3 X 660 MW NORTH KARANPURA STP

TECHNICAL SPECIFICATION

FOR

STATION LIGHTING SYSTEM

SPECIFICATION NO. : PE-TS-405-558–E002 R01

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP [INDIA]

CONTENTS

TOTAL NO. OF SHEETS= 206
(INCLUDING COVER/ SEPARATOR SHEETS)

IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS)

PREAMBLE

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 The 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.

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-A, B, C,D,E,F and G: 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.

    No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.

2. No comments/ additions/ deletions shall be made by the bidder on the signed & stamped copy of the specification. Any such changes made by the bidder shall not be considered.

3. 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.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the STATION LIGHTING SYSTEM description/ quantities, notes etc. from those given in Annexure-A, B, C, D, E, F and G 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

SECTION – 'A'

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to 3 X 660MW NORTH KARANPURA STP site, storage erection & commissioning of STATION LIGHTING SYSTEM as mentioned in different sections of this specification for the project as indicated in Section B (Project Information). Lighting fixture complete with lamps & accessories, lighting panels, receptacles, switchboxes, conduits, lighting wires, ceiling fans with regulators, lighting poles, lighting masts, earth wires & rods, junction boxes, maintenance ladders shall be in scope of contract.

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 be hereby made part of technical specification.

4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.

5.0 Requirements of the specification including the QP shall be agreed upon for total compliance by Bidders without any deviations. Price offers of only those bidders complying with the above requirement shall be acceptable.

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

7.0 For every shipment made to site, a shipping list, containing item reference [item number and description as per specification Bill of Materials or package drawings], and quantity of the same [in nos./ weight] shall be provided by vendor at the time of despatch of materials to site.

SECTION – 'B'

PROJECT INFORMATION

PROJECT INFORMATION

1.00.00 **BACKGROUND**

North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.

1.01.00 **Location and Approach**

The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.
Major rail/road distances from the project site are as under:

City		**Distance Approx. (kms)**
Ranchi	:	150
Khalari	:	40

The site is located near Tandwa town having latitude and longitude of about 23^0 50' N to 23º 52' N and 84^0 59' E to 85º 2' E respectively. The Vicinity Plan of the project is placed at **Annexure-I.**

Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.

1.02.00 **Land**

About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.
Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.

1.03.00 **Water**

Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.

1.04.00 **Fuel (Coal)**

1.04.01 **Coal Requirement, Availability and Linkage**

Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.

Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.

1.04.02 **Coal Transportation**

Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.

1.05.00 **Meteorological Data**

Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II**.**

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling System**

It is proposed to adopt Air Cooled Condenser for the project.

1.06.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

1.06.03 **Ash Water System**

It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.

1.06.04 **Other Miscellaneous Water Systems**

(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.

(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.

(c) The drinking water requirement of the plant shall be provided from water treatment plant.

(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.

(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.

1.07.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

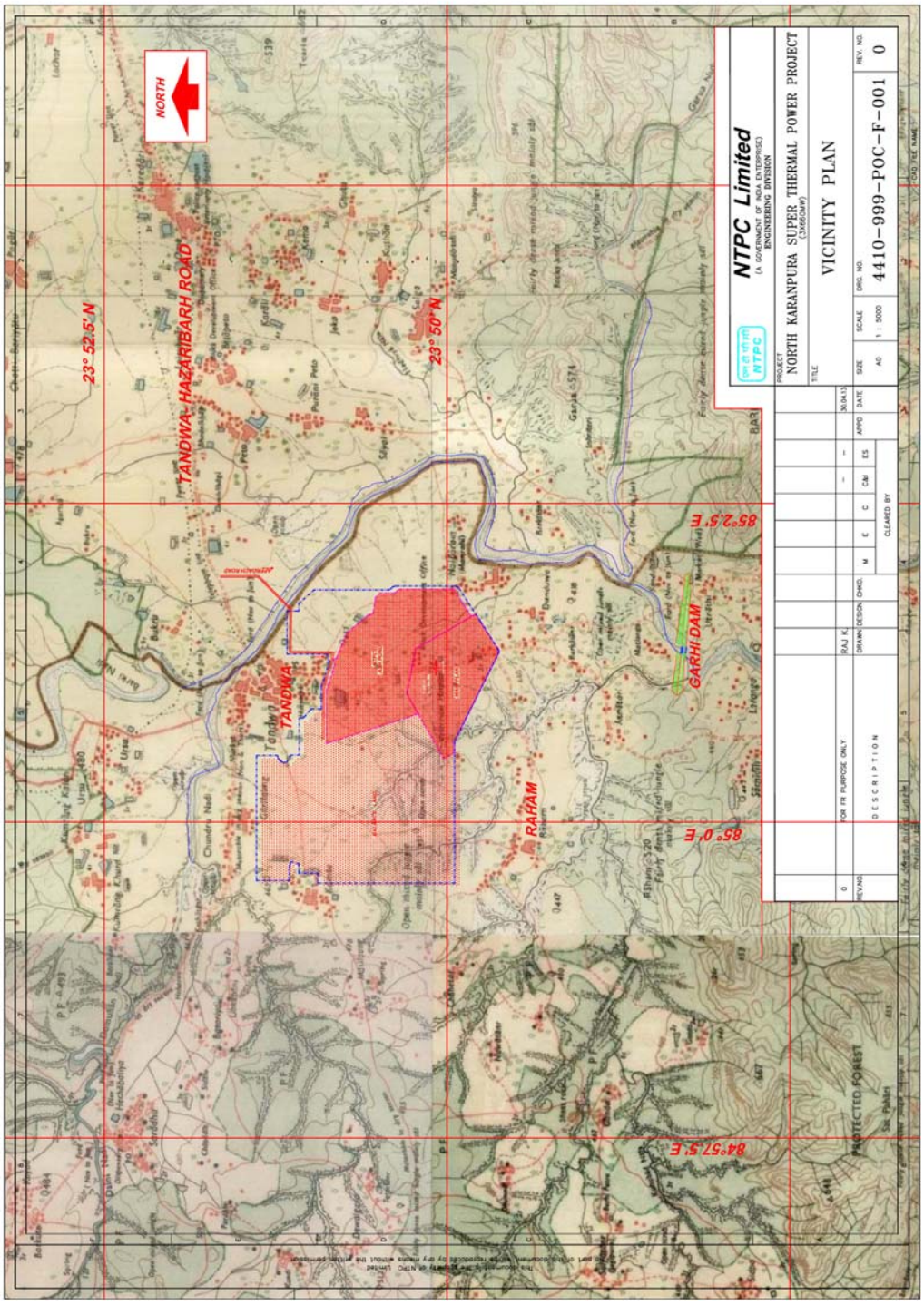
1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.

PROJECT INFORMATION

Annexure-I

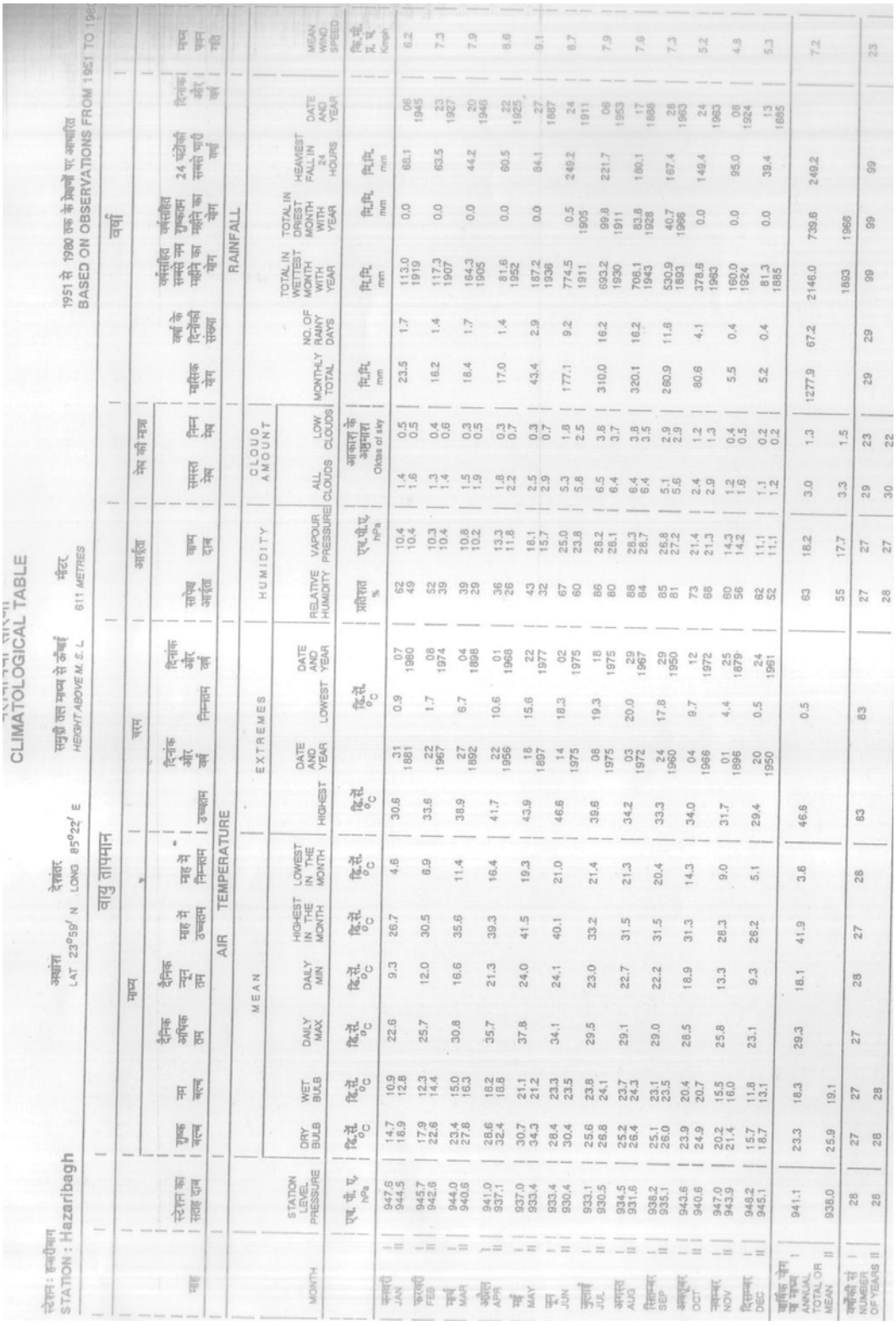
VICINITY PLAN



PROJECT INFORMATION

Annexure-II

CLIMATOLOGICAL TABLE



CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग — STATION : Hazaribagh

अक्षांश LAT 23°59′ N — देशांतर LONG 85°22′ E — समुद्री तल माध्य से ऊँचाई HEIGHT ABOVE M.S.L. 611 METRES

1951 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1951 TO 1980

MONTH	STATION LEVEL PRESSURE एच. पी. ए. hPa	AIR TEMPERATURE MEAN ड्राइ बल्ब DRY BULB डि.से. °C	MEAN वेट बल्ब WET BULB डि.से. °C	MEAN दैनिक अधिक तम DAILY MAX डि.से. °C	MEAN दैनिक न्यून तम DAILY MIN डि.से. °C	HIGHEST IN THE MONTH माह में उच्चतम डि.से. °C	LOWEST IN THE MONTH माह में निम्नतम डि.से. °C	EXTREMES HIGHEST दैनिक और उच्चतम DATE AND YEAR डि.से. °C	EXTREMES LOWEST दैनिक और निम्नतम DATE AND YEAR डि.से. °C	HUMIDITY RELATIVE HUMIDITY प्रतिशत %	HUMIDITY VAPOUR PRESSURE वाष्प दाब एच.पी.ए. hPa	CLOUD AMOUNT ALL CLOUDS समस्त मेघ आकाश के अष्टमांश Oktas of sky	CLOUD AMOUNT LOW CLOUDS निम्न मेघ आकाश के अष्टमांश Oktas of sky	RAINFALL MONTHLY TOTAL मासिक योग मि.मि. mm	RAINFALL NO. OF RAINY DAYS वर्षा के दिनों की संख्या	RAINFALL TOTAL IN WETTEST MONTH WITH YEAR वर्षासहित समस्त मास का योग मि.मि. mm	RAINFALL TOTAL IN DRIEST MONTH WITH YEAR वर्षासहित शुष्कतम मास का योग मि.मि. mm	RAINFALL HEAVIEST FALL IN 24 HOURS 24 घंटों में समस्त वर्षा मि.मि. mm	RAINFALL DATE AND YEAR दिनांक और वर्ष	MEAN WIND SPEED माध्य वायु गति कि.मी. प्र. घं. Kmph
जनवरी JAN	I 947.6	14.7	10.9	22.6	9.3	26.7	4.6	30.6	31 1881	0.9	07 1980	62	10.4	1.4	0.5	23.5	1.7	113.0 1919	0.0	68.1	06 1945	6.2
	II 944.5	18.9	12.8									49	10.4	1.6	0.5							
फरवरी FEB	I 945.7	17.9	12.3	25.7	12.0	30.5	8.9	33.6	22 1967	1.7	08 1974	52	10.3	1.3	0.4	16.2	1.4	117.3 1907	0.0	63.5	23 1927	7.3
	II 942.6	22.6	14.4									39	10.4	1.4	0.8							
मार्च MAR	I 944.0	23.4	15.0	30.8	16.6	35.6	11.4	38.9	27 1892	6.7	04 1898	39	10.8	1.5	0.3	18.4	1.7	164.3 1905	0.0	44.2	20 1946	7.9
	II 940.6	27.8	16.3									29	10.2	1.9	0.5							
अप्रैल APR	I 941.0	28.6	18.2	35.7	21.3	39.3	16.4	41.7	22 1956	10.6	01 1968	36	13.3	1.8	0.3	17.0	1.4	81.6 1952	0.0	60.5	22 1925	8.6
	II 937.1	32.4	18.8									26	11.8	2.2	0.7							
मई MAY	I 937.0	30.7	21.1	37.8	24.0	41.5	19.3	43.9	18 1897	15.6	22 1977	43	18.1	2.5	0.3	43.4	2.9	187.2 1936	0.0	84.1	27 1867	9.1
	II 933.4	34.3	21.2									32	15.7	2.9	0.7							
जून JUN	I 933.4	28.4	23.3	34.1	24.1	40.1	21.0	46.6	14 1975	18.3	02 1975	67	25.0	5.3	1.8	177.1	9.2	774.5 1911	0.5 1905	249.2	24 1911	8.7
	II 930.4	30.4	23.5									60	23.8	5.8	2.5							
जुलाई JUL	I 933.1	25.6	23.8	29.5	23.0	33.2	21.4	39.6	08 1975	19.3	18 1975	86	28.2	6.5	3.8	310.0	16.2	693.2 1930	99.8 1911	221.7	06 1953	7.9
	II 930.5	26.8	24.1									80	28.1	6.4	3.7							
अगस्त AUG	I 934.5	25.2	23.7	29.1	22.7	31.5	21.3	34.2	03 1972	20.0	29 1967	88	28.3	6.4	3.8	320.1	16.2	706.1 1943	83.8 1928	180.1	17 1886	7.6
	II 931.6	26.4	24.3									84	28.7	6.4	3.5							
सितम्बर SEP	I 938.2	25.1	23.1	29.0	22.2	31.5	20.4	33.3	24 1960	17.8	29 1950	85	26.8	5.1	2.9	260.9	11.8	530.9 1893	40.7 1966	167.4	28 1963	7.3
	II 935.1	26.0	23.5									81	27.2	5.6	2.9							
अक्टूबर OCT	I 943.6	23.9	20.4	28.5	18.9	31.3	14.3	34.0	04 1966	9.7	12 1972	73	21.4	2.4	1.2	80.6	4.1	378.6 1963	0.0	149.4	24 1963	5.2
	II 940.6	24.9	20.7									68	21.3	2.9	1.3							
नवम्बर NOV	I 947.0	20.2	15.5	25.8	13.3	28.3	9.0	31.7	01 1896	4.4	25 1879	60	14.3	1.2	0.4	5.5	0.4	160.0 1924	0.0	95.0	06 1924	4.8
	II 943.9	21.4	16.0									56	14.2	1.6	0.5							
दिसम्बर DEC	I 948.2	15.7	11.8	23.1	9.3	26.2	5.1	29.4	20 1950	0.5	24 1961	62	11.1	1.1	0.2	5.2	0.4	81.3 1885	0.0	39.4	13 1885	5.3
	II 945.1	18.7	13.1									52	11.1	1.2	0.2							
वार्षिक योग ANNUAL TOTAL OR MEAN	I 941.1	23.3	18.3	29.3	18.1	41.9	3.8	46.6		0.5		63	18.2	3.0	1.3	1277.9	67.2	2146.0 1893	739.6 1968	249.2		7.2
	II 938.0	25.9	19.1									55	17.7	3.3	1.5							
वर्षों की सं NUMBER OF YEARS	I 28	27	27	27	28	27	28	83		83		27	27	29	23	29	29	99	99	99		23
	II 28	28	28									28	27	30	22							

1.00.00 **General Requirements**

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment. However, for equipment in air conditioned areas, design ambient temperature shall be 35 deg.C, if 2x100% air conditioning system is provided.

1.02.00 All equipments shall be suitable for rated frequency of 50Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification. The step-up voltage level for the project shall be 400 KV. The turbo generator unit will be connected to its own step-up transformers for feeding power into the EHV grid. The overall system shall be designed considering voltage variation of +/- 5% and fault level of 50kA for 400KV and 40kA for 220 KV system. Under black start condition the minimum fault level of 1000 MVA shall be considered at 400KV voltage level and voltage variation at 400kV may be considered as +/-10% till system stabilization.

1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services for the entire station/plant in his scope as well as those specifically required by the Employer.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 The auxiliary AC voltage supply arrangement shall have 33 kV, 11 kV, 3.3KV and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition:

a)	33KV/11KV/3.3KV (MV)	+/- 6%
b)	415 V/240 V	+/- 10%
c)	220V DC	-15% to +10% However the nominal continuous DC power supply shall be 240V.

1.06.00 The voltage level for motors shall be as follows:

a) Upto 0.2 KW	:	Single phase 240V AC / 3 phase 415V AC
b) Above 0.2 KW and upto 200 KW	:	3 phase, 415V AC
c) Above 200 KW and upto 1500 KW	:	3 phase, 3.3 kV AC
d) Above 1500 KW	:	11 kV

The bidder may adopt 415V/3.3 KV for the drives rated in the range of 160-210 KW.

For CHP conveyor motor's rating above 160 kW, 3.3 KV, three phase AC supply is to be used.

The voltage rating of the drives indicated above is for basic guideline. Minor variations in above can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.

Voltage rating for special purpose motors viz, VFD and screw compressors, shall be as per manufacturer's standard. All the motors ratings on Stacker/ reclaimer shall be 415V ac supply only.

1.07.00	The preferred AC control supply voltage shall be 110V for all 415 V non breaker controlled feeders. Control supply voltages other than above may be offered by bidder based on the bidder's standard proven practice.
1.08.00	The designed fault levels for 11 KV & 3.3 KV systems shall be restricted to 40 kA rms for 1 second and 50 kA rms for 1 second for 415 V systems. The 33 KV system equipments shall have a minimum short circuit fault withstand rating of 12.5 kA for 1 second.
1.09.00	The nominal voltage of main DC system shall be 220V. DC batteries shall be designed for continuous float operation with trickle charge, hence all the associated components like batteries, battery chargers, DC motors, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous battery float voltage including suitable temperature correction factors. The operational limits of variation of DC voltage is (+)10 % to (-)15%. In addition, the bidder may propose 110V, 48V or 24V systems as per requirements of control and instrumentation of his equipment and design.
1.10.00	The Contractor shall furnish calculations of maximum loading and fault levels under the most onerous conditions for the various equipment/systems as defined else where in the specification to prove adequacy of their parameters. In case any equipment or system is found to be inadequate, it shall be changed/ modified without any additional liability to the Employer.

SECTION – 'C'

SPECIFIC TECHNICAL REQUIREMENTS

1.00.00 **GENERAL**

1.01.00 This specification covers the general description of design, manufacture and construction features, testing, supply, installation and commissioning of the Station Lighting system equipment.

