTION	P.O.	Unit	E&C		
				QTY.	Unit Ex-works (Rs)	Total Ex-works (Rs)
	MAIN EQUIPMENT					
5.0	Junction boxes					
5.1	Type JB-F	Nos.	17500			
5.2	Type JB-FE	Nos.	340			
5.3	Type JB-S	Nos.	475			
6.0	Receptacles					
6.1	Type RA	Nos.	960			
6.2	Type RA (Flame proof)	Nos.	25			
6.3	Type RB	Nos.	500			
6.4	Type RC	Nos.	270			
6.5	Type RD	Nos.	3			
7.0	Ceiling fans with electronic regulators					
7.1	1200 mm sweep	Nos.	60			
8.0	Poles Along with fixtures					
8.1	Type PS1 (410 SP51 as per IS-2713)	Nos.	150			
8.2	Type PS2 (410 SP67 as per IS-2713)	Nos.	250			
8.3	Type PF2 (410 SP51 as per IS-2713)	Nos.	55			
8.4	Type PF1 (410 SP51 as per IS-2713)	Nos.	20			
9.0	Wires					
9.1	1x2.5 mm ² Cu PVC	mtrs.	5,14,000			
9.2	1x 4 mm ² Cu PVC	mtrs.	23,500			
9.3	1x 10 mm ² Al PVC	mtrs.	6,800			
10.0	GI wire, flat & MS rod					
10.1	8 SWG GI wire	mtrs.	346000			
10.2	35X6 mm GI flat	mtrs.	5,000			
10.3	50X6mm GI flat	mtrs.	1,000			
10.4	40mm dia MS rod	nos.	700			
11.0	Hot dip Galvanised Rigid Steel Conduits (Heavy Duty)					
11.1	20 mm dia GI conduit, 1.6 mm thick	mtrs.	2,77,000			
11.2	25 mm dia GI conduit, 1.6 mm thick	mtrs.	38,300			
11.3	40 mm dia GI conduit, 2 mm thick	mtrs.	38,500			
11.4	25 mm dia GI conduit with epoxy coating, 1.6 mm thick	mtrs.	6,000			
12.0	Flexible epoxy coated conduit					
12.1	20 mm dia epoxy coated conduit	mtrs.	53,100			
13.0	Hume pipe					
13.1	Hume pipe 100 mm dia	mtrs.	1000			
14.0	24V supply module & lamp unit complete with all accessories					
14.1	Fixed type 24V supply modules	Nos.	30			
14.2	5A, 24V industrial type sockets	Nos.	275			
15	LIGHTING MAST	Nos.	15			
16	EXIT SIGN	Nos.	30			
17.1	LAYING & TERMINATION OF CABLES (CABLE SUPPLY : FREE ISSUE BY BHEL. BIDDER TO QUOTE ONLY LAYING & TERMINATION CHARGES.)					
	a) 3.5C X 50 mm ² Al (Unarm)	mtrs.	22000			
	b) 3.5C X 95 mm ² Al (Unarm)	mtrs.	5000			
	c) 3.5C X 25 mm ² Al (Unarm)	mtrs.	1600			
	d) 3C X 2.5 mm ² Cu (Unarm)	mtrs.	1000			
	e) 2C X 25 mm ² Al (Unarm)	mtrs.	5000			
17.2	Armoured cables to be buried underground					
	a) 3.5C X 95 mm ² Al (Arm)	mtrs.	500			
	a) 3.5C X 50 mm ² Al (Arm)	mtrs.	2500			
	b) 3.5C X 25 mm ² Al (Arm)	mtrs.	500			
	C) 4C X 16 mm ² Al (arm)	mtrs.	10000			

ANNEXURE-2

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER : BOQ cum Price Schedule for E&C of Main items for Station Lighting System

Item No.	DESCRIPTION	P.O.	Unit	E&C	
				Unit Ex-works (Rs)	Total Ex-works (Rs)
	<u>MAIN EQUIPMENT</u>	QTY.			

NOTES:

1. The unit rates of supply and installation (E&C) for all equipment and services quoted by the bidder shall be firm for a variation of quantities limited to $\pm 30\%$ of total order value till completion of works at site.

2. Erection & commissioning materials (such as double compression cable glands, conduit fittings viz. couplers, elbows, bends, tees, circular boxes etc., conduit accessories viz. clips, saddles, spacing plates, entry bushes, lock nuts, plugs, heavy duty lugs, ferrules, expansion fasteners, ball & sockets, earth clips, fan boxes, clamps, screws etc. form part of erection activities) and accessories including commissioning & operational spares upto system handing over to TANGEDCO has to be worked out for complete and successful erection & commissioning of the total supply as per BOQ. The price to be quoted for E & C accordingly for equipment and fittings.

3. Fabrication & painting charges of structural steel shall be part of erection charges of those equipment for which the same is being used.

4. Installation of lamp shall be part of E&C of respective fixture. The E&C price of fixtures to be quoted accordingly.

5. All measuring and testing instruments required during erection, testing, commissioning and performance testing shall be arranged by the bidder and taken back.



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR
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DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE :1.06.2015

SHEET

1 of 1

SECTION – 'D'

STANDARD TECHNICAL SPECIFICATION



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 1 OF 63

**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)
SPECIFICATION NO. PE-SS-999-558-E001**



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 2 OF 63

CONTENTS

<u>CLAUSE No.</u>	<u>DESCRIPTION</u>
1.0	SCOPE
2.0	CODES & STANDARDS
3.0	LIGHTING SYSTEM DESCRIPTION (CONCEPTUAL VIEW)
4.0	SYSTEM DESIGN ENGINEERING
4.1	ENGINEERING INPUTS
4.2	DESIGN CRITERIA
4.3	ENGINEERING OUTPUTS
5.0	LUMINAIRES, ACCESSORIES AND LAMPS
5.1	GENERAL REQUIREMENTS OF LUMINAIRES
5.2	LUMINAIRE TYPES
5.2.1	Channel Mounted (Fluorescent) Luminaires
5.2.2	Bay Type Luminaires
5.2.3	Well Glass Luminaires
5.2.4	Street Lighting Luminaires (Other than fluorescent luminaires)
5.2.5	Flood Lighting Luminaires
5.2.6	Post Top Luminaires
5.2.7	Bulk Head Luminaires
5.2.8	Emergency Lighting Luminaires
5.3	CONTROLGEAR BOX (NON-INTEGRAL TYPE)
5.4	REFLECTORS
5.5	LAMP HOLDERS
5.6	STARTER HOLDERS
5.7	BALLASTS
5.8	STARTERS



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 3 OF 63

- 5.9 CAPACITORS
- 5.10 LAMPS
- 6.0 DESIGN REQUIREMENTS (MAIN EQPT. EXCEPT LUMINAIRES AND LAMPS)
- 6.1 LIGHTING DISTRIBUTION BOARDS (LDBs)
 - 6.1.1 General Requirements of LDBs
 - 6.1.2 LDBs with transformers (Additional Features)
 - 6.1.3 Lighting Transformer
 - 6.1.4 Busbars, Connections and Joints
 - 6.1.5 Wiring and Terminations
 - 6.1.6 Controls
 - 6.1.7 Switch-Fuse Units
 - 6.1.8 Cable Terminations
 - 6.1.9 Earthing
 - 6.1.10 Type of LDBs
 - 6.1.10.1 AC LDBs
 - 6.1.10.2 DC LDBs
- 6.2 LIGHTING PANELS (LPs)
 - 6.2.1 General Requirements of Lighting Panels
 - 6.2.2 Types of Lighting Panels
 - 6.2.3 AC Lighting Panel
 - 6.2.4 DC Lighting Panel
 - 6.2.5 Decorative Type Lighting Panel
 - 6.2.6 Street Lighting Panel
- 6.3 LIGHTING POLES



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 4 OF 63

- 6.4 LIGHTING MASTS
- 6.5 JUNCTION BOXES
- 6.6 FUSE BOXES
- 6.7 RECEPTACLES
- 6.8 CEILING FANS & REGULATORS
- 6.9 LIGHTING CONTROL SWITCH-BOXES
- 7.0 COMPONENTS OF MAIN EQUIPMENT (OTHER THAN LUMINAIRES)
- 7.1 MOULDED CASE CIRCUIT BREAKERS
- 7.2 SWITCH-FUSE UNITS
- 7.3 INDICATING METERS
- 7.4 CONTACTORS
- 7.5 RELAYS
- 7.6 CURRENT TRANSFORMERS
- 7.7 VOLTAGE AND CONTROL TRANSFORMER
- 7.8 MINIATURE CIRCUIT BREAKERS
- 7.9 SELECTOR SWITCHES
- 7.10 INDICATION LAMPS
- 7.11 PUSH BUTTONS
- 7.12 TERMINALS
- 7.13 CABLE GLANDS
- 7.14 CABLE LUGS
- 7.15 TIMERS
- 8.0 LABELING
- 9.0 SURFACE TREATMENT
- 10.0 PACKING
- 11.0 GUARANTEED PERFORMANCE REQUIREMENTS



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 5 OF 63

12.0 INSPECTION & TESTING

13.0 QUANTITY VARIATION

14.0 SPARES

15.0 TOOLS & TACKLES

16.0 DOCUMENTATION

ANNEXURE-I

ANNEXURE-II



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 6 OF 63

1.0 SCOPE

1.1 GENERAL

- a) This specification covers the design, manufacture, assembly, testing and inspection at vendor's / sub-vendor's works, packing and despatch to site of lighting system and low voltage power services equipment.
- b) The "design" shall broadly cover the selection of components, materials, sizes etc. for the equipment of supply in vendor's scope. Complete responsibility of establishing the correctness of equipment design rests with the vendor.
- c) It is not the intent to specify here 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 the required duties in a manner acceptable to Engineer / 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.
- d) Make of all equipment and components shall be to the approval of purchaser.

1.2 ENGINEERING

- a) Specification also covers the aspect of System Design Engineering generally termed as "Engineering". Engineering shall be the responsibility of vendor if indicated in Data Sheet A. Engineering inputs shall be furnished by the purchaser to the successful bidder.
- b) Engineering, if covered in vendor's scope, shall include design of complete lighting system for indoor and outdoor areas. 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.
- c) Complete engineering shall be as per the guidelines of purchaser and shall be subject to the purchaser's approval.

1.3

1.4 The requirements given in enclosed drawings, documents and Data Sheet A form part of this specification and shall be fully complied with. In case any discrepancy arises, the requirements of Data Sheet A shall prevail.

1.5 In case of any deviation, the bidder shall indicate the same clause-by-clause in the enclosed "Schedule of Deviations". In the absence of duly filled schedules it will be construed that the bid conforms strictly to the specification.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 7 OF 63

2.0 CODES & STANDARDS

2.1 Unless specified otherwise, the latest revisions of standards, codes and other applicable statutory rules and regulations specified in Annexure-I are applicable and shall be referred to.

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 Normal 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.

4.0 SYSTEM DESIGN ENGINEERING

Engineering shall be done by the vendor only during the contract engineering stage if 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.

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



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 8 OF 63

- 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. Preferred pole heights / mounting height
 - iv. AC Emergency lighting requirement
 - v. DC lighting requirements
- c) Requirement of sockets

4.1.3 Other inputs

- a) Suggestive location of LDBs
- b) Suggestive power distribution scheme (SLDs)
- c) Control schemes
- d) Single phase feeder details
- e) No. of sockets / criteria for computation of no. of sockets / location of sockets etc.

4.2 DESIGN CRITERIA :

4.2.1 General Requirements of Design

4.2.1.1 Lighting system shall be provided to ensure adequate visual performance, safety and amenity 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.

4.2.1.2 Complete system design shall be done on the basis of inputs provided by the purchaser and in line with the laid down criteria.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 9 OF 63

- 4.2.1.3 Requirements of sockets shall be as per the criteria / number of sockets given by the purchaser during detailed engineering stage.
- 4.2.2 Sources of Power Supply
- 4.2.2.1 The lighting system shall be provided with the power from the following sources :
- AC - normal
 - AC - emergency
 - DC - normal
 - DC - emergency
- 4.2.2.2 AC emergency supply is made available from purchaser's AC emergency Board. This board in turn has two incomers; one from the normal supply source i.e. station supply and other from emergency source i.e. diesel generator supply which is available upon failure of normal supply.
- 4.2.2.3 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.
- 4.2.2.4 Power from the purchaser's supply sources shall be brought upto the Lighting Distribution Boards (LDBs) of various types. Each LDB shall in turn feed power to various Lighting Panels (LPs).
- 4.2.2.5 Power to the AC normal luminaires shall be available through AC normal LDB & LP. Power to the AC emergency luminaires shall be available through AC emergency LDB & AC emergency LP. Power to DC normal luminaires shall be available through DC normal LP, which in turn shall be fed directly from DCDB / Sub-DCDB. However power to the DC emergency luminaires shall be available through DC emergency LDB & LP.
- 4.2.2.6 Complete power distribution system shall be designed keeping following criteria in view :
- Simplicity
 - Controlled voltage drop
 - Cost effectiveness
- 4.2.2.7 Area Classification
- The detailed requirements of luminaires depending upon type of power supply source for each area shall be as per the details to be furnished by purchaser during contract engineering. Area classification on the basis of type of luminaires to be provided shall be as under :
- Area A : AC normal, AC emergency, DC normal and DC emergency luminaires.
 - Area B : AC normal, AC emergency and DC emergency luminaires.
 - Area C : AC Normal and AC emergency luminaires
 - Area D : AC Normal luminaires.
 - Area E : AC Normal luminaires and portable emergency lighting.
- 4.2.3 Lighting Philosophy



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 10 OF 63

4.2.3.1 In the normal course, for areas A, B and C, all the AC luminaires shall remain switched on through two different sources of supply i.e. AC normal and AC emergency. DC normal luminaires shall also remain switched on for areas A.

4.2.3.2 In case of failure of AC normal supply the following shall apply :

- a) Areas A shall remain lit through DC normal luminaires.
- b) Areas A & B shall automatically get illuminated from DC emergency luminaires. This supply shall be available till AC emergency power is restored and stabilised.
- c) Areas C shall remain temporarily dark till the AC emergency supply is restored from diesel generator set.
- d) Areas D shall remain dark till the AC normal supply is restored.

4.2.3.3 As soon as the AC emergency supply is restored, the AC emergency luminaires shall come into operation. DC emergency luminaires shall have time delayed switching off after a specified duration to ensure that the AC emergency supply is stabilised.

4.2.3.4 When the AC normal supply is restored, the following shall apply :

- a) DC emergency luminaires shall be switched off immediately, if they are switched on.
- b) AC emergency luminaires shall switch off momentarily when AC emergency board incoming supply is changed over from diesel generator to the AC normal supply.

4.2.3.5 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:

- a) Manual
- b) Automatic through 00 - 24 hrs time switch
- c) 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

4.2.4.1 All calculations shall be done as per the input data covered under "Engineering Inputs".

4.2.4.2 Total AC luminaires



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 11 OF 63

Indoor Areas : Total number of AC luminaires shall be calculated by the Lumen Method for average light intensity.

Outdoor Areas : Total number of AC luminaires for 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.

4.2.4.3 AC Normal & AC Emergency Luminaires

Area A, B & C : A specified percentage of total AC luminaires shall be considered as AC emergency luminaires. The percentage shall be as specified in Data Sheet A. The remaining luminaires shall be AC normal luminaires.

Area D : All the luminaires shall be considered as AC normal luminaires.

4.2.4.4 DC Normal & DC Emergency Luminaires

Where specified, DC normal luminaires shall be provided for areas A. The vendor shall consider the quantities of DC emergency luminaires as suggested by purchaser for Area A & B types. Unless otherwise indicated, DC luminaires are for the functional purpose only and no design calculations are to be done. Vendor shall ensure that adequate number of DC emergency lights are provided for essential operations of the plant and shall suggest the changes in purchaser's DC lighting stipulations, if required.

4.2.4.5 Independent DC Luminaires

In areas comparatively remote from power house building, emergency illumination, where required will be provided by rechargeable emergency units. Such units will be installed at suitable location without plug and socket and will be permanently connected to normal AC supply. These emergency units will automatically light-up upon failure of normal AC supply.

4.2.5 Layout Considerations

4.2.5.1 General Layout Considerations

- a) Layout of equipment such as LDBs and LPs shall be on the basis of following criteria :
 - i. Ease of operation
 - ii. Maintainability
 - iii. Aesthetics
- b) Luminaires shall be located to meet the functional requirements of the area. Aesthetics shall form part of layout considerations.
- c) Due considerations shall be given to the mounting arrangement depending upon location and type of area.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 12 OF 63

- d) While preparing lighting system layout drawings for air conditioned control rooms/areas having false ceilings, the vendor shall be required to coordinate with the Air Conditioning / Ventilation Duct layout and false ceiling layout drawings to avoid fouling / interference.

4.2.5.2 Conduit System

- a) Unless indicated otherwise, conduits shall originate from respective lighting panels and shall continue upto the luminaires for all indoor areas.
- b) Conduits shall run in straight runs, parallel to building columns, walls etc. as far as practicable.
- c) Unnecessary bends and crossings shall be avoided.
- d) In the corrosive environment, conduit installations shall be made with corrosion proof conduits. Such requirements shall be clearly indicated while preparing BOQ.

4.2.5.3 Wiring

- a) Each circuit starting from LP shall be taken in a separate conduit.
- b) Receptacle wiring conduits shall be distinct from lighting conduits.
- c) All wiring shall be of PVC insulated copper conductors. The following conductor sizes shall be applicable :
- i. Luminaires 2.5 sq.mm.
 - ii. 5A plug and socket 2.5 sq.mm.
 - iii. 5A-15A plug and socket 4.0 sq.mm.
- d) 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 that there is generally uniform light intensity in the event of failure of one or two phases.
- e) Luminaires located in the offices, stores, laboratories, toilets etc. shall be individually or group controlled.

4.2.5.4 Cabling

- a) Cables shall be considered wherever it is not desirable to run the insulated wires due to long runs or for any other valid reason.
- b) 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 :



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 13 OF 63

- 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.
- d) Control schemes for DC and street lighting.
- e) Loads on each phase of LP and LDB with consideration of diversity factor for sockets.
- f) 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.
- g) 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 Normal and DC Emergency). Bill of Material shall also be covered for various types of luminaires.
- h) 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.
- i) Wiring and load distribution details for outdoor areas.
- j) Master Bill of Material (to be submitted at regular intervals).

5.0 LUMINAIRES, ACCESSORIES AND LAMPS

5.1 GENERAL REQUIREMENTS OF LUMINAIRES

- 5.1.1 All luminaires and accessories shall be designed for continuous operation and shall be suitable for the system design data given in Data Sheet A.
- 5.1.2 Luminaires shall be complete with accessories mounted inside the luminaire assembly. Lamps shall be supplied separately as per BOQ.
- 5.1.3 All luminaires and accessories shall be suitable for operation in the atmospheric conditions prevailing at site.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 14 OF 63

- 5.1.4 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.
- 5.1.5 Luminaires shall be designed for minimum glare. No bright spots should appear from the lamp or from the reflectors.
- 5.1.6 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.
- 5.1.7 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.
- 5.1.8 All luminaires and accessories including the breathing holes shall be vermin proof.
- 5.1.9 Surface Treatment:
- a) 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.
- b) Finish of surfaces shall be non-porous, smooth and unfaded.
- 5.1.10 All metal parts of the luminaires shall be bonded and connected to the earthing terminal. Earthing terminal shall be suitable for connecting 16 SWG GI wire.
- 5.1.11 Flood lights shall be provided with base frame / base plate for mounting on structural steel members / wall.
- 5.1.12 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
- General requirements depending upon type of luminaire are listed below. Specific requirements of each luminaire are indicated in "Luminaire Details" enclosed as Annexure-II.
- 5.2.1 Channel Mounted Luminaires (Fluorescent Luminaires)
- 5.2.1.1 Channel mounting 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.
- 5.2.1.2 Twin fluorescent luminaires shall be wired in lead-lag circuit to minimise stroboscopic effect.
- 5.2.1.3 Luminaires suitable for surface mounting shall also be suitable for pendant mounting. Knockouts of 20mm ET conduit fixation shall be provided for this purpose.
- 5.2.1.4 Decorative Fluorescent Luminaires



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 15 OF 63

- a) Decorative luminaires shall be provided with one of the following as per “Luminaire Details” :
- Perspex acrylic diffuser.
 - High purity, anodised aluminium, mirror optic reflectors with anodised aluminium matt finish transverse fins to control glare.
 - Opal polystyrene louvers and sheet steel side panels.
 - Vertical metallic louvers finished in stove enamelled white and with sheet steel side panels.
- b) End plates of decorative luminaires shall be of high impact polystyrene or sheet metal finished in black colour.
- c) 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.
- d) Recessed type decorative luminaires shall be suitable for mounting with gypsum boards / luxalon / plaster of paris false ceiling of standard size as per Data Sheet A and “Luminaire Details”.

5.2.1.5 Industrial Fluorescent Luminaires (General Purpose)

- a) Industrial luminaires shall be provided with vitreous enameling, if specified in “Luminaire Details”.
- b) Additional reflectors, wherever provided, shall be easily removable type.

5.2.1.6 Industrial Fluorescent Luminaires (Special Purpose)

- a) 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.
- b) 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.
- c) Luminaires for highly corrosive environment shall have fiberglass reinforced polyester 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.
- d) 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 : 54 unless mentioned otherwise in Data Sheet A. Luminaire shall be suitable for side entry mounting with the pole bracket arm.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 16 OF 63

5.2.2 Bay Type Luminaires

5.2.2.1 Luminaires shall be designed for following indoor applications:

- a) High bay above 8 metres
- b) Medium bay 6 - 8 metres
- c) Low bay below 6 metres

5.2.2.2 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.

5.2.2.3 Controlgear shall be connected to the detachable lamp housing at the bottom such that heat dissipation is proper and distributed.

5.2.2.4 Lamp housing-cum-reflector shall be made from spun aluminium, electrochemically brightened and anodised.

5.2.2.5 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.

5.2.2.6 Mounting arrangement shall consist of MS brackets with an anti-vibration eye-bolt.

5.2.2.7 Side mounted controlgear box shall be provided for low bay luminaires, if mentioned in "Luminaire Details".

5.2.3 Well Glass Luminaires

5.2.3.1 Well glass luminaires shall be suitable for dust and vapour laden environment.

5.2.3.2 Luminaires shall be provided with a die-cast aluminium canopy and heat resistant well glass, fitted with a ring type gasket.

5.2.3.3 All well glass luminaires shall be provided with vitreous enamelled reflector.

5.2.3.4 Zinc plated MS wire guard shall be provided for protection of well glass.

5.2.3.5 Separate side mounted and top connected controlgear box shall be provided for use with HPMV & HPSV lamps. Separate, non-integral controlgear box is also acceptable.

5.2.3.6 Integral controlgear 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.

5.2.3.7 Luminaires shall be conduit mounted type for incandescent lamps and surface mounting type for HPMV & HPSV lamps.

5.2.3.8 Flame Proof Well Glass Luminaires



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 17 OF 63

- a) Housing material shall be cast aluminium alloy LM6. Housing outer surface shall be provided with cooling fins.
- b) Flame proof luminaires shall be provided with heavy toughened well glass cemented in a retaining ring.
- c) Zinc-coated / chrome-plated MS chain connected to the main body and glass retaining ring shall be provided.
- d) A detachable terminal box at the top shall be provided.
- e) Neoprene gaskets, where needed, shall be provided for weather proof construction and indoor and outdoor application.
- g) Two cable entries of 20mm ET conduit shall be provided with one flame proof plug.
- h) Mounting shall be through eye-bolt or MS galvanised strap as per Data Sheet A.
- i) 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.

5.2.4 Street Lighting Luminaires (Other than Fluorescent Luminaire)

5.2.4.1 These luminaires shall be suitable for street lighting and general purpose outdoor area lighting.

5.2.4.2 Luminaire housing shall be one piece cast aluminium alloy to accommodate lamp housing and controlgear in two different compartments for lamp wattage upto 125 Watts. For lamp wattage above 125 Watts, controlgear housing shall be of cast aluminium alloy whereas lamp housing shall be of deep drawn aluminium.

5.2.4.3 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.

5.2.4.4 Clear acrylic bowl fitted with a rubber gasket and easily removable type shall be secured to the lamp housing.

5.2.4.5 Provision shall be made for adjustment of lamp location for proper focussing.

5.2.4.6 Luminaires shall be suitable for mounting with pole bracket arm.

5.2.5 Flood Lighting Luminaires

5.2.5.1 Flood light lamp housing and reflector shall be separate from controlgear box. Requirements of controlgear box are specified elsewhere.

5.2.5.2 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.

5.2.5.3 Reflector shall be closed from the front by heat resistant toughened glass and synthetic "S" type weather proof gasket.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 18 OF 63

- 5.2.5.4 Luminaire shall be provided with special lamp centering and focussing device ensuring good beam control.
- 5.2.5.5 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"
- 5.2.5.6 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.
- 5.2.5.7 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.
- 5.2.6 Post Top Lanterns
- 5.2.6.1 Luminaire shall comprise of a spun aluminium canopy, opal acrylic diffuser and a cast aluminium spigot.
- 5.2.6.2 Controlgear shall be integral type and shall be housed in the spigot.
- 5.2.6.3 Luminaire shall be supplied without mounting pole.
- 5.2.7 Bulk Head Luminaires
- 5.2.7.1 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.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 19 OF 63

- i) 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.

5.2.7.2 Bulk Head (Weather Proof)

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

5.2.8 Emergency Lighting Luminaires

5.2.8.1 The luminaire shall be automatic, 40W incandescent bulb unit having in-built battery.

5.2.8.2 Battery shall have integral charging unit. Battery rating shall be 4 hours i.e. during AC supply failure emergency lighting shall operate for 4 hours without recharging.

5.2.8.3 Charger shall be suitable for operation as per system design data.

5.2.8.4 Battery shall be maintenance free sealed lead-acid type unless mentioned otherwise in Data Sheet A as Ni-Cd battery.

5.2.8.5 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)

5.3.1 Non-integral controlgear boxes shall be of 1.6 mm thick CRCA sheet steel construction unless specified otherwise in Data Sheet A.

5.3.2 Boxes shall have weatherproof construction and shall be provided with one piece neoprene gasket. Unless mentioned otherwise in Data Sheet A, degree of protection shall be IP:55.

5.3.3 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.

5.3.4 Boxes shall be suitable for mounting on structures, walls and columns.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 20 OF 63

- 5.3.5 Unless mentioned otherwise in Data Sheet A, boxes shall be galvanised.
- 5.3.6 Suitable number of terminals shall be provided for looping-in and looping-out of cable connections and also connections to the luminaire(s).
- 5.3.7 Cable / conduit knock-outs shall be for each loop-in and loop-out connection and also connection to the luminaire(s).
- 5.4 REFLECTORS
- 5.4.1 Reflectors shall be made of sheet steel or aluminium as applicable.
- 5.4.2 The aluminium reflectors shall be made of high purity aluminium sheet. Sheet will be polished, electrochemically brightened and anodised.
- 5.4.3 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
- 5.5.1 Holders shall be resistant to wear and shall be smooth in operation.
- 5.5.2 Contacts shall be of durable quality.
- 5.5.3 Holders shall hold the lamp under condition of shock and vibration.
- 5.5.4 Lamp holders for fluorescent lamp shall be spring loaded, bi-pin, rotor type with low contact resistance.
- 5.5.5 Live parts of the holder shall not be exposed when the lamp is inserted or removed in case of fluorescent luminaires.
- 5.5.6 Lamp holders for HPMV & HPSV lamps shall be of porcelain material.
- 5.5.7 Holders shall be screw type for HPSV & HPMV lamps. Holders for incandescent lamps shall be screw type, unless mentioned otherwise in Data sheet A.
- 5.5.8 Lamp holders for incandescent lamps shall be of brass or porcelain.
- 5.6 STARTER HOLDERS
- 5.6.1 Starter holders shall be designed and manufactured as per the applicable standard.
- 5.7 BALLASTS
- 5.7.1 Fluorescent fixtures, installed in other than control room areas shall have electronic ballasts. For control room, the ballast shall be copper wound, inductive, heavy duty type, filled with thermosetting insulating moisture repellent polyster and designed for long service life and low power loss.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 21 OF 63

- 5.7.2 Ballasts shall be totally enclosed type.
- 5.7.3 Ballasts shall be easily removable type.
- 5.7.4 Core shall be made of low loss, electrical grading stampings.
- 5.7.5 Coils shall be annealed copper wire wound, inductive, heavy duty type.
- 5.7.6 The core and coil assembly shall be impregnated with suitable insulating material of high thermal stability and integrally encapsulated in thermosetting polyester compound. The compound shall be insulating and moisture resistant filled under pressure or vacuum.
- 5.7.7 End connections shall be made available in a terminal block, rigidly fixed to the ballast enclosure.
- 5.7.8 Ballasts shall be free from humming.
- 5.7.9 Ballast shall be provided separately for each lamp in a multi-lamp luminaire.
- 5.7.10 Tappings shall be provided to set the voltage within range for HPMV & HPSV luminaires.
- 5.8 STARTERS
- 5.8.1 Starters shall be made of aluminium material. Plastic or any other material if used shall be subject to purchaser's approval.
- 5.8.2 Starters shall have bi-metal electrodes.
- 5.8.3 Starter shall be replaceable without the use of any tool and without disturbing any accessory or lamp.
- 5.8.4 Starters shall have high mechanical strength.
- 5.8.5 Starters shall be provided with radio interference suppressing capacitors.
- 5.8.6 Starters shall have brass contacts.
- 5.9 CAPACITORS
- 5.9.1 Capacitors shall have constant value of capacitance, suitable for operation at supply voltage.
- 5.9.2 Capacitors shall be hermetically sealed, preferably in a metal enclosure to prevent seepage of impregnant and ingress of moisture.
- 5.10 LAMPS
- 5.10.1 Lamps shall be suitable for use in any position.
- 5.10.2 Lamps shall be capable of withstanding small vibrations without breakage to filaments / electrodes and lead-in wire.
- 5.10.3 Type of Lamps



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 22 OF 63

- a) Fluorescent Lamp
 - i. They shall be of the “cool daylight” type, unless mentioned otherwise in Data Sheet A.
 - ii. Anode rings shall be provided to prevent blackening of the ends.
 - iii. Lamp caps shall be two pin type at each end.
- b) Incandescent (GLS) Lamps
 - i. Incandescent lamps shall be “clear” type.
 - ii. Lamp caps shall be screw type , unless mentioned otherwise in Data sheet A.
- c) Mercury Vapour Lamps
 - i. Lamps shall have outer envelope with colour corrected fluorescent powder, unless mentioned otherwise in Data Sheet A.
 - ii. 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.
 - ii. Lamps shall be of immediate start type.
 - iii. Design of lamps shall ensure high performance and high efficiency.

6.0 DESIGN REQUIREMENTS (MAIN EQUIPMENT EXCEPT LUMINAIRES AND LAMPS)

6.1 LIGHTING DISTRIBUTION BOARD (LDB)

6.1.1 General Requirements of LDBs

6.1.1.1 LDBs shall be totally enclosed, modular in construction, indoor type and suitable for electrical system data as specified in Data Sheet A. The LDB shall be free standing type suitable for installation on cable trenches / floor.

6.1.1.2 LDBs shall be constructed from CRCA sheet and structural sections. Sheet thickness for load bearing members shall be 2.0 mm and that for non-load bearing members shall be 1.6 mm,



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 23 OF 63

unless specified otherwise in Data Sheet A. The design and construction of LDBs shall ensure adequate rigidity.

- 6.1.1.3 Vertical cable chambers / alleys of adequate width but not less than 250 mm shall be provided for incoming / outgoing cables of each panel.
- 6.1.1.4 LDBs shall have only one operational front. Door shall be provided at the front of each module to give full access to all the components.
- 6.1.1.5 LDBs shall consist of dust and vermin proof cubicles without the use of louvers (except the transformer compartment, where applicable).
- 6.1.1.6 Good quality synthetic rubber / neoprene gaskets shall be put around the door, cover edges and cutout edges for pushbutton, lamps etc. for protection against dust. The door when closed, shall compress the gasket uniformly.
- 6.1.1.7 Cutout edges for instruments, relays etc. shall have sufficient overlap surface to minimize the dust entry. The arrangement for the front mounting of switch handles shall render the LDB reasonably dust free such that the normal operations are not affected.
- 6.1.1.8 Degree of protection for completed LDBs (Distribution Board) shall be IP:52 unless mentioned otherwise in Data Sheet A.
- 6.1.1.9 The LDBs shall be designed to prevent contact with live parts both within the modules and in the cable alley.
- 6.1.1.10 The ratings of all components shown in the enclosed drawings are indicative only. The bidder shall be responsible to check and coordinate the MCB characteristic with back up fuses etc. provided. Any change in size / ratings of components required for final arrangement may be complied with and provided by the vendor at no extra cost.
- 6.1.1.11 All equipment shall be constructed of non-hygroscopic and non-inflammable materials.
- 6.1.1.12 All components mounted in the LDBs shall be accessible and shall not impede access to wiring or terminals. All faults except busbar fault which may occur within any individual unit shall be confined within that unit only and shall not cause shutdown of any section of the board other than the affected unit itself. Maintenance and inspection shall be possible in any individual unit without affecting other units.
- 6.1.1.13 Incoming unit shall comprise of either switch-fuse / composite fuse-switch unit or MCCB as per scheme / Data Sheet A. Outgoing units shall be a switch-fuse / composite fuse-switch unit / MCB.
- 6.1.1.14 The rated continuous current of the equipment and components shall be as given in the schemes. These ratings shall be obtained with the components mounted in their housing as in service without exceeding the permissible temperature rise.
- 6.1.1.15 Interlock between compartment door and modules shall be provided such that the door cannot be opened without switching off the power supply to the module.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 24 OF 63

- 6.1.1.16 Defeat interlock shall be provided for the units comprising of switch or moulded case circuit breaker as a means of isolation device, such that it is possible to open the door with device ON. It shall not be possible to close the door till the interlock has been reinstated.
- 6.1.1.17 Each LDB shall be fitted with base frame made of angle or channel.
- 6.1.1.18 All fixing nuts and bolts together with grounding bolts shall be provided.
- 6.1.1.19 Lifting lugs shall be provided for each shipping section of LDB. Removal of such lugs or hooks shall leave no opening in the LDB.
- 6.1.2 LDBs with transformers (Additional Features)
- 6.1.2.1 The lighting distribution board shall be arranged in two adjacent but separate compartments, one compartment for the lighting transformer and the other for the incoming & outgoing feeders etc.
- 6.1.2.2 The transformer shall be mounted on the base channel and it shall be possible to easily remove the transformer from the cubicle after opening the door. Necessary portable ramp made of mild steel shall be supplied along with each LDB.
- 6.1.2.3 Independent gasket hinged door with operating handle shall be provided for access to transformer & its taps. Operating handle shall have built-in key locking arrangement.
- 6.1.2.4 Suitable ventilation arrangement for the transformer compartment to dissipate the heat of the transformer shall be provided. The arrangement shall be in the form of louvers and the same shall be provided with galvanised wire mesh with dust catchers on the inside.
- 6.1.2.5 The degree of protection for transformer compartment shall be IP:42 unless mentioned otherwise in Data Sheet A.
- 6.1.2.6 Connections between transformer secondary terminals and the busbars shall be made by using PVC insulated flexible copper cables or busbars.
- 6.1.2.7 Warning plate shall be provided on transformer enclosure. The inscription of warning plate shall be as given below :
- DO NOT OPEN DOORS WHEN ENERGISED
 - KEEP TAPS AT SAME POSITION FOR ALL PHASES
- 6.1.2.8 Transformer enclosure shall be provided with a danger plate.
- 6.1.3 Lighting Transformer
- 6.1.3.1 Lighting transformer, where specified, shall form an integral part of lighting distribution board.
- 6.1.3.2 Lighting transformer shall be dry type, natural air cooled and suitable for mounting inside the lighting distribution board. Transformer shall be non-encapsulated type, unless specified otherwise in Data Sheet A.
- 6.1.3.3 Rating of transformer shall be 50 kVA or 100 kVA as per type of LDB.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 25 OF 63

- 6.1.3.4 Voltage rating shall be as given in Data Sheet A.
- 6.1.3.5 Percentage impedance shall be 3% for 50 kVA and 4% for 100 kVA transformers, unless specified otherwise in Data Sheet A.
- 6.1.3.6 Off circuit tap changers / links shall be provided for +5% in steps of 2.5%.
- 6.1.3.7 Transformer winding insulation shall be class “F” or better.
- 6.1.3.8 Transformer shall be of vector group Dyn1.
- 6.1.3.9 Winding shall be of copper material and maximum winding temperature at full load and under site conditions shall not exceed 120 oC.
- 6.1.3.10 Transformer shall be suitable for cable connections on the primary side and flexible cable or busbar connection on the secondary side.
- 6.1.3.11 The secondary neutral of the transformer shall be brought out for getting a grounded 4 wire supply system.
- 6.1.3.12 The transformer neutral shall be brought outside the LDB for earthing. The neutral bus bar shall be insulated from the LDB enclosure.
- 6.1.3.13 Transformers shall be provided with the rollers, pulling holes, lifting lugs, jacking positions etc.
- 6.1.4 Busbars, Connections and Joints
- 6.1.4.1 Busbars shall be made of aluminium grade E 91E or high conductivity copper (ETC). Busbar material shall generally be aluminium unless mentioned otherwise in Data Sheet A.
- 6.1.4.2 Busbars shall be supported on non-hygroscopic and non-inflammable insulators of material such as glass reinforced moulded plastic material, epoxy cast resin etc. Separate supports shall be provided for each phase of the busbars. Insulation level of neutral busbar shall be same as that of phase busbars.
- 6.1.4.3 Busbars shall be contained in a separate vermin-proof compartment within the LDB and shall have bolted sheet steel covers for providing suitable access.
- 6.1.4.4 Busbar clearances in the air shall be as per applicable standard for 500V, 3 phase system.
- 6.1.4.5 Temperature for busbars, droppers and connections shall not exceed 90oC for an ambient of 50oC while carrying maximum continuous current.
- 6.1.4.6 The busbar, busbar connections and supports shall have sufficient strength to withstand thermal and electromechanical stresses produced by the specified short circuit level of the system.
- 6.1.4.7 Busbars (including neutral busbar) shall be capable of carrying the short-time current specified in Data Sheet A. The duration of short-time current shall be 1 sec unless mentioned otherwise



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 26 OF 63

in Data Sheet A. For the specified current and duration, there shall be no damage to the equipment.

- 6.1.4.8 The neutral bus shall be rated same as phase bus.
- 6.1.4.9 Main busbars and connections shall be prominently marked and displaced for standard sequence counting from rear to front, top to bottom, or left to right as viewed from the switching device operating mechanism side.
- 6.1.4.10 Busbars and connections shall be provided with colour coded PVC sleeves. All live parts shall be properly shrouded with insulating material.
- 6.1.4.11 Earth busbar shall be provided separately. Material of earth busbar shall be GI unless mentioned otherwise in Data Sheet A.
- 6.1.4.12 Busbar Joints
- a) Busbar and tap off joints shall be bolted type.
 - b) Busbars shall be thoroughly cleaned before jointing. Suitable contact grease shall be applied to remove oxide film just before jointing.
 - c) For copper busbars, the connecting portion shall be tinned or silver plated.
- 6.1.5 Wiring and Terminals
- 6.1.5.1 All internal wiring for connections to remote equipment shall be brought to terminal boards. Spare contacts of devices shall also be wired upto terminal board as per schemes. Wires shall not be jointed or teed-off except at terminal points.
- 6.1.5.2 Wiring shall be made by 1000 volt grade three / seven strand PVC insulated copper wire having a cross-sectional area of not less than 1.5 sq.mm. All connections from CT leads upto instruments, terminals shall be made by copper wires of minimum 2.5 sq.mm. size.
- 6.1.5.3 All wiring shall be made with the Colour Codes specified below :
- a) 3 phase AC Connections
 - Phase 1 (R) Red
 - Phase 2 (Y) Yellow
 - Phase 3 (B) Blue
 - Neutral Black

 - b) 1 phase AC Connections
 - Phase Red / Yellow / Blue
(as per associated circuit)
 - Neutral Black



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 27 OF 63

c) DC Connections

Positive	White
Negative	Grey

d) Earth Connection Green

6.1.5.4 Where wiring passes from one compartment to another, the aperture shall be 'Bushed' to prevent damage to wires against sheet metal edges. Bushes may comprise of good quality rubber / PVC grommets.

6.1.5.5 Every wire end shall be fitted with numbered ferrules of white or yellow colour having glossy finish with identification number engraved in black. Ferrules shall be made of moisture and oil resisting insulating material. Ferrules shall be of interlocked type or tight fitting type. Ferrules shall be so fitted that they will not get detached, when the wire is removed from the terminal.

6.1.5.6 System of marking of wiring shall be as per applicable standard.

6.1.5.7 All wires used internally shall have crimped on tinned copper lugs for terminations.

6.1.5.8 Terminal boards shall be stud type with insulating barriers of adequate height.

6.1.5.9 Terminal boards shall have separate terminals for incoming and outgoing wires with not more than two wires connected to any one terminal.

6.1.5.10 Terminal boards shall be mounted vertically or in the horizontal rows and properly spaced to have clean wiring arrangement, adequate access for putting ferrules, making terminations etc. It shall be possible to read the ferrule numbers when the wiring is complete. Where terminals may be live when the equipment is isolated from the main supply, these shall be clearly marked near the terminal boards.

6.1.6 Controls

The controls shall be provided as per purchaser's requirements covered in the specification and control schemes.

6.1.7 Switch Fuse Units

Refer clause 7.0 (COMPONENTS OF MAIN EQUIPMENT)

6.1.8 Cable Terminations

6.1.8.1 All cables, either incoming or outgoing to the LDB, shall be terminated in a cable chamber. For each panel, there shall be a cable chamber on the side. The door of cable chamber should open or be locked with the help of a tool. Unless stated otherwise in Data Sheet A, all cables shall enter from the bottom.