2.00.00 **CODES AND STANDARDS**

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

2.02.00 Lighting Fixtures and Accessories

IS:1913	General and safety requirements for luminairies.
IS:2148	Flame proof enclosures of electrical apparatus.
IS:418	Tungsten filament general service electric lamps.
IS:1258	Bayonet lamp holders.
IS:1534	Ballast for fluorescent lamps.
IS:1569	Capacitors for use in tubular fluorescent, high pressure mercury vapour and low pressure sodium vapour discharge lamp circuit.
IS:1777	Industrial luminaire with metal reflectors.
IS:2149	Luminaire for Street lighting.
IS:2215	Starters for fluorescent lamps.
IS:2418	Tubular fluorescent lamps for general lighting services.
IS:3323	Bi-pin lamp holders for tubular fluorescent lamps.
IS:3324	Holders for starters for tubular fluorescent lamps.
IS:4013	Dust-tight electric lighting fittings.
IS:6616	Ballasts for high pressure mercury vapour lamps.
IS:8224	Electric Lighting fittings for Division 2 areas.
IS:9900	High-pressure mercury vapour lamps.
IS:9974	High pressure Sodium vapour lamps.
IS:10276	Edison screw lamp holders.
IS:10322	Luminaires.
IS:13021	AC Supplied Electronic Ballasts for tubular fluorescent lamps.

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

IS:2147	Degree of protection provided by enclosures for low-voltage switchgear and control gear.
IS:1293	Plugs & socket outlets of rated voltage upto and Including 250volts & rated current upto and including 16 Amps.
IS:2551	Danger notice plates.
IS:13947	Low voltage switchgear and controlgear
IS:3854	Switches for domestic and similar purposes.
IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC.
IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500 V DC.

2.04.00 **Conduits, Pipes and Accessories**

IS:2667	Fittings for rigid steel conduit for electrical wiring.
IS:3837	Accessories for rigid steel conduits for electrical wiring.
IS:9537	Conduits for electrical installations.

2.05.00 **Lighting Wires/Cables**

IS:694	PVC insulated cables for working voltages upto and including 1100 V
IS:3961	Recommended current ratings for cables.(PVC Insulated and PVC sheathed heavy duty cables and light duty cables).
IS:8130	Conductors for insulated electric cables and flexible cords.
IS:10810	Methods of tests for cables.

2.06.00 **LED Luminaries**

16101:2012	General Lighting. LEDs and LED modules Terms and definitions
16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.
16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.
16103(Part I):2012	LED modules for General lighting Safety Requirements.
15885(Part 2/Sec. 13) :2012	Lamp control gear Part 2 particular

	16104:2012	Requirements Section 13 d.c. or a.c. Supplied Electronic control gear for LED modules d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.
	16105:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.
	16106:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products
	16108:2012	Photobiological safety of Lamps and Lamp Systems
	IS 513	Cold rolled low carbon steel sheets and strips
	IS 12063	Classification of degree of protection provided by enclosures.
	IS 14700 (Part 3/Sec. 2)	Electro magnetic compatibility (EMC) – Limits for Harmonic current emission – THD < 15% (equipment, input current < 16 Amps. per phase.
	IS 9000 (Part 6)	Environment testing: Test Z – AD: composite temperature/humidity cyclic test.
	IS 15885 (Part 2/Sec. 13)	Lamp control gear: particular requirements for DC or AC supplied electronic control gear IS 16004 – 1 and 2)for LED modules.
	IS 4905	Method for random sampling
2.07.00	**Electrical Installation Practices & Miscellaneous**	
	IS:1944	Code of practice for lighting of public thorough fare
	IS:3646	Code of practice for interior illumination.
	IS:5572	Classification of Hazardous areas (other than Mines) having flammable gases and Vapours for electrical installation
	S:6665	Code of practice for industrial lighting.
	.	National Electrical Code
	-	Indian Electricity Rules.
	IS:5	Indian Electricity Act Colour for ready mixed paints & enamels.

	IS:280	Mild steel wires for general engineering purposes.
	IS:374	Electric ceiling type fans & regulators.
	IS:732	Code of practice for electrical wiring installations.
	IS:1255	Code of practice for installation and maintenance of power cables Upto and including 33KV rating.
	IS:2062	Steel for general structural purposes
	IS:2629	Recommended practice for hot-dip galvanizing of iron and steel.
	IS:2633	Methods for testing uniformity of coating of zinc coated articles.
	IS:2713	Tubular steel poles for overhead power lines.
	IS:3043	Code of practice for earthing
	IS:5216	Guide for safety procedures and practices in electrical work.
	IS:5571	Guide for selection of electrical equipments for hazardous areas.
	BS:6121	Mechanical cable glands

3.00.00 LIGHTING SYSTEM DESCRIPTION

The illumination of various indoor and outdoor areas in the main plant and off site areas shall be provided as described here. The lighting system of various areas shall comprise of one or more of the following systems:

(a) Normal AC Lighting System

(b) Emergency AC Lighting System

(c) DC Lighting System

3.01.00 **Normal AC Lighting System**

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

3.02.00 **Emergency AC Lighting System**

This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These will be fed from emergency lighting panels (ELPs) which in turn will be fed 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights will go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energised by Diesel generator set. Four (4) nos. 240V AC lighting fixtures fed from UPS (provided by contractor) shall be provided on each stacker reclaimer machine.

3.03.00	**DC Lighting System**
3.03.01	At strategic locations in the main plant, a few lighting fixtures fed from 220V, DC supply, shall be provided to enable safe movement of operating personnel and access to important control points during an emergency, when both the normal AC and Emergency Lighting system fail. These lighting fixtures will be fed from 220V DC LDBs which in turn will be fed from DC lighting panels.
3.03.02	The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply at station service switchgear as well as Emergency switch-gear. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.
3.03.03	In auxiliary /off site buildings except Coal Handling plant, emergency DC lighting is to be provided through self contained DC emergency fixture at strategic locations. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.
3.03.04	For Coal Handling plant, 100W, 220V DC Lighting fixture shall be provided in underground portion of conveyor, each switchgear room, control room, office room, pump house, each drive floor of TPs, staircases of various TPs and buildings and each local control area. DC lighting fixtures shall be fed from 220V DC LDB which in turn will be fed from CHP DC system. The supply to the DC lighting panels shall be automatically switched ON in case of loss of normal AC supply.
4.00.00	**DESIGN PHILOSOPHY**
	1. A comprehensive illumination system shall be provided in the entire project 2. All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel. 3. In the Off site area / buildings (except CHP) DC lighting shall be provided by self-contained 4hours duration Emergency lighting fixtures. 4. The system shall include distribution boards, normal/ emergency lighting panels, lighting fixtures, junction boxes, receptacles, switch boards, lighting pole/masts, conduits, cables and wires, etc. The system shall cover all interior and exterior lighting such as area lighting, including Transformer yard & Switch yard area, aviation obstruction lighting, Street lighting, security lighting, etc. The constructional features of lighting distribution boards shall be similar to AC/DC distribution boards described in chapter of LT Switchgear. Outgoing circuits in LPs shall be provided with MCBs of adequate ratings. 5. The illumination system shall be designed on the basis of best engineering practice and shall ensure uniform, reliable, aesthetically pleasing and glare free illumination. The lighting fixtures shall be designed for minimum glare. The design shall prevent glare/luminous patch seen on VDU/ Large video screens, when viewed from an angle. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection. The diffusers/ louvers used in fluorescent fixtures shall be made of impact resistant polystyrene sheet and shall have no yellowing property over a prolonged period. The Lux levels to be adopted for various area are indicated at Annexure - A. (placed at the end of this Chapter).

Further Lighting System shall be designed considering maximum utilization of natural light. To achieve this lighting circuit may be designed with segregation and usage of lux control philosophy. Energy efficiency codes shall be followed in principle.

6. Different Lighting Systems envisaged for various plant areas are indicated in Annexure-B: While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipments should be taken into account to have adequate illumination at desired locations.

7. **LED Luminaires:**

LED Luminaires shall be used for the lighting of all the Control Room & Control Equipment areas with false ceiling.

The individual lamp wattage for LED shall be min 3 watt. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70 Lm/W. Suitable heat sink shall be designed & shall be provided in the luminaire. The LED used in the luminaires shall have colour rendering index (CRI) of Min 65. Colour designation of LED shall be “cool day light” (min 5700K) type. The LED luminaire shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.

The beam angle for LED chip shall be 120 degrees. The max. junction temperature of LED shall be 85 deg C, further the lumen maintenance at this temperature shall be min 90%. The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per relevant standards. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire & safety requirements of luminaire shall be as per IS standards. Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.

The connecting wires used inside the system, shall be low smoke halogen free, fire retardant PTFE cable and fuse protection shall be provided in input side specifically for LED luminaires.

Care shall be taken in the design that there is no water stagnation anywhere. The entire housing shall be dust and water proof protection as per IS 12063.

Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver’s ratings and makes shall be as recommended by corresponding LED manufacturer.

LED Drivers may have following control & protections :-

- Suitable precision current control of LED.
- Open Circuit Protection
- Short Circuit Protection
- Over Temperature Protection
- Overload Protection

8. Apart from maintenance factor as given below, Temperature correction factor shall be considered in the lighting design for flourescent fixtures located in non air conditioned area.

(a.)	Office area airconditioned	:	0.8
(b.)	Office area non airconditioned and other indoor area	:	0.7
(c.)	Dust prone indoor and outdoor area	:	0.6
(d.)	Coal Handling Plant, Ash Handling Conveyor /Transfer Points etc.	:	0.5

9. All lighting fixtures and control gears shall be powder coated. All outdoor fixtures shall be weather proof and of IP55 degree of protection.

10. Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have IP55 degree of protection.

11. Wires of different phase shall normally run in separate conduit.

12. Power supply shall be fed from 415 / 240 V normal AC supply, emergency AC supply and 220V DC supply through suitable number of conveniently located lighting distribution boards (LDB) and lighting panels (LP). AC lighting supply shall be isolated from main supply by isolation transformers of max. rating of 100KVA and fault level restricted to 3 KA at Lighting Panels.

13. Atleast one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc. Further 20A, 240V AC industrial receptacle with switch shall be provided strategically in all industrial areas (For conveyor gallery and track hopper shed at 30m interval on both sides and for yard conveyor at 50m interval on one side).
Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for entire plant for welding purposes, particularly near all major equipment and at an average distance of 50m. Atleast one 63A, 3ph, 415V AC receptacle shall be provided in each floor of off-site buildings/ structures, at 50m interval (starting from one end) on both sides of the conveyor galleries and at 50m interval on one side of the yard conveyor.
In coal handling plant, One no 10A, 24V AC receptacle with IP55 DOP shall be provided in each switchgear/ MCC room, Pump house, TPs, crusher house and on stacker-reclaimer.

14. The type of fixtures, LP, JB, and receptacle used in Hydrogen generation plant building shall be suitable for group II C as per IS:2148 or class I, Division II as per NEC 70-428.

15. In the hazardous areas like gas/ liquid fuel storage/ handling areas lighting shall be flame proof.

16. All flourescent fixtures, shall have energy efficient 'T5' type flouresent lamps except the flouresent fixtures used for division 2 hazardous area. The louvers of these fixtures shall be designed for 'T5' type flouresent lamps. All flouresent lamps shall be have "Cool day light" colour designation. The mirror optics type flouresent fixtures shall have no irridescence effect. Fixtures with better efficiency and upgraded proven system may also be considered
In candescent lamps may be used only with DC Lighting.

17 Aviation warning lights shall be provided as per the recommendations of ICAO and Director general of civil aviation, India. The arrangement of light should be marked such that the object is indicated from every angle in azimuth. The aviation warning lighting system shall also conform to the latest Indian standard IS 4998.

4.01.00 **Ballasts**

4.01.01 All HPSV and HPMV lamp fixtures shall be provided with wire-wound ballasts. All fluorescent fixtures except for Class-I, Div-II fittings/ increased safety fittings (Div-II/Hazardous Area) shall be provided with electronic ballasts.

4.02.00	All luminaires and their accessories and components shall be of type readily replaceable by available Indian makes.
4.03.00	**Fans & Regulator**
4.03.01	Ceiling Fans, to be provided in non air-conditioned office/control room area, shall be suitable for operation on 240 V +/-10%, 50 Hz, AC supply comprising of class 'E' or better insulated copper wound single phase motor, 1200mm sweep, aerodynamically designed well balanced AL blades (3 Nos.), down rod, die cast aluminium housing, capacitor, suspension hook, canopies etc. finished in stove enameled white or with electro static powder coating. Power factor of fans shall not be less than 0.9. Fan regulators shall be stepped electronic type suitable for operation on 240V +/-10% AC supply.
4.04.00	**Junction Boxes, Conduits, Fitting & Accessories , Pull Out Boxes:** Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55. All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate. Conduits, Pipes and Accessories Galvanised heavy duty steel conduits for normal area and galvanised heavy duty steel conduits with an additional epoxy coating for corrosive area shall be offered. Alternatively glass reinforced epoxy conduits with comparable compressive and impact strength with that of heavy duty steel conduits may be offered. Rigid steel conduits shall be heavy duty type,hot dip galvanised conforming to IS : 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside. Flexible conduit shall be water proof and rust proof made of heat resistant lead coated steel. Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, Structures, etc.. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP :55 degree of protection and those used indoor shall be suitable for IP :52 degree of protection. Pull out box & its cover shall be hot dip galvanised.
4.05.00	**Lighting Wires**
4.05.01	Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases & neutral, respectively and white & grey for DC positive & DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper and 4 sq.mm. for aluminium.

4.06.00 **Receptacles**

Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped galvanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity. Type RA flameproof : specification shall be same as that of RA receptacle in addition that it shall be flameproof.
Type RD receptacle : 125A, 415V TPN with earth surface mounting 5 pin industrial type.

4.07.00 **Lighting / Welding Transformers**

Each AC Lighting Distribution Board (LDB) / Welding DB shall be fed from 415V / 415V, 100kVA isolating transformer. The lighting / welding transformer may, preferably, be located inside the LDB / Welding DB panel itself. Otherwise, the same shall be located by the side of respective LDB / Welding DB. Lighting / Welding transformers shall be dry type, natural air cooled with class B insulation or better. Impedance of lighting / Welding transformer shall be so selected that the fault level of lighting /Welding system shall be reduced to 3 to 5 KA. Lighting / Welding transformers shall be tested as per IS: 2026. Off-circuit tap changer with ± 2.5% and ± 5% tapping shall be provided. In case the transformers are not mounted inside the LDB panels, the same shall be housed in a separate 2 mm thick CR sheet steel enclosure with IP-42 degree of protection as per IS/IEC 60947. However, the transformer terminal box shall have IP-52 degree of protection. For main plant (TG & SG areas- TG hall area- all floors, Boiler area, Mill area, ESP area, chimney & ID fan area) and service building, each lighting DB shall have 1 X 100% transformer. For all other offsite areas, each lighting DB shall have 2 X 100 % transformers. Welding sockets shall be connected from welding DBs, which shall be fed through 1 x 100% welding transformers. LDB shall be considered to 70% of their loading.

4.08.00 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:60439 as applicable. They shall meet all other requirements specified elsewhere in the specification.

4.09.00 Number of fixtures to be mounted on lighting mast is envisaged as 16. However, fixtures and lamps are covered in BOQ of station lighting spec, no additional fixtures are to be considered by bidder for lighting mast.

4.10.00	**Lighting Poles**
4.10.01	The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. The Poles shall be mounted above ground using base plate and minimum height of pole shall be 8 mtrs The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.
4.11.00	**Lighting Masts**
4.11.01	Lighting Mast shall be of continuously tapered polygonal cross section hot dip galvanised. The Mast shall be of 30 M or suitable height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame, Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaires, suitable aviation warning light, lightning alongwith necessary power cables within the mast. The mast shall be delivered in not more than 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 The Mast together with the fixtures shall be capable of withstanding the appropriate wind loads as per IS:875. The Mast shall be fabricated from special steel plates conforming to BS-EN10-025 and folded to form a polygonal section. Suitable feeder pillar with TPN MCB, contactors, timer, MCB and other necessary accessories for operation & protection of the mast and fixtures shall be provided.
4.12.00	Lighting fixtures shall generally be group controlled directly from lighting panel. However, in office areas, control shall be provided through switch boxes. Each switch shall control a maximum of three fluorescent fixtures.
4.13.00	A.C. normal, AC emergency and DC system wiring shall run throughout in separate conduits. Wires of different phase shall run in different conduits.
4.14.00	Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run alongwith each conduit run. Cable armours shall be connected to earthing system at both the ends.
4.12.00	Alternately Vendor may offer technically superior and proven product subject to approval of employer.
5.00.00	**TESTS**
5.01.00	All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
5.02.00	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such

tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

5.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

5.04.00 Selection of samples for type test, acceptance test & routine test and acceptance criteria for all the items shall be as per relevant I.S

5.05.00 Type test reports of the following items as per relevant standards shall be submitted for approval.

SL NO.	DESCRIPTION
i.	Lighting fixtures of each type
ii.	Lamps of each type and rating.(life cycle and rating test only)
iii.	Lighting panel of each type (Degree of Protection)
iv.	Junction Box of each type

5.06.00 Acceptance Test and Routine Test

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

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

5.07.00 **Galvanizing Tests**

5.07.01 The quality of galvanizing shall be smooth, continuous, free from flux stains and shall be inspected visually.

5.07.02 In addition following tests shall be conducted as acceptance tests.

(a) Uniformity of coating - The coating of any article shall withstand four 1minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.

(b) The quality of cadmium/zinc plating on items with screw threads shall be free from visible defects such as unplated areas, blisters and modules and shall be inspected visually.

(c) In addition, the plating thickness shall be determined microscopically/ chemically or electronically.

6.00.00 COMMISSIONING CHECKS

1. On completion of installation work, the Contractor shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.

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

3. The installation shall be then tested and commissioned in presence of the Project manager.

4. The contractor shall provide all, men material and equipment required to carry out the tests.

5. All rectifications, repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor without any extra cost. The handing over the lighting installation shall be effected only after the receipt of written instruction from the Employer/his authorized representative.

6. The testing shall be done in accordance with the applicable Indian Standards and codes of practices. The following tests shall be specifically carried out for all lighting installation.

   (a) Insulation Resistance.

   (b) Testing of earth continuity path.

   (c) Polarity test of single phase switches.

   (d) Functional checks.

7. The lighting circuits shall be tested in the following manner :

   (a) All switches ON and consuming devices in circuit, both poles connected together to obtain resistance to earth.

   (b) Insulation resistance between poles with lamps and other consuming devices removed and switches ON.

7.0 ILLUMINATION DESIGN CALCULATION

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

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

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

Where
L = Length of room (Restricted to Max. 5W)
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:

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

Where MH = Mounting height of luminaire.

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

	Ceiling (rc)	Wall (rw)	Floor (rf)
For air-conditioned area	50	30	10
For non air-conditioning area	30	30	10
For boiler area	00	00	00
White & very light colours	70	70	10
Light colours	50	50	10
Dark colours	10	10	10

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

a) Boiler area : 0.6

b) Indoor area non-AC (except fluorescent fixture) : 0.7

c) Indoor area non-AC (fluorescent fixture) : 0.61$

d) Control room & air conditioned area : 0.8

$: (0.7X0.87 = 0.609 ≈ 0.61).

Where 0.87 is the ambient temperature correction factor for fluorescent fixture at 40°C in motionless air.

Maintenance factor for outdoor and road lighting : 0.6

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

8.0 QUALITY CHECKS

A sample copy of Quality Plan is enclosed (Standard quality plan) with the specification for compliance. During detailed engineering, the bidder shall furnish this QP for purchaser/customer approval. The changes in the Quality Plan (QP) during customer approval shall be without any implication on cost and delivery.

9.0 SECTION-D Technical specification for Lighting system (Installation) clauses to be read as

Clause no 1.1

Above mentioned clause is replaced by following clause :

"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.