6.1.8.2 Removable undrilled gland plates of sheet steel shall be provided in the cable chamber for entry of cables. Minimum thickness of gland plate shall be 3mm. The gland plate shall be of adequate size for connecting requisite number of cable glands for power and control cables.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 28 OF 63

- 6.1.8.3 Heavy duty bolt-on termination tinned copper lugs of compression type shall be used in for power cable termination.
- 6.1.8.4 For supporting and clamping of cable cores at regular interval in cable alleys, suitable slotted angle upto the respective terminal blocks shall be provided.
- 6.1.8.5 The supply of tinned copper cable lugs for power cables forms part the supply of equipment.
- 6.1.9 Earthing
- 6.1.9.1 An earth busbar of adequate size of galvanised MS shall be provided at the bottom for the entire length of the LDB.
- 6.1.9.2 Every metal part other than those forming parts of an electrical circuit shall be connected to the earth bus by means of high conductivity copper wire of size not less than 2.5 sq. mm. cross-sectional area.
- 6.1.9.3 Doors shall have a flexible copper wire for earth connection to fixed unit.
- 6.1.9.4 Each LDB shall be fitted with two earthing studs located in accessible position on sides for connection of internal earth busbar to the external earthing connection.
- 6.1.9.5 Earth busbar shall be brought outside LDB for making external connections.
- 6.1.10 Types of LDBs

The LDBs shall be of following type :

- a) LDB-H (n) - AC LDB with 100 kVA transformer
- b) LDB-F (n) - AC LDB with 50 kVA transformer
- c) LDB-N (n) - AC LDB with no transformer
- d) LDB-D (n) - DC LDB

NOTE : (n) indicates number of outgoing feeders.

6.1.10.1 AC LDBs (LDB-H, LDB-F, LDB-N)

Each LDB shall comprise of the following and comply with the enclosed single line diagrams :

- a) One lighting transformer (LDB-H & LDB-F).
- b) One incomer of TP / TPN switch-fuse unit or MCCB / MCCB with neutral link as per Data Sheet A. It shall be provided on the primary side of transformer for LDB type LDB-H & LDB-F.
- c) Set of busbars with 3 phase and neutral.
- d) TPN switchfuse units for each outgoing circuit.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 29 OF 63

- e) Three indicating lamps with fuses for indicating bus supply ON.
- f) CT operated ammeter with selector switch.
- g) VT operated voltmeter with selector switch.
- h) Power & control terminals, earth-stud, earth busbar, designation labels, internal wiring, power cable lugs, glands etc. shall be provided to complete the LDB in all respects.

6.1.10.2 DC LDBs (LDB-D)

Each LDB shall comprise of the following and comply with the enclosed single line diagrams :

- a) One incomer of two pole switch-fuse unit.
- b) Two pole DC contactor on the incoming circuit for changeover to DC in case of AC normal supply failure.
- c) One under voltage relay of suitable range, if specified in Data Sheet A.
- d) One ON delay timer.
- e) One test push button.
- f) Set of busbars for positive and negative.
- g) Two pole switch-fuse units / MCB for outgoing feeders.
- h) Two indicating lamps with fuses for indicating bus supply ON.
- i) Power & control terminals, earth-stud, earth busbar, designation labels, internal wiring, power cable lugs, glands etc. shall be provided to complete the LDB in all respects.

6.2 LIGHTING PANELS (LPs)

6.2.1 General Requirements of Lighting Panels

- 6.2.1.1 LPs shall be totally enclosed, suitable for electrical system data as specified in Data Sheet A. The LP shall be suitable for mounting on wall / column / structure.
- 6.2.1.2 Panels shall be suitable for indoor / outdoor application as per Data Sheet A and BOQ. Outdoor panels shall have a sloping canopy.
- 6.2.1.3 LPs shall be constructed from CRCA sheet. Sheet thickness shall be 2.0 mm, unless mentioned otherwise in Data Sheet A. The construction of LPs shall ensure adequate rigidity.
- 6.2.1.4 All components of the LP shall be fully mounted inside the panel. LPs shall have only one operational front. Door shall be provided to give full access to all the components. Door shall have padlocking arrangement.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 30 OF 63

- 6.2.1.5 LPs shall consist of dust and vermin proof cubicles without the use of louvers.
- 6.2.1.6 Good quality synthetic rubber / neoprene gaskets shall be put around the door. The door when closed, shall compress the gasket uniformly.
- 6.2.1.7 Unless mentioned otherwise in Data Sheet A, degree of protection for completed LPs shall be IP:52 for indoor LPs and IP:55 for outdoor LPs.
- 6.2.1.8 The LPs shall be designed to prevent contact with live parts when the front door is open.
- 6.2.1.9 All busbars (phase, neutral, positive, negative as applicable) within a panel shall be of the same size.
- 6.2.1.10 All control wiring inside the panels shall be carried out with 1100 V grade, PVC insulated flexible copper wire of 2.5 sq. mm size.
- 6.2.1.11 The rated continuous current of the equipment and components shall be as given in the single line diagrams. These ratings shall be obtained with the components mounted in their housing as in service without exceeding the permissible temperature rise.
- 6.2.1.12 Each LP shall be fitted with M.S. mounting brackets.
- 6.2.1.13 Panel shall be suitable for top / bottom cable / conduit entries. However, outdoor LPs shall have bottom cable / conduit entry. Removable undrilled gland plate of sheet steel shall be provided for entry of cables. Minimum thickness of gland plate shall be 3 mm. The gland plate shall be of adequate size having knock-outs for requisite number cable connections. Gland plate shall be provided with gasket.
- 6.2.1.14 The lighting panel shall be complete with copper busbars, and shall incorporate switch fuse or MCB on the incoming side, single pole miniature circuit breakers (MCBs) for AC outgoing circuits and double pole MCBs for DC outgoing circuits. Number of outgoing circuits shall be as per BOQ.
- 6.2.1.15 Each lighting panel shall be fitted with two GI earth studs located in accessible position on the outside of the panel on opposite sides.
- 6.2.1.16 All metal parts of the panel except current carrying parts shall be bonded together electrically to the earthing stud.
- 6.2.1.17 Each panel shall be fitted with phase barriers of fireproof insulating material in such a manner that it is not readily possible for personnel to touch the phase busbars. Insulating sheet shall be fitted around the MCBs such that only the surface and toggle of the MCBs are available on the front.
- 6.2.1.18 The supply of cable lugs for power and control cable connections forms part the supply of equipment.
- 6.2.1.19 Each panel shall be provided with a circuit directory plate with inscriptions neatly typed and laminated, fitted on the inside of door.
- 6.2.2 Type of Lighting Panels



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 31 OF 63

- a) LP-A (n) - AC Lighting Panel
- b) LP-D (n) - DC Lighting Panel
- c) LP-F (n) - Fancy Lighting Panel (Decorative)
- d) LP-S (n) - Street Lighting Panel

NOTE : (n) indicates number of outgoing circuits.

6.2.3 AC Lighting Panel (LP-A)

6.2.3.1 LPs shall be provided with TPN switch as incomer.

6.2.3.2 Requisite number of single pole MCBs shall be provided for outgoing circuits.

6.2.3.3 Separate neutral shall be available at terminal block for each outgoing circuit.

6.2.3.4 Construction of AC Normal and AC Emergency panels shall be same.

6.2.4 DC Lighting Panels (LP-D)

6.2.4.1 LPs shall be provided with double pole switch as incomer.

6.2.4.2 Requisite number of double pole MCBs shall be provided for outgoing circuits.

6.2.5 Decorative Type Lighting Panels (LP-F)

6.2.5.1 Decorative lighting panels shall be designed for use in areas like administrative building, service building, canteen, residential premises etc.

6.2.5.2 Thickness of sheet steel shall be as per manufacturer's practice.

6.2.5.3 LPs shall be of tone colour with elegant finish.

6.2.5.4 LPs shall be provided with TPN switch as incomer and requisite number of MCBs shall be provided for outgoing circuits.

6.2.5.5 LPs shall be suitable for either surface or flush mounting as per Data Sheet A and BOQ. Flush mounted panels shall have the collared door suitable for matching with the wall.

6.2.5.6 Lighting Panels may be provided with transparent acrylic cover for operation of MCBs, if asked for in Data Sheet A.

6.2.5.7 LPs shall be provided with knockouts on the top, bottom and sides.

6.2.6 Street Lighting Panel (LP-S)

6.2.6.1 Street Lighting Panels shall be provided for feeding power supply to luminaires of street light poles, flood lighting poles, lighting masts etc.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 32 OF 63

6.2.6.2 Each Street Lighting Panel shall comprise of the following :

- a) One TPN door interlocked switch-fuse unit. Interlock defeat feature shall also be provided.
- b) Three pole AC Contactor
- c) 00 - 24 hrs timer and a photo-electric switch for automatic switching of contactor
- d) Three phase & neutral busbars
- e) Single pole or three pole MCBs for each outgoing circuit as per Data Sheet A
- f) Two lamps for bus supply ON & OFF indications
- g) Complete wiring arrangement as per control scheme.
- h) Auto-Manual selector switch
- i) ON push button
- j) OFF push button
- k) Photo switch

6.2.6.3 Switching ON and switching OFF shall be through both 00 - 24 hrs timer and light sensor in automatic mode.

6.2.6.4 One number light sensor in weather proof enclosure having IP:55 degree of protection shall be supplied loose along with each SLP.

6.2.6.5 Internal power wiring shall be done with PVC insulated Cu wire of suitable size. All control wiring inside the panel shall be carried out with 1100 V grade, PVC insulated flexible copper wires.

6.3 LIGHTING POLES

6.3.1 Lighting poles as required for street lighting and flood lighting shall be of swaged/stepped tubular steel of swan neck construction as per applicable standard. As an alternative RCC tubular pole construction as per applicable standard can also be quoted.

6.3.2 Unless mentioned otherwise in Data Sheet A, lighting poles shall be painted type provided with following surface treatment:

- a) The poles shall be coated with black bituminous paint, conforming to applicable standard, throughout on the inside surface and on the outside surface up to the level which is embedded in ground.
- b) Exposed outside surface shall be painted with two coats of red lead oxide primer and followed by two coats of aluminium paint.

6.3.3 Where galvanization of poles is specified;



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 33 OF 63

- a) All inside and outside surfaces of the pole and base plate shall be hot dip galvanised as per manufacturer's practice.
- b) Base plate shall be galvanised after welding to the pole base.
- c) Manufacturer's procedure for galvanisation shall be submitted for purchaser's approval during detailed engineering stage.

6.3.4 Each street lighting pole shall be supplied with necessary pipe-reducer / fixing-bracket for fixing the luminaire. The details of bracket arm are indicated in enclosed drawing.

6.3.5 Each street lighting pole shall be suitably provided with weather proof, galvanised steel junction box and two numbers fixing brackets suiting the diameter of the pole. The requirements of junction box are stipulated elsewhere. The fixing brackets shall be supplied loose.

6.3.6 Street lighting pole shall be provided with wiring hole. The location shall be coordinated with mounting position of street lighting pole JB. The diameter of hole shall be 20 mm. The hole shall be provided with a rubber / PVC grommet.

6.3.7 Flood lighting pole shall be provided with painted MS plate and shall be suitable for the number of flood lighting luminaires and controlgear boxes as per enclosed drawings.

6.3.8 Provision for earthing shall be provided for flood / street lighting poles at a height 1 metre above the ground.

6.3.9 Types of Lighting Poles

Exact type and designation of lighting pole is as given in Data Sheet A. Basic types are as follows :

- a) PS1 - Street Lighting Pole for one luminaire with 1200mm bracket arm.
- b) PS2 - Street Lighting Pole for one luminaire with 1800mm bracket arm.
- c) PS3 - Street Lighting Pole for one luminaire with 2500mm bracket arm.
- d) PS4 - Street Lighting Pole for two luminaires with 1800mm bracket arm each.
- e) PS5 - Street Lighting Pole for two luminaires with 2500mm bracket arm each.
- f) PS6 - Street Lighting Pole for four luminaires with 1800mm bracket arm each.
- g) PS7 - Street Lighting Pole for four luminaires with 2500mm bracket arm each.
- h) PF1 - Flood Lighting Pole for one luminaire.
- i) PF2 - Flood Lighting Pole for two luminaires.
- j) PF3 - Flood Lighting Pole for three luminaires.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 34 OF 63

k) PF4 - Flood Lighting Pole for four luminaires.

6.4 LIGHTING MASTS

6.4.1 The lighting mast (tower) shall be of steel sections having lattice structure construction with ladder, cage and top platform.

6.4.2 Lighting mast design shall be suitable for following :

- a) Height of the lighting mast as per type.
- b) Maximum number of luminaires as per Data Sheet A.
- c) Additional load of 500 kg towards the weight of maintenance crew.

6.4.3 Permissible design parameters should be according to relevant standard. The deflection under the maximum wind pressure of 150 kg/sq.m shall not exceed 1 in 360.

6.4.4 All steel sections, members and hardware used shall be hot dip galvanised as per applicable standard.

6.4.5 The mast shall be provided with a platform at the top, a steel cage ladder connecting to the ground and a midway landing. Height of the platform provided on the top of the mast shall be 2.0 metre and mid-way landing platform height shall be minimum 1.0 metre.

6.4.6 The span of rung shall not be less than 300mm and spacing between two adjacent rungs shall not be more than 300mm. Diameter of cage for ladder shall not be less than 1000 mm. Ladder shall be supported to give adequate rigidity.

6.4.7 Necessary mounting facilities for mounting of luminaires and controlgear boxes shall be provided at top platform. This shall include provision of holes in the fixing bracket for movable fixing plate. Adequate number of movable plates affixed to the bracket shall also be provided. Size of movable plates and the position of holes shall match with the luminaire fixing arrangement.

6.4.8 Mast shall be provided with 600mm long air termination for the lightning protection. Suitable arrangement for connection of down comer (not in the scope of vendor) shall be provided. Provision of earth connection of GI strip shall also be kept at an height of one metre from the ground.

6.4.9 Provision shall be made for supporting cables, down conductors etc. at regular intervals on lighting tower. Hot dip galvanised brackets of required size shall be provided for the same.

6.4.10 Height of lighting tower shall be the height of tower above the ground and upto the top of the top platform. Other members such as foundation members and lightning arrester shall not be considered for defining the height of tower.

6.4.11 Types of Lighting Masts

- a) LM25 - Lighting Mast with 25 m height



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 35 OF 63

- b) LM28 - Lighting Mast with 28 m height
- c) LM30 - Lighting Mast with 30 m height
- d) LM32 - Lighting Mast with 32 m height
- c) LM35 - Lighting Mast with 35 m height

6.5 JUNCTION BOXES

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

6.5.2 Construction Features

The junction boxes shall be fabricated out of MS sheet of thickness not less than 2.0mm 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.

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.

The junction boxes shall be weather proof type conforming to IP-55 of IS:2147. Junction boxes for street light poles and lighting/lightning masts shall be provided with hinged doors and allen keys with bolts as locking arrangement.

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.

The junction boxes shall be suitable for mounting on wall, columns, lighting poles, mast structures etc. The brackets, bolts, nuts, screws and any other erection accessories required for erection shall be included in the erection price. Circuit number, number of street lighting panel and pole/mast at site by the contractor after their installation.

6.5.3 Terminals

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.

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.

6.5.4 The junction boxes shall be of following types:

Type of junction boxes:



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 36 OF 63

Type	Description
JB-F	Provided with four (4) way stud type terminals for terminating upto 2Nos. 10 mm ² stranded aluminium conductors on each terminal, suitable for outdoor installations.
JB-FE	Same as above but with an additional epoxy coating of 50micron thickness.
JB-S	Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of 16mm ² stranded aluminium conductors & with one no.6A HRC fuse and link.
JB-M	Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of incoming 35mm ² stranded aluminium conductors, with three nos. 25A HRC fuses, one link, and one number 32A TPN switch, and four way stud type terminals each suitable for terminating 16sq.mm. Al conductor outgoing cable.
JB-M1	6way stud type terminal block for three phases and three neutrals of adequate size to receive 4C-16mm ² incomer cables and three nos. 2Cx2.5mm ² Cu conductor outgoing cables.
JB-SW1	Provided with four (4) way stud type terminals each terminal suitable for terminating to 10mm ² stranded aluminium conductor.
JB-SW2	Similar to the JB-SW1 but provided with ten (10) way terminals.
JB-SW3	Similar to JB-SW1 but provided with eighteen (18) way terminals.

6.6 FUSE BOXES

- 6.6.1 Boxes shall be suitable for accommodating fuses, neutral links and termination of cables on each side.
- 6.6.2 Boxes shall be of rectangular shape and fabricated out of sheet steel, hot dip galvanised and of weather proof construction.
- 6.6.3 Sheet steel thickness shall be 1.6 mm, unless mentioned otherwise in Data Sheet A.
- 6.6.4 Unless specified otherwise in Data Sheet A, degree of protection of fuse boxes shall be IP:55.
- 6.6.5 Galvanisation shall be done corresponding to the sheet thickness and as per the applicable standard.
- 6.6.6 Boxes shall be provided with a hinged lockable door with neoprene gasket lining all over. Lock shall be operable with an allen key.
- 6.6.7 Terminals shall be stud type suitable for ring type lugs. The size of cable shall be intimated during detailed engineering.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 37 OF 63

- 6.6.8 Boxes shall be provided with suitable knock outs for conduit / cable connections.
- 6.6.9 Two earthing terminals suitable for GI earthing wire shall be provided for each box.
- 6.6.10 Boxes shall be suitable for mounting on walls, structural members etc. Suitable welded fixing brackets shall be provided for this purpose.
- 6.6.11 Fuse boxes shall be provided with a danger plate for the rated line to line voltage.
- 6.6.12 Types of Fuse Boxes
- a) FB - 1 Fuse Box with 1 fuse and 1 link
 - b) FB - 2 Fuse Box with 2 fuses and 2 links
 - c) FB - 3 Fuse Box with 3 fuses and 3 links
 - d) FB - 4 Fuse Box with 3 fuses and 1 link
- 6.7 RECEPTACLES
- 6.7.1 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.
- 6.7.2 Receptacle boxes shall be fabricated from CRCA sheets or made of heavy duty cast aluminium alloy as per Data Sheet A. Thickness of sheet steel shall be 1.6 mm, unless mentioned otherwise in Data Sheet A.
- 6.7.3 Steel boxes shall be hot dip galvanised as per the requirements of applicable standard corresponding to the sheet thickness.
- 6.7.4 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.
- 6.7.5 The boxes shall be provided with neoprene rubber gaskets to make them moisture and dust proof.
- 6.7.6 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.
- 6.7.7 The receptacle units shall be of the following types:
- i) Type RA: It shall have the following:
 - a) 20A, 250V, 1-phase, 2 pole, 3-pin (third pin scrapping earth) porcelain, metal clad socket with a metallic cover tied to it, similar to 'Crompton Greaves' type AS20 or equivalent.
 - b) Rotary, heavy duty 20A switch conforming to applicable standard.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 38 OF 63

- c) Shrouded, die-cast aluminium plug similar to `Crompton Greaves' type AS20 or equivalent. Combined interlocked weather proof industrial unit.
 - d) Mechanical interlock shall be provided as follows :
 - i) Switch can be put ON only when plug is fully engaged.
 - ii) Plug can be withdrawn only when switch is in OFF position.
 - iii) Cover can be opened only when switch is in OFF position.
 - e) The arrangement should ensure that water does not enter tyhe plug when socket is ON.
 - f) 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:
- a) 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.
 - b) 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:
- a) 63A, 415V, 3-phase-neutral earth, metal clad socket with cover, similar to `Crompton Greaves' type CS63.
 - b) Rotary, heavy duty 63A switch conforming to applicable standard.
 - c) Shrouded, die-cast aluminium plug similar to `Crompton Greaves' type CP63
 - d) It shall be combined, interlocked weather proof industrial unit.
 - e) Mechanical interlock shall be same as that are applicable for RA type receptacles
 - f) 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.

6.8 CEILING FAN & REGULATORS

- 6.8.1 The bidder shall supply the following ceiling fans complete with suspension rod, canopy and accessories and regulators:
- i) 1200 mm sweep



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 39 OF 63

ii) 1400 mm sweep

6.8.2 The fan motor shall be totally enclosed. The motor winding shall be of copper wire provided with double or reinforced class-E insulation.

6.8.3 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.

6.8.4 The regulator shall be conventional/electronic type with stepped/smooth (stepless) control of approved make.

6.8.5 The ceiling fans shall generally conform to relevant IS.

6.9 LIGHTING CONTROL SWITCH-BOXES

6.9.1 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.

6.9.2 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.

6.9.3 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.

6.9.4 Switches shall be of piano-key type having quick-make, quick-break mechanism, provided with position marking, suitable for mounting on insulating plate. The 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.

6.9.5 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.

6.9.6 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 with JB type SW2.

iii) Type SWB3 - 7 nos. 5A switches and 3 nos. fan regulator with JB type SW3.

7.0 COMPONENTS OF MAIN EQUIPMENT (OTHER THAN LUMINAIRES)

7.1 MOULDED CASE CIRCUIT BREAKERS

7.1.1 Moulded case circuit breakers (MCCBs) shall be provided when called for in Data Sheet A for use in lieu of switch fuse for LDB incomer. MCCB shall meet the requirements stipulated in Data Sheet A.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 40 OF 63

- 7.1.2 MCCBs in AC circuits shall be of triple pole construction arranged for simultaneous three pole manual closing and opening and for automatic tripping at short circuit and overload. Neutral link shall be provided for LDBs without transformers.
- 7.1.3 Operating mechanism shall be quick make, quick break and trip free type.
- 7.1.4 The ON, OFF & TRIP positions of the MCCB shall be clearly indicated so as to be visible to the operator when mounted as in service. Operating handle shall be provided on front of the LDB.
- 7.1.5 MCCBs shall be capable of withstanding the thermal stresses caused by overloads and short circuits. The maximum tripping time under short circuit shall not exceed 20 milli seconds.
- 7.1.6 MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.
- 7.1.7 Under voltage release and other releases shall be provided as specified in Data Sheet A / BOM / schemes.
- 7.2 SWITCH-FUSE UNITS
- 7.2.1 These units shall preferably comprise of switches having integral fuses, called composite units. Alternatively, combination units of separate switch and fuse may also be acceptable.
- 7.2.2 These units shall be provided for general purpose i.e. incoming or outgoing units.
- 7.2.3 The units shall be of the air break air insulated type and designed to ensure safety to operating personnel.
- 7.2.4 Composite units shall have integral fuses i.e. fuse carrier with fuse link (fuse link forming the moving contact). The design shall ensure that the moving contact is not live when switch is open i.e. in OFF position, so as to facilitate removal of fuse.
- 7.2.5 The switch shall be capable making and carrying the system prospective fault current, but limited in magnitude and duration by the cut off characteristics of the largest HRC fuse link that may be fitted to that unit.
- 7.2.6 The fixed contact shall be so shrouded that maintenance of the unit can be carried out in safety with the busbars live.
- 7.2.7 Where one isolating switch is used as the incoming device, the incoming side fixed contacts shall be shrouded to ensure that maintenance can be carried out with the remote fuse and switch closed.
- 7.2.8 Composite switch-fuse or the combination of switch and fuse shall meet the requirements of its components as follows:
- 7.2.9 Isolating Switch
- a) Switches shall be air-break, quick make, quick break heavy duty type conforming to applicable standard.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 41 OF 63

- b) All switches shall have visible ON / OFF position indication and shall be padlockable in any (ON / OFF) position.
- c) Switches shall be door interlocked such that it shall not be possible to gain access to inside the unit unless the isolating switch is in OFF position.
- d) The switches shall be suitable for independent manual operation.
- e) The switch contacts shall be of silver alloy or silver plated copper and springs of non-corrosive material.
- f) Inter-phase barriers shall be provided to prevent possibilities of phase to phase fault in the switch. The switch shall also be shrouded from all sides to prevent access to live parts on the switch after opening the unit door. The barriers and shrouding shall extend upto the height of switch to fully enclose both side terminals of the device. The arrangement shall permit easy maintenance.

7.2.10 High Rupturing Capacity (HRC) Fuses

- a) The fuse serving as the short-circuit protective device in isolating fuse-switch units shall be of HRC cartridge, current limiting and plug-in non-deteriorating type.
- b) The fuse carriers shall be easily withdrawable for replacement of fuse. Insulated fuse pullers shall be provided where fuses are not mounted in insulating carriers to remove and replace fuses in live conditions.
- c) Fuses shall preferably be fitted with a device to indicate operation (i.e. when the fuse has blown).
- d) Live terminals of fuse bases shall be shrouded to prevent contact with personnel where fuse links are not mounted in carriers and are directly plugged into the fuse base. Inter-phase barriers extending throughout the length of the fuse base shall be provided to prevent inter-phase short circuit. They shall be shrouded from all sides to prevent accidental contact.
- e) Fuse carriers and bases shall be of good quality moulded insulating material. Porcelain fuse bases and carriers will not be accepted.
- f) The rating and characteristics of fuse links shall be chosen appropriately for short circuit protection of circuits down stream.

7.3 INDICATING METERS

7.3.1 Meters shall be panel mounted, flush type and suitable for rear terminal connection.

7.3.2 Meters and instruments shall be enclosed in dust proof, moisture resistant black finished cases and shall be suitable for tropical use. Instruments shall be suitable for operation from the secondary windings of CTs and VTs.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 42 OF 63

- 7.3.3 All instruments shall be calibrated to enable direct reading of primary quantities. Instruments shall be adjusted and calibrated at manufacturer's works and shall have means of calibration, checking and zero adjustment at site.
- 7.3.4 Instruments pointer shall have 90° movement. All the divisions and the quantity to be measured shall be clearly marked. Instruments shall conform to applicable standard and shall have accuracy class 1.5 or better having black numerals and lettering on white anti-parallax dial with knife edge pointer. Indicating instruments shall be of moving iron type for AC and moving coil type for DC circuits.
- 7.3.5 Ammeter, voltmeter etc. shall be of 96mm x 96mm (minimum) size.
- 7.3.6 Instruments having metallic cases shall be fitted with earthing terminals.
- 7.4 CONTACTORS
- 7.4.1 Contactors shall be of the air break type fitted with arc shields.
- 7.4.2 The operating coil shall be suitable for satisfactory operation in the range of 85% - 110% of nominal voltage specified under the Data Sheet A. The coil shall be tropicalized having insulation not less than class 'E'.
- 7.4.3 Electrically independent auxiliary contacts not less than 2NO + 2NC for interlocking and indication shall be fitted to individual power contactor.
- 7.4.4 All springs shall be made out of a corrosion proof material.
- 7.5 RELAYS
- 7.5.1 Relays shall be provided on the various circuits as per schemes. Relays shall be flush mounted on front of the board. Relay case shall be painted with dull black or egg shell black enamel and with back connected terminals. Metal cases and frames of relay shall be earthed.
- 7.5.2 All relays shall be of withdrawable type with built-in testing facilities, with provision for inspection, maintenance and replacement. Where built-in test facility is not provided for a particular relay, separate suitable test block shall be provided on the board for this purpose.
- 7.5.3 Relay performance shall not alter due to mechanical shock or vibration or external magnetic field which may be present at the place of mounting.
- 7.5.4 Each relay shall not have less than two independent pairs of contacts.
- 7.6 CURRENT TRANSFORMERS
- 7.6.1 CTs shall be air insulated having insulation class E or better, cast resin type and shall be capable to withstand the thermal and mechanical stresses resulting from maximum short circuit.
- 7.6.2 The short time current duration for CTs shall be one second.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 43 OF 63

7.6.3 CT primary current shall not be less than the full load thermal rating of the associated circuit. CT secondary shall have 5Amp rating unless specified otherwise in Data Sheet A. Polarity shall be marked in a suitable manner. The ratings shall be adequate to cater for the burden of connected instruments.

7.6.4 Measuring CTs shall have accuracy class 1.0 and instrument security factor less than 5.

7.6.5 CTs shall be of bar primary / wound primary / ring type capable of carrying the rated primary current.

7.7 VOLTAGE TRANSFORMER

7.7.1 Voltage transformers (VT) shall be dry, cast resin type comprising of single phase or three phase units. They shall have their primary windings protected by current limiting fuses with interrupting capacity corresponding to that of the lighting board / panel.

7.7.2 VT secondary windings shall be earthed in LDB / LP through link, which can be removed for insulation testing.

7.7.3 Three phase voltage transformers shall have 110 V secondary voltage unless mentioned otherwise in Data Sheet A. Single phase VTs shall have voltage rating of :

$$(\text{Nominal System Voltage} / \sqrt{3}) \text{ V} / (110 / \sqrt{3}) \text{ V}$$

So that secondary voltage shall be 110 volts phase to phase when the secondary winding is star connected. The accuracy class of VTs shall be 1.0. VTs shall have an output rating adequate to cater to the burden connected to them.

7.8 MINIATURE CIRCUIT BREAKERS

7.8.1 The use of miniature circuit breakers (MCBs) combining thermal overload and magnetic short circuit protection shall be application for the outgoing circuits of Lighting Panels.

7.8.2 MCBs shall have suitable rating but not less than 20A, 9kA.

7.8.3 MCBs shall be suitable for housing in the lighting panel and for connection of copper link bus bar at the incoming and copper lugs at the outgoing ends.

7.8.4 The terminals of MCB and ON / OFF positions shall be clearly and indelibly marked.

7.9 SELECTOR SWITCHES

7.9.1 The rating and other features of the switches shall be suitable for the application. The number of positions and the number of contacts required for each switch shall be as indicated in the schemes enclosed.

7.9.2 Selector switches shall be stay put type, provided with properly designated escutcheon plates clearly marked to show operating position.

7.9.3 Terminals carrying potential above 120 Volts shall be shrouded to prevent accidental contact with personnel.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 44 OF 63

- 7.9.4 Ammeter selector switches shall have make before break contacts.
- 7.9.5 The switches shall be suitable for semi-flush mounting with the front plate and operating handle projecting out. All connection to the switches shall be from the back.
- 7.9.6 The arrangement for front mounting of these devices shall be such as to make them reasonably dust free so as not to interfere with normal operation.
- 7.10 INDICATION LAMPS
- 7.10.1 Indication lamps shall be complete with lens covers and holders.
- 7.10.2 Each lamp shall be fitted with a durable resistance integrally wired in series with the lamp. Alternatively, lamps with built in transformers are acceptable.
- 7.10.3 The lamp cover (lens) shall be translucent of appropriate colour.
- 7.10.4 Bulbs and covers shall be interchangeable, easily replaceable from the front without the need for any special means.
- 7.10.5 Terminals having potential above 120V shall be shrouded to prevent contact with personnel.
- 7.11 PUSH BUTTONS
- 7.11.1 Push button shall be heavy duty, flush mounted suitable for the application.
- 7.11.2 Push button shall be provided with integral escutcheon plates marked with its function identified as per schemes.
- 7.11.3 Colour shall be appropriate to the function.
- 7.11.4 Minimum number of contacts shall be 1 NO + 1 NC or as per the requirements of control scheme.
- 7.12 TERMINALS
- 7.12.1 Terminals shall be stud type of copper material.
- 7.12.2 Terminals shall be provided with transparent cover(s).
- 7.12.3 Separate terminals shall be available for each termination of loop-in and loop-out power connections.
- 7.12.4 Terminals shall be suitable for ring type copper cable lugs of size depending upon the circuit rating.
- 7.13 CABLE GLANDS
- 7.13.1 Whether specifically mentioned or not, cable glands of suitable sizes shall be supplied along with each equipment for power and control cables.
- 7.13.2 Cable glands shall be single compression type of brass material.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 45 OF 63

- 7.13.3 Cable glands shall be nickel plated, unless specified otherwise in Data Sheet A.
- 7.13.4 Rubber components used in the gland shall be of neoprene.
- 7.13.5 Name / trade name of manufacturer, type no. and applicable range of outer diameter of cable shall be engraved / indelibly printed on the cable gland.
- 7.14 CABLE LUGS
- 7.14.1 All equipment shall be supplied with the power and control cable lugs of suitable size, whether specifically mentioned or not.
- 7.14.2 Cable lugs shall be of tinned copper.
- 7.14.3 Name / trade name and size of lug shall be engraved/ indelibly printed on each cable lug.
- 7.15 TIMERS
- 7.15.1 Time Switch
- Time switch shall be suitable for automatic switching ON and OFF of street lighting / flood lighting circuits.
 - Time switch have 00 - 24 hrs clock base.
 - Time switch shall indicate actual time and shall permit accurate time setting.
 - Time switch shall be rugged, independent of normal fluctuations of voltage / frequency and free from maintenance.
 - Contact rating, clock accuracy, rated voltage rating and frequency rating of timer shall be suitable to its application.
 - Time switch shall be provided with Ni-Cd battery.
 - Time switch shall be suitable for mounting inside the panel.
- 7.15.2 On Delay Timer
- On delay timer shall be required for continuation of DC supply for a limited duration when the AC Emergency supply has been restored and DG set is under stabilisation.
 - Timer shall be fully static and suitable for operation on normal frequency and system voltage.
 - Timer shall have high setting accuracy, high repeat accuracy, low reset time and low power consumption.
 - Timer shall have the time setting range of 24 - 240 seconds, unless mentioned otherwise in Data Sheet A.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 46 OF 63

e) Timer shall be suitable for mounting inside the panel.

8.0 LABELING

8.1 Labels to identify all the Main assemblies, Sub-assemblies and components of the LDBs and LPs shall be provided.

8.2 Name and rating plate / marking shall be provided as required by relevant standard applicable to each component / assembly to be identified.

8.3 Labels shall be of two colour, three layer plastic material with matt or semi matt finish or of the anodised aluminium sheet.

8.4 All labels other than "Danger" or "Warning" labels shall have black lettering on a white background. Danger labels shall be as per applicable standard and shall not be affixed on to removable parts.

8.5 All labels shall be securely fixed on to the equipment by means of self tapping screws or other approved means.

8.6 Stick-on type labels of good quality and permanent mounting shall be acceptable for internally mounted components only.

8.7 A list of all such items to be labeled and text and type of labels to be provided is given below :

a) BOARD DESIGNATION (MAIN EQUIPMENT LABEL)

i. Inscription : Designation & LDB number for LDBs.
Designation and LP number for LPs.

ii. Location : Top centre in the front of the LDB.
Top centre in the front of the LP.

iii. Material : 3 Layer plastic material, fixation by self tapping, non-rusting screws, black inscription on white back ground.

b) OUTGOING - FEEDER DESIGNATION

i. Inscription : Module number, LP number / purpose.

ii. Material : Black engraving on white anodised aluminium plate of thickness 1.6 mm or more. Plate to be secured with screws.

c) COMPONENT DESIGNATION

i. Inscription : Letter symbol / Legend as assigned in schemes.

ii. Location : Near or on the component



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 47 OF 63

iii. Material : Stick-on type

8.8 CIRCUIT DIAGRAM / DIRECTORY PLATE

8.8.1 A diagram is to be prepared for fixing to the inside cover of every lighting panel giving details of the points controlled by each circuit.

8.8.2 The circuit list shall be typed or printed stating the location of the equipment served, rating of the protective unit and the circuit loadings.

8.8.3 The list shall be mounted on the inside of the cover door and shall be protected by an acrylic sheet cover to be easily removable to permit circuit modifications.

9.0 SURFACE TREATMENT

9.1 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.

9.2 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.

9.3 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.

9.4 All parts shall then be subjected to a coat of red oxide primer paint.

9.5 All inside and outside surfaces of panel shall be spray painted with synthetic enamel of the shade as per Data Sheet A.

9.6 Paint thickness shall be minimum 80 microns unless specified otherwise in Data Sheet A.

9.7 Electrostatic or powder painting shall be acceptable subject to purchaser's approval.

9.8 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.

10.0 PACKING

10.1 Packing procedure shall conform to the General Technical Conditions (Volume IIC).

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



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 48 OF 63

11.0 GUARANTEED PERFORMANCE REQUIREMENTS

- 11.1 The vendor shall guarantee satisfactory performance of the equipment supplied under all conditions and requirement as laid down by this specification.
- 11.2 For the general requirements of performance guarantees refer to other parts of the specification.

12.0 INSPECTION & TESTING

- 12.1 Inspection and testing of Lighting equipment shall be performed as per BHEL standard Quality Plans. Bidder shall sign and stamp the Quality Plans for conforming compliance. The equipment which are not covered in the Quality Plan shall be tested as per the QP to be submitted by bidder. Purchaser's comments shall be incorporated and final QPs shall be submitted for purchaser's approval during contract engineering stage. Modifications in the QP shall be incorporated without any cost implication to the purchaser.
- 12.2 All the components and completely assembled equipment shall be tested as per the latest edition of standards indicated in Annexure-I.
- 12.3 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.
- 12.4 Functional testing shall be carried out for Lighting Distribution Boards.
- 12.5 All manufacturing processes viz. machining, sheet forming, electroplating, wire routing, cleating & crimping, assembly, surface preparation shall conform to good manufacturing practices.
- 12.6 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.
- 12.7 Safety interlocking verification shall be done.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 49 OF 63

- 12.8 Each lighting transformer shall be routine tested and one transformer of each rating shall be type tested in accordance with relevant standard in case type test certificates of similar transformers are not available / not acceptable to the purchaser.
- 12.9 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.
- 13.0 QUANTITY VARIATION
- 13.1 Quantities of various items are indicated in BOQ as part of Section C, Volume IIB for the purpose of bidding.
- 13.2 Purchaser reserves the right to delete / add any of the equipment from the vendor's scope of supply. Unit prices quoted shall be considered for this purpose.
- 13.3 Unless stated otherwise in Data Sheet A, the unit rates quoted by the bidder for various equipment shall be firm for a variation of quantities limited to as follows :
- a) +30% of the total order value till the finalisation of engineering details and Master BOQ.
- b) +10% of total order value till the completion of works at site.
- 14.0 SPARES
- 14.1 A list of commissioning spares and O&M spares' quantities for a duration specified in Data Sheet A shall be filled up in the applicable schedule / format and submitted by bidder along with offer.
- 14.2 The bidder shall indicate any additional start-up and O&M spares and their recommended quantities, which may be required as per vendor's usual practice. However, the acceptance of the same shall not be binding on purchaser.
- 15.0 TOOLS AND TACKLE
- 15.1 Tools & tackle which are essential to facilitate assembly, adjustments, erection, maintenance & dismantling of equipment shall be provided as part of equipment supplied.
- 15.2 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.
- 15.3 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.
- 15.4 Schedule of tools & tackle shall be filled up by bidder.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 50 OF 63

16.0 DOCUMENTATION

16.1 Purchaser's documents as part of tender

Purchaser's single line diagrams, schematic drawings, documents etc. being enclosed in the specification are listed in Data Sheet A.

Specification of sea-worthy packing forms part of the specification for export jobs.

16.2 Documents to be submitted by the Bidder along with the bid.

- a) Complete technical literature on luminaires, accessories and lamps.
- b) Quality Plans enclosed with the tender with bidder's seal and signature of acceptance on each sheet.
- c) Quality Plan for additional items.
- d) Catalogues / technical leaflets of all major components.
- e) Deviations from the technical specification, if any, brought out in the enclosed "Schedule of Deviations" (Volume III).
- f) Unpriced Price Schedules enclosed in Vol.III.
- g) Schedule of quantities of commissioning spares.
- h) Schedule of quantities of O&M spares.

16.3 Documents to be submitted by the vendor immediately after award of contract (Along with Data Sheet B).

- a) General arrangement drawings for all types of LDBs with following details :
 - i. Dimensions of each panel and overall dimensions.
 - ii. Arrangement of panels / modules.
 - iii. Floor mounting details and cutout details.
 - iv. Single Line Diagram.
 - v. Rating of components.
 - vi. Bill of quantities.
- b) General arrangement drawing of Lighting Transformer.
- c) Bar chart of activities of manufacture, testing, inspection and despatch.

16.4 Documents to be submitted during detailed engineering of contract



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 51 OF 63

16.4.1 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) Control schemes for DC and street lighting
- e) Power load on each LP & LDB
- f) Layout drawings for indoor areas
- g) Layout drawings for outdoor areas.
- h) Conduit layout drawings.
- i) Wiring and load distribution details for outdoor areas.
- j) Master Bill of Material.

16.4.2 Other documents :

- a) Final Quality Plans
- b) Polar curves, zonal flux diagram and CoU charts of luminaires.
- c) Complete design calculations for arriving at number of luminaires.
- d) Fixing / mounting details of luminaires and other items.
- e) General arrangement drawings of following :
 - i. Luminaires
 - ii. Controlgear boxes
 - iii. LPs
 - iv. Lighting Poles
 - v. Lighting Masts
 - vi. Street Lighting Pole JBs
 - vii. Fuse Boxes
 - viii. Receptacles
 - ix. 24 V Supply module



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 52 OF 63

- f) Field Quality Plan as per General Technical Conditions.
- g) Rating and diagram plate drawing for lighting transformer.
- h) Structural design calculations for lighting tower.
- i) Foundation design calculations for lighting tower.
- j) Control Scheme for fluorescent, HPMV and HPSV luminaires.
- k) Schematic drawings for LDBs / LPs.
- l) Type test certificates.
- m) Catalogues / leaflets

16.4.3 Operation and maintenance (O&M) manual :

16.4.3.1 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) Characteristic curves of HRC fuses, MCCBs, MCBs etc.
- d) Technical leaflet of various items / components.
- e) Copies of the type, acceptance and routine test certificates in bound volume.
- f) Details of all components liable to be replaced during the life of the equipment.
- g) List of maintenance tools required.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 53 OF 63

h) List of testing equipment required.

16.4.3.2 Draft O & M manual shall be submitted for approval

16.4.3.3 Final O&M shall be submitted in bound volume.

16.5 AS BUILT DRAWINGS

16.5.1 In case Engineering is the scope of vendor, the preparation of As Built Drawings shall be the scope of vendor.

16.5.2 The As Built Drawings shall be prepared on the basis of marked up copies received from the erection contractor.

16.5.3 Entire work of As Built Drawings shall be to the satisfaction of purchaser. Requisite number of prints and RTFs shall be submitted by vendor.