The above scope of LV services also include arrangement like conduiting and wiring for power supply for LIE/LIR, Propellor fans, exhaust fans, Computer UPS, etc**."**

10.0 GREEN LIGHTING

i) Service building, Administration building, Auditorium building and Canteen building shall be designed as GRIHA (Green Rating for Integrated Habitat Assessment) compliant Green building, with a minimum three (3) star rating. Bidder shall perform all services related to GRIHA certification including preliminary assessment, GRIHA facilitation, simulation & analysis leading to obtaining the final certification by GRIHA. For information about GRIHA, bidder is requested to visit the web site www.grihaindia.org.

10.1 Administration Building

Salient Features

The Administration Building shall be a multi–storeyed RCC frame superstructure. The building shall have an RCC Lift structure accommodating the Lifts. The structural framing plan and elevations shall be based on the architectural concept to be developed by the bidder. The minimum thickness of Lift Superstructure RCC Wall shall be 230mm.

Architectural Features

This building shall be designed as GRIHA (Green Rating for Integrated Habitat Assessment) compliant Green building seven storied (G+6 stories above) and area 5500 sq.m. with RCC Frame structure &Autoclave Aerated Concrete Block masonry. Floor-to-floor height shall be minimum 4.50m. The building shall have a central atrium covered with polycarbonate sheet dome.

Hermetically sealed double glazing with toughened Glass to be provided for external glazing. There shall be provisions for Exhibition Hall, Conference Room for 50 persons, Canteen for 30 persons, Bank, Bank ATM space, AHU, MCC Room, First Aid Centre, Library, offices. In addition, adequate space shall be provided for IT & Communication Area. Separate toilet facilities shall be provided for ladies and gents in each floor. One toilet shall be provided for physically handicapped at each floor. The building shall have provision of attached toilet with the cabin for senior executives and conference rooms. The Administrative Building shall also have adequate floor area reserved for SATCOM facility. Dish antenna for SATCOM purpose shall be placed on the roof of the Admin Building. 2Nos Panoramic Lifts and minimum 2Nos stairs shall be provided. Atrium with dome shall be provided. The provision for car and scooter parking shall be made. Covered Parking space for 28 Nos. cars and 28 Nos. scooters shall be provided. Minimum 23 Sq.m. area per car (including circulation area) and 2.5 Sq.m per scooter shall be considered for working out covered parking space. Covered parking shall be of RCC construction. The rain water down comers shall be provided as per General architectural specification.The rain water down comers shall be suitably concealed by the external wall enclosure. External finish shall be combination of solvent based exterior paint & aluminium composite panel.

10.2 Auditorium

Salient Features

Auditorium shall be an RCC framed superstructure. The building shall have large span Roof structure over the Auditorium Hall. The large span roof structure shall comprise either RCC beams (with camber at bottom surface) and roof slab or structural steel girders/ roof truss (with adequate lateral stability

through tie & rafter level bracings / girders in orthogonal direction) and RCC slab over profiled metal deck sheets with purlins. All the external wall shall be of Autoclaved aerated concrete block wall 250 thick for this fully
covered Auditorium with additional internal & external plastering. Handrail for all balconies & staircases shall be made of stainless steel. Floor wall and false ceiling details shall be as per architectural specification.

Architectural Features:

This building shall be of RCC Frame structure & Autoclave Aerated Concrete Block masonry. The area of building shall be 1000 sq.m. and shall have seating capacity of 150 persons.

There shall be provisions for Main Entrance Foyer, Lounge, AHU, AC Plant room, MCC room, stage, Green rooms, pantry etc. Separate toilet facilities shall be provided for Ladies & Gents & physically handicapped people. Provisions for air-conditioning for the building for all the areas except toilets, and other service areas shall be kept. External finishing shall be of Premium Acrylic Smooth Paint, and Coloured Aluminium Composite panel. False ceiling & wall panelling shall be provided as per Acoustical consideration.

10.3 Canteen

Salient Features:

The Canteen Building shall be a RCC framed superstructure with large span roof system. The building shall be designed as per the latest guidelines of IS:456, IS 1893 & IS 13920(for seismic ductility requirement)

Architectural Features

This building shall be of RCC Frame structure & Autoclave Aerated Concrete Block masonry. The area of building shall be 1000 sq.m. The building shall have entrance lobby, dining hall for staff, dining room for executives,pantry, kitchen, office, stores, wash areas, rest room for kitchen staff, toilets, etc.
External finish shall be of Premium Acrylic Smooth Paint. There shall be separate service road and entrance for supply of cooking materials and garbage disposal.

10.4 Service Building

This building shall be an RCC structure having RCC frame with RCC floors and roof slab. For the building, floor-to-floor height shall be as per architectural features. A connecting corridor with MPH building shall be provided at operating floor level. The grade of concrete for RCC frame (including foundation) shall be M25.

Architectural Features

This building shall be designed as GRIHA (Green Rating for Integrated Habitat Assessment) compliant and shall be with floor area of 5500 sq.m in Ground + 4 Storeys. Autoclave Aerated Concrete Block masonry wall shall be provided for the full height of the building for both external and internal walls. Floor-to-floor height shall be minimum 4.25m.

This building shall provide offices for Operation staff, Conference room for 50 persons, C & I Laboratory, Exhibition Hall, VIP Lounge etc. This will be fully airconditioned building with adequate provision of toilets, pantry, cabins for senior executives and separate rooms for executives, supervisors etc. Lift structure with
RCC lift pits shall be located inside the service building. Separate toilet facilities shall be provided for ladies and gents in each floor. One toilet shall be provided for physically handicapped on each floor. The building shall have provision of attached toilet with the cabin for senior executives and conference rooms. 2 no's of staircases and 2 no's of lifts with adequate capacity shall be provided. One store room shall be provided. Hermetically sealed double glazing with toughened glass shall be provided for external glazing.

A connecting corridor with Main Power House building shall be provided at operating floor level of Main Power House. The floor of the connecting corridor shall have vitrified ceramic tiles, stainless steel hand rail & fixed windows. The connecting corridor shall have double skin metal cladding & insulated metal sheet sloped roof. The provision for car and scooter parking shall be made. Covered Parking space for 30 Nos. cars shall be provided. Covered parking shall be of RCC construction. Open parking space shall be provided for 35 Nos. cars and for 65 Nos. scooters, Minimum 23 Sq.m. area per car (including circulation area) and 2.5 Sq.m area per scooter shall be considered for working out parking space. External finishing shall be of Premium Acrylic Smooth exterior paint and Coloured Aluminium Composite panel combination.

11.00.00 **SPARES**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

11.01.00 **MANDATORY SPARES**

(a) The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

(b) The Employer reserves the right to buy any or all the mandatory spares parts.

(c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

(d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

(e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

11.02.00 **RECOMMENDED SPARES**

(a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in the price schedule and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

(b) Price of recommended spars will not be used for evaluation of the bids. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

11.03.00 **START-UP & COMMISSIONING SPARES**

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

11.04.00 The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.

12.00.00 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.

13.00.00 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.

14.00.00 All the spares (both recommended and mandatory) shall be manufactured alongwith the main equipment components as a continuous operation as per same specification and quality plan.

15.00.00 The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.

16.00.00 Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a

	detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
17.00.00	All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
18.00.00	The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
19.00.00	The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
20.00.00	In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
21.00.00	The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer atleast 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.
22.00.00	The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.
23.00.00	Adequate number of containers are to be supplied for storing of material at site. The same can be taken back by the vendor after completion of work.

ANNEXURES TO SECTION- C

A) Unpriced Price schedule – Main

i) Lighting system (supply) Lot – Refer Annexure-A for item wise BOQ breakup.

ii) Mandatory spares Lot - Refer Annexure-E for item wise BOQ breakup.

iii) Startup and commissioning spares Lot – Refer Annexure-G (Bidder to furnish the list)

B) Unpriced Price schedule E & C Lot - Refer Annexure-B for item wise BOQ breakup.

C) Optional Items

i) Type test Lot – Refer Annexure- C

ii) Recommended spares Lot – Refer Annexure- F

ANNEXURE-A

PRICE SCHEDULE FOR LIGHTING SYSTEM (SUPPLY)

Item No.	DESCRIPTION			SUPPLY	
	MAIN SUPPLY ITEMS	UNIT	QTY.	UNIT PRICE	TOTAL PRICE
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 1 no. 100 kVA transformer)	Nos.	36		
1.1b	100kVA transformer for housing in 1.1a- normal non-encapsulated type	Nos.	36		
1.2	AC LDB Type LDB-H2 (12)				
1.2a	AC LDB Type LDB-H2 (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	12		
1.2b	100kVA transformer for housing in 1.2a- normal non-encapsulated type	Nos.	24		
1.3	DC LDB Type LDB-D (6)	Nos.	9		
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 1 no. 100 kVA transformer)	Nos.	3		
1.4b	100kVA transformer for housing in 1.4a - normal non-encapsulated type	Nos.	3		
1.5	AC LDB Type LDB-F (8)				
1.5a	AC LDB Type LDB-F (8) without transformer (including cubicle suitable for 1 no. 50 kVA transformer)	Nos.	1		
1.5b	50kVA transformer for housing in 1.5a	Nos.	1		
2.0	**Lighting Panels (LP)- With Timer**				
2.1	AC Normal /Emergency indoor Type LP – A (6)	Nos.	39		
2.2	AC Normal (Decorative) Type LP – A (6)	Nos.	1		
2.3	AC Normal /Emergency indoor Type LP – A (12)	Nos.	106		
2.4	AC Normal /Emergency outdoor Type LP – A (12)	Nos.	47		
2.5	AC Normal (Decorative) Type LP – A (12)	Nos.	35		
2.6	AC Normal /Emergency indoor Type LP – A (18)	Nos.	24		
2.7	AC Normal /Emergency outdoor Type LP – A (18)	Nos.	54		
2.8	DC indoor Type LP – D (6)	Nos.	27		
2.9	DC outdoor Type LP – D (6)	Nos.	15		

2.10	Street Lighting Type LP – S (6)	Nos.	25		
3.0	**Lighting Luminaires (complete with accessories)**				
	Purchasers type reference (* Bidders type reference)				
3.1	Luminaires Type FC02 (*) with 28W T5 tube	Nos.	157		
3.2	Luminaire Type FC06 (*)	Nos.	2125		
3.3	Luminaire Type FC26 (*)	Nos.	654		
3.4	Luminaire Type FC81 (*)	Nos.	225		
3.5	Luminaire Type FC32 (*)	Nos.	91		
3.6	Luminaire Type TB22 (*)	Nos.	408		
3.7	Luminaire Type TX04 (*)	Nos.	186		
3.8	Luminaire Type TW41 (*)	Nos.	672		
3.9	Luminaire Type SF63 (*)	Nos.	182		
3.10	Luminaire Type SF64 (*)	Nos.	10		
3.11	Luminaire Type SF66 (*)	Nos.	118		
3.12	Luminaire Type SB11 (*)	Nos.	219		
3.13	Luminaire Type SB02 (*)	Nos.	746		
3.14	Luminaire Type SB03 (*)	Nos.	349		
3.15	Luminaire Type SS61 (*)	Nos.	10		
3.16	Luminaire Type SS62 (*)	Nos.	1207		
3.17	Luminaire Type SS63 (*)	Nos.	862		
3.18	Luminaire Type SW41 (*) [with integral CG box]	Nos.	14359		
3.19	Luminaire Type SW42 (*) [with integral CG box]	Nos.	2973		
3.20	Luminaire Type MW96 (*)	Nos.	585		
3.21	Luminaire Type MW98 (*)	Nos.	70		
3.22	Luminaire Type FC30 (*)	Nos.	200		
3.23	Luminaire Type CF01 (*)	Nos.	10		
3.24	Luminaire Type CF02 (*)	Nos.	10		
3.25	Dichroic spot light fixture [for halogen lamp]	Nos.	10		
4.0	**Lighting Lamp**				
4.1	28W T5 fluorescent tube	Nos.	6993		
4.2	100W Incandescent lamp	Nos.	1199		
4.3	100W Comptalux lamp	Nos.	186		
4.4	70W HPSV lamp (SON-E)	Nos.	14359		
4.5	150W HPSV lamp (SON-E)	Nos.	3192		
4.6	250W HPSV lamp (SON-E)	Nos.	928		
4.7	400W HPSV lamp (SON-E)	Nos.	604		

4.8	125W HPMV lamp	Nos.	655		
4.9	150W HPSV lamp (SON-T)	Nos.	1164		
4.10	250W HPSV lamp (SON-T)	Nos.	905		
4.11	12V, 50W Dichroic lamp	Nos.	10		
5.0	**Switch boxes for individual control of circuits**				
5.1	Type SWB1	Nos.	285		
5.2	Type SWB2	Nos.	150		
5.3	Type SWB3	Nos.	70		
5.4	Type SWB4	Nos.	10		
5.5	Type SWB5	Nos.	10		
6.0	**Junction boxes**				
6.1	Type JB-F	Nos.	21143		
6.2	Type JB-FE	Nos.	222		
6.3	Type JB-S	Nos.	1446		
7.0	**Receptacles**				
7.1	Type RA	Nos.	843		
7.2	Type RA (Flame proof)	Nos.	34		
7.3	Type RB	Nos.	671		
7.4	Type RC	Nos.	197		
7.5	Type RD	Nos.	9		
7.5	Type RC (Flameproof)	Nos.	10		
8.0	**Ceiling fans with electronic regulators**				
8.1	1200 mm sweep	Nos.	53		
8.2	Pedestal Fan	Nos.	10		
9.0	**Emergency lighting Units**	Nos.	69		
	With Ni-Cd battery and 2 X 10W fluorescent lamp				
10.0	**Poles [Swaged, Steel tubular poles Galvanized]**				
10.1	Type PS1 (410 SP51 as per IS-2713)	Nos.	650		
10.2	Type PS2 (410 SP67 as per IS-2713)	Nos.	650		
10.3	Type PF2 (410 SP51 as per IS-2713)	Nos.	61		
10.4	Type PS4 (410 SP51 as per IS-2713)	Nos.	85		
10.5	Type PF1 (410 SP51 as per IS-2713)	Nos.	20		

11.0	**Wires**				
11.1	1x1.5 mm^2 Cu PVC	mtrs.	367,000		
11.1	1x2.5 mm^2 Cu PVC	mtrs.	367,000		
11.2	1x 4 mm^2 Cu PVC	mtrs.	95,000		
12.0	**GI wire, flat & MS rod**				
12.1	14 SWG GI wire	mtrs.	531,000		
12.2	25X3 mm GI flat	mtrs.	500		
12.3	50X6mm GI flat	mtrs.	1,000		
12.5	20mm dia MS rod	nos.	1,470		
13.0	**Hot dip Galvanised Rigid Steel Conduits (Heavy Duty)**				
13.1	20 mm dia GI conduit, 1.6 mm thick	mtrs.	296,000		
13.2	25 mm dia GI conduit, 1.6 mm thick	mtrs.	21,000		
13.3	40 mm dia GI conduit, 2 mm thick	mtrs.	18,800		
13.4	50 mm dia GI conduit, 2 mm thick	mtrs.	1,000		
13.5	25 mm dia GI conduit with epoxy coating, 1.6 mm thick	mtrs.	3,000		
14.0	**Flexible lead coated conduit**				
14.2	20 mm dia lead coated conduit	mtrs.	31,700		
15.0	**Structural steel**	MT	45		
16.0	**Hume pipe**				
16.1	Hume pipe 100 mm dia	mtrs.	2000		
17.0	**24V supply module & lamp unit complete with all accessories**				
17.1	Fixed type 24V supply modules	Nos.	50		
17.2	Portable type 24V supply modules	Nos.	38		
17.3	Portable halogen lamp unit	Nos.	10		
17.4	5A, 24V industrial type sockets	Nos.	220		
18	**LIGHTING MAST**	Nos.	4		
19.0	**Ladder**				
19.1	Free standing ladder	Nos.	10		
19.2	Wheel mounted ladder	Nos.	10		
20	EXIT SIGN	Nos.	40		

21	**GREEN BUILDING ECBC COMPLIANCE**				
a	LED FIXTURE & LAMP (6X3W)	Nos.	3117		
b	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (dimmable)	Nos.	676		
c	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (non-dimmable)	Nos.	79		
d	FC-30 with dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.	29		
e	FC-30 without dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.	66		
f	Downlighter 2X 18 W CFL / Flouroscent with dimmable ballast	Nos.	71		
g	Fixture for 150W metal hallide lamp	Nos.	25		
h	Luminaire type FC-06 (with dimmable ballast)	Nos.	152		
i	Luminaire type FC-32 (with dimmable ballast)	Nos.	32		
j	14W LAMP	Nos.	4202		
k	18 W CFL	Nos.	142		
l	36 W CFL	Nos.	20		
m	150 Metal Hallide Lamp	Nos.	25		
n	Occupancy sensor	Nos.	50		
o	Lighting sensor system	Nos.	4		
p	Lighting dimmer system	Nos.	1		
q	Control system (Green Buildings)	set	4		

NOTES:

1. All Fluorescent fixtures shall have electronic ballast, except for those mentioned in price schedule.

2.'Basic Design Documents' cover: Drawings/ documents schedule, technical data sheets, GA dwgs. of equipments, quality plan, type test reports & type test proposal (as required) for Station Lighting System.

3. Items shall be cleared for manufacturing and supply in stages on the basis of engineering information to be furnished by vendor who is responsible for engineering of lighting system.

4. For green building, lighting shall be Energy conservation building code (ECBC) compliant. Bidder to include supply of all items (like lighting fixtures, lighting lamps, lighting panel, switch boxes, sensors, automatic control system) required for the same and furnish detailed BOQ along with the bid.

5. For any clarification please refer technical specification No : PE-TS-405-558-E002 R01.

6. Control system for green building lighting shall include all items (like Dali controller, field through controller, network gateway, universal sensor, manual user control panel, BMS interface, control cable etc) required for control of lighting in service building, canteen, admin building & auditorium to achieve GRIHA- 3 rating as per technical specification. LOT indicated above shall mean all items required for completion of control system in all respects.

7.Design engineering charges are considered to be included in main equipment supply price. No separate charges shall be applicable.

ANNEXURE-B

PRICE SCHEDULE FOR LIGHTING SYSTEM (INSTALLATION)

Item No.	DESCRIPTION MAIN E&C ITEMS	UNIT	QTY.	INSTALLATION UNIT	 TOTAL PRICE
1.0	**Lighting Distribution Board (LDB)**				
1.1	AC LDB Type LDB-H (12)				
1.a	AC LDB Type LDB-H (12) without transformer (including cubicle suitable for 1 no. 100 kVA transformer)	Nos.	36		
1.1b	100kVA transformer for housing in 1.1a - Normal Non encapsulated type	Nos.	36		
1.2	AC LDB Type LDB-H2(12)				
1.2a	AC LDB Type LDB-H2 (12) without transformer (including cubicle suitable for 2 no. 100 kVA transformer)	Nos.	12		
1.2b	100kVA transformer for housing in 1.2a - Normal non encapsulated type	Nos.	24		
1.3	DCLDB Type LDB-D (6)	Nos.	9		
1.4	AC WDB Type WDB-H (12)				
1.4a	AC WDB Type WDB-H (12) without transformer (including cubicle suitable for 1 no. 100 kVA transformer)	Nos.	3		
1.4b	100kVA transformer for housing in 1.4a - Normal Non encapsulated type	Nos.	3		
1.5	AC LDB Type LDB-F (8)				
1.5a	AC LDB Type LDB-F (8) without transformer (including cubicle suitable for 1 no. 50 kVA transformer)	Nos.	1		
1.5b	50kVA transformer for housing in 1.5a	Nos.	1		
2.0	**Lighting Panels (LP)- With Timer**				
2.1	AC Normal /Emergency indoor Type LP – A (6)	Nos.	39		
2.2	AC Normal (Decorative) Type LP – A (6)	Nos.	1		
2.3	AC Normal /Emergency indoor Type LP – A (12)	Nos.	106		
2.4	AC Normal /Emergency outdoor Type LP – A (12)	Nos.	47		
2.5	AC Normal (Decorative) Type LP – A (12)	Nos.	35		
2.6	AC Normal /Emergency indoor Type LP – A (18)	Nos.	24		
2.7	AC Normal /Emergency outdoor Type LP – A (18)	Nos.	54		

2.8	DC indoor Type LP – D (6)	Nos.	27		
2.9	DC outdoor Type LP – D (6)	Nos.	15		
2.10	Street Lighting Type LP – S (6)	Nos.	25		
3.0	**Lighting Luminaires (complete with accessories)**				
3.1	Luminaire Type FC02 (*)	Nos.	157		
3.2	Luminaire Type FC06 (*)	Nos.	2125		
3.3	Luminaire Type FC26 (*)	Nos.	654		
3.4	Luminaire Type FC81 (*)	Nos.	225		
3.5	Luminaire Type FC32 (*)	Nos.	91		
3.6	Luminaire Type TB22 (*)	Nos.	408		
3.7	Luminaire Type TX04 (*)	Nos.	186		
3.8	Luminaire Type TW41 (*)	Nos.	672		
3.9	Luminaire Type SF63 (*)	Nos.	182		
3.10	Luminaire Type SF64 (*)	Nos.	10		
3.11	Luminaire Type SF66 (*)	Nos.	118		
3.12	Luminaire Type SB11 (*)	Nos.	219		
3.13	Luminaire Type SB02 (*)	Nos.	746		
3.14	Luminaire Type SB03 (*)	Nos.	349		
3.14	Luminaire Type SS61 (*)	Nos.	10		
3.15	Luminaire Type SS62 (*)	Nos.	1207		
3.16	Luminaire Type SS63 (*)	Nos.	862		
3.17	Luminaire Type SW41 (*) [with integral CG box]	Nos.	14359		
3.18	Luminaire Type SW42 (*) [with integral CG box]	Nos.	2973		
3.20	Luminaire Type MW96 (*)	Nos.	585		
3.21	Luminaire Type MW98 (*)	Nos.	70		
3.22	Luminaire Type FC30 (*)	Nos.	200		
3.23	Luminaire Type CF01 (*)	Nos.	10		
3.24	Luminaire Type CF02 (*)	Nos.	10		
3.25	Dichroic spot light fixture [for halogen lamp]	Nos.	10		
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.	285		
4.2	Type SWB2	Nos.	150		
4.3	Type SWB3	Nos.	70		
4.4	Type SWB4	Nos.	10		
4.5	Type SWB5	Nos.	10		

5.0	**Junction boxes**				
5.1	Type JB-F	Nos.	21143		
5.2	Type JB-FE	Nos.	222		
5.3	Type JB-S	Nos.	1446		
6.0	**Receptacles**				
6.1	Type RA	Nos.	843		
6.2	Type RA (Flame proof)	Nos.	34		
6.3	Type RB	Nos.	671		
6.4	Type RC	Nos.	197		
6.5	Type RD	Nos.	9		
6.6	Type RC (Flame proof)	Nos.	10		
7.0	**Ceiling fans with electronic regulators**				
7.1	1200 mm sweep	Nos.	53		
7.2	Pedestal Fan	Nos.	10		
8.0	**Emergency lighting Units**	Nos.	69		
	With Ni-Cd battery and 2 X 10W fluorescent lamp				
9.0	**Poles [Swaged, Steel tubular poles Galvanized]**				
9.1	Type PS1 (410 SP51 as per IS-2713)	Nos.	650		
9.2	Type PS2 (410 SP67 as per IS-2713)	Nos.	650		
9.3	Type PF2 (410 SP51 as per IS-2713)	Nos.	61		
9.4	Type PS4 (410 SP51 as per IS-2713)	Nos.	85		
9.5	Type PF1 (410 SP51 as per IS-2713)	Nos.	20		
10.0	**Wires**				
10.1	1x1.5 mm^2 Cu PVC	mtrs.	367,000		
10.2	1x2.5 mm^2 Cu PVC	mtrs.	367,000		
10.3	1x 4 mm^2 Cu PVC	mtrs.	95,000		
11.0	**GI wire, flat & MS rod**				
11.1	14 SWG GI wire	mtrs.	531,000		
11.2	25X3 mm GI flat	mtrs.	500		
11.3	50X6mm GI flat	mtrs.	1,000		
11.4	20mm dia MS rod	nos.	1,470		

12.0	**Hot dip Galvanised Rigid Steel Conduits (Heavy Duty)**				
12.1	20 mm dia GI conduit, 1.6 mm thick	mtrs.	296,000		
12.2	25 mm dia GI conduit, 1.6 mm thick	mtrs.	21,000		
12.3	40 mm dia GI conduit, 2 mm thick	mtrs.	18,800		
12.4	50 mm dia GI conduit, 2 mm thick	mtrs.	1,000		
12.5	25 mm dia GI conduit with epoxy coating, 1.6 mm thick	mtrs.	3,000		
13.0	**Flexible lead coated conduit**				
13.2	20 mm dia flexible lead coated conduit, 1.6 mm thick	mtrs.	31,700		
14.0	**Hume pipe**				
14.1	Hume pipe 100 mm dia	mtrs.	2000		
15.0	**24V supply module & lamp unit complete with all accessories**				
15.1	Fixed type 24V supply modules	Nos.	50		
15.2	5A, 24V industrial type sockets	Nos.	220		
16	**Lighting Mast**	Nos.	4		
17	EXIT SIGN	Nos.	40		
18	**GREEN BUILDING ECBC COMPLIANCE**				
a	LED FIXTURE & LAMP (6X3W)	Nos.	3117		
b	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (dimmable)	Nos.	676		
c	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (non- dimmable)	Nos.	79		
d	FC-30 with dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.	29		
e	FC-30 without dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.	66		
f	Downlighter 2X 18 W CFL / Flouroscent with dimmable ballast	Nos.	71		
g	Fixture for 150W metal hallide lamp	Nos.	25		
h	Luminaire type FC-06 (with dimmable ballast)	Nos.	152		
i	Luminaire type FC-32 (with dimmable ballast)	Nos.	32		
j	Occupancy sensor	Nos.	50		
k	Lighting sensor system	Nos.	4		
l	Lighting dimmer system	Nos.	1		
m	Control system (Green Buildings)	set	4		

19.0	**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 (Arm)	mtrs.	13000		
	b) 3.5C X 25 mm^2 Al (Arm)	mtrs.	8000		
	c) 3C X 2.5 mm^2 Cu (Arm)	mtrs.	4000		
	D) 2C X 25 mm^2 Al (Unarm)	mtrs.	3000		
20.0	Armoured cables to be buried underground				
	a) 3.5C X 50 mm^2 Al (Arm)	mtrs.	4000		
	b) 3.5C X 25 mm^2 Al (Arm)	mtrs.	30000		
	C) 4C X 10 mm^2 Al (Unarm)	mtrs.	2000		

NOTES:

1. 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 CUSTOMER 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.
2. Fabrication & painting charges of structural steel shall be part of erection charges of those equipment for which the same is being used.
3. All measuring and testing instruments required during erection, testing, commissioning and performance testing shall be arranged by the bidder and taken back.
4. Cost of E&C for lighting fixture shall be inclusive of cost of lamp installation.
5. Lighting shall be Energy conservation building code (ECBC) compliant, bidder to include E & C of all items (like lighting fixture, lighting lamp, lighting panel, switch boxes, sensors, automatic control system) required for the same and furnish detailed BOQ along with the bid.
6. For any clarification please refer technical specification : PE-TS-405-558-E002 R01.
7.Design engineering charges are considered to be included in main equipment supply price. no separate charges shall be applicable.

PRICE SCHEDULE FOR LIGHTING SYSTEM

Item No.	DESCRIPTION TYPE TESTS (OPTIONAL)	QTY.	Unit	TOTAL TYPE TEST CHARGES (Rs.)
1.0	**Following tests as per relevant standards on each type & rating of lighting fixtures:** a) Visual examination b) Dimensional checking c) Insulation resistance (dry) test d) High voltage tests e) Test for mechanical strength f) Heating test g) Endurance test h) Photometric test i) Protection against electric shock j) Thermal shock proof test for glass (as applicable) k) Rain proof test followed by IR test l) Test for dust tightness m) Wind loading test n) Luminous output and light distribution test 0) Power factor measurement test	1	No.	
2.0	**Lamp:** Rating and life test for each type and rating of lamp (at rated voltage)	1	No.	
3.0	**Test on following items as per relevant standards:**			
3.1	Lighting panel of each type (including IP-55 DOP test)	1	No.	
3.2	MCB of each rating	1	No.	
3.3	Receptacles of each rating	1	No.	
3.4	Wires of each size	1	No.	
3.5	Conduits of each size	1	No.	
3.6	Poles of each size	1	No.	
3.7	IP-55 DOP test on JBs and receptacle boxes of each type	1	No.	

NOTE:
1. Bidder to indicate lump sum charges for conducting all type tests as per relevant standard on one piece.

ANNEXURE-D

UNIT PRICE SCHEDULE FOR STATION LIGHTING SYSTEM

Item No.	DESCRIPTION	QTY.	Unit
	UNIT PRICE EQUIPMENT		
1.0	**Lighting Luminaires (complete with accessories)** Purchasers type reference (* Bidders type reference)		
1.1	Luminaire Type FC01 (*) for 20W Fluorescent lamp & electronic ballast	1	
1.2	Luminaire Type FC26 (*) for 36W Fluorescent lamp & Cu ballast	1	No.
1.3	Luminaire Type SP21 (*)	1	No.
1.4	Luminaire Type MP22 (*)	1	No.
1.5	Luminaire Type HF61 (*)	1	No.
1.6	Luminaire Type HF62 (*)	1	No.
1.7	2x36W CFL light fixture	1	No.
1.7	4x36W CFL light fixture	1	No.
1.8	1x70W Metal halide light fixture	1	No.
1.9	1x250W Metal halide light fixture	1	No.
1.10	1x400W Metal halide light fixture	1	No.
2.0	**Fixture**		
2.1	20W fluorescent tube lamp	1	No.
3.0	**Ballast**		
3.1	Cu ballast	1	No.
3.2	Electronic ballast	1	No.

4.0	**Lighting Mast with mounting arrangement for lighting fixtures & required accessories**		
4.1	Flood light tower of Lattice structure type with 30 meter height, maintenance platform and approach ladder.	1	No.
4.2	Flood light tower of Lattice structure type with 20 meter height, maintenance platform and approach ladder.	1	No.
5.0	**Junction Box**		
5.1	Type JB-M	1	No.
5.2	Type JB-M1	1	No.
6.0	**GI wires / Flat**		
6.1	8 SWG GI wire	1	Km
6.2	12 SWG GI wire	1	Km
6.3	35x6 GI flat	1	Mtr
7	**Switchboxes**		
7.1	Switch boxes type SWB4	1	No.
7.2	Switch boxes type SWB5	1	No.
8	**Receptacles**		
8.1	Receptacle Type RC (Flame proof)	1	No.
8.2	Receptacle Type RD	1	No.
8.3	Receptacle type RF (5A, 24V Industrial Type socket)	1	No.
9.0	TESTING EQUIPMENT		
9.1	BUZZER	2	Nos.
9.2	500V MEGGER	2	Nos.
9.3	EARTH MEGGER	2	Nos.
10.0	VIBRATION DAMPER FOR HIGH BAY FIXTURE	1	No.
11.0	POLE TYPE PF-4	1	No.
12.0	TIMER	1	No
13.0	PHOTOCELL	1	No
**	**Detailed price Schedule attached saperately.**		

ANNEXURE-E

PRICE SCHEDULE (MANDATORY SPARES)

1	**LAMPS**	UNIT	QTY	UNIT PRICE	TOTAL PRICE
(a)	100 W incandescent	Nos.	2% OR 2 NO WHICHEVER IS MORE		
(b)	28 W fluorescent 'T5' type	Nos.			
(c)	70 W HPSV elliptical	Nos.			
(d)	150 W HPSV tubular	Nos.			
(e)	150 W HPSV elliptical	Nos.			
(f)	250 W HPSV tubular	Nos.			
(g)	250 W HPSV elliptical	Nos.			
(h)	400 W HPSV elliptical	Nos.			
(i)	125 W HPMV	Nos.			
(j)	12V, 50W Dichroic lamp	Nos.			
(k)	100 W comptalux lamp	Nos.			
(l)	LED FIXTURE & LAMP (6X3W)	Nos.			
(m)	14W LAMP	Nos.			
(n)	18W CFL	Nos.			
(o)	36W CFL	Nos.			
(p)	Fixture for 150W metal hallide lamp	Nos.			
2	**FRONT GLASS**				
(a)	Luminaires Type FC02 (*) with 28W T5 tube	Nos.	2% OR 2 NO WHICHEVER IS MORE		
(b)	Luminaire Type FC06 (*)	Nos.			
(d)	Luminaire Type FC26 (*)	Nos.			
(e)	Luminaire Type FC81 (*)	Nos.			
(f)	Luminaire Type FC32 (*)	Nos.			
(g)	Luminaire Type TB22 (*)	Nos.			
(h)	Luminaire Type TX04 (*)	Nos.			
(i)	Luminaire Type TW41 (*)	Nos.			
(j)	Luminaire Type SF63 (*)	Nos.			
(k)	Luminaire Type SF64 (*)	Nos.			
(l)	Luminaire Type SF66 (*)	Nos.			
(m)	Luminaire Type SB11 (*)	Nos.			
(n)	Luminaire Type SB02 (*)	Nos.			
(o)	Luminaire Type SB03 (*)	Nos.			
(p)	Luminaire Type SS61 (*)	Nos.			
(q)	Luminaire Type SS62 (*)	Nos.			
(r)	Luminaire Type SS63 (*)	Nos.			
(s)	Luminaire Type SW41 (*) [with integral CG box]	Nos.			
(t)	Luminaire Type SW42 (*) [with integral CG box]	Nos.			
(u)	Luminaire Type MW96 (*)	Nos.			
(v)	Luminaire Type MW98 (*)	Nos.			
(w)	Luminaire Type FC30 (*)	Nos.			
(y)	Luminaire Type CF01 (*)	Nos.			
(z)	Luminaire Type CF02 (*)	Nos.			
(a1)	Dichroic spot light fixture [for halogen lamp]	Nos.			
(a2)	LED FIXTURE & LAMP (6X3W)	Nos.			
(a3)	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (dimmable)	Nos.			
(a4)	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (non- dimmable)	Nos.			
(a5)	FC-30 with dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.			
(a6)	FC-30 without dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.			
(a7)	Downlighter 2X 18 W CFL / Flouroscent with dimmable ballast	Nos.			
(a8)	Fixture for 150W metal hallide lamp	Nos.			
(a9)	Luminaire type FC-06 (with dimmable ballast)	Nos.			

(a10)	Luminaire type FC-32 (with dimmable ballast)	Nos.			
3	**LAMP HOLDERS**				
(a)	Luminaires Type FC02 (*) with 28W T5 tube	Nos.	2% OR 2 NO WHICHEVER IS MORE		
(b)	Luminaire Type FC06 (*)	Nos.			
(d)	Luminaire Type FC26 (*)	Nos.			
(e)	Luminaire Type FC81 (*)	Nos.			
(f)	Luminaire Type FC32 (*)	Nos.			
(g)	Luminaire Type TB22 (*)	Nos.			
(h)	Luminaire Type TX04 (*)	Nos.			
(i)	Luminaire Type TW41 (*)	Nos.			
(j)	Luminaire Type SF63 (*)	Nos.			
(k)	Luminaire Type SF64 (*)	Nos.			
(l)	Luminaire Type SF66 (*)	Nos.			
(m)	Luminaire Type SB11 (*)	Nos.			
(n)	Luminaire Type SB02 (*)	Nos.			
(o)	Luminaire Type SB03 (*)	Nos.			
(p)	Luminaire Type SS61 (*)	Nos.			
(q)	Luminaire Type SS62 (*)	Nos.			
(r)	Luminaire Type SS63 (*)	Nos.			
(s)	Luminaire Type SW41 (*) [with integral CG box]	Nos.			
(t)	Luminaire Type SW42 (*) [with integral CG box]	Nos.			
(u)	Luminaire Type MW96 (*)	Nos.			
(v)	Luminaire Type MW98 (*)	Nos.			
(w)	Luminaire Type FC30 (*)	Nos.			
(y)	Luminaire Type CF01 (*)	Nos.			
(z)	Luminaire Type CF02 (*)	Nos.			
(a1)	Dichroic spot light fixture [for halogen lamp]	Nos.			
(a2)	LED FIXTURE & LAMP (6X3W)	Nos.			
(a3)	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (dimmable)	Nos.			
(a4)	Fixture for 4 no 14 W lamps - With parabolic specular louvere with > 99% high purity aluminium reflector with high LOR - (non- dimmable)	Nos.			
(a5)	FC-30 with dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.			
(a6)	FC-30 without dimmable ballast - with parabolic specular louvere with > 99% high purity aluminium reflector with high LOR	Nos.			
(a7)	Downlighter 2X 18 W CFL / Flouroscent with dimmable ballast	Nos.			
(a8)	Fixture for 150W metal hallide lamp	Nos.			
(a9)	Luminaire type FC-06 (with dimmable ballast)	Nos.			
(a10)	Luminaire type FC-32 (with dimmable ballast)	Nos.			

**	**Detailed price Schedule attached saperately.**
NOTE:	The requirement for mandatory spares as per above Annexure shall be fully complied with .Any additional items/quatity required to comply with the change in supply items shall be incliuded & supplied with out any cost implication to BHEL.

ANNEXURE-F

	PRICE SCHEDULE (RECOMMENDED SPARES FOR 3 YEARS OF OPERATION) - OPTIONAL			
	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (EX- WORKS)
(a)	RECOMMENDED SPARES	I SET		

NOTE : Bidder to furnish the detailed list of recommended spares.