16.6 Number of copies of documents to be submitted by vendor shall be as per section-C of specification.

17.0 24 V SYSTEM

17.1 Each 24V AC supply module will have one no. air-cooled two winding, 500VA, 1-phase, 50HZ, 240/24V transformer with 5A (240V side) and 15A (24V side) HRC fuse and necessary 240V and 24V terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module will be fed from respective lighting panels (LP). A group of 5A, 24V AC sockets identified with colour coding in order to distinguish them from the normal 240V sockets will be envisaged.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 54 OF 63

**ANNEXURE-I
LIST OF APPLICABLE STANDARDS**

ILLUMINATION

1. Code of practice for interior illumination [] IS 3646
2. Code of practice for industrial lighting [] IS 6665
3. Code of Practice for Lighting of Public Thoroughfares [] IS 1944

LUMINAIRES

4. General and safety requirement for electric lighting fittings [] IS 1944
5. Luminaires [] IS 10322
6. Industrial luminaire with metal reflectors [] IS 1777
7. Industrial lighting fittings with plastic reflectors [] IS 3287
8. Decorative lighting outfits [] IS 5077
9. Water proof electric lighting fittings [] IS 3528
10. Specification for Watertight Electric Lighting Fittings [] IS 3553
11. Dust proof electric lighting fittings [] IS 4012
12. Dust tight electric lighting fittings [] IS 4013
13. Flame proof electric lighting fittings well glass & bulk head types [] IS 2206 : Part 1
14. Electric lighting fittings for division 2 areas [] IS 8224

LAMPS

15. Tungsten Filament Lamps for Domestic and Similar General Lighting Purposes [] IS 418
16. Specification for Tubular Fluorescent Lamps for General Lighting Service [] IS 2418
17. High pressure mercury vapour lamps [] IS 9900
18. High pressure sodium vapour lamps [] IS 9974

LUMINAIRE COMPONENTS

19. Ballast for fluorescent lamps for switch start circuits [] IS 1534 : Part 1
20. Ballast for high pressure mercury vapour lamps [] IS 6616
21. Capacitors for use in tubular fluorescent high pressure mercury and low pressure sodium vapour discharge lamp circuit [] IS 1569
22. Bi-pin lamp holders for tubular fluorescent lamps [] IS 3323
23. Methods of measurement of lamp cap temp. rise [] IS 8913
24. Starters for fluorescent lamps [] IS 2215



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 55 OF 63

25. Holders for starters for tubular fluorescent lamps [] IS 3324
26. Cast acrylic sheets for use in luminaires [] IS 7569

ASSEMBLED EQUIPMENT AND COMPONENTS

27. Low-Voltage Switchgear and Controlgear : Part 1 - General Rules [] IS/IEC 60947 : Part 1 *

* replaces IS 4237 (General requirements for swgr. and control gear for voltage not exceeding 1000 V AC or 1200 V DC) and IS 2147 (Degree of protection provided by enclosures for LV switchgear & control gear)

28. Code of practice for selection, installation & maintenance of switchgear & control gear [] IS 10118
29. Electrical Apparatus for Explosive Gas Atmospheres - Flameproof Enclosures "d" [] IS 2148
30. Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation [] IS 5572
31. [See Sl. No. 27 above] [] IS 2147
32. Specification for Dry-Type Power Transformers [] IS 11171
33. Low-Voltage Switchgear and Controlgear - Part 3 : Switches, Disconnectors, Switch-Disconnectors and Fuse Combination Units [] IS/IEC 60947 : Part 3 *

* replaces IS 4064 (Air break switches, disconnector etc. and fuse combinations units)

34. Electrical Accessories - Circuit-Breakers for Overcurrent Protection for Household and Similar Installations - Part 2 : Circuit-Breakers for ac and dc Operation [] S/IEC 60898 : Part 2 *

* replaces IS 8828 (Electrical Accessories - Circuit Breakers for Over Current Protection for Household and Similar Installations) ; this IS was assigned in the listing before for "Miniature air break circuit breaker for voltages not exceeding 1000 V"

35. LV Fuses for voltages not exceeding 1000 V ac or 1500 V dc [] IS 13703 *

* replaces IS 9224 (Low voltage Fuses)

36. Low-Voltage Switchgear and Controlgear- Part 4 Contractors and Motor-Starters – Section 1 :Electromechanical Contactors and Motors-Starters [] IS/IEC 60947 Part 4 *

* replaces IS 2959 (Contactors for voltags not exceeding 1000 V AC or 1200V DC)

37. Visual indicator lamps [] IS 1901

POLES, SOCKETS AND OTHER MISCELLANEOUS



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 56 OF 63

38. Specification for Tubular steel poles [] IS 2713
for over head power lines
39. Plugs and Socket-Outlets of Rated Voltage [] IS 1293
Up to and Including 250 Volts and Rated
Current Up to and Including 16 Amperes - Specification
40. Switch socket outlets (non-interlocking) [] IS 4615 *
* Std. withdrawn ; superceding one not known.
41. Interlocking switch socket outlets [] IS 4160
42. Hot Rolled Low, Medium and High Tensile [] IS 2062 *
Structural Steel
* replaces IS 226 [Structural steel (Standard quality)]
43. Danger notice plates [] IS 2551
44. General Requirements for Enclosures for [] IS 14772 *
Accessories for Household and Similar Fixed Electrical Installations - Specification
* replaces IS 5133 (Boxes for enclosure of electric accessories steel & cast iron boxes)
45. General Construction in Steel [] IS 800
- Code of Practice
46. Wrought aluminium and aluminium [] IS 5082 *
alloy bars, rods, tubes and sections for electrical purposes
* this standard not found in the web-listing "Indian standards (on CD-ROM)"
47. Code of practice for phosphating [] IS 6005
of iron and steel
48. Colours for ready mixed paints & enamels [] IS 5
49. Recommended practice for hot dip [] IS 2629
galvanising of iron & steel
50. Methods for testing uniformity of [] IS 2633
coating on zinc coated articles
51. PVC Insulated cables for working [] IS 694
voltages upto and including 1100 V
52. PVC insulated (heavy duty) electric cables [] IS 1554 : Part 1 & Part 2
53. Direct Acting Indicating Analogue Electrical [] IS 1248
Measuring Instruments and their Accessories
54. Specification for Electrical Relays for Power [] IS 3231 : Part 1
System Protection - Part 1 : General Requirements
55. Specification for Electrical Relays for Power [] IS 3231 : Part 3 : Sec 1
System Protection - Part 3 : Requirements for
Particular Group of Relays- Section 1 :
Non-specified Time or Independent Specified
Time Measuring Relays



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

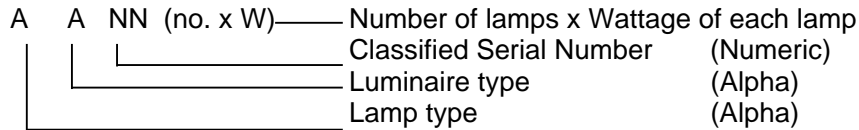
REVISION 0 | DATE: 31-01-2006

SHEET 57 OF 63

LUMINAIRE DETAILS

LUMINAIRE CODING SCHEME

1.0 Code Structure



2.0 Lamp types

- a) F - Fluorescent
- b) M - Mercury Vapour
- c) S - Sodium Vapour
- d) T - Tungsten
- e) H - Halogen

3.0 Luminaire types

- a) C - Channel Mounted (Fluorescent)
- b) B - Bay Mounted
- c) W - Well Glass
- d) S - Street Lighting
- e) F - Flood Lighting
- f) H - Bulk Head
- g) P - Post Top Lantern
- h) E - Emergency Lighting
- i) X - Others

4.0 Serial Numbers

- a) 01 - 20 General Purpose (Industrial)
- b) 21 - 40 Decorative
- c) 41 - 50 Vapour Proof
- d) 51 - 60 Dust Proof
- e) 61 - 70 Drip Proof
- f) 81 - 90 Corrosion Proof
- g) 91 - 99 Flame Proof

NOTES :

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.

1.0 Fluorescent Lamp Luminaires



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 58 OF 63

- 1.1 FC01 1 x 40 Fluorescent, industrial box type base without any cover.
 - 1.2 FC02 2 x 40 Fluorescent, industrial box type base without any cover.
 - 1.3 FC03 1 x 40 Fluorescent, industrial box type base and stove enamelled side reflectors.
 - 1.4 FC04 2 x 40 Fluorescent, industrial box type base and stove enamelled side reflectors.
 - 1.5 FC05 1 x 40 Fluorescent, industrial box type base and vitreous enamelled side reflectors.
 - 1.6 FC06 2 x 40 Fluorescent, industrial box type base and vitreous enamelled side reflectors.
 - 1.7 FC21 1 x 40 Fluorescent, decorative with 3 side perspex acrylic diffuser.
 - 1.8 FC22 2 x 40 Fluorescent, decorative with 3 side perspex acrylic diffuser.
 - 1.9 FC23 1 x 40 Fluorescent, decorative, recessed type with perspex acrylic diffuser.
 - 1.10 FC24 2 x 40 Fluorescent, decorative, recessed type with perspex acrylic diffuser.
 - 1.11 FC25 1 x 40 Fluorescent, decorative, recessed type with mirror optic reflector.
 - 1.12 FC26 2 x 40 Fluorescent, decorative, recessed type with mirror optic reflector.
 - 1.13 FC27 2 x 40 Fluorescent, decorative with opal polystyrene louvers.
 - 1.14 FC28 2 x 40 Fluorescent, decorative, recessed type with opal polystyrene louvers.
 - 1.15 FC29 2 x 40 Fluorescent, decorative with vertical metallic louvers.
 - 1.16 FC30 4 x 20 Fluorescent, decorative, recessed type, 600 x 600 size with perspex acrylic diffuser.
 - 1.17 FC31 4 x 20 Fluorescent, decorative, recessed type, 600 x 600 size with opal polystyrene louvers.
 - 1.18 FC32 2 x 20 Fluorescent, decorative, surface mounted with mirror optic reflector.
 - 1.19 FC41 2 x 40 Fluorescent, vapour proof with end boxes and control gear box of cast Al.
 - 1.20 FC51 2 x 40 Fluorescent, dust proof, totally enclosed type with sheet steel housing.
 - 1.21 FC61 1 x 40 Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover.
 - 1.22 FC62 2 x 40 Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover.
 - 1.23 FC81 2 x 40 Fluorescent, corrosion proof, totally enclosed type with sheet aluminium housing.
- 2.0 **High Pressure Mercury Vapour (HPMV) Lamp Luminaire**



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 59 OF 63

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.
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 housing.
2.21	MW92	1 x 125	Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium housing.
2.22	MW93	1 x 80	Mercury, well glass, flame proof with vitreous enamelled reflector and cast iron housing.
2.23	MW94	1 x 125	Mercury, well glass, flame proof with vitreous enamelled reflector and cast iron housing.
2.24	MW95	1 x 80	Mercury, well glass, flame proof increased safety luminaire



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 60 OF 63

		with vitreous enamelled reflector and cast iron 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 iron housing for Div. 2 areas.
2.25a	MW98 1 x 125	Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast iron housing for Div. 2, Group-IIC areas.
2.26	MS61 1 x 125	Mercury, street light with one piece cast aluminium body.
2.27	MS62 1 x 250	Mercury, street light with two piece cast aluminium body.
2.28	MS63 1 x 400	Mercury, street light with two piece cast aluminium body.
2.29	MF61 1 x 250	Mercury, flood light, general purpose.
2.30	MF62 1 x 400	Mercury, flood light, heavy duty type.
2.31	MF63 2 x 400	Mercury, flood light, heavy duty type.
2.32	MP21 1 x 80	Mercury, post top lantern
2.33	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.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 61 OF 63

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 reflector.
3.19	SW42	1 x 150	Sodium, well glass, vapour proof with vitreous enamelled 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 housing.
3.23	SW92	1 x 150	Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium housing.
3.24	SW93	1 x 70	Sodium, well glass, flame proof with vitreous enamelled reflector and cast iron housing.
3.25	SW94	1 x 150	Sodium, well glass, flame proof with vitreous enamelled reflector and cast iron housing.
3.26	SW95	1 x 70	Sodium, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast iron 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 iron 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.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 62 OF 63

3.37 SF66 2 x 400 Sodium, flood light, heavy duty type.

3.38 SP21 1 x 70 Sodium, post top lantern.

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 Dispersive vitreous enamelled reflector.

4.17 TX02 1 x 100 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.

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

5.0 Halogen



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (SUPPLY)**

SPECIFICATION NO. PE-SS-999-558-E001

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 63 OF 63

- | | | | |
|-----|------|----------|-----------------------------------|
| 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. |



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (CONDUIT)**

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 1 OF 9

**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (CONDUIT)
SPECIFICATION NO. PE-SS-999-558-E002**



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (CONDUIT)**

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 2 OF 9

CONTENTS

<u>CLAUSE No.</u>	<u>DESCRIPTION</u>
1.0	GENERAL
2.0	CODES & STANDARDS
3.0	DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES
4.0	INSPECTION
5.0	TESTING
6.0	PACKING
7.0	DRAWING, DATA AND DOCUMENTS REQUIRED
8.0	TECHNICAL DETAILS OF CONDUITS



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 3 OF 9

1.0 GENERAL

1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.

2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

- a) IS:9537 (All Parts) Conduits for electrical installation.
- b) IS:3480 Flexible steel conduits for electrical wiring.
- c) IS:6946 Flexible non-metallic conduits for electrical installation.
- d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings (for size above 63mm dia of rigid conduits).
- e) IS:2667 Fittings for rigid steel conduits for electrical wiring.
- f) IS:3837 Accessories for rigid steel conduits for electrical wiring.
- g) IS:3419 Fittings for rigid non-metallic conduits.
- h) IS:6005 Code of practice for phosphating iron & steel.
- i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.
- j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.
- k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 4 OF 9

3.1 Rigid Conduits and Fittings

3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.

3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.

3.1.3 Conduits shall be supplied in approximate length as specified below

- a) Rigid Conduits 3 - 4 metres
- b) Flexible Conduits 10 - 30 metres

3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.

3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.

3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.

3.2 Flexible Metallic Conduits and Fittings

3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.

3.2.2 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.

3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.

3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.

3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.

3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.

3.3 PVC Conduits

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



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 5 OF 9

4.0 INSPECTION

4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.

4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.

4.1.2 Inspection of packing material and procedure.

4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

a) Acceptance Tests: As per IS: 9537 Part 1 & 2 upto 63mm OD and IS:1239 above 63mm OD.

- i) Dimension checks
- ii) Bending test (below 32mm OD)
- iii) Compression test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

a) Acceptance Tests: As per IS: 3480.

- i) Dimension checks
- ii) Linear breaking test
- iii) Test for flexibility
- iv) Bend fracture test
- v) Crushing test

b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

a) Type Tests: As per IS: 9537 (Part 1 & 3).

- i) Dimension checks
- ii) Bending test
- iii) Compression test
- iv) Impact test
- v) Collapse test
- vi) Resistance test
- vii) Resistance to burning
- viii) Electrical Characteristics



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (CONDUIT)**

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 6 OF 9

b) Acceptance tests: As per IS: 9537 (Part 1 & 3).

- i) Dimension checks
- ii) Bending test
- iii) Compression test
- iv) Collapse test
- v) Resistance to burning
- vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

- a) Data Sheet-B
- b) Final quality plan

8.0 TECHNICAL DETAILS OF CONDUITS

Refer Annexure-1 as "TECHNICAL DETAILS OF CONDUITS ".



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (CONDUIT)**

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 7 OF 9

**ANNEXURE-1
TECHNICAL DETAILS OF CONDUITS**

- 1.0 APPLICABLE STANDARDS : IS
- 2.0 RIGID STEEL CONDUITS & STEEL PIPES
- a) Material : Cold rolled mild steel to IS:226
- b) Applicable standard
- i) Upto 63mm OD : IS:9537 Part I & II
- ii) Above 63mm OD : IS:1239
- c) Surface treatment : Hot dip galvanizing inside & outside as per IS:2629
- d) Min. Weight of zinc coating (gm/m²) : 340 upto 32 mm dia
460 above 32 mm & upto 50 mm dia
- e) Duty : Heavy duty type
- f) Fittings : Screw type as per IS:2667
- 2.1 Sheet thickness (minimum) : 1.6 mm upto 32 mm dia
2.0mm above 32 mm & upto 50 mm dia
- 2.2 Min. Thickness of zinc coating (microns) [By Elcometer] : 48 upto 32 mm dia
65 above 32 mm & upto 50 mm dia
- 2.3 Standard length approximate : 3 - 5 meters
- 3.0 FLEXIBLE CONDUITS:
- a) Material : Strip steel cold rolled and annealed
- b) Standard applicable : IS: 3480
- c) Surface treatment : Electro galvanized as per IS: 3480
- d) Whether lead coated : YES
- e) Minimum thickness : 25 microns of zinc coating
- 4.0 PVC CONDUITS



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 8 OF 9

- a) Material : PVC
- b) Applicable standard : IS: 9537 (Part I & III)

5.0 SALIENT PARAMETERS OF CONDUIT ACCESSORIES

5.1 LOCKNUTS

Size of Conduit	Thickness	Width Across Flat (mm)
20 mm	5 mm	27
25 mm	5mm	33
32 mm	5 mm	41
40 mm	5 mm	50

5.2 SADDLES

Size of Conduit	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)	F(mm)	G(mm)
20mm	53	20	-	22	4	15.5	40
25mm	60	25	-	22	4	18	46
32mm	68	32	-	18	5	17.5	55
40mm	65	40	-	18	5	20	67

5.3 COUPLER (ELECTRO GALVANISED)

Nominal Size of Coupler	L(min).(mm)
20 mm	35
25mm	43
32mm	43
40mm	43

5.3 CIRCULAR BOXES (Refer IS)



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-SS-999-558-E002

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 9 OF 9

DIMENSIONS OF SMALL CIRCULAR BOXES

Size of Conduit	B(mm)	C(mm)	D(mm)	E(mm)	F(mm)	G(mm)	H(mm)	I(Cixmm)
20mm	25	-	18	16.5	25	60	50	3mm
25mm	30	-	19	18	28	60	50	3mm
32mm	38	-	14	13	35	75	60	2.5
40mm	45	-	19	18	44	75	64	2.5

5.4 NORMAL BEND

Size of Conduit	Straight Length (mm)	Radius (mm)
20mm	30	60
25mm	50	69.5
32mm	60	90
40mm	60	130

5.5 INSPECTION BENDS

The main criteria is for the threaded portion which has to be taken same as that of a normal bend.

Conduit Size	Threaded Portion (mm)
20mm	15.0
25mm	19.0
32mm	19.0
40mm	19.0



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 1 OF 15

**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)
SPECIFICATION NO. PE-SS-999-558-E003**



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 2 OF 15

CONTENTS

<u>CLAUSE No.</u>	<u>DESCRIPTION</u>
1.0	SCOPE OF WORK
2.0	CODES & STANDARDS
3.0	GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK
4.0	TESTING & INSPECTION AT CONTRACTOR'S WORKS
5.0	DRAWINGS/ DOCUMENTS
6.0	PRICES



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 3 OF 15

1.0 SCOPE OF WORK

The scope of installation work of the complete lighting and low voltage power services equipment shall be as follows:

1.1 Receipt at site, unloading, handling, unpacking, storing and preservation of all lighting equipment specified under technical specification (Supply) of Section-D and all other materials required for completion of this package

1.2 Erection, testing and commissioning of complete lighting and low voltage power services for the power station.

1.3 The contractor's scope shall also be deemed to include all such other equipment/materials and services required for the completeness of the job, but not listed above, as applicable and shall be quoted for accordingly.

1.4 Supply & erection of consumable like conduit accessories & fittings, conduit boxes, saddles, clamps, flexible conduit, junction boxes, fixing hardwares, anchors, wedges, nuts & bolts, concrete inserts, materials required for mounting the fixtures, consumable and other incidental materials required to complete the installation testing & commissioning of complete lighting system for successful operation, & to the satisfaction of purchaser/ customer. Supply scope of these items shall form part of the installation rates quoted for the item.

Minor civil works Plumbing/Grouting/Foundation required to complete the lighting installation are covered under the scope of this contract and form part of the item installation cost and are not payable separately.

1.5 Power cables from lighting distribution boards LDBs to lighting panels (LPs), LDBs to street lighting panel, street lighting panels to poles and control cables from LDBs to remote street lighting control panel will be supplied by purchaser as free issue item to contractor, Laying & termination of these cables are to be done by the bidder.

1.6 Supply & Erection of supporting structural steel i.e. angles, channels etc. are to be quoted on tonnage basis. During contract stage contractors has to furnish total requirement for structural steel.

1.7 All tools & tackles, ladders, testing equipment etc. required for erection, testing & commissioning of complete lighting system are to be arranged by the contractors.

1.8 The entire work shall be carried out in accordance with specified installation instruction, manufacturer's recommendations, purchaser's approved drawings and/or as directed by the purchaser. Manufacturer' drawings and instructions shall be correctly followed in handling setting, testing and commissioning of all equipment and care shall be taken in handling to avoid distortion to structures, marring of finished surface, damage to delicate instruments etc. The equipment shall be installed in a neat work-manship like manner.

1.9 The erection work shall conform to latest applicable Indian standards, codes and practices, Electricity rules, fire insurance regulations and safety regulations of the locality where the equipment will be installed. All apparatus, wiring and connections shall be designed so as to minimise risk of fire or any damage which will be caused in the event of fire. Contractor to furnish the installation drawings of all equipment for purchaser's approval.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 4 OF 15

2.0 CODES AND STANDARDS

The design, Manufacture and performance of equipment shall comply with all currently applicable regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be constructed to relieve the bidder of these responsibilities.