ANNEXURE-G

PRICE SCHEDULE (START UP & COMMISSIONING SPARES)

	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (EX-WORKS)
(a)	START UP & COMMISSIONING SPARES	I SET		

NOTE : Bidder to furnish the detailed list of start up and commisioning spares

ANNEXURE-1
AVERAGE LUX LEVEL

Sl No.	Location	Average Illumination Level(Lux)	Type of Fixture
(a)	Turbine Hall operating floor	200	HPSV high/medium bay
(b)	Turbine Hall Other Platforms	200	HPSV high/medium bay, HPSV well glass fixtures
(c)	Switchgear rooms, Charger, Rectifier room	200	Industrial trough type fluorescent
(d)	Control room, computer room, control equipment room	350	Mirror optics with anti-glare features type LED fixtures/ downlighter & halogen downlighter
(e)	Offices, conference rooms, etc.	300	Decorative mirror optics Type fluorescent or CFL downlighter
(f)	Battery rooms	100	Totally enclosed corrosion Proof fluorescent
(g)	Transformer yard	20 (general) 50 (on equipment)	HPSV flood light,
(h)	Boiler platforms	100	HPSV well glass fixtures,
(i)	Diesel generating room, Compressor room, pump house etc.	150	HPSV medium bay/ Industrial trough type fluorescent
(j)	Fuel oil pump house	150	Flame proof fluorescent fixtures suitable for division-2 hazardous area
(k)	Cable galleries/vault	50	Industrial trough type fluorescent
(l)	Street lighting- primary roads secondary roads	20 10	HPSV street lights
(m)	Outdoor storage handling and unloading area	20	HPSV flood light,
(n)	DM plant, water treatment plant	150	Industrial trough type/ corrosion proof fluorescent, HPSV high/medium bay/ Floodlight
(o)	Cement stores	150	Industrial trough type

			fluorescent dust proof
(p)	Chemical stores/House	150	Corrosion proof fluorescent
(q)	Permanent stores	150	HPSV high/medium bay / industrial trough type fluorescent
(r)	Workshop. Building	150	Industrial trough type Fluorescent, Industrial high bay
(s)	Laboratory General Analysis area	 150 300	 Mirror optics fluorescent Corrosion resistant, fluorescent
(t)	Garage/Car Parking	50	Industrial trough type fluorescent
(u)	AIS Switchyard and Substation	20(general 50(on strategic equipment)	HPSV flood light
(v)	CW pump house, Chlorination plant building, Raw water and fire water pump house	150	Industrial trough type fluorescent/ Well glass HPSV fitting or HPSV high/ medium bay fitting/ HPSV flood light
(w)	Transfer points, crusher house, Sheds, tunnels, bunker house etc.	100	HPSV Dust tight/Well glass type
(x)	Cooling Tower	10 (general) 50 (on equipment)	Well Glass Fixtures
(y)	Facility building, canteen etc	150	Industrial trough type fluorescent
(z)	Hydrogen Plant Building	150	Explosion proof HPMV/ Flourcent fittings suitable for class-I and Division –IIC
(aa)	DC Lighting- Control room	-	In candescent down light fixtures, Decorative recessed type with cylindrical reflector
(ab)	DC Lighting- Other Area	-	Incandescent Industrial Bulkhead
(ac)	Corridors, Walkways	50	Fluorescent type
(ad)	Buiding Periphery Lighting	-	Street Light fixture, HPSV Floodlight fixtures

(ae)	Security Lighting along Boundary	10	Street Light fixture, HPSV Floodlight fixtures
(af)	ESP platform	150	HPSV well glass fixtures
(ag)	Gate complex/Time Office	150	HPSV Flood Light/ Fluorescent fixtures

ANNEXURE-2

AREAWISE LIGHTING DISTRIBUTION

Sl. No.	Plant Areas	Normal AC Lighting System	Emergency AC Lighting System	220 V DC Lighting System	Portable DC Fixtures
1	TG Building(turbine hall, switchgear room etc)	80%	20%	√	—
2.	Boiler Platform	80%	20%	√	
3	DG Area/ Room	80%	20%		
4	Compressor Room				√
5	ESP Control Room	80%	20%		√
6	Unit Control Room	70%	30%	√	
7	Switchyard Control Room	80%	20%	√	
8	Battery Room	80%	20%		
9	Cable Spreader Room/ Vault	80%	20%	√	
10	Make Up Water Pump House	100%			√
11	Chemical House	100%			√
12	Fuel Oil Pump House	100%			√
13	Ash Handling Plant	100%			√
14	Water Treatment Plant	100%			√
15	CT Switchgear Room	100%			√
16	Cooling Towers	100%			
17	Workshop	100%			√
18	Service Building	100%			
19	Area Lighting	100%			
20	Street Lighting	100%			
21	Transformer Yard and Storage Yard	100%			
22	Coal Handling Plant	100%		√	
23	AIS Switchyard	80%	20%		

DC Emergency Lighting:

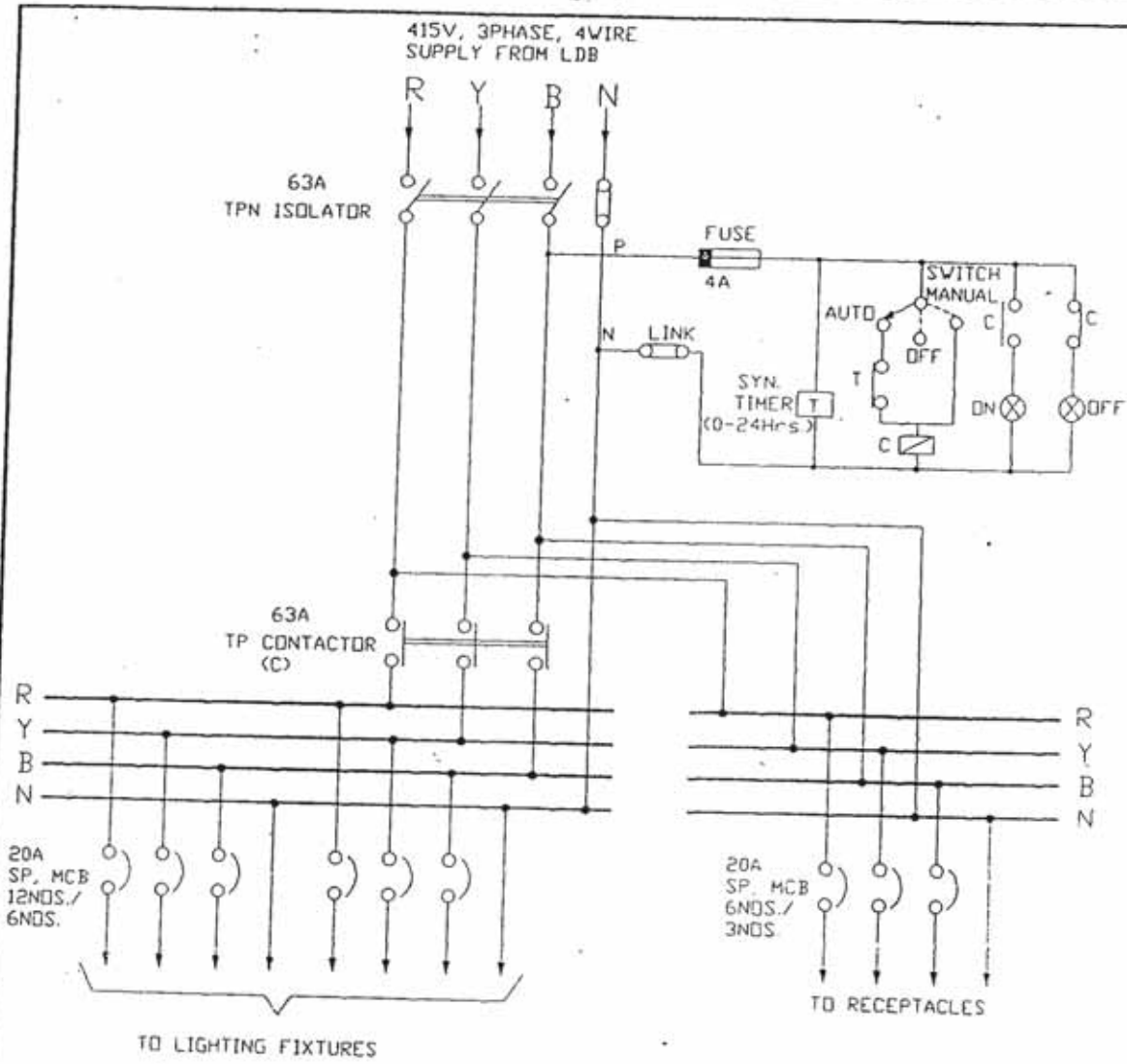
	Area	Average Lux Level
1	Unit Control Room	100
2	Control Equipment Room	100
3	Switchyard Control Room	20
4	Strategic Control Points (In TG Building & Boiler Area, Switchgear room, SWAS, Battery Room, UPS Area, TG Hall, Luboil Room etc	20
5	Cable Vault & Galleries	1 fixture at every 20 metres spacing along walkways
6	Boiler Stair Case	1 fixture at every 20 metres spacing along walkways
7	Exit/ Entry of Main Plant Building	1 fixture
8	Fire Exit Sign	1 fixture
9	Coal Handling Plant	Control room - 50 Swgr room - 50 Strategic control points - 20 Others areas(cl3.03.04)- 20

ANNEXURE-3

STATION LIGHTING SQE_17

Item Components / Sub System Assembly — Attributes / Characteristics	Make, Type , Rating/ TC	Dimension	Pre-Treatment of sheat	Paint Shade Thickness Adhesion & Finish	Galvanization Tests	IP Test	Bought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Constructional Feature as per NTPC spec.	Routine Test as per relevant std and spec	Acceptance Test as per relevant std and spec	Item to conform to relevant standard
Luminaries (IS-10322 Part-5 Sec.1) including LED fixture	Y					Y		Y			Y	Y	Y
Electronic Ballast	Y										Y	Y	Y
Lighting Wire (IS-694)	Y										Y		
Fans (IS-374)	Y										Y		
Pole (IS-2713)	Y			Y						Y	Y	Y	
Lamps (IS-9800, IS-9974)	Y										Y	Y	
Lighting Mast (with raise & lower lantern type)	Y	Y			Y					Y	Y	Y	
Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Switch Box/ Junction Box/Receptacles/ Local Push Button Station / Lighting Panel (IS-513, 2629, 2633, 4759, 6745)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Cable Gland (BS-6121)	Y	Y									Y		
Cable Lug (IS-8309)	Y	Y									Y		
Flexible Conduit	Y										Y		
Lighting Transformer (IS-1117)	Y									Y	Y		
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y									Y		Y

Notes:
1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. LED driver make, model, type & rating may be as per recommendations of LED module manufacturer.
2. Make of all major Bought Out Items will be subject to NTPC approval.



S.NO.	LP TYPE	INCOMER ISOLATOR	OUTGOING 20A MCB'S
1.	LP-1	63A TPN + 63A CONT + SYNC. TIMER + INDICATING LAMPS	12 NOS. SP+ 6 NOS. SP
2.	LP-2	63A TPN + 63A CONT + SYNC. TIMER + INDICATING LAMPS	6 NOS. SP+ 3 NOS. SP

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

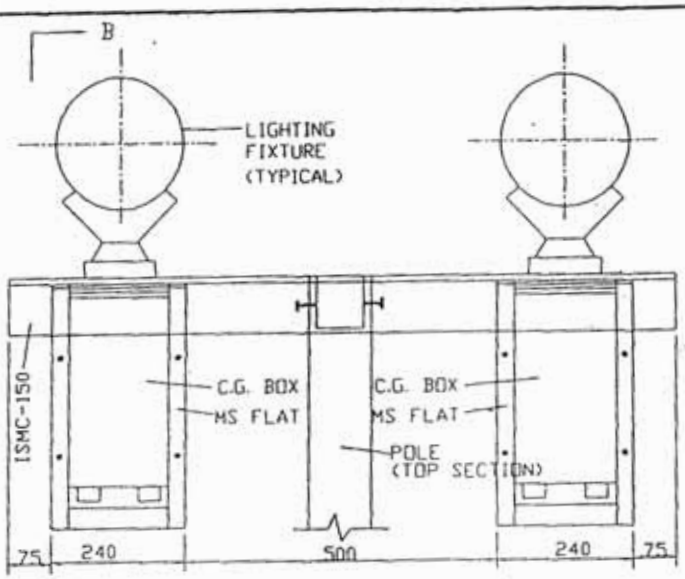
NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: STANDARD

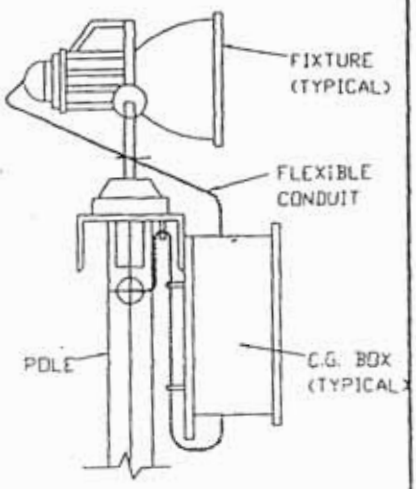
TITLE: SCHEMATIC DIAGRAM FOR LIGHTING PANELS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-PDE-A-001 SH. 1 OF 20	RB

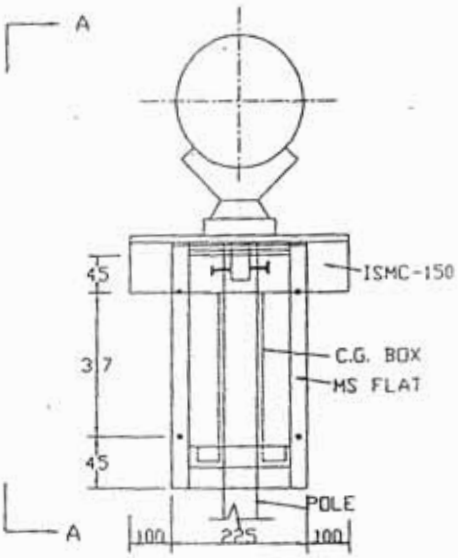
L19.DWG



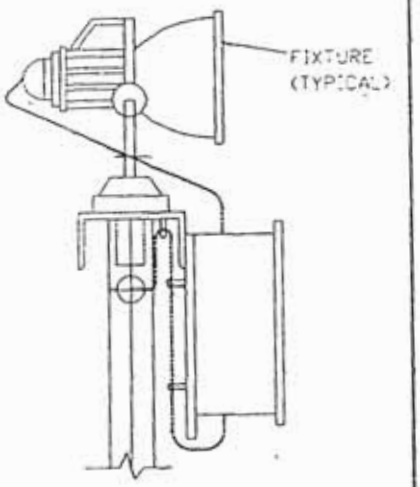
FOR POLE TYPE-C2



VIEW-BB



FOR POLE TYPE- C1 & E2



VIEW-AA

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE	RSC			-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

CLEARED BY

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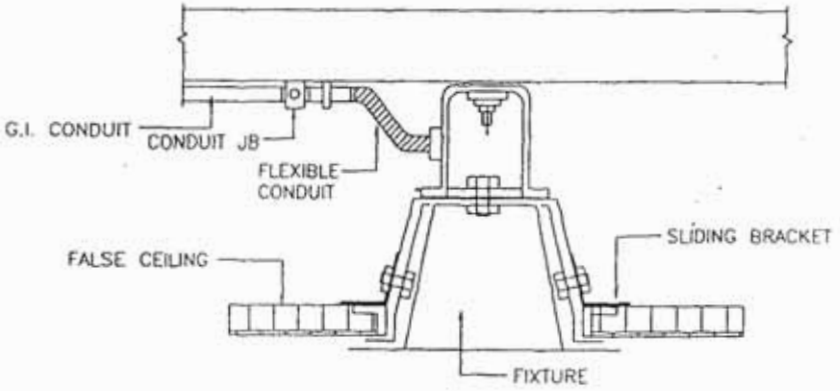
ENGINEERING DIVISION

PROJECT	STANDARD
TITLE	MOUNTING DETAIL OF FLOOD LIGHT FIXTURE & CONTROL GEAR BOX ON POLES.

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 8 OF 20	RB

L8.DWG

46



TYPICAL FIXING DETAIL OF RECESSED LIGHTING FIXTURE IN FALSE CEILING AREA (TYPE-B)

NOTE:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

CLEARED BY

एन टी पी सी NTPC

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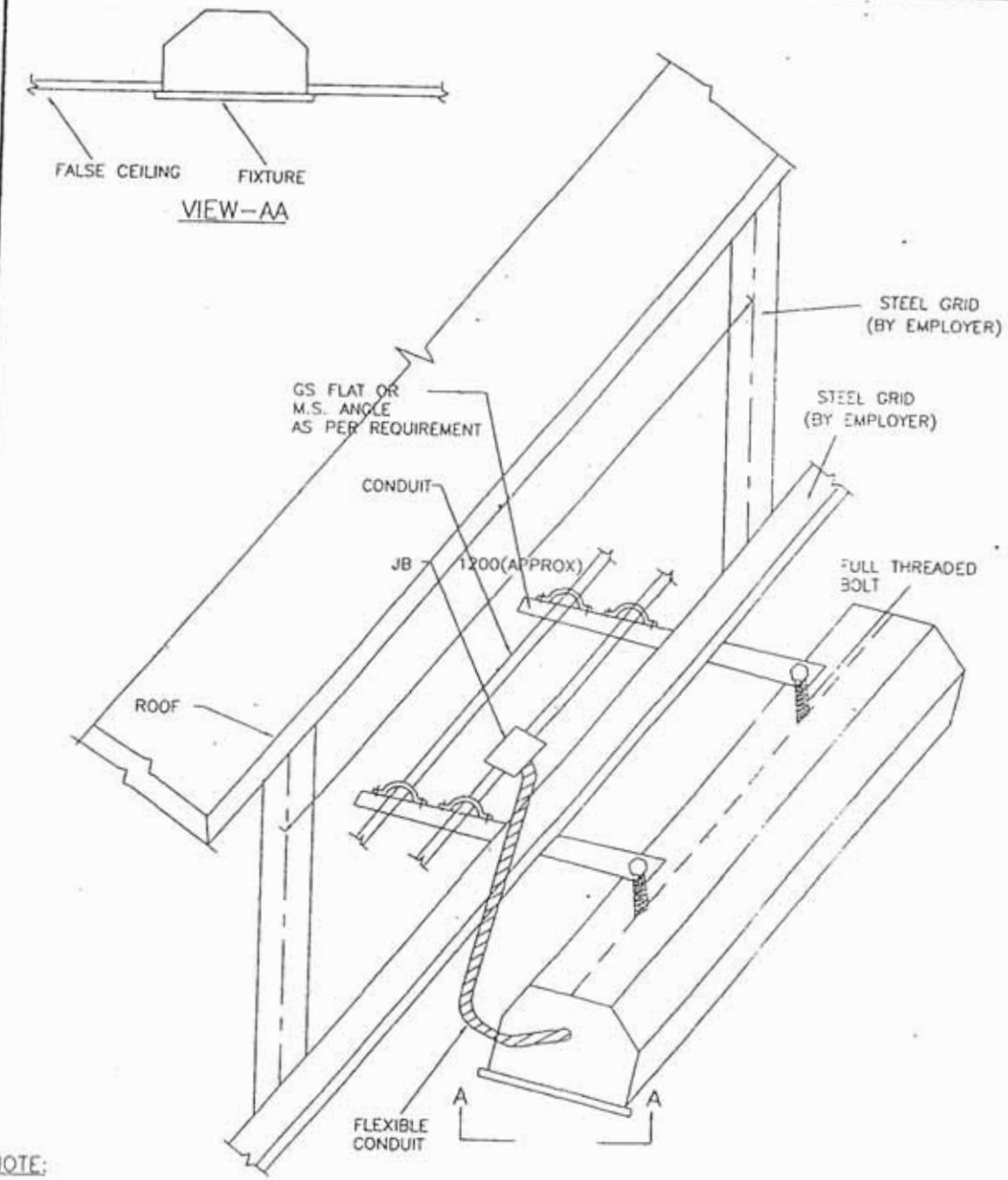
ENGINEERING DIVISION

PROJECT	STANDARD		
TITLE: TYPICAL MOUNTING DETAIL OF FIXTURES IN FALSE CEILING AREA			
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 10 OF 20	REV. NO. RB

L10.DWG

47



NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. MINIMUM CLEAR DISTANCE BETWEEN FALSE CEILING AND STRUCTURE SHALL BE 300MM (APPROX.)