- 2.1 Unless otherwise specified, equipment offered shall conform to latest applicable Indian and IEC standards. Equipment complying with any other authoritative standards such as British, U.S.A, VDE etc. may also be considered provided these standards ensure performance equivalent to or superior to Indian Standards. In such cases the Bidder shall clearly indicate the standard adopted and furnish a copy of the latest English version of the standard along with the tender. Should there be any dispute of design standard, the most stringent one shall be followed. The relevant Indian Standards are:

Lighting Wires

- IS: 694 PVC insulated cables for working voltages upto and including 1100V.
IS: 3961 Recommended current ratings for PVC insulation light out put cables.
IS: 5331 PVC insulation and sheath of electric cables
IS: 8130 Conductors for insulated electric cables and flexible cards.
IS: 10810 Methods of tests for cables.

Conduits & Accessories and Junction Boxes

- IS: 1653 Rigid steel conduits for electrical wiring.
IS: 3480 Flexible steel conduit for electrical wiring.
IS: 2667 Fittings for rigid steel conduits for electrical wiring.
IS: 3837 Accessories for rigid steel conduits for electrical wiring.
IS: 4649 Adaptors for flexible steel conduits.
IS: 5077 Decorative Lighting outfits.
IS: 5133 Steel and Cast Iron Boxes. (Part-I)
IS: 5133 Boxes made of Insulating materials (part-II)
IS: 2629 hot dip galvanising of iron & Steel.
IS: 9537 Specification for conduits for Electricals installation. (part-I & II)



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 5 OF 15

Electrical Installation Practices & Miscellaneous

IS: 5	Colour for ready mixed paints 2 enamels.
IS: 1293	3 Pin, Plug & Socket Outlets.
IS: 226	Structural steel (standard quality).
IS: 2509	Rigid non metallic conduits for electric wire.
IS: 371	Ceiling roses
IS: 3854	Switches for domestic and similar purposes.
IS : 5216	Guide for safety procedures and practices in electrical work.
IS: 1913	General and safety requirements for electric lighting fittings.
IS: 3419	Fittings for rigid non metallic conduit.
IS: 732	Code of practice for Electrical Wiring installation (System Voltage not exceeding 650V).
IS: 3646	Code of practice for interior illumination part I, II & III.
IS: 1944	Code of practice for lighting of public thorough forces.
IS: 3106	Code of practice for selection of installation and maintenance of fuses. (Voltage not exceeding 650V).
IS: 4615	Switch socket out let (Non-locking).
IS: 5571	Guide for selection of electrical equipment for hazardous areas.
IS: 5572	Classification of hazardous areas electrical installation.
IS: 800	Code of practice for use of structural steel in general building construction.
IS: 2633	Method of testing uniformity of coating in zinc plated articles.
IS: 6005	Code of practice for phosphating of form & steel.
IS: 3043	Code of practice for earthing.

INDIAN ELECTRICITY ACT AND RULES

IS: 6665	Code of practice for industrial lighting.
IS: 458	Specification for concrete pipes.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 6 OF 15

Fire Insurance Regulations

Rule no. 35, 48, 49, 50, 61 & 64 of Indian Electricity Rule with amendment-3 rules 1986 Regulations laid down by the chief Electrical Inspector of the State.

3.0 GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK.

- 3.1 The contractor shall work in co-ordination with civil, air-conditioning, ventilation & switchgear vendors. Where holes or openings in walls and floors are required for routing the conduits, the contractor shall provide the same. Cut-outs in false ceiling shall be provided by false ceiling contractor.
- 3.2 The contractor shall be responsible if any parts of lighting fixtures, LDBs, LPs are lost or damaged and lamps are broken during installation. All damage and thefts shall be made good by the contractor till the installation is handed over to the customer.
- 3.3 The contractor shall note that for any change in the location of lighting panels, lighting fixtures, switch boxes/receptacles, no extra charges will be paid so long as the modifications are indicated to the contractor before commencement of the work on that particular equipment or circuit.
- 3.4 The contractor shall have a separate cleaning gang to clean all equipment under erection as well as the work area and the project site at regular intervals to the satisfaction of Engineer-in-charge. In case this is not done, the purchaser will have the right to carry out the cleaning operation and any expenditure incurred in this regard will be to the contractor account.
- 3.5 Except as specifically approved by the Engineer-in-Charge, installation of exposed conduits, mounting of lighting fixtures, etc. shall be taken up only after other services such as piping, air ducting, cable tray/bus duct hangers, structural bracing's etc. in a particular area have been installed
- 3.6 After installation of lighting fixtures/receptacles, panel number and circuit number shall be painted on them at a suitable place
- 3.7 Lighting Fixtures and Accessories.
- 3.7.1 Lighting fixtures of appropriate type as per the lighting layout drawings shall be installed by the contractor. The type of mounting, arrangement of fixtures shall be selected from the typical arrangements shown in enclosed fixture mounting details drawings in section-E. The type of mounting will generally be indicated on the layout drawings. The exact mounting will, however, be decided at site depending upon the actual space/other facilities available at site.
- 3.7.2 The contractor shall submit for purchaser's approval the drawings showing the detailed mounting arrangements of various types of fixtures prior to installation.
- 3.7.3 Wooden plugs in walls and ceilings for fixing of lighting fixtures and accessories are not acceptable. A suitable fool-proof method (preferably using nylon rawl plug) of fixing these shall be offered and this be subject to the purchaser approval.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 7 OF 15

- 3.7.4 The bracket for mounting the lighting fixtures on boiler platforms shall be fabricated at site using 40 mm GI conduit with a reducing socket to suit the fixture and clamped to the hand rails. However, the clamping of these conduits at points of large vibrations should be avoided. The fixing shall be strong enough to withstand vibrations and wind velocity. If a roof (or other platform over the platform is available, the fixture will be pendant mounted (supported to the structural members of the platform above).
- 3.7.5 Flood lights shall be mounted on steel base facing the tentative direction shown on drawings. Bolts shall be tightened with spring washers. Terminals connection to the flood lights shall be through flexible conduits.
- 3.7.6 In the rooms where false ceilings are provided, the lighting fixtures shall be supported separately by false ceiling grid of roof over false ceiling if it is of steel structural or form ceiling and not by the false ceiling board. The arrangement shall be to the approval of purchaser. The erection rate of lighting fixtures shall include the supply of steel brackets, supporting, anchoring material, hardware and also steel brackets/hangers for bridging the gap above false ceilings, etc., required for installation of lighting fixtures as shown in the approved fixture mounting arrangement drawings.
- 3.7.7 A four (4) way terminal junction box type F shall be provided near each lighting fixture, for loop-in, loop-out and off connection of lighting wires or as required.
- 3.7.8 To distinguish emergency AC fixtures from normal AC fixtures, red painted circular mark of 1 cm dia. shall be provided on emergency fixtures.
- 3.7.9 The self contained emergency lighting fixtures shall be installed in required areas. Mounting brackets are to be provided by the contractor.
- 3.8 Lighting distribution board and Lighting Panels.
- 3.8.1 Lighting DB's consisting of lighting transformer etc, shall be mounted on floor and LP's shall be mounted on the walls/columns/steel structures at the locations indicated in the drawings.
- 3.8.2 Suitable Space provision for LDB mounting on floor would be made by the purchaser. The contractor will supply necessary foundation bolts and do the grouting to fix up the LDBs.
- 3.8.3 LPs shall be installed by fastening to studs of not less than 12 mm dia. which will be suitably grouted/welded to the wall/column by the contractor. All the required accessories including studs for the erection of the panel shall be supplied by the contractor. If Mounting channels are required for, LPs the same will be provided by contractor.
- 3.8.4 Unless specifically noted otherwise on the drawings the height of the centre line of lighting panels from the floor shall be 1200 mm.
- 3.9 Lighting control Switch Boxes & Receptacle Boxes.
- 3.9.1 The locations of switch/receptacle boxes will be approximately as shown in the drawings. The exact location shall be finalised by the contractor in consultation with the engineer-in-Chief.
- 3.9.2 All switch/receptacle boxes in offices and control room shall be flush mounted in the wall. In other areas they shall be mounted on wall or column.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 8 OF 15

3.9.3 Unless Otherwise noted on the drawings the mounting height of switch/receptacle boxes shall be as follows.

- i. Lighting Control switch boxes - 1500 mm.
- ii. Receptacle boxes 500 mm for indoor and 900 mm for outdoor locations.

3.10 Conduits and Accessories

3.10.1 All lighting wires shall be run inside the conduit. Size of conduit shall be selected as per the table given below.

Size of Wire	Max. number of wires in	
	20mm conduit	25mm conduit
1.5 sq. mm.	4	
2.5 sq. mm.	4	6

3.10.2 Conduit shall run along wall, floor, ceiling, on steel structures, embedded in wall, floor, for ceiling, in accordance with relevant layout drawings. The contractor shall closely co-ordinate his work with the civil contractor. Exposed conduits shall be run in straight lines parallel to building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance. In the office area as specified conduits shall be embedded along the entire run. It is the responsibility of the lighting contractor to co-ordinate with the civil contractor of these buildings. Conduits supports shall be provided at an interval of 750 mm for horizontal runs and 1000 mm vertical runs

3.10.3 Conduit shall be clamped on to approved type spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs.

3.10.4 Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.

3.10.5 Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less than 40mm.

3.10.6 Where conduits are along cable trays provided by purchaser, they shall be clamped to supporting steel at an interval of 600 mm.

3.10.7 For direct embedding in soil, the conduits shall be coated with an asphaltbase compound. Concrete pier or anchor shall be provided where necessary to support the conduit rigidly and to hold it in place.

3.10.8 Conduits shall be installed in such a way as to ensure against trouble from trapped condensation.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 9 OF 15

- 3.10.9 The contractor shall made available at site, dies for threading various conduits. Running threads shall be avoided as far as practicable. Where it is unavoidable, check nut shall be used. All field thread ends shall be reamed after threading and anti-corrosive paint applied.
- 3.10.10 Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc.
- 3.10.11 Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run
- 3.10.12 For long conduit runs junction/pull boxes shall be provided at suitable intervals (not exceeding 10 m) to facilitate wiring.
- 3.10.13 Conduits shall be securely terminated at LPs/junction boxes or lighting fixtures by proper fastening with a lock put on inside and outside. The number of conduits terminating at LP's shall not exceed the permissible number considering the glanding area of lighting panel. Conduit termination's shall be made water & vermin proof.
- 3.10.14 Conduits lengths shall be jointed by acrewed couplers. Conduit shall be cleanly cut. The cut ends shall be within three (3) degrees of square with the conduit axis. Cut ends shall be reamed and all burrs and sharp edges removed.
- 3.10.15 Conduits lengths shall be jointed connection and shall be made thoroughly water-tight and rust-proof by application of a thread compound which will not insulate the joints. White lead will be uses for embedded conduit and red lead for exposed conduit.
- 3.10.16 Water treatment plant chlorination plant lighting installations shall be made with epoxy coated steel conduits and accessories.
- 3.10.17 Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations or flattened surfaces. Heat shall not be applied in making any conduct bend. Separate bends may be sued for this purpose.
- 3.10.18 The entire metallic conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded where slip joints used, suitable bending shall be provided around the joint to ensure a continuous ground circuit.
- 3.10.19 Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.
- 3.10.20 After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.
- 3.10.21 Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.
- 3.11 Lighting wires
- 3.11.1 Lighting wires from lighting panels to junction boxes and junction boxes to lighting fixtures, switch boxes and receptacle boxes shall run in conduits (Rigid/flexible).



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 10 OF 15

- 3.11.2 All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.
- 3.11.3 Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Wherever required, suitable conduit junction boxes/pull boxes shall be provide. All types of wiring, concealed or unconcealed shall be capable of easy inspection.
- 3.11.4 Receptacles and lighting circuits shall be fed from different circuits. The switch controlling these circuits shall be on the live side (phase wire) of the circuits.
- 3.11.5 A.C. normal, A.C. emergency and D.C. emergency system wiring shall run throughout in separate conduits.
- 3.11.6 Wiring shall be spliced only at junction boxes. Maximum two wires shall be connected at each terminal.
- 3.11.7 In vertical run of wires in conduit the wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.
- 3.11.8 All lighting wires shall be crimped using suitable type of solderless, crimping, tinned fork type copper lugs. Cost of the lugs shall be included in the erection price of wire.
- 3.12 Junction Boxes
- 3.12.1 Junction boxes having volume upto 1600 cubic centimetre may be installed without any support other than that resulting from connecting conduits where two or more rigid metallic conduits enter and accurately position the box. Boxes shall be installed so that they are levelled, properly aligned and present a pleasing appearance. Boxes with volumes greater that 1600 cubic cm. or for other reasons not rigidly held, shall be adequately supported. The contractor shall perform all drilling, cutting, welding, shimming and bolting required for attachment to supports.
- 3.12.2 Necessary holes for conduit/cable entry shall be done during installation depending on the requirement. The holes shall be drilled/punched neatly and shall be dust/vermin proof after installation of the conduit.
- 3.12.3 All welds, bolts holes, conduit entry holes etc.,. made during installation as mentioned above shall be wire brushed and touched up with metal primer (lead oxide and zinc chromate in synthetic medium
- 3.13 Street Lighting/Flood Lighting Poles
- 3.13.1. The lighting poles and lighting Tower shall be erected by the contractor at locations shown in the street lighting layout to be prepared by contractor and shall be got approved from the purchaser. The erection work shall include making of foundations (with supply of all materials). Installation of necessary wiring/ cabling, junction/ switch box and mounting of assembled fittings The cable from junction box at the bottom of pole upto the lighting fixture shall be supplied by the contractor. All the above erection work shall be done by contractor for lighting masks including making of foundations. 50mm GI pipe shall be provided for cable protection from trench to junction box by the contractor for loop-in-loop-out cables.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 11 OF 15

3.13.2 The lighting poles shall be painted with two coats of aluminium paint after completion of installation or as specified by purchaser.

3.13.3 The flood light fixtures shall be mounted on galvanised M.S. base making use of shop drilled holes or by suitable clamps. No cutting or drilling of galvanised structure is permitted.

3.13.4 Each lighting poles and lighting/lightning mast junction box shall be earthed by 25X3 mm GS flat bonded to one (1) 20 mm dia MS earth electrode of 3 meter length driven vertically in the ground. The flat and electrode shall be supplied by the bidder and price of these shall be included in the erection price of individual pole/mast. 14 SWG GI wire shall be taken from fixture to JB.

The bidder shall submit the foundation drgs of poles/masts for purchaser's approval.

3.14 Earthing of Lighting system

3.14.1 All junction boxes, receptacles, switch boxes, lighting fixtures, conduit etc. shall be earthed in compliance with the provision of I.E. rules and applicable Indian Standard amended upto date.

3.14.2 A continuous earth conductor of 14 SWG G.I. wire shall be run all along each conduit run and bonded at every 600 mm by not less than two turns of the same size of wires. This conductor shall be connected to the earth bus of lighting panel from which the conduits originate. All junction boxes, receptacles, lighting fixtures etc. shall be connected to this 14 SWG GI earth conductor. All lighting panels and LDBs shall be earthed by GI flats to the purchasers earthing bus. The supply of GI flat and erection shall be in contractor's scope and rates of the same shall be included in the erection rates of the respective LDB/LP.

3.15 Ceiling Fans and Regulators (If Applicable)

3.15.1 The contractor shall install the ceiling fans and regulators at the locations shown in the relevant drawings. The exact location will however, be decided at site in consultation with engineer-in-charge.

3.15.2 The fan regulators shall be flush mounted on the lighting control switch boxes provided in that area.

3.15.3 Hook alongwith rubber bush shall be supplied and grouted by contractor in ceiling for mounting the fan. All necessary material and hard wares for installation shall be supplied by contractor.

3.16 Foundation & Civil Works

3.16.1 Equipment foundations, for street lighting Poles/Flood Lighting Poles, lighting mast, street lighting panel and other panels mounting foundation and other civil work including supply of cement, steel and other materials as per relevant drawings and specification clauses shall be provided by the contractor. Cost of foundation works, including supply of necessary material is to be quoted as part of E & C rates for these items.

3.16.2 All foundation drawings shall be subject to the purchaser's approval. However, it shall be the responsibility of the contractor to check these foundations before commencement of erection to ensure their suitability.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 12 OF 15

- 3.16.3 All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil work as may be required for erection.
- 3.16.4 Any cutting of masonry/concrete work, which is necessary, shall be done by the contractor at his own cost and shall be made good to match the original work. The contractor shall obtain approval of the purchaser before proceeding with any cutting of masonry/concrete work.
- 3.16.5 The contractor shall perform all excavation and backfilling as required for ground connections and casting foundations.
- 3.16.6 Excavation shall be performed upto the required depth. Such measures shall be taken as may be necessary for protection of the wall.
- 3.16.7 The contractor shall make use of his own arrangements for pumping out any water that may be accumulated in the excavation.
- 3.16.8 All excavation shall be backfilled to the original level with good consolidation.
- 3.17 Cabling work:
- 3.17.1 The owner will supply necessary cables required for the system as per the specification & the bidder shall have to lay & terminate the same. This shall include all clamping, fixing, drilling, cutting, glanding, lugging, connecting to terminal blocks, grounding etc. as required to complete the job. Cost of all consumable materials required for cable laying & cable termination shall be included in the erection rate to be quoted by the bidder.
- 3.17.2 Bidder shall supply all necessary glands & lugs required for cable termination carried out by him. Size of glands & lugs shall be as per the size of the cables selected during detailed engg.
- 3.17.3 Cable glands shall be double compression type & made of tin plated heavy duty brass casting and machine finished. Glands shall be of robust construction capable of clamping cable & cable armour firmly without injury to the cable. Thickness of tin coating shall not be less than 10 microns. All washers and hardwares shall be made of brass & tinned. Rubber components used in the glands shall be made of neoprene of tested quality.
- 3.17.4 Cable lugs shall be tinned copper, solderless crimping type, conforming to IS:8309 suitable for Al or Cu conductors. Crimping of terminals shall be done by using corrosion inhibitory compound.
- 3.17.5 All cable entry points shall be sealed & made vermin & dust proof. Unused opening shall be effectively closed.
- 3.17.6 Cables shall be laid in owner's trays wherever available. In areas, where owners trays are not available, cable shall be clamped to the structures or laid in conduit or buried depending on the area.
- 3.17.7 Each cable shall be tagged with the cable no. as per cable schedule. The tag shall be of rectangular shape & attached to the cable by not less than two turns of 20 SWG GI wire. Cable tag shall be provided at each end of the cable before entering the equipment enclosure, on both sides of wall or floor crossing and every 30 meter of cable runs.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 13 OF 15

- 3.17.8 Minimum bending radius for the cables shall not be less than 12D, where D is the overall dia of the cable.
- 3.18 Steel Fabrication
- 3.18.1 The steel structures supplied and fabricated by the contractor shall be made from standard quality steel sections/flats/plates. The steel fabricated structures shall be free from defects, cleaned of rust, grease, oil etc., and sharp edges shall be removed.
- 3.18.2 The welds shall be wire brushed or cleaned otherwise. The holes shall be touched up with metal primer.
- 3.18.3 All steel fabrications shall be painted with two coats of metal primer (lead oxide and zinc chromate in synthetic medium) followed by two coats of aluminium paint. The welds to galvanised steel shall be touched up with galvanised weld rod applied in accordance with manufacturer's instruction.
- 3.19 Cutting & wastage allowances:
- 3.19.1 Contractor shall carefully plan cutting schedule of each cable drum, conduit, lighting wires, GI wires such that wastage's are minimised and any resultant short length can be used where appropriate route length are available. The following wastage's allowances are permissible for various materials.
- 3.19.2 Power cables, and control cables, Cutting & wastage's allowance shall be computed on the length actually measured, used & accepted. Break up of above 3% wastage allowances are given below :
- a) 1% unaccountable wastage.
b) 2% accountable wastage.
- Note: Usable length to be returned to purchaser. Minimum wastage length is to be decided in consultant with site engineers.
- 3.19.3 The contractor shall take-back the unused installation materials which has not been entered in the measurement records by the purchaser after completion of job.
- 3.20 Quantity measurement:
- 3.20.1 For all payment purpose, measurement shall be made on physical measurements. Physical measurements shall be made by the contractor in the presence of the site engineer/purchaser.
- 3.20.2 The measurement of cable laying shall be made on the basis of length actually laid from lug to lug including that of loops provided.
- 3.20.3 In the measurement of conduits, the accessories will not be include GI wire / GI strip.
- 3.20.4 The E & C cost of of lighting wires and earthing wires shall be included in the E & C cost of conduits. No separate cost of erection of lighting wires and earthing wires shall be paid.