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
RB	FOR TENDER PURPOSE	PRC	RWC		-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

NTPC Limited
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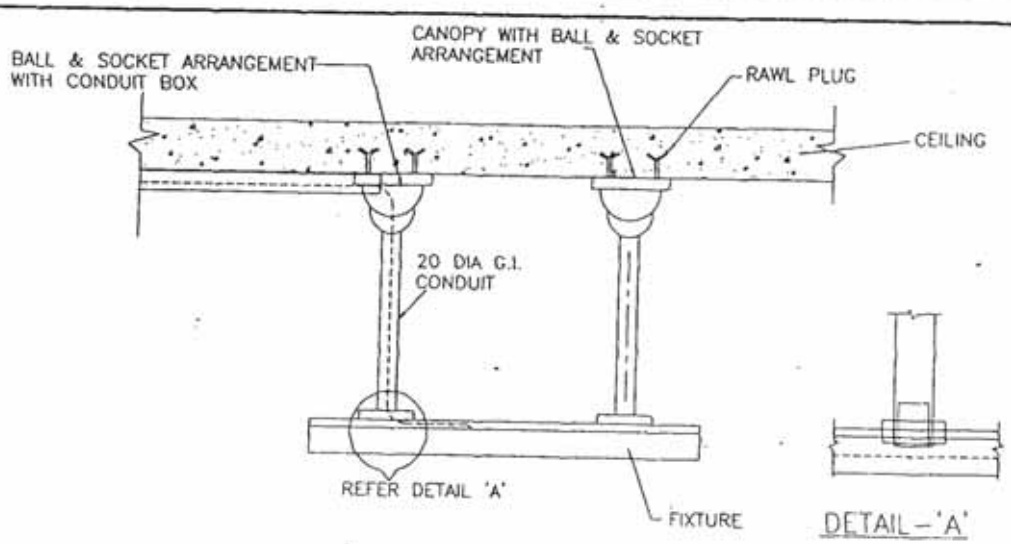
ENGINEERING DIVISION

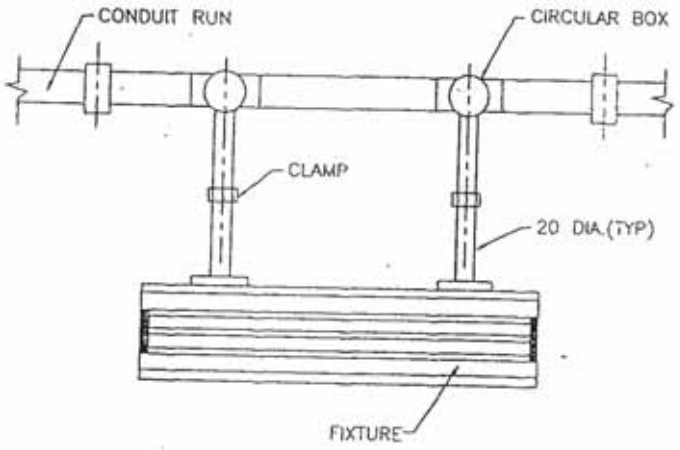
PROJECT	STANDARD		
TITLE	TYPICAL MOUNTING DETAIL OF FIXTURES IN FALSE CEILING AREA		
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 11 OF 20	REV. NO. RB

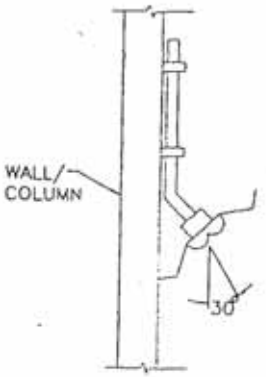
L21.DWG



DETAIL – 'A'

TYPE – C





TYPE – D

END VIEW

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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ENGINEERING DIVISION

PROJECT: STANDARD

TITLE: TYPICAL MOUNTING DETAIL OF FLUORESCENT FIXTURE

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 12 OF 20	RB

L11.DWG

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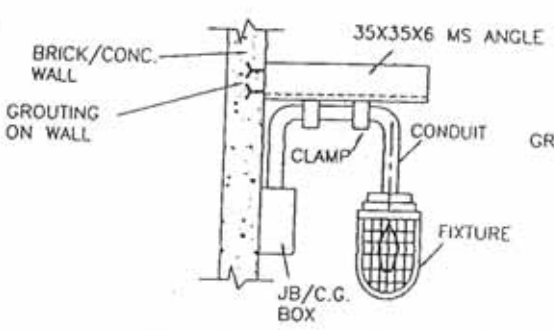
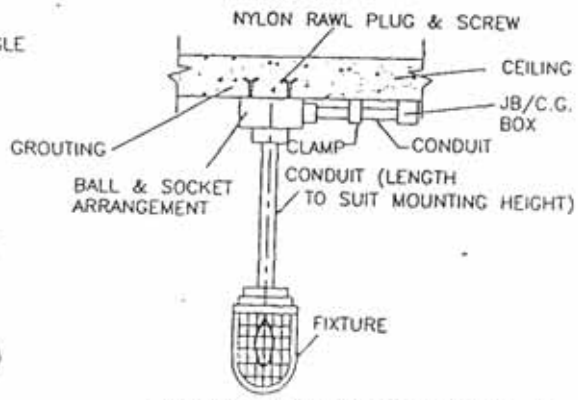
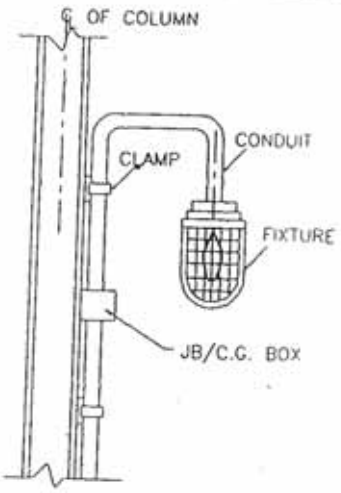


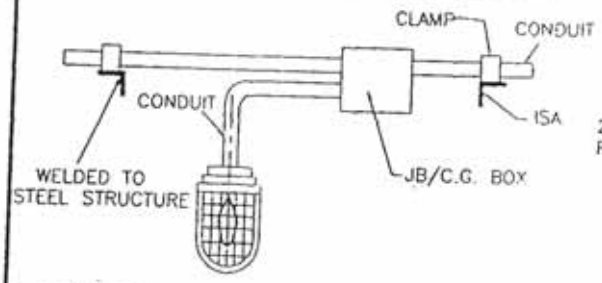
WALL MOUNTING (TYPE-E)



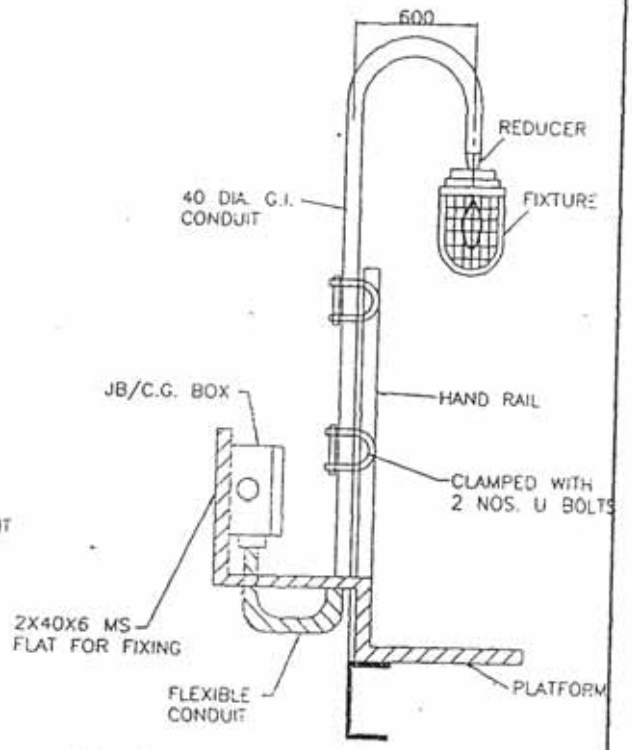
CEILING MOUNTING (TYPE-F)



COLUMN MOUNTING (TYPE-G)



STRUCTURE MOUNTING (TYPE-H)



HAND RAIL MOUNTING (TYPE-I)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-			-			
RA	FOR TENDER PURPOSE	NS			-			-			

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PROJECT	STANDARD		
TITLE	TYPICAL MOUNTING DETAIL OF WELL GLASS FIXTURE		
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 13 OF 20	REV. NO. RB

L12.DWG

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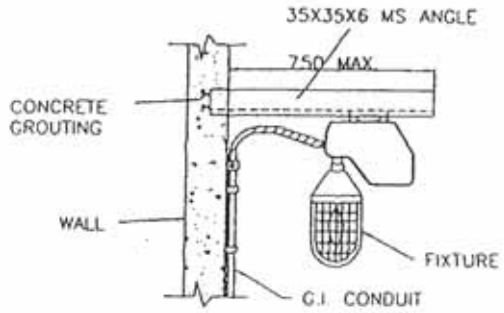
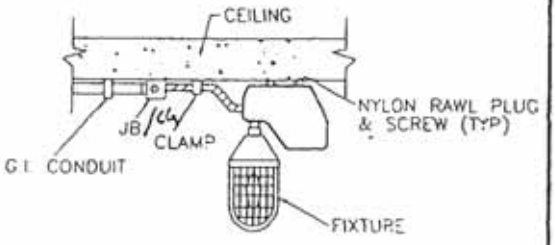
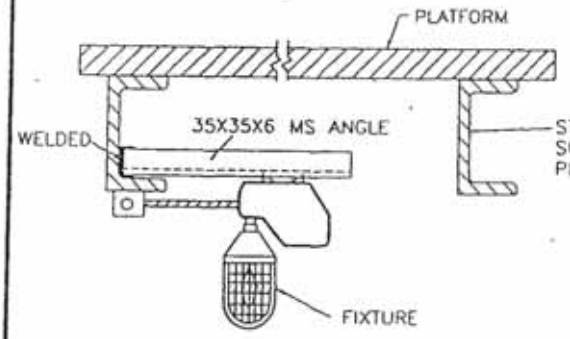


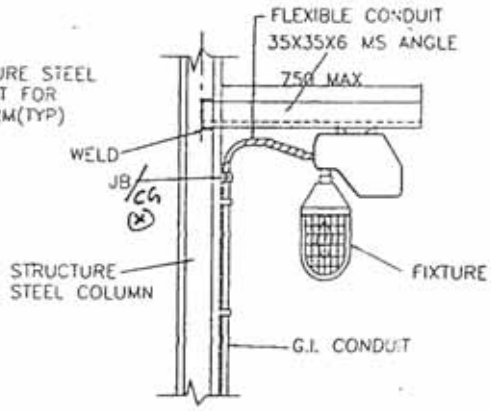
WALL MOUNTING (TYPE-J)



CEILING MOUNTING (TYPE-K)



STRUCTURE MOUNTING (TYPE-L)



COLUMN MOUNTING (TYPE-M)

NOTES:

ALL DIMENSIONS ARE IN MM.

@ In case of non-integral CG box

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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ENGINEERING DIVISION

PROJECT: STANDARD

TITLE: TYPICAL MOUNTING DETAIL OF INTEGRAL TYPE WELL GLASS FIXTURE

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 14 OF 20	RB

L13.DWG

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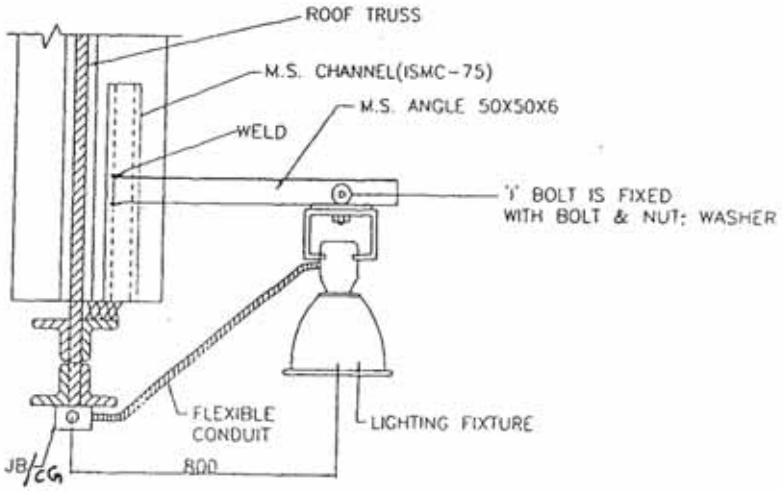
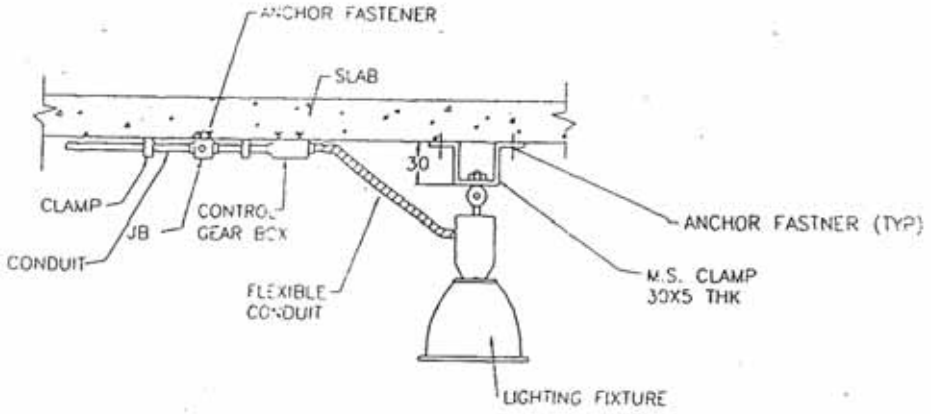


STRUCTURE MOUNTING (TYPE-N)



CEILING MOUNTING (TYPE-O)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE				-		-	-	-		

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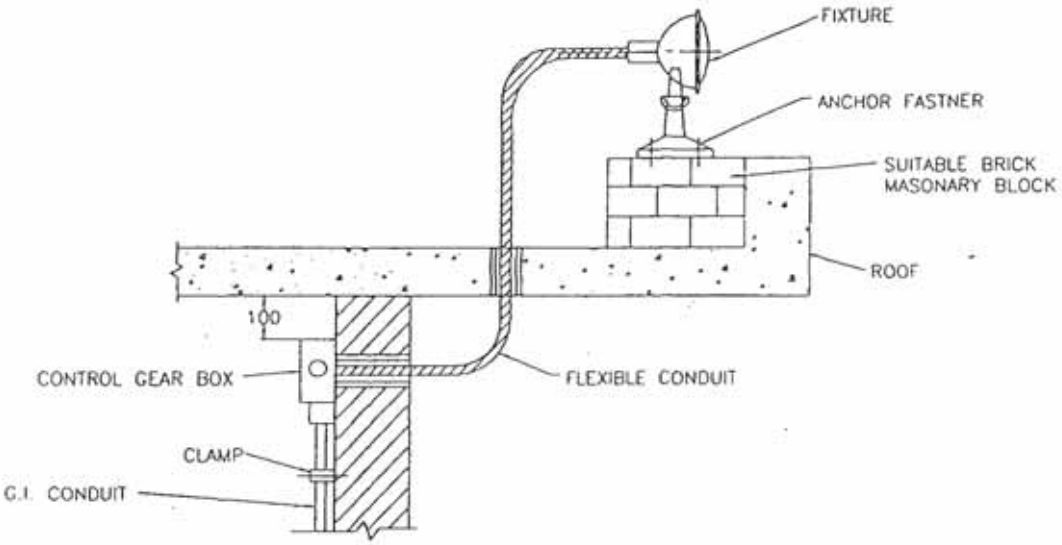
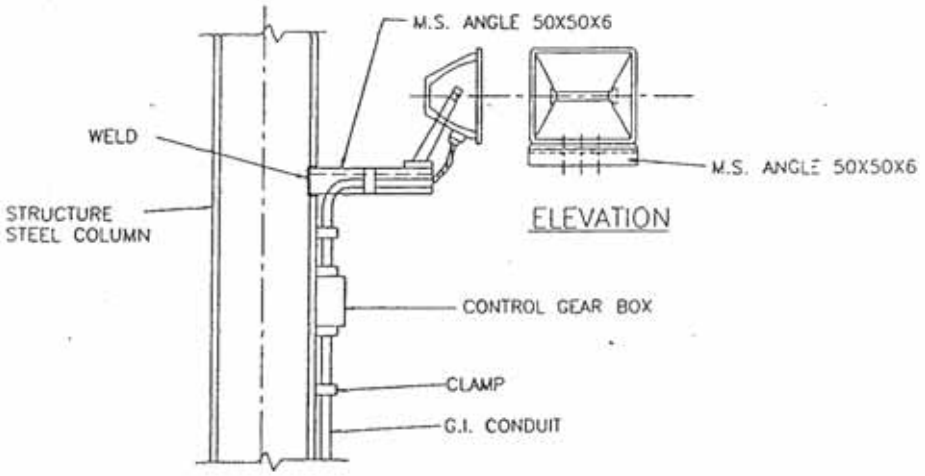
PROJECT	STANDARD
TITLE	TYPICAL MOUNTING DETAIL OF HIGHBAY FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 15 OF 20	RB

L14.DWG



ROOF MOUNTING (TYPE-P)



COLUMN MOUNTING (TYPE-Q)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-	-	-	-	-		
RA	FOR TENDER PURPOSE	NS			-	-	-	-	-		

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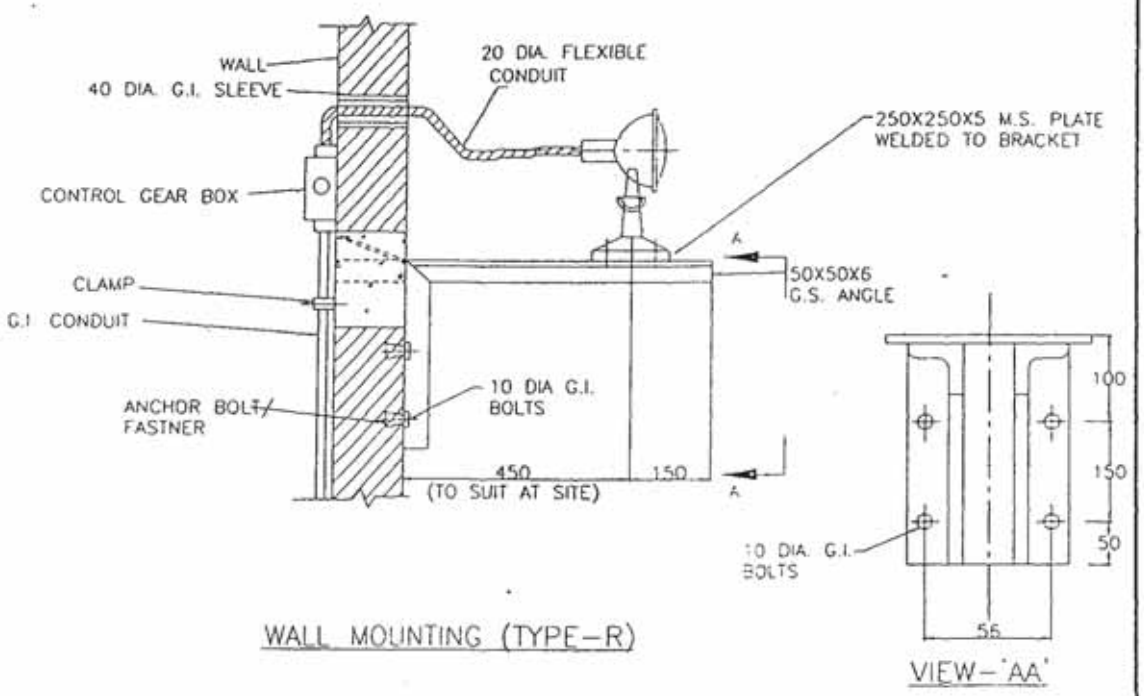
ENGINEERING DIVISION

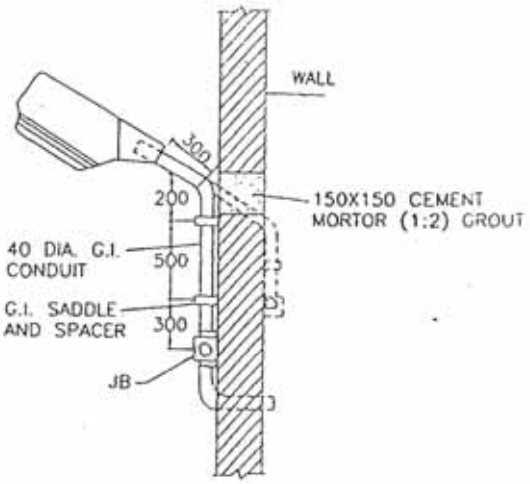
PROJECT	STANDARD		
TITLE	TYPICAL MOUNTING DETAIL OF AREA LIGHTING FIXTURES		
SIZE A4	SCALE NTS	DRG. NO. 0000-217-POE-A-001 SH. 16 OF 20	REV. NO. RB

L15.DWG



WALL MOUNTING (TYPE–R)

VIEW–'AA'



WALL MOUNTING (TYPE–S)

NOTES:

ALL DIMENSIONS ARE IN MM.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				–		–	–	–		
RA	FOR TENDER PURPOSE				–		–	–	–		

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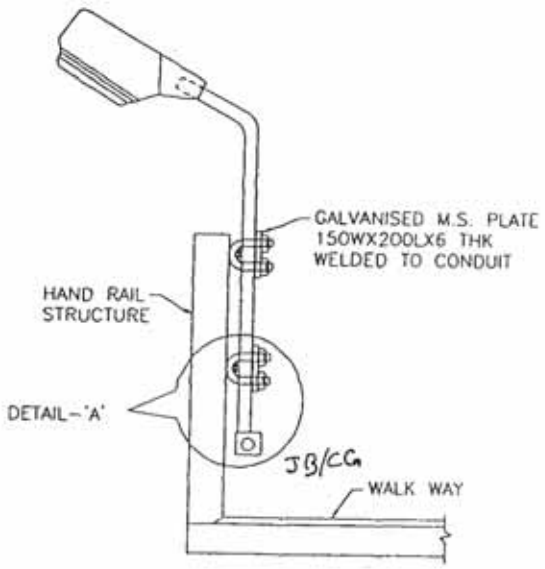
ENGINEERING DIVISION

PROJECT: STANDARD

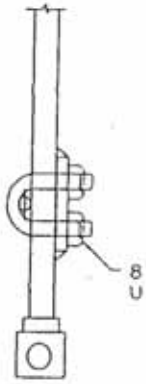
TITLE: TYPICAL MOUNTING DETAIL OF AREA LIGHTING FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000–217–POE–A–001 SH. 17 OF 20	RB

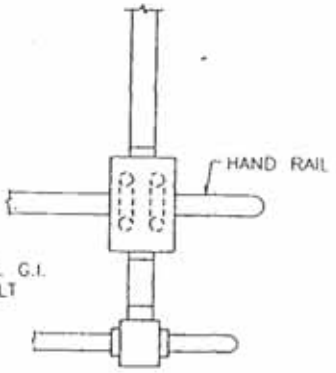
L16.DWG



TYPE-T

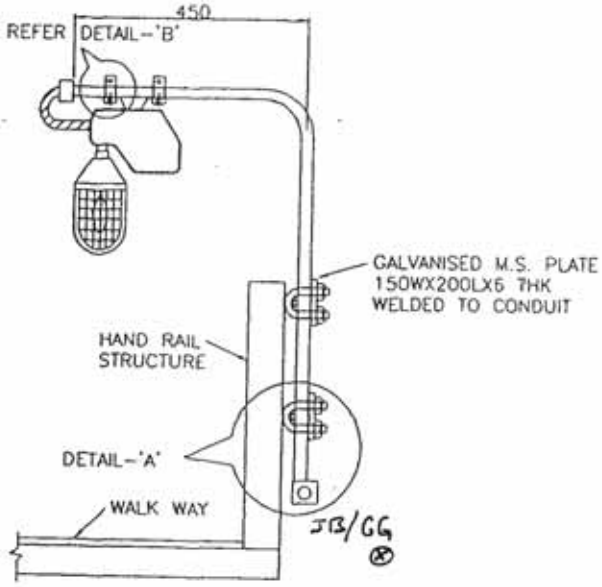


ELEVATION

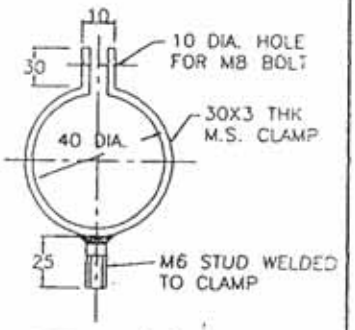


SIDE VIEW

DETAIL-'A'



TYPE-U



DETAIL-'B'

NOTES:

ALL DIMENSIONS ARE IN MM.