TECHNICAL SPECIFICATION FOR LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 14 OF 15

- 3.20.5 The accountable wastage to be returned to purchaser's store in good condition and as directed by site engineer.
- 3.20.6 Any wastage granted by the vendor in excess of the allowable percentage shall be charged at the panel rates decided by the site engineer whose decision shall be final and binding on the vendor.
- 3.21 Contractor to make a protocol in consultation with site engineer and customer's representative for erection, testing & commissioning of all lighting equipment.
- 4.0 TESTING & INSPECTION AT CONTRACTOR'S WORKS
- 4.1 Standard quality plan (QP) for lighting equipment is enclosed. Bidder to confirm compliance to this QP by signing every page of it.
- 4.2 All accessories shall be subject to routine and type tests in accordance with requirement of appropriate IS in the presence of purchaser's representative.
- 4.3 Samples selected by the purchaser of all galvanising material shall be subjected to galvanising tests. All fittings, fabrications, hardwares etc. as specified shall be inspected & tested in accordance with IS recommendation. Type test certificates from National Test House or from reputed agency shall be considered.
- 4.4 Field quality plan for quality checks to be observed at site during erection, testing & commissioning shall also be furnished by contractor alongwith offers as per standard format.
- 4.5 Testing and commissioning
- 4.5.1 On completion of erection work, the contractor shall request the site engineer for inspection and test.
- 4.5.2 The site engineer shall arrange for joint inspection of the installation by purchaser's and customers representative for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the contractor.
- 4.5.3 The installation shall be then tested and commissioned in presence of the site Engineer & customer's representative
- 4.5.4 The contractor shall provide all men, material and equipment required to carry out the tests.
- 4.5.5 All rectification's, repairs or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the contractor without nay extra cost. The handing over of the lighting installation shall be effected only after the receipt of written instruction from the site engineers/ customer.
- 4.5.6 The testing shall be done in accordance with the applicable Indian standards and codes of practice. The following tests shall be specifically carried out for all lighting installation.
- Insulation resistance
 - Testing of earth continuity path
 - Polarity test of single phase switches.



**TECHNICAL SPECIFICATION FOR
LIGHTING SYSTEM (INSTALLATION)**

SPECIFICATION NO. PE-SS-999-558-E003

VOLUME II B

SECTION D

REVISION 0 | DATE: 31-01-2006

SHEET 15 OF 15

- 4.5.7 The lighting circuits shall be tested in the following manner.
- All switches ON and consuming devices in circuit, both poles connected together, to obtain resistance to earth.
 - Insulation resistance between poles with lamps and other consuming devices removed and switches ON
- 5.0 DRAWINGS/ DOCUMENTS
- REFER VARIOUS CLAUSES OF ELSEWHERE
- 6.0 PRICES
- 6.1 The contractor shall quote his prices for supply, erection, testing & commissioning of complete lighting system as per format attached with the specification.
- 6.2 Unit price quoted for erection, testing & commissioning of items listed under B O M shall be deemed to have been included the prices for erection material as described in clause 1.4 of this specification and other relevant clauses of this specification for various lighting equipment.
- 6.3 The unit rates of supply & installation (E & C) for all equipment and service quoted by the bidder shall be firm for a variation of quantities limited to
- $\pm 30\%$ of total order value till finalisation of engineering details & BOQ.
 - $+10\%$ of the total order value in addition to (a) above, till the completion of job.
- 6.4 Purchaser reserves the right to right to delete/add any equipment or services from the bidders scope, and for price adjustment in such cases, unit prices quoted by the bidder will be considered.
- 6.5 The bidder shall furnish unpriced price schedule of all equipment and services inclusive of E & C and recommended spares alongwith the technical bid.



TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

1 of 11

1.0 SYSTEM DESIGN DATA

1.1 Design Ambient : 50°C

1.2 Details of Operating Parameters

a) AC Supply

- i. Rated Voltage : 415 V
- ii. Rated Frequency : 50 HZ
- iii. Voltage variation:
(Permissible) : $\pm 10\%$
- iv. Frequency variation
(Permissible) : +3% to - 5%
- v. Combined voltage &
frequency variation
(sum of absolutes
permissible) : 10 %
- vi. System fault level
at rated voltage : 50 KA for 1sec

b) DC Supply

- i. Rated Voltage : 220 V
- ii. Voltage variation
(Permissible) : +10% to -15%
- iii. System fault level
at rated voltage : 25kA

2.0 APPLICABLE STANDARDS : As per specification

3.0 LIGHTING CONCEPT

3.1 Areas

- a) Location : Indoor Outdoor
 Both
- b) Street Lighting : Yes No
- c) Boiler Platforms : Yes No

3.2 Types of supplies considered



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

2 of 11

(other than AC Normal)

- a) DC Normal : Yes No
- b) DC Emergency : Yes No
- c) AC Emergency : Yes No

3.3 Diversity Factor Considered for Sockets : 25%

4.0 **SCOPE OF SYSTEM DESIGN ENGG.** : Included in vendor's scope
 Excluded from vendor's scope

5.0 **LUMINAIRES, LAMPS & ACCESSORIES**

5.1 Whether all type of luminaires as per BOQ: Yes No
offered

5.1.1 If no, Types of luminaires not : NA
offered as per BOQ

5.2 List of lamps which can be installed only : None
specified angle.

5.3 Type of false ceiling for recessed : After award of contract
fluorescent luminaire

5.4 Degree of Protection for drip proof : IP55
luminaires

5.5 Flame proof luminaires

- a) Hazardous area classification : IS-2148 Zone II Group-IIA & IIB
- b) Degree of Protection : IP
- c) Mounting type for well glass. : eye-bolt screw neck

5.6 Non-Integral control gear box

- a) Sheet thickness : 2 mm
- b) Degree of protection : IP-55
- c) Surface treatment : Painted Galvanised
- d) If galvanised
- i. Wt. of Zinc : 460 gm / mm² (65 microns)
- ii. Process : Hot dip
- e) If painted : NA



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

3 of 11

i. Colour to RAL : Shade

ii. Minimum paint thickness : Microns

5.7 Type of lamp holder for incandescent luminaires : Screw type
 Pin type

5.8 Tap setting for Ballasts

a) HPSV luminaires : 220 V

b) HPMV Luminaires : 220 V

5.9 Lamps

a) Type of Fluorescent Lamps : Energy efficient T5
 White Light

b) Type of cap for incandescent lamp : Screw Type Pin type

c) Type of HPMV lamp : Clear
 Fluorescent powder coated

d) Type of lamp cap for HPMV & HPSV : Screw Type

e) Type of beam for

i. HPMV lamps : Short beam Long beam
 Both

ii. HPSV lamps : Short beam Long beam
 Both

5.10 Emergency lighting unit

5.10.1 Wattage and No. of incandescent lamp : 2x6 W FLT

5.10.2 Type of battery : Ni-Cd

5.10.3 Emergency duration of unit : 2 Hours

6.0 DESIGN PARAMETERS OF MAIN EQUIPMENT

6.1 Lighting Distribution Boards

6.1.1 Sheet Thickness : 2 mm for load bearing & 1.6mm for other member

6.1.2 Degree of Protection

a) Main Panel : IP-54 for indoor and IPW-55 with canopy for outdoor

b) Transformer cubicle : IP-42

6.1.3 Type of Incomer : MCCB



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

4 of 11

- [] Switch-Fuse
- 6.1.4 Type of Outgoing feeders : [] Switch-Fuse
[√] MCCB
- 6.1.5 Bus bar material : [√] Aluminium [] Copper
- 6.1.6 Cable entry : [√] Bottom [] Top
- 6.1.7 Whether under voltage relay required in : [] Yes [] No [√] Contactor & timer
DC LDB
- 6.1.8 Range of time delay relay : later
- 6.1.9 Whether hinged door with locking facility : [√] Yes [] No
provided
- 6.1.10 Whether earth busbar provided : [√] Yes [] No
- 6.1.11 Earth busbar material : [√] GI steel strip [] No
- 6.1.12 Fault current and duration : later
- 6.1.13 Lighting Transformer
- a) Voltage Rating : 415/433 V
- b) Whether encapsulated : [] Yes [√] No
- c) Transformer impedance : 4% for 100 VA, 3% for 50 kVA
- 6.1.14 Material of construction : FRP
Of MLDB
- 6.2 Lighting Panel**
- 6.2.1 Application : [] Indoor [] Outdoor [√] Both
- 6.2.2 Sheet thickness : 2 mm for load bearing & 1.6mm for other
member
- 6.2.3 Degree of protection
- a) Indoor : IP-54
- b) Outdoor : IPW-55 with canopy
- 6.2.4 Type of Incomer : [] Switch-Fuse [√] MCCB
- 6.2.5 MCB type for street lighting panel : [] 1 pole [√] 3 pole TPN
- 6.2.6 Busbar material : Aluminium (electrolyte grade hard drawn)
- 6.2.7 Whether hinged door with locking facility : [√] Yes [] No
provided



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

5 of 11

6.2.8 Whether earthing studs provided : Yes [] No

6.2.9 Material of construction : FRP
Of LP

6.3 Lighting Poles

6.3.1 Type as per IS : IS-2713

- a) PS-1 : 410 SP51
- b) PS-2 : 410 SP67
- c) PF-2 : 410 SP51
- d) PS-3 : 410 SP51
- e) PF-1 : 410 SP51

6.3.2 Surface Treatment : [] Galvanised [] Painted

6.3.2.1 Galvanisation details(if applicable)

- a) Process : NA
- b) Wt. of Zinc deposited : NA

6.3.2.2 Painting details (if applicable)

- a) Shade as per IS : As per customer spec
- b) Paint thickness : As per customer spec

6.4 Lighting Masts

6.4.1 Number of luminaires on each mast : 12 nos 400W flood light fixture

6.4.2 Type of design : Polygonal shape

6.4.3 Material : MS

6.4.4 Height : 30 meter

6.4.5 Galvanization

- a) Process : Hot dip
- b) Wt. of Zinc deposited : 460 gm / mm² (65 microns)

6.5 Street Lighting Pole Junction Boxes

6.5.1 Material : Sheet steel/FRP weather proof

6.5.2 Sheet thickness : 2 mm(16SWG)

6.5.3 Galvanization



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

6 of 11

- a) Process : Hot dip
b) Wt. of zinc deposited : 460 gm / mm² (65 microns)

6.5.4 Degree of protection : IPW-66

6.6 Fuse Boxes

6.6.1 Material : Sheet steel

6.6.2 Sheet thickness : 2 mm

6.6.3 Galvanization

- a) Process : Hot dip
b) Wt. of zinc deposited : As per spec.

6.6.4 Degree of Protection : IP-55

6.7 **Receptacles**

6.7.1 Material : Sheet steel

6.7.2 Sheet thickness : 2 mm

6.7.3 Galvanization

- a) Process : Hot dip
b) Wt. of zinc deposited : As per spec.

6.7.4 Degree of protection : IP-55

6.8 **24 V Supply Module**

6.8.1 Enclosure

- a) Material : Sheet steel
b) Sheet Thickness : 2 mm

6.8.2 Transformer

- a) Rating : 500 VA
b) Primary Voltage : 240 V
c) Secondary voltage : 26.5 V

6.8.3 Lamp



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

7 of 11

- a) Rating : 40 watt
b) Type : Portable halogen lamp

6.8.4 No. of outgoing sockets : As per spec.

6.8.5 Whether cord coiling arrangement considered : Yes air cooled No

6.8.6 Louvers : Provided Not Provided

6.9 Junction box(outdoor) : FRP type(IPW-66)
Junction box(indoor) : sheet steel hot dip galvanized type(IP-66)

7.0 **COMPONENT OF LIGHTING SYSTEM EQUIPMENT**

7.1 **Moulded Case Circuit Breakers(MCCB) :**

7.1.1 Rated voltage : 415 V

7.1.2 Number of poles : Three

7.1.3 Rated Short circuit duty : P2

7.1.4 Rated breaking capacity (rms) at 415V : 10 kA

7.1.5 Rated making current (peak) : 21 kA

7.1.6 Releases provided

- a) Over load : Yes No
b) Under voltage : Yes No
c) Short circuit : Yes No
d) Shunt trip : Yes No

7.2 **Switch-Fuse Unit**

7.2.1 Utilisation category for main contacts : NA

7.3 **Indicating Meters**

7.3.1 Ammeter

- a) Type : As per IS-1248
b) Shape :
c) Size : 96 X 96 mm
d) Accuracy class : 2
e) Current coil rating : 1A



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

8 of 11

f) Angle of deflection : 240°

7.3.2 Voltmeter

- a) Type : As per IS-1248
b) Shape :
c) Size : 96 X 96 mm
d) Accuracy class : 2
e) Voltage Coil rating : 0-500V AC, 0-250V DC
f) Angle of deflection : 240°

7.4 **Power Contactors**

7.4.1 Coil Voltage (nominal)

- a) AC contactors : 240 V
b) DC contactors : 220 V

7.5 **Under Voltage Relay**

- 7.5.1 Type : Static Electromagnetic
7.5.2 Coil Voltage Rating :
7.5.3 Means for in-built testing provided : Yes No

7.6 **Current Transformers**

- 7.6.1 Type : Cast resin
7.6.2 Secondary Rating : 1 Amp 5 Amp
7.6.3 Output : VA
7.6.4 Accuracy Class : 1

7.7 **Voltage Transformers**

- 7.7.1 Type : Cast resin
7.7.2 System Earthing : Effective Non-Effective
7.7.3 Secondary Terminal voltage(phase-phase) : 415 V
7.7.4 Accuracy Class : 1



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

9 of 11

- 7.7.5 Output : 5 VA
- 7.7.6 Winding configuration : Star / Star
- 7.8 **Miniature Circuit Breaker**
- 7.8.1 Min. Rating : As per spec.
- 7.8.2 Short Time rating : 10 KA
- 7.8.3 Thermal overload and magnetic short circuit protection provided : Yes [] No
- 7.9 **Selector Switch**
- 7.9.1 Type of selector switch : Stay put [] Wing knob
- 7.9.2 Lockability : [] Provided Not provided
- 7.10 **Indication Lamps (CLUSTER LED type)**
- 7.10.1 Lens Colour
- a) On condition : Red
- b) OFF condition : Green
- 7.10.2 Circuit Voltage : As per control supply voltage
- 7.11 **Push Buttons**
- 7.11.1 Voltage Grade : 500 V
- 7.11.2 No. of Contacts : (2NO + 2NC)
- 7.12 **Terminals**
- 7.12.1 Type : 660V Grade box clamp, 10 mm² minimum
- 7.12.2 Material : Copper
- 7.12.3 Whether inter-terminal barrier provided: Yes [] No
- 7.13 **Cable Glands**
- 7.13.1 Provision for all power and control cables: By vendor for all incoming & outgoing cables considered
- 7.13.2 Type : Double compression
- 7.13.3 Material : Brass
- 7.13.4 Nickel Plating provided : Yes [] No



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

10 of 11

7.14 Cable Lugs

7.14.1 Provision for all power and control terminations considered : By vendor for all power & control connections

7.14.2 Type : Ring type

7.14.3 Material : Tinned copper

7.15 Timers

7.15.1 Time Switch

a) Type : As per spec

b) Range : 00 - 24 Hours

7.15.2 Delay Timer :

a) No. of Contacts : As per scheme

i. ON time delay :

ii. OFF time delay :

iii. Instantaneous : -

b) Coil Voltage Rating

i. AC timer : 240 V

ii. DC timer : 220 V

c) Time delay range

i. AC timer : 1 – 99 Sec.

ii. DC timer : 24 – 240 Sec.

8.0 Conduit (Rigid)

8.1 Rigid Conduit

8.1.1 Duty : Heavy duty type

8.1.2 Application standard : IS:9537 Part I & II

8.1.3 Material : Cold rolled mild steel to IS:226

8.1.4 Sheet thickness (minimum) : 16 SWG upto 20 mm dia,
14SWG above 25 mm dia



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-A)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

11 of 11

- 8.1.5 Surface treatment : Hot dip galvanizing inside & outside as per IS:2629
- 8.1.6 Min. Weight of zinc coating (gm/m²) : 340 upto 32 mm dia,
460 above 32 mm & upto 50 mm dia
- 8.1.7 Min. Thickness of zinc coating (microns): 48 upto 32 mm dia, 65 above 32 mm & upto 50 mm dia [By Elcometer]
- 8.1.8 Standard length approximate : 3 – 5 meters

9.0 LABELING

Requirement of Specification complied : Yes [] No

10.0 PAINTING

10.1 Shade (As per RAL)

- a) LDBs : as per customer spec
- b) LPs : as per customer spec
- c) Receptacles :
- Decorative : WHITE
- Industrial : as per customer spec
- d) 24V Supply Module : as per customer spec
- e) Emergency lighting Unit : as per customer spec

10.2 Finish

- a) Interior : [] Matt [] Semi - glossy
- b) Exterior : [] Semi - glossy [] Full - glossy

10.3 Paint Thickness(min) : 50 microns

11.0 MAKE : Approved make



TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

1 of 13

1.0 SYSTEM DESIGN DATA

1.1 Design Ambient : °C

1.2 Details of Operating parameters

a) AC Supply

- i. Rated voltage : V
- ii. Rated frequency : Hz
- iii. Voltage variation (Permissible) : %
- iv. Frequency variation (Permissible) : %
- v. Combined voltage & frequency variation (sum of absolutes permissible) : %
- vi. System fault level at rated voltage :

b) DC Supply

- i. Rated voltage : V
- ii. Voltage variation (Permissible) : %
- iii. System fault level at rated voltage :

2.0 **APPLICABLE STANDARDS :** As per Annexure-I

3.0 LIGHTING CONCEPT

3.1 Areas

- a) Location : Indoor Outdoor
 Both
- b) Street Lighting: Yes No
- c) Boiler Platforms : Yes No

3.2 Types of supplies considered (other than AC Normal)

- a) DC Normal : Yes No



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

2 of 13

b) DC Emergency : Yes No

c) AC Emergency : Yes No

3.3 Diversity Factor considered :
for sockets

4.0 **SCOPE OF SYSTEM DESIGN:
ENGINEERING** Included in vendor's scope
 Excluded from vendor's scope

5.0 **LUMINAIRES, LAMPS & ACCESSORIES**

5.1.0 **LUMINAIRES**

5.1.1 Whether all types of luminaires:
as per BOQ offered Yes No

5.1.2 If no,
Types of luminaires not offered :
as per BOQ

5.1.3 List of lamps which can be :
installed only at specified
angle

5.1.4 Type of false ceiling for :
recessed fluorescent luminaire

5.1.5 Degree of protection for :
drip proof luminaires

5.1.6 Flame proof luminaires

a) Hazardous area :
classification

b) Degree of protection :

c) Mounting type for well: eye-bolt
 strap

5.1.7 Non-integral controlgear box

a) Sheet thickness :

b) Degree of protection :

c) Surface treatment : Painted
 Galvanised



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

3 of 13

d) If galvanised

i. Wt. of zinc : gms / m²

ii. Process :

e) If painted

i. Colour to IS :

ii. Minimum paint thickness : microns

5.1.8 Type of lamp holder for incandescent luminaires :
[] screw type
[] Pin type

5.1.9 Tap setting for Ballasts

a) HPSV luminaires :

b) HPMV luminaires :

5.2.0 **LAMPS :**

a) Type of fluorescent lamps :
[] Cool day light
[] White light

b) Type of lamp cap for incandescent lamp :
[] Screw type
[] Pin type

c) Type of HPMV lamp :
[] Clear
[] Fluorescent powder coated

d) Type of lamp cap for HPMV & HPSV

e) Type of beam for

i. HPMV lamps :
[] Short beam [] Long beam
[] Both

ii. HPSV lamps :
[] Short beam [] Long beam [] Both

5.3.0 **EMERGENCY LIGHTING SET**

5.3.1 Wattage and No. of incandescent lamp : Watts

5.3.2 Battery voltage: Volts

5.3.3 Type of battery :

5.3.4 AH capacity of battery:



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

4 of 13

5.3.5 Lumen output of lamp at :
rated voltage

5.3.6 Emergency duration of unit :

5.3.7 Weight of unit :

6.0 **DESIGN PARAMETERS OF MAIN EQUIPMENT**

6.1 Lighting Distribution Boards

6.1.1 Sheet thickness : mm

6.1.2 Degree of protection

a) Main panel :

b) Transformer cubicle :

6.1.3 Type of Incomer :
 MCCB
 Switch-Fuse

6.1.4 Type of Outgoing Feeders :
 Switch-Fuse
 MCB

6.1.5 Bus bar material : Aluminium Copper

6.1.6 Cable entry : Bottom Top

6.1.7 Whether under voltage relay :
required in DC LDB Yes No

6.1.8 Range of time delay relay :

6.1.9 Whether hinged door with :
locking facility provided Yes No

6.1.10 Whether earth busbar provided : Yes No

6.1.11 Earth busbar material : GI Copper

SYSTEM DESIGN DATA

6.1.12 Fault current and duration : kA

6.1.13 Lighting Transformer

a) kVA Rating(s) : 50 100

b) Type of cooling :

c) Rated current

i. Primary : Amp.