Ⓐ In case of non-integral control gear

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE										
RA	FOR TENDER PURPOSE										

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PROJECT: STANDARD

TITLE: TYPICAL HANDRAIL MOUNTING DETAIL OF FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 18 OF 20	RB

L17.DWG

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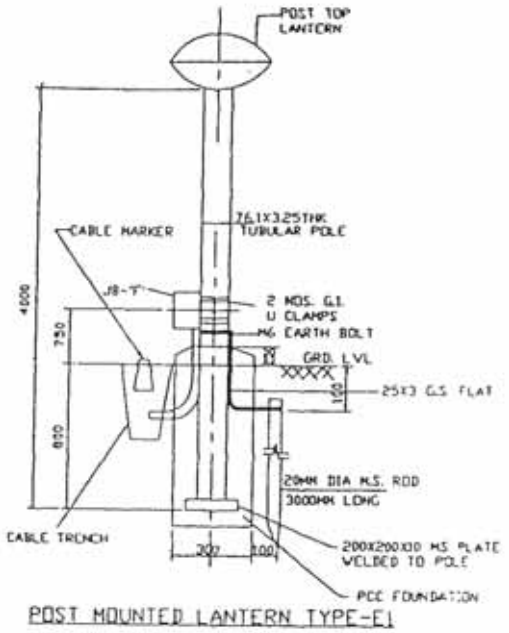
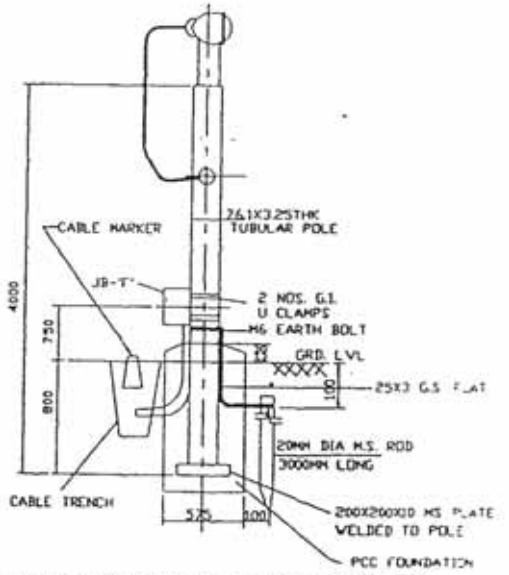


POST MOUNTED LANTERN TYPE-E1



POST MOUNTED FLOOD LIGHT TYPE-E2

NOTES:
1. ALL DIMENSIONS ARE IN MM.
2. FOUNDATION DIMENSIONS SHOWN ARE TENTATIVE ONLY.

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
RB	FOR TENDER PURPOSE				-		-	-	-		
RA	FOR TENDER PURPOSE	NS			-		-	-	-		

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PROJECT: STANDARD

TITLE: GENERAL ARRANGEMENT OF POST MOUNTED FIXTURES

SIZE	SCALE	DRG. NO.	REV. NO.
A4	NTS	0000-217-POE-A-001 SH. 19 OF 20	RB

LS.DWG

DOCUMENT DISTRIBUTION SCHEDULE

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk .
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
1	Floor mounted fixed type indoor LT Switchgear Panel (ACDB/DCDB/Lighting DB/MLDB/Solenoid valve distribution boards)	I				Switching Circuits	Kolkata	A			
						Tricolite	Sahibabad / Manesar	A			
						Hindustan Control & equipment Ltd	kolkata	A			
						Maktel	Vadodara	A			
						Jakson	Greater Noida	A			
						Vidyut Control	Gaziabad	A			
						Adlec Power	Rohad (Jhajjar)	A			
						Pyrotech	Udaipur	A			
						Anand Power Ltd.	Noida	A			
						Control & Schematics	Hyderabad	A			
						Positronics	Vadodara	A			
						L&T	Mumbai / Coimbatore/Ahmednagar	A			
						GE	Bangalore	A			
						C&S Electric	Noida / Hardwar	A			
						Schneider	Nasik	A			
						Unilec	Gurgaon	A			
						Avaids Technovators	Manesar	DR			

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
						Mika Engineers	Mumbai	DR			
						Advance Engg	Mumbai	DR			
						Sterling Generators	Noida	DR			
						Elexpro Electric	Navsari	DR			
						Popular Swgr	Mumbai	DR			
						Adroit Control Engg	Faridabad	DR			
						Cands	Mumbai	DR			
						Milestone Swgr	Gurgaon	DR			
2	LT Contactor	III				C&S Electric	Noida	A			
						GE	Bangalore	A			
						L&T	Mumbai	A			
						Siemens	Mumbai / Aurangabad	A			
						Any make's model with VDE or CE or UL or CSA marking or *BIS approved with CML no*. -					Refer Note 1
3	Switch Fuse Unit/MCCB	III				Siemens	Mumbai / Aurangabad	A			
						L&T	Mumbai	A			
						C&S Electric	Noida	A			
						GE	Bangalore	A			
						Any make's model with VDE or CE					Refer Note-1

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
						or UL or CSA marking or *BIS approved with CML no*.					
4	Auxiliary Relays	III				Any make's model with VDE or CE or UL or CSA marking or *BIS approved with CML no*.					Refer Note-1
5	Lighting Transformer	III				Automatic Electric Ltd.,	Lonavla	A			
						Indcoil,	Kurla West Mumbai	A			
						Power Pack Enterprises	Mumbai	A			
						Vijay Electricals Ltd	Hyderabad	A			
						Gilbert & Maxwell,	Nasik	A			
						Kappa Electricals,	Chennai	A			
						Ames Impex Electricals Pvt. Ltd	Ahmedabad	A			
6	LT CT/PT/CBCT/ Control Transformer	III				Kappa	Bangalore	A			
						Southern Electric	Chennai	A			

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
						Precise	Mumbai	A			
						G&M	Baroda	A			CBCT Only
						Silkaans	Mumbai	A			
						Ind Coil	Mumbai	A			
						Pragati	Thane	A			
						Prayog	Pune	A			
						AE	Mumbai	A			
						Logicstat	Delhi	A			For control transformer only
						C&S Electric	Noida	A			For CT only
7	A) LT AC / DC Control & Selector Switch B) Indicating Meters C) Transducer D) Indicating Lamp E) LT fuse F) Push Button G) Terminal Block H) MCB I) LT PVC Copper Wires J) Timers	III				Any make with VDE or CE or UL or CSA marking or *BIS approved with CML no*.					Refer Note-1

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
8	GI Wires & Flats	III				M/s APT Engineering Works	New Delhi	A			
						M/s Gram Engineering	Howrah	A			
						M/s Arun Engg Works	Mumbai	A			
						Indiana Cable Trays Corporation	Mumbai	A			
						Jamna Metal Company	Delhi	A			
						M.J. Works	New Delhi	A			
						Mettalite Industries	Delhi	A			
						National Galvanising Co	Calcutta	A			
						Press Metal Corporation	Mumbai	A			
						System Encl. Enterprises	Calcutta	A			
9	Lighting Lamps for conventional lighting fixtures	III				BIS approved sources		Noted			Refer note-1
						Crompton	Mumbai	A*			*DR for LED lamps
						Bajaj Electricals	Mumbai	A*			
						Philips	Noida	A*			

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
						Wipro	Mumbai	A*			
10	Wall mounted fixed type indoor / outdoor LT switchgear non compartmentalized panel (lighting panels /AC/DC/Fuse boards/MCB boxes)	I	Q-29			Mika Engineers	Mumbai	DR			
						Control Device	Kolkata	A			
						Novateur Electrical & distribution systems	Murthal	A			
						Schneider	Nasik	A			
						Tricolite	Sahibabad / Manesar	A			
						Hindustan Control & equipment Ltd	kolkata	A			With fabrication & painting at unit II & MP Electrical Narendrapur
						Adlec Power	Rohad (Jhajjar)	A			
						Control & Schematics	Hyderabad	A			
						Positronics	Vadodara	A			
						L&T	Coimbatore/ Mumbai	A			
						Havells	Faridabad	A			Wall mounted type only
						Maktel	Vadodara	A			
						Jakson	Noida	A			
						Switching Circuit	Kolkata	A			
						Sarvana	Bangalore	A			

	PROJECT :NORTH KARANPURA SUPER THERMAL POWER PROJECT	SUB VENDOR LIST DATE 26/12/15	ANNEXURE-6

Sl. No.	ITEM	QP / INS CAT.	QP No:- 4410-001– QVE-	QP SUB. SCH.	QP APPL SCHEDULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHEDULE	SC DETAIL SUB SCH	REMARKS
						Switchgear					
						Indoasian Electric	Sonepat	A			Wall mounted type only
						C&S	Noida/Hardwar	A			
						GEII	Bangalore	A			
						ICA	Mumbai	A			
						Conquerent control systems	Manesar	A			
						ISC	Mumbai	A			
						Siemens	Mumbai	A			
						Avaids Technivators	Gurgaon	A			Wall mounted type only
						Jasper	Gurgaon	A			
						Vidut Control	Ghaziabad	A			
						Anand	Noida	A			
						Unilec	Gurgaon	A			
						Pyrotech	Udaipur	A			
						Ajmera	Mumbai	DR			
11	Lighting Fixtures(conventional type)	I	Q-27			Surya Roshni	Noida	A			
						CGL	Mumbai	A			
						Bajaj Electricals	Mumbai	A			
						Philips	Noida	A			
						Wipro	Mumbai	A			
12	Lighting Fixtures(	I	Q-28			Surya Roshni	Noida	A			

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	LED type)					Wipro	Pune	A			
						Bajaj Electricals	Mumbai	DR			
						CGL	Mumbai	DR			
						Philips	Noida	DR			
13	Lead Coated Flexible Conduits	II	Q-23			Bansal Labs	Bhopal	A			
						Plica	Ghaziabad	A			
						Lapp	Germany	DR			
14	Lighting Mast with raise & lower type lantern carriage / polygonal poles.	I	Q-31			Skipper	Howrah	A			
						Bajaj	Pune	A			
						CGL	Mumbai	DR			Fabrication, Galvanising & testing at M/s B.P. Projects, Kolkata
						Philips	Kolkata	A			Fabrication, Galvanising & testing at M/s B.P. Projects, Kolkata
						Wipro	Pune	DR			
15	Occupancy Sensor	III				Vendor recommended source.		Noted			
16	24V supply module with complete accessories (240V to 24V Converter)	III				Power Pack Enterprises	Mumbai	Noted			
						Indcoil	Mumbai	Noted			
						Ames Impex	Ahmedabad	Noted			

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						Electricals Pvt. Ltd					
17	Emergency Lighting Unit					Bajaj Electricals	New Delhi	Noted			
						Prolite Autoglo Limited	Mumbai	Noted			
18	Dimmer units & passive infrared sensors					Lighting fixture supplier approved sources.		Noted			
19	STEEL CONDUIT / Epoxy coated conduit	II	Q-22			BIS Licensee					Refer note - 1
20	Junction boxes / Link boxes / test link box / adaptor box	II	Q-24			Positronics	Vadodara	A			Galvanising shall be carried at sources given in note no 3.
						Pyrotech	Udaipur	A			
						Conquerent control systems limited	Manesar	A			
						Jakson	Noida	A			
						Switching circuit	Kolkata	A			
						Sarvana Switchgear	Bangalore	A			
						Ajmera	Mumbai	A			
						Jasper Engineers	Noida	Noted			a) Galvanisin

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						Pvt. Ltd					g shall be carried at sources given in note no 3. b) Documents require for fabrication facility along with facility & experience details.
						Electro control & devices	Greater Noida	Noted			
						Shrenik & co	Ahmedabad	Noted			
						Phoenix mecano Ltd	Pune	Noted			
						Adroit control Engineers Pvt Ltd	faridabad	Noted			
						Mika Engineers	Mumbai	Noted			
						Bajaj Electricals	New delhi	Noted			
						S.B. electrical Engineering corporation	Mumbai	Noted			
21	Junction boxes-FRP/ Thermosetting Plastic / Thermo Plastic	II	Q-25			Sumip Composites	Ahmedabad	A			
						Kemrock	Vadodara	A			
						Ajmera	Mumbai	A			
						Trinity Touch	Palwal	A			
						Ercon composites	Jodhpur	DR			
22	Cable gland	III				Sunil & Co	Kolkata	A			
						Arup Engg	Kolkata	A			
						Comet	Mumbai	A			
						Quality Precision	Kolkata	A			

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						Standard Metal Industries	Mumbai	A			
						Braco	Mumbai	A			
						Any make with VDE or CE or UL or CSA marking or *BIS approved with CML no*.		A			Refer note 1
23	Cable Lugs / Ferrules	III				Dowell	Mumbai	A			
						3D	Umbergaon	A			
						Chetna	Nasik	A			
						Any make with VDE or CE or UL or CSA marking or *BIS approved with CML no*.		A			Refer note - 1
24	Tubular Pole	I	Q-26			BIS licensee as per IS2713 with valid CML no					a)Refer note – 1, b)SQP no : 0000-999-QOE-S-19 will be applicable. License shall be verified during inspection.
25	LED module	III				To be informed by LED fixture manufacturer		Noted			

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						during detailed engineering.					
26	Ballast	III				Lighting Fixture manufacturer approved sources		Noted			
27	Lighting wire	III				ISI marked wires with valid CML no					Refer note-1
28	Industrial / welding receptacles & boxes	III				Schneider	Nasik	A			
						BCH	Faridabad	A			
						Ajmera	Mumbai	A			
						Sakthi & crown	Chennai	A			
29	Ceiling fans with regulators & exhaust fans	III				Crompton		Noted			
						Orient		Noted			
						Khaitan		Noted			
						Polar		Noted			
						GEC		Noted			
						Havells		Noted			
						Bajaj		Noted			
30	Switchboxes	III				Anchor	Mumbai				a)Galvanisation shall be at sources as per note no 3.
						Elexpro Electricals	Navsari				
						Bajaj Electricals	New Delhi				

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						Ajmera industries & Engg. works	Navi Mumbai				b) Subject to submission of required documents for fabrication facility and experience details by main contractor.
						S.B electrical Engineering corporation	Mumbai				
31	PVC conduit	III				BIS licensee / ISI marked with valid CML no					Refer note- 1
32	Flameproof receptacles	III				Baliga Electricals	Chennai	Noted			a)Valid CMRI report required.
						Sudhir switchgear	Mumbai	Noted			
						FCG flameproof control gear	Mumbai	Noted			
33	Hume Pipe	III				BIS licensee					Refer note- 1
34	Flameproof lighting fixtures	III				Havells India Limited	Noida	Noted			a)Valid CMRI report required.
						Baja Electricals	New Delhi	Noted			
						Baliga Electricals	Chennai	Noted			
35	Maintenance ladder					Vendor recommended sources		Noted			

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36	Control system					Vendor recommended sources		Noted			
37	Lighting dimmer system					Vendor recommended sources		Noted			
38	Lighting sensor system					Vendor recommended sources		Noted			

Note-1- VDE / CE / UL / CSA MARKING FOR PRODUCT QUALITY: CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY OR BIS APPROVAL LETTER WITH CML NO. FOR PRODUCT QUALITY SHALL BE SUBMITTED FOR NTPC's VERIFICATION/ INFORMATION, PRIOR TO FIRST SUBMISSION/ During submission of QP.

Vendor shall furnish a copy of valid BIS license of manufacturer for the particular item prior to raising inspection call for further transmission to NTPC for their information and record.

Note 2 : Abbreviations

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any.

DR – For these items "Detailed required" for BHEL/NTPC review. To be identified with letter "DR" in the list.

NOTED – For these items vendors shall be approved by BHEL. Vendor to furnish required credentials.

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QP/INSPN CATEGORY:
CAT-I : For these items the Quality Plans are approved by NTPC/BHEL and the final acceptance will be on physical inspection witness by NTPC/BHEL.
CAT-II : For these items the Quality Plans approved by NTPC/BHEL.BHEL reserves the right to inspect. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.
CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC/BHEL shall be on the basis certificate of conformance by the main supplier.

Note 3 : List of acceptable galvanisers:

a) M/s MJ Engg, Delhi
b) M/s Jamna Metal, Delhi
c) M/s A.V. Engg, Kolkata
d) M/s Inar Profiles, Vishakhapatnam
e) M/s Anand Udyog, Mumbai
f) M/s Techno Engg, Chandigarh
g) M/s Steelite Engg, Mumbai
h) M/s National Galvaniser, Kolkata
i) M/s Unistar Galvaniser, Kolkata
j) M/s B.P. Projects , Kolkata
k) M/s Bajaj, Pune
l) M/s Electrocare Industries, Mumbai
m) M/s B.G. Shirke, Pune
n) M/s Gurpreet Galvanisers, Hyderabad
o) M/s Sigma, Mumbai
p) M/s Radhakrishnan Shetty, Chennai

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q) Karamtara , Mumbai
r) Poona Galvanisers, Pune
s) Neha Galvaniser, Kolkata
t) Unitech Galvanisers, Hoogly
u) Gurpreet Galvanisers, Hyderabad

Additional galvanisers, if any, proposed by manufacturer through main contractor during detailed engineering shall be reviewed and assesses by NTPC as per merits of the case.

SECTION – 'D'

SPECIFIC TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION FOR

LIGHTING SYSTEM (SUPPLY)

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

CONTENTS

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

1.4 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.

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

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 hall be paid to ensure that level of illumination is satisfactory in all respects including viewing of all instruments, alarms, annunciations 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.

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 :

a) AC - normal
b) AC - emergency
c) DC - normal
d) 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 :

a) Simplicity
b) Controlled voltage drop
c) 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 :

a) Area A : AC normal, AC emergency, DC normal and DC emergency luminaires.

b) Area B : AC normal, AC emergency and DC emergency luminaires.

c) Area C : AC Normal and AC emergency luminaires

d) Area D : AC Normal luminaires.

e) Area E : AC Normal luminaires and portable emergency lighting.