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

5 of 13

- ii. Secondary : Amp.
- d) Rated voltage
- i. Primary : Volts
- ii. Secondary : Volts
- e) Rated frequency : Hz
- f) No. of phases :
- g) Temperature rise above ambient in winding by resistance : °C
- h) Vector Group :
- i) Tap changer
- i. Type :
- ii. Range :
- iii. No. of taps :
- iv. Voltage of each tap :
- j) Type of ventilation arrangement provided for transformer enclosure
- k) Iron loss at 50 Hz and 100% rated voltage : kW
- l) Regulation at full load and at 75 °C and 0.8 p.f. lagging
- m) Copper loss at rated load and 75 °C : kW
- n) Impedance at rated current, frequency and at 75 °C
- o) Winding conductor material
- p) Whether transformer is encapsulated : Yes No
- q) Insulation class :



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

6 of 13

r) Weight : kg

6.2 Lighting Panel

6.2.1 Application : Indoor Outdoor Both

6.2.2 Sheet thickness : mm

6.2.3 Degree of protection

a) Indoor : IP :

b) Outdoor : IP :

6.2.4 Type of Incomer : Switch-Fuse
 MCB

6.2.5 MCB type for street lighting : 1 pole 3 pole
panel.

6.2.6 Busbar material :

6.2.7 Whether hinged door with : Yes No
with locking facility provided

6.2.8 Whether earthing studs provided : Yes No

6.3 Lighting Poles

6.3.1 Type as per IS :

a) PS-1 :

b) PS-2 :

c) PS-3 :

d) PS-4 :

e) PS-5 :

f) PS-6 :

g) PS-7 :

h) PF-1 :

i) PF-2 :

j) PF-3 :

k) PF-4 :



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

7 of 13

6.3.2 Surface Treatment : Galvanised
 Painted

6.3.2.1 Galvanisation details (if applicable)

a) Process :

b) Wt. of zinc deposited : gms / m²

6.3.2.2 Painting details (if applicable)

a) Shade as per IS:5 :

b) Paint thickness : microns

6.4 Lighting Masts

6.4.1 Number of luminaires (max.) :
on each mast

6.4.2 Type of design :

6.4.3 Material :

6.4.4 Height (above ground) : meters
excluding Lightning Arrester

6.4.5 Galvanization

a) Process :

b) Wt. of zinc deposited : gms / m²

6.4.6 Weight : Tonnes

6.5 Street Lighting Pole Junction Boxes

6.5.1 Material :

6.5.2 Sheet thickness : mm

6.5.3 Galvanization

a) Process :

b) Wt. of zinc deposited : gms / m²

6.5.4 Degree of protection : IP :

6.6 Fuse Boxes

6.6.1 Material :



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

8 of 13

6.6.2 Sheet thickness : mm

6.6.3 Galvanization

a) Process :

b) Wt. of zinc deposited : gms / m²

6.6.4 Degree of protection : IP :

6.7 Receptacles

6.7.1 Material :

6.7.2 Sheet thickness : mm

6.7.3 Galvanization

a) Process :

b) Wt. of zinc deposited: gms / m²

6.7.4 Degree of protection : IP :

6.8 24 V Supply Module

6.8.1 Enclosure

a) Material :

b) Sheet thickness :

6.8.2 Transformer

a) Rating : VA

b) Primary voltage : Volts

c) Secondary voltage : Volts

d) Class of insulation :

6.8.3 Lamp

a) Rating : Watts

b) Type :

6.8.4 No. of outgoing sockets :

6.8.5 Whether cord coiling arrangement considered : Yes No



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

9 of 13

6.8.6 Louvers : Provided Not provided

7.0 **COMPONENT OF LIGHTING SYSTEM EQUIPMENT**

7.1 Moulded Case Circuit Breakers (MCCB)

7.1.1 Rated voltage : V

7.1.2 Number of poles :

7.1.3 Rated short circuit duty :

7.1.4 Rated breaking capacity (rms) at 415 V : kA

7.1.5 Rated making current (peak) : kA

7.1.6 Releases provided

a) Overload : YES NO

b) Under voltage : YES NO

c) Short circuit : YES NO

d) Shunt trip : YES NO

7.1.7 Auxiliary contacts

a) Numbers : (NO + NC)

b) Rating : Amp

7.2 Switch-Fuse Unit

7.2.1 Utilization category for main contacts : AC -

7.3 Indicating Meters

7.3.1 Ammeter

a) Type :

b) Shape :

c) Size :

d) Accuracy class :

e) Current coil rating : Amps.

f) Angle of deflection : deg.



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

10 of 13

7.3.2 Voltmeter

- a) Type :
- b) Shape :
- c) Size :
- d) Accuracy class :
- e) Voltage coil rating : Volts
- f) Angle of deflection : deg.

7.4 Power Contactors

7.4.1 Coil voltage (nominal)

- a) AC contactors : Volt (AC)
- b) DC contactors : Volt (DC)

7.4.2 Current rating of contacts

- a) Power : Amp
- c) Control: Amp

7.5 Under Voltage Relay

7.5.1 Type : Static Electromagnetic

7.5.2 Coil Voltage Rating :

7.5.3 Means for in-built testing provided : YES NO

7.6 Current Transformers

7.6.1 Type :

7.6.2 Secondary Rating : 1 Amp. 5 Amp.

7.6.3 Output : VA

7.6.4 Accuracy class :

7.7 Voltage Transformers

7.7.1 Type :

7.7.2 System Earthing : Effective Non-effective



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

11 of 13

- 7.7.3 Secondary terminal : voltage (phase-phase) : Volt
- 7.7.4 Accuracy class :
- 7.7.5 Output : VA
- 7.7.6 Winding configuration :
- 7.8 Miniature Circuit Breaker
- 7.8.1 Min. Rating : Amp.
- 7.8.2 Short time rating : kA
- 7.8.3 Thermal overload and: magnetic short circuit protection provided : YES No
- 7.9 Selector Switch
- 7.9.1 Type of selector switch : Stay put Wing knob
- 7.9.2 Lockability : Provided Not Provided
- 7.10 Indication Lamps
- 7.10.1 Lens colour
- a) ON condition :
- b) OFF condition :
- 7.10.2 Circuit voltage :
- 7.11 Push Buttons
- 7.11.1 Voltage Grade: Volt
- 7.11.2 No. of Contacts : (NO + NC)
- 7.12 Terminals
- 7.12.1 Type :
- 7.12.2 Material :
- 7.12.3 Whether inter-terminal barriers provided : Yes No
- 7.13 Cable Glands
- 7.13.1 Provision for all power and : Yes No



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

12 of 13

control cables considered

7.13.2 Type :

7.13.3 Material :

7.13.4 Nickel plating provided : Yes No

7.14 Cable Lugs

7.14.1 Provision for all power and control terminations considered : Yes No

7.14.2 Type :

7.14.3 Material :

7.15 Timers

7.15.1 Time Switch

a) Type :

b) Range :

7.15.2 Delay Timer

a) No. of contacts

i. ON time delay : (NO + NC)

ii. OFF time delay : (NO + NC)

iii. Instantaneous : (NO + NC)

b) Coil voltage rating

i. AC timer : volt

ii. DC timer : volt

c) Time delay range

i. AC timer : sec.

ii. DC timer : sec.

8.0 LABELING

Requirement of specification : Yes No
complied with



TECHNICAL SPECIFICATION FOR
STATION LIGHTING SYSTEM

(DATA SHEET-C)

DOC. NO. PE-TS-412-558-E001

VOLUME II B

SECTION D

REVISION 01

DATE : 01.06.2015

SHEET

13 of 13

9.0 **PAINTING**

9.1 Shade (as per IS:5)

Interior

Exterior


- a) LDBs :
- b) LPs :
- c) Receptacles :
- d) Lighting kit box :
- e) 24V Supply Module :
- f) Emergency Lighting Unit :


9.2 Finish


- a) Interior : Matt Semi-glossy
- b) Exterior : Semi-glossy Full-glossy

9.3 Paint thickness (min.) :

microns

		QUALITY PLAN			CUSTOMER : TANGEDCO			PROJECT : 2X660 MW ENNORE SEZ			SPECIFICATION : PE-TS-412-558-E001 R1		
					BIDDER/ VENDOR :			TITLE			NUMBER		
SHEET 1 OF 4		SYSTEM			QUALITY PLAN NUMBER PED-558-00-Q-001/02			SPECIFICATION : STATION LIGHTING SYSTEM			TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOC.	ACCEPT. NORM	FORMAT OF RECORD	SECTION			VOLUME III	
1	2	3	4	5	6	7	8	9	P	W	V	REMARKS	
1.0	LUMINAIRES & LAMPS	1. ACCEPTANCE TEST											
		a) VISUAL	MA	VISUAL	IS 10322 (PART5 SEC1)	IS 10322 / DS	IS 10322 / DS	INSP. REPORT	3/2	(2),1	-		
		b) IR (Dry)	CR	ELECTRICAL	IS 10322	-DO-	-DO-	-DO-	INSP./T. REPORT	3/2	(2),1	-	
		c) HIGH VOLTAGE	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	(2),1	-	
		d) DUST PROOF	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	-DO-	3/2		(2),1	TYPE TEST Cert. BY MFR.
		e) PHOTOMETRIC	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	(2),1	-	
		2. ROUTINE TEST											
		a) VISUAL	MA	VISUAL	100%	-DO-	-DO-	-DO-	INSP. REPORT	3/2		(2),1	TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER
		b) IR (Dry)	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	INSP./T. REPORT	3/2		(2),1	
		c) HIGH VOLTAGE	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	-DO-	3/2		(2),1	
2.0	LIGHTING PANELS AND LIGHTING DISTRIBUTION BOARDS	1.DIMENSIONS	MA	MEASUREMENT	SAMPLE	DRG.	DRG.	INSP. REPORT	3	2,1	-	COMPONENTS TO BE OF APPROVED MAKE	
		2.PAINT SHADE/ THICKNESS	MA	VISUAL/ MEASUREMENT	-DO-	SPEC/DRG	SPEC/DRG	-DO-	3	2,1	-		
		3.DEGREE OF PROTECTION (INCLUDING EXPLOSION PROOF IF ANY)	MA	TESTS	1/SIZE	SPEC / RELEVANT STD.	SPEC / RELEVANT STD.	TEST CERT	3	-	2,1	TYPE TEST Cert. BY MFR.	
		4.PERFORMANCE TESTS	MA	ELECT.	100%	SPEC	SPEC	INSP./T. REPORT	3/2	(2),1	-	BHEL SHALL WITNESS ON RANDOM ONE SAMPLE, THOUGH EACH ITEM SHALL BE CHECKED BY THE MANUFACTURER	
		5.HV/IR/HV	MA	ELECT	100%	2.5KV AC FOR 1 MINUTE	2.5KV AC FOR 1 MINUTE	-DO-	3/2	(2),1	-	-DO-	
BHEL		LEGEND	LEGEND :		PARTICULARS		BIDDER/VENDOR						
		P-perform	1 - BHEL		NAME								
		W-witness	2 - BHEL's Vendor		SIGNATURE								
		V-verify	3 - Manufacturer		DATE				BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 2 OF 4		CUSTOMER : TANGEDCO		PROJECT : 2X660 MW ENNORE SEZ		SPECIFICATION : PE-TS-412-558-E001 R1															
				BIDDER/ VENDOR :		TITLE		NUMBER															
SL. NO.		COMPONENT/OPERATION		CHARACTERISTIC CHECK		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOC. [Vendor DS / Drg. / Spec.to be duly apprvd. by BHEL (& Cust. If required) ; otherwise BHEL-spec. / Drg. prevails.]		ACCEPT. NORM		FORMAT OF RECORD		SECTION			VOLUME III		
1		2		3		4		5		6		7		8		9		10			11		
3.0	LIGHTING TRANSFORMER		1. ROUTINE TEST		CR	VISUAL	100%	IS 11171 / DS / Spec.	IS 11171 / DS / Spec.	INSP./T. REPORT	3/2		(2),1										
			a) TYPE / RATING																				
			b) WIND. RESISTANC																				
			c) V. RATIO /VECTOR																				
			d) Z VOLT/ Z SCKT																				
			e) LOAD LOSS/ CURREN																				
			f) NO LOAD LOSS																				
			g) SOURCE WITHSTAND																				
h) INDUCED O/V																							
		2. TEMP. RISE TEST (FOR COMPLETE ASSEMBLED LDB)		MA	ELECT	1/RATING	SPEC / RELEVANT STD.	SPEC / RELEVANT STD.	INSP./T. REPORT	3/2	(2),1	-											
		3. TYPE TEST		MA	TEST	1/RATING	-DO-	IS 11171 / BHEL SPEC.	TEST REPORT	3/2		(2),1	TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER										
4.0	CONDUITS Conduit Type & relevant IS No. : RIGID (Metallic or Nonmetlic) IS 9537 Flexible-Metallic IS 3480 Flexible-Non-metallic IS 6946		1. MATERIAL		MA	VISUAL, MECH, & CHEMICAL	relevant IS	relevant IS	relevant IS	INSP./T. REPORT	3/2	(2),1	Not appl. for Epoxy-coatd mtllic or Non-mtllic type conduit BY ELCOMETER For Rigid condit Epoxy coated and not galvanised										
			2. DIMENSIONS		MA	MEASUREMENT	relevant IS	relevant IS	relevant IS	INSP. REPORT	3/2	(2),1											
			3. GALVANISATION TEST		CR	a) ZINC COATING		INSP. / TEST	relevant IS	relevant IS	relevant IS	INSP./T. REPORT				3/2	(2),1						
			b) MASS OF ZINC COAT.			TEST	IS:9537	IS-6745/4759/SPEC	IS-6745/4759/SPEC	INSP./T. REPORT	3/2	(2),1											
					c) COATING THICKNESS		CR	TEST	S:9537OR348	IS:9537 OR 3480	IS:9537 OR 3480	INSP./T. REPORT				3/2	(2),1						
					4. EPOXY THICKNESS		MA	VISUAL/PHYSICAL	IS:9537	50 MICRONS	50 MICRONS	INSP./T. REPORT				3/2	(2),1						
BHEL		LEGEND	LEGEND :		PARTICULARS		BIDDER/VENDOR																
		P-perform	1 - BHEL		NAME																		
		W-witness	2 - BHEL's Vendor		SIGNATURE																		
		V-verify	3 - Manufacturer		DATE							BIDDER'S/VENDORS COMPANY SEAL											

		QUALITY PLAN SHEET 3 OF 4		CUSTOMER : TANGEDCO		PROJECT : 2X660 MW ENNORE SEZ		SPECIFICATION : PE-TS-412-558-E001 R1				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-558-00-Q-001/02		SPECIFICATION : STATION LIGHTING SYSTEM				
SYSTEM		ITEM : ILLUMINATION		SECTION			VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOC. [Vendor DS / Drg. / Spec.to be duly apprvd. by BHEL (& Cust. If required) ; otherwise BHEL-spec. / Drg. prevails.]	ACCEPT. NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
5.0	ELECTRIC POLES											
5.1	MATERIAL	1.CHEMICAL COMP.	MA	CHEM. ANALYSIS	SAMPLE	IS-2713	IS-2713	TEST REPORT	3/2		(2),1	
		2.PHYSICAL PROP.	MA	PHY.TESTS	-DO-	-DO-	-DO-	-DO-	3/2		(2),1	
5.2	FINAL INSPECTION	1.WORKMANSHIP AND FINISH	MA	VISUAL & MEAS	SAMPLES	DRG./ IS:2713	DRG./ IS:2713	INSP. REPORT	3/2	(2),1	-	FOR DEFLECTION & DROP TEST, TC VERIFICATION BY BHEL
		2.DIMENSIONS	MA	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	(2),1	-	
		3.WEIGHT	MA	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	(2),1	-	
		4.TESTS AS PER IS-2713	MA	-DO-	-DO-	IS-2713	IS-2713	INSP./T. REPORT	3/2	(2),1	-	
6.0	JUNCTION BOXES & RECEPTACLES											
		1.DIMENSIONS	MA	MEASUREMENT	100%	DRG./	DRG./	INSP. REPORT	3/2	-	[2]	COMPONENTS TO BE OF APPROVED MAKE
		2.PAINT SHADE/ THICKNESS	MA	VISUAL/MEAS.	SAMPLE	SPEC/DRG	SPEC/DRG	-DO-	3/2	-	[2]	If galvanised apply tests as per checks 3 a) & b) for conduits.
		3.HV/IR/HV	MA	ELECT.TESTS	100%	2KV AC FOR 1 MINUTE	2KV AC FOR 1 MINUTE	TEST REPORT	3/2	-	[2]	
		4.DEGREE OF PROTECTION	MA	TEST	1/SIZE	IS:2147	IS:2147	TEST CERT.	3/2		(2),1	
		5.SPECIAL TESTS IF ANY,EXPLOSION PROOF ETC.	MA	TEST	1/SIZE	IS:2148	IS:2148	TEST CERT.	3/2		(2),1	
7.0	PVC WIRES											
	NOTE : TO BE PROCURED FROM APPROVED SOURCE ONLY.	1.SURFACE DEFECTS	MA	VISUAL	SAMPLE	IS:694 / IS:1554	IS:694 / IS:1554	INSP. REPORT	3/2		(2),1	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-DO-	-DO-	-DO-	3/2		(2),1	
		3.TYPE TESTS	CR	ELEC.TESTS	ONE/TYPE & SIZE SAMPLING	BHEL SPEC. IS:694 / IS:1554	BHEL SPEC. IS:694 / IS:1554	TEST CERT.	3/2		(2),1	
		4.ACCEPTANCE TESTS	MA	-DO-		-DO-	-DO-	-DO-	3/2	(2),1	-	
BHEL		LEGEND	LEGEND :		PARTICULARS		BIDDER/VENDOR					
		P-perform	1 - BHEL		NAME							
		W-witness	2 - BHEL's Vendor		SIGNATURE							
		V-verify	3 - Manufacturer		DATE							BIDDER'S/VENDORS COMPANY SEAL

Format of Memorandum of Agreement (MOU) between bidder (who is not an approved lighting vendor) and bidders associate's(who is an approved Lighting vendor) for Station Lighting System Package on turnkey basis. To be executed on non judicial paper of Rs.100/- between the bidder and his associate.

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding is made in.....on.....of..... 2009.

BETWEEN

(Bidder Name) having its registered Office at.....(hereinafter referred as 'Contractor which expression shall unless excluded by or repugnant to the context, means and include its successors-in-interest and assigns)

AND

(name of associate) having its registered Office at.....(hereinafter referred as 'Contractor which expression shall unless excluded by or repugnant to the context, means and include its successors-in-interest and assigns)

Whereas Project Engineering Management, Bharat Heavy Electricals Ltd. (PEM-BHEL) Noida (hereinafter referred to as 'Employer') has issued invitation for bids bearing No..... dated..... for Station Lighting System package and requires that bidders who are not approved for this package are required to associate with approved vendors of lighting system.

Now this MOU witness and it is hereby agreed by the Contractor and Associate hereto as follows:

Whereas the Contractor and Associate hereto and interested to share their capabilities, strength and resources and co-operate for Station Lighting System package involving design, procurement, supply, erection, testing and commissioning of complete indoor and outdoor illumination system.

Balance engineering documents / drawings for the illumination system such as conduit layout etc. may be done by Contractor. Associate agrees to review these drawings on need base and where specifically desired by the Employer.

Annexure IX

Detailed BOQ for the luminaries & lamps shall be worked out by Associate who will also be responsible to obtain approval for the same from the Employer and their customer. For this purpose Associates agrees to depute technical experts to Employer's and Employer's Customer's offices as and when required. Further Associate undertake coordination with inspection authority for supplies under his scope. Contractor is responsible for preparation of Detailed BOQ, Data Sheets etc. for all other items. Inputs whereas required for the same will be provided by the Associate who agrees to review the documents/ data prepared by the contractor on a need basis and where specifically desired by the Employer.

Contractor will be responsible for contract planning, site mobilization, storage, erection, commissioning and performance testing as per contract specification and project schedule. Associate shall provide engineering site supply when found essential by Contractor and / or by Employer.

Contractor & Associate undertake to keep secret and confidential all information exchanged between themselves in connection with the agreement herein contemplated and not disclose any such information to any third party or person, except as required by the Employer for the successful execution of the project.

In the event of the contractor ordering the above agreed part on the Associate, we, the aforesaid Contractor and Associate do hereby undertake that we shall be jointly and severally responsible to the Employer for the successful completion and performance of the station Lighting System package. This is without the prejudice to any rights of the Employer against the contractor under the contract and / or guarantee.

This agreement shall be effective from the date of its execution by the contractor and Associate and shall terminate by mutual agreement only after obtaining prior written permission from the Employer who will have the sole discretion to reject such permission in the interest of the project.

VERIFICATION

The Contractor and his Associate fully endorse to the above statements made on this date, the 2009 and verify to the true to the best of their knowledge and belief.

Signature & official Seal of _____ (Contractor) _____ (Associate)

Witnessed by (name, address and signature)

- 1.
- 2.

2x660MW ENNORE SEZ SUPER CRITICAL THERMAL POWER

DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

S.NO	Description	Consultant	TANGEDCO CHENNIA	TANGEDCO SITE	BHEL UNIT	BHEL SITE
A	Relevant post contract correspondance	S	1	0	1	0
		1	S	0	1	0
		0	1	S	0	1
		1	1	0	S	1
		0	1	1	1	S
B	Drawing / document submission					
	a) submission	2	1	0	S	0
	b) return of submission with comments	S	1	0	1	0
	c) RFC issue	1	1	1	S	4
	d) as built	0	2	1	S	1
	e) erection drawings	0	0	2	S	5
C	Progress report(monthly)					
	EPC contractor's report in soft format	1	1	1	S	1
D	Instruction manuals					
	Erection & commissioning	0	1	2	S	3
	O&M manual	0	1+1CD	3+1CD	S	2+1CD

Note:

- 1) Submission of drawings/documents will be in soft format through email. drawing will be submitted in PDF format.
- 2) Consultant/TANGEDCO will mark comments on the pdf drawings. Prints will be generated after incorporating those comments for final approval of drawings.