4.2.3 Lighting Philosophy

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

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.

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 :

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.

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

a) Decorative luminaires shall be provided with one of the following as per "Luminaire Details" :

i. Perspex acrylic diffuser.

ii. High purity, anodised aluminium, mirror optic reflectors with anodised aluminium matt finish transverse fins to control glare.

iii. Opal polystyrene louvers and sheet steel side panels.

iv. Vertical metallic louvers finished in stove enamelled white and with sheet steel side panels.

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.

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

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.

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

a) Luminaires shall be compact in design with aluminium alloy housing and three piece highly polished and anodised reflector assembly.

b) Toughened glass panel in the front shall be provided with silicon gaskets.

c) 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)

a) Bulk head luminaires shall be used for the locations where explosion or fire hazard exists.

b) Luminaire shall be made of cast iron housing with integral terminal box.

c) Front of the luminaire shall be covered with flat toughened glass cemented into a retaining ring.

d) Lamp replacement shall be from the front.

e) Controlgear box for HPMV lamps shall be integral to the housing.

f) MS fixing straps shall be provided for mounting.

g) Luminaire shall be stove enameled grey outside and white inside.

h) Terminal box shall be provided with 20 mm ET conduit entry.

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.

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.

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

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,

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.

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.

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

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 that 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

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.

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.

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.

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

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.

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;

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.

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

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:

Type	Description
JB-F	Provided with four (4) way stud type terminals for terminating upto 2Nos. 10 mm2 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 16mm2 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 35mm2 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-16mm2 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 10mm2 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.

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.

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 backelite (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

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.

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.

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.

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 90^0 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.

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 :

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

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.

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

a) Time switch shall be suitable for automatic switching ON and OFF of street lighting / flood lighting circuits.

b) Time switch have 00 - 24 hrs clock base.

c) Time switch shall indicate actual time and shall permit accurate time setting.

d) Time switch shall be rugged, independent of normal fluctuations of voltage / frequency and free from maintenance.

e) Contact rating, clock accuracy, rated voltage rating and frequency rating of timer shall be suitable to its application.

f) Time switch shall be provided with Ni-Cd battery.

g) Time switch shall be suitable for mounting inside the panel.

7.15.2 On Delay Timer

a) 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.

b) Timer shall be fully static and suitable for operation on normal frequency and system voltage.

c) Timer shall have high setting accuracy, high repeat accuracy, low reset time and low power consumption.

d) Timer shall have the time setting range of 24 - 240 seconds, unless mentioned otherwise in Data Sheet A.

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

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.

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 Distrbution 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.

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 VOID

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.

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

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

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.

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.

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 design of electrical street lighting installations	[ ] IS 1944

LUMINAIRES

4.	General and safety requirement for electric lighting fittings	[ ] IS 1944
5.	Luminaires	[ ] IS 10322
6.	Industrial lighting fittings with metal reflector	[ ] 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.	Water tight 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
14.	Electric lighting fittings for division 2 areas	[ ] IS 8224

LAMPS

15.	Electric lamps, tungsten filament general service	[ ] IS 418
16.	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
20	Ballast for high pressure mercury vapour lamps	[ ] IS 6616
21.	Capacitors for electric discharge lamps (fluorescent and MV)	[ ] IS 1569
22.	Bi-pin lamp holders for tubular fluorescent lamps	[ ] IS 3223
23.	Methods of measurement of lamp cap temp. rise	[ ] IS 8913
24.	Starters for fluorescent lamps	[ ] IS 2215
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.	General requirements for swgr. and control gear for voltage not exceeding 1000 V AC or 1200 V DC	[ ] IS 4237
28.	Code of practice for selection, installation & maintenance of switchgear & control gear	[ ] IS 10118
29.	Flame proof enclosures for electrical apparatus	[ ] IS 2148
30.	Classification of hazardous areas for electrical installations	[ ] IS 5572
31.	Degree of protection provided by enclosures for LV switchgear & control gear	[ ] IS 2147
32.	Dry type transformers	[ ] IS 11171

33.	Air break switches, disconnector etc. and fuse combinations units	[ ] IS 4064
34.	Miniature air break circuit breaker for voltages not exceeding 1000 V	[ ] IS 8828
35.	Low voltage Fuses	[ ] IS 9224
36.	Contactors for voltags not exceeding 1000 V AC or 1200V DC	[ ] IS 2959
37.	Indicator lamps (visual)	[ ] IS 1901

POLES, SOCKETS AND OTHER MISCELLANEOUS

38.	Tubular steel poles for over head power lines	[ ] IS 2713
39.	Three pin plugs and sockets	[ ] IS 1293
40.	Switch socket outlets (non-interlocking)	[ ] IS 4615
41.	Interlocking switch socket outlet	[ ] IS 4160
42.	Structural steel (Standard quality)	[ ] IS 226
43.	Danger notice plates	[ ] IS 2551
44.	Boxes for enclosure of electric accessories steel & cast iron boxes	[ ] IS 5133
45.	Code of practice for general construction in steel	[ ] IS 800
46.	Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes	[ ] IS 5082
47.	Code of practice for phosphating of iron and steel	[ ] IS 6005
48.	Colour for ready mixed paints & enamels	[ ] IS 5
49.	Recommended practice for hot dip galvanising of iron & steel	[ ] IS 2629
50.	Method of testing uniformity of coating on zinc coated articles	[ ] IS 2603

ANNEXURE-II

LUMINAIRE DETAILS

LUMINAIRE CODING SCHEME

1.0 Code Structure

A A NN (no. x W) — Number of lamps x Wattage of each lamp
Classified Serial Number (Numeric)
Luminaire type (Alpha)
Lamp type (Alpha)

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**

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 controlgear 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**

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

			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.

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.

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**

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

CONTENTS

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 phostating 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.

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).

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

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 ".

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/m^2) : 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

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)

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

CONTENTS

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.

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)

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.

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.

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 form 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.

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 then 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.

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).

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.

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 Appilicable)

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.

3.16.3 Al 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, luging, 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.

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.

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.

i. Insulation resistance
ii. Testing of earth continuity path
iii Polarity test of single phase switches.

4.5.7 The lighting circuits shall be tested in the following manner.

i. All switches ON and consuming devices in circuit, both poles connected together, to obtain resistance to earth.

ii. 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 VOID

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.

1.0 **SYSTEM DESIGN DATA**

1.1 Design Ambient : 50^0 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 1 sec

b) DC Supply

i. Rated Voltage : 220 V

ii. Voltage variation (Permissible) : +10% to -15%

iii. System fault level at rated voltage : 20kA

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 (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: offered		[√] Yes	[ ] No
5.1.1	If no, Types of luminaires not offered as per BOQ	:	NA	
5.2	List of lamps which can be installed only specified angle.	:	None	
5.3	Type of false ceiling for recessed fluorescent luminaire	:	After award of contract	
5.4	Degree of Protection for drip proof luminaires	:	IP54	
5.5	Flame proof luminaires			
	a) Hazardous area classification	:	Group IIC as per IS:2148 or class I, Div II as per NEC 70-428	
	b) Degree of Protection	:	IP	
	c) Mounting type for well glass.	:	[ ] eye-bolt	[ ] strap [√] screw neck
5.6	Non-Integral control gear box			
	a) Sheet thickness	:	2mm	
	b) Degree of protection	:	IP-55	
	c) Surface treatment	:	[√] Painted (Powder coated)[ ] Galvanised	
	d) If galvanised			
	i. Wt. of Zinc	:	N.A.	

ii. Process : N.A.

e) If painted

i. Colour to IS : Relevant IS

ii. Minimum paint thickness : DDE

5.7 Type of lamp holder for incandescent luminaires : [√] Screw type
[ ] Pin type

5.8 Tap setting for Ballasts

a) HPSV luminaires : 220V, 240V

b) HPMV Luminaires : 220V, 240V

5.9 Lamps

a) Type of Fluoroscent Lamps : [√] Cool Daylight
[√] Energy efficient T5

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 : 2 x 10 W FLT

5.10.2 Type of battery : Ni-Cd

5.10.3 Emergency duration of unit : 4 Hours

6.0 DESIGN PARAMETERS OF MAIN EQUIPMENT

6.1 Lighting Distribution Boards

6.1.1 Sheet Thickness : 2mm

6.1.2 Degree of Protection

a) Main Panel	:	IP 52
b) Transformer cubicle	:	IP42
c) Transformer terminal box	:	IP52

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 [√] Contactor & Timer

6.1.8 Range of time delay relay : Later

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 flat [ ] No

6.1.12 Fault current and duration : Later

6.1.13 Lighting Transformer

a) Voltage Rating(s)	:	415/415 V
b) Whether encapsulated	:	No
c) Transformer Impedance	:	4% for 100 kVA and 3% for 50 kVA

6.2 **Lighting Panel**

6.2.1 Application : [ ] Indoor [ ] Outdoor [√] Both

6.2.2 Sheet thickness : 2mm

6.2.3 Degree of protection

a) Indoor	:	IP55
b) Outdoor	:	IP55 with canopy

6.2.4 a) Type of Incomer : [√] Switch-Fuse
b) Type of outgoing feeder : [√] SPN MCB

6.2.5 MCB type for street lighting panel : [ ] 1 pole [√] 3 pole TPN

6.2.6 Busbar material : Aluminium / Copper

6.2.7 Whether hinged door with locking facility provided : [√] Yes [ ] No

6.2.8 Whether earthing studs provided : [√] Yes [ ] No

6.3 **Lighting Poles**

6.3.1 Type as per IS : IS2713

a) PS-1 : 410 SP51

b) PS-2 : 410SP67

c) PF-2 : 410SP51

d) PF-1 :

e) PS-4 :

6.3.2 Surface Treatment : [√] Galvanised [ ] Painted

6.3.2.1 Galvanisation details(if applicable)

a) Process : IS2629 / IS2633 / IS4759

b) Wt. of Zinc deposited : 70 micron

6.3.2.2 Painting details (if applicable)

a) Shade as per IS : NA

b) Paint thickness : NA

6.4 **Lighting Masts** :

6.4.1 Number of luminaires on each mast : During detailed engineering

6.4.2 Type of design : Polygonal shape

6.4.3 Material : Special sheet plates conforming to BS-EN10-025

6.4.4 Height : 30m

6.4.5 Galvanization

a) Process : Hot dip

b) Wt. of Zinc deposited : 610 gm / m2

6.4.6 Weight (approx.) : Kg

6.5 Street Lighting Pole Junction Boxes

6.5.1 Material : CRCA sheet

6.5.2 Sheet thickness : 1.6 mm

6.5.3 Galvanization

a) Process : Hot dip

b) Wt. of zinc deposited : 610 gm / m^2

6.5.4 Degree of protection : IP-55

6.6 Fuse Boxes :

6.6.1 Material : CRCA

6.6.2 Sheet thickness : 1.6 mm

6.6.3 Galvanization

a) Process : Hot dip

b) Wt. of zinc deposited : 610 gm / m^2

6.6.4 Degree of Protection : IP-55

6.7 **Receptacles**

6.7.1 Material : MS sheet & hot dip galvanised/ Die cast aluminium alloy

6.7.2 Sheet thickness : 2mm (min) / 2.5mm (min) respectively

6.7.3 Galvanization

a) Process :

b) Wt. of zinc deposited :

6.7.4 Degree of protection : IP-55

6.8 **24 V Supply Module**

6.8.1 Enclosure

a) Material : CRCA Sheet Steel

b) Sheet Thickness : 2.0 mm

6.8.2 Transformer

a) Rating : 3kVA, 3 phase, 4 wire

b) Primary Voltage : 415V

c) Secondary voltage : 42V

d) Class of Insulation : Class- F or better

6.8.3 Lamp

a) Rating :

b) Type :

6.8.4 No. of outgoing sockets : 24

6.8.5 Whether cord coiling arrangement considered : [√] Yes [ ] No

6.8.6 Louvers : [√] Provided [ ] Not Provided

7.0 **COMPONENT OF LIGHTING SYSTEM EQUIPMENT**

7.1 **Moulded Case Circuit Breakers(MCCB)** : NA

7.1.1 Rated voltage :

7.1.2 Number of poles :

7.1.3 Rated Short circuit duty :

7.1.4 Rated breaking capacity (rms) at 415V :

7.1.5 Rated making current (peak) :

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 : AC23

7.3 **Indicating Meters**

7.3.1 Ammeter

a) Type : As per IS-1248

b) Shape :

c) Size : 96 x 96 m

d) Accuracy class : 2

e) Current coil rating : 1A

f) Angle of deflection : 240°

7.3.2 Voltmeter

a) Type : As per IS-1248

b) Shape :

c) Size : 96 x 96 m

d) Accuracy class : 2 (min.)

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 : 220V

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	:	5 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)	:	110 V
7.7.4	Accuracy Class	:	0.5
7.7.5	Output	:	5 VA
7.7.6	Winding configuration	:	Vee Vee

7.8 **Miniature Circuit Breaker**

7.8.1	Min. Rating	:	As per spec
7.8.2	Short Time rating	:	9 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	:	Red
	b) OFF condition	:	Green
7.10.2	Circuit Voltage	:	As per control supply voltage

7.11 **Push Buttons**

7.11.1	Voltage Grade	:	500V

7.11.2 No. of Contacts : (2 NO + 2 NC)

7.12 **Terminals**

7.12.1 Type : 600 V grade box clamp, 10 mm^2 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 considered : By vendor all incoming & outgoing cables

7.13.2 Type : Double compression

7.13.3 Material : Brass

7.13.4 Nickel Plating provided : [√] Yes [ ] No

7.14 **Cable Lugs**

7.14.1 Provision for all power and control terminations considered : By vendor for all power and 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,L4T

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 Secs

8.0 **Conduit (Rigid)**

8.1 Rigid Conduit

8.1.1	Duty	:	Heavy duty
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)	:	1.6 mm upto 32 mm dia 2.0 mm upto 32 mm & upto 50 mm dia.
8.1.5	Surface treatment	:	Hot dip galvanising inside and outside as per IS 2629
8.1.6	Min. Weight of zinc coating (gm/m^2)	:	340 upto 32 mm dia 460 above 32 mm & upto 50 mm dia.
8.1.7	Min. Thickness of zinc coating (microns)	:	48 utpto 32 mm dia, 65 above 32 mm & Upto50 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 IS:5)	:	**Interior**	**Exterior**
	a) LDBs	:	RAL9002	RAL9002
	b) LPs	:	RAL9002	RAL9002
	c) Receptacles	:		
	Decorative	:		

	Industrial	:		
d)	Lighting kit box	:		
e)	24V Supply Module	:		
f)	Emergency lighting Unit	:		
g)	Junction Box	:	RAL7035	RAL7035

10.2 Finish

a) Interior : [ ] Matt [√] Semi - glossy

b) Exterior : [√] Semi - glossy [ ] Full - glossy

10.3 Paint Thickness(min) : As per spec

11.0 **MAKE** **:** As per spec

12.0 QUANTITY VARIATION (Limited to the value of the Contract) : ± 30 %

13.0 O & M SPARES

13.1 Duration for which O&M spares considered : 3 Years

1.0 SYSTEM DESIGN DATA

1.1 Design Ambient : ^{o}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

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 glass : [ ] eye-bolt
[ ] strap

5.1.7 Non-integral controlgear box

a) Sheet thickness :

b) Degree of protection :

c) Surface treatment : [ ] Painted
[ ] Galvanised

d) If galvanised

i. Wt. of zinc : gms / m^2

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:

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.

	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		:	^{o}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 ^{o}C and 0.8 p.f. lagging		:	
m)	Copper loss at rated load and 75 ^{o}C		:	kW
n)	Impedance at rated current, frequency and at 75 ^{o}C		:	
o)	Winding conductor material		:	
p)	Whether transformer is encapsulated		:	[ ] Yes [ ] No
q)	Insulation class		:	

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 panel. : [ ] 1 pole [ ] 3 pole

6.2.6 Busbar material :

6.2.7 Whether hinged door with with locking facility provided : [ ] Yes [ ] No

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 :

6.3.2 Surface Treatment : [ ] Galvanised
[ ] Painted

6.3.2.1 Galvanisation details (if applicable)

a) Process :

b) Wt. of zinc deposited : gms / m^2

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) excluding Lightning Arrester : meters

6.4.5 Galvanization

a) Process :

b) Wt. of zinc deposited : gms / m^2

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 / m^2

6.5.4 Degree of protection : IP :

6.6 Fuse Boxes

6.6.1 Material :

6.6.2 Sheet thickness : mm

6.6.3 Galvanization

a) Process :

b) Wt. of zinc deposited : gms / m^2

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 / m^2

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

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.

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

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

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 complied with : [ ] Yes [ ] No

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

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE	3X660MW NORTH KARANPPURA STATION LIGHTING		SPECIFICATION : NUMBER :	PE-TS-507-558-E002 R01			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02			SPECIFICATION : TITLE				
		SHEET 1 OF 4	SYSTEM			ITEM :ILLUMINATION			SECTION	VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	LUMINAIRES & LAMPS	1. ACCEPTANCE TEST										
		a) VISUAL	MA	VISUAL	IS 10322 (PART5 SEC1)	IS 10322 / BHEL SPE	IS 10322 /BHEL SPE	TEST CERT	3/2	1	-	AFTER SUCCESSFUL COMPLETION OF 1a, 1b & 1c FURTHER TESTING OF 1d) TO BE DINE BY PAPER INSERTION METHOD.
		b) IR (Dry)	CR	ELECTRICAL	IS 10322	-DO-	-DO-	-DO-	3/2	1	-	
		c) HIGH VOLTAGE	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	3/2	1	-	
		d) DUST PROOF	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	3/2	1	-	
		e) PHOTOMETRIC	CR	ELECTRICAL	*	-DO-	-DO-	-DO-	3/2	1	-	*: ONE NO. LUMINAIRE OF EACH TYPE TO BE WITNESSED BY BHEL. MAIN VENDOR TO WITNESS AS PER IS-10322
		2. ROUTINE TEST										
		a) VISUAL	MA	VISUAL	100%	IS 10322 / BHEL SPE	IS 10322 /BHEL SPE	TEST CERT	3/2	-	1	TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER
		b) IR (Dry)	CR	ELECTRICAL	-DO-	-DO-	-DO-	-DO-	3/2	-	1	
		c) HIGH VOLTAGE	CR	ELECTRICAL	`	-DO-	-DO-	-DO-	3/2	-	1	
2.0	LIGHTING PANELS AND LIGHTING DISTRIBUTION BOARDS	1.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DRG.	BHEL DRG.	INSPT. REPORT	3	2,1	-	COMPONENTS TO BE OF APPROVED MAKE
		2.PAINT SHADE/ THICKNESS	MA	VISUAL/ MEASUREMENT	-DO-	BHEL SPEC/DRG	BHEL SPEC/DRG	INSPT. REPORT	3	2,1	-	
		3.DEGREE OF PROTECTION (INCLUDING EXPLOSION PROOF IF ANY)	MA	TESTS	1/SIZE	BHEL SPEC/ RELEVANT IS	BHEL SPEC/ RELEVANT IS	TEST CERT	-	-	2,1	
		4.PERFORMANCE TESTS	MA	ELECT.	100%	BHEL SPEC.	BHEL SPEC.	INSPT. REPORT	3	2,1	-	
		5.HV/IR/HV	MA	ELECT	100%	2.5KV AC FOR 1 MINUTE	2.5KV AC FOR 1 MINUTE	INSPT. REPORT	3	2,1	-	
	BHEL		**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE	3X660MW NORTH KARANPPURA STATION LIGHTING		SPECIFICATION : NUMBER :	PE-TS-507-558-E002 R01		
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02			SPECIFICATION : TITLE			
		SHEET 2 OF 4	SYSTEM			ITEM :ILLUMINATION			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		6.TEMP.RISE TEST (FOR COM-PLETE ASSEMBLED LDB)	MA	ELECT	1/RATING	BHEL SPEC.	BHEL SPEC.	-DO-	3	2	1	
3.0	LIGHTING TRANSFORMER	1. ROUTINE TEST										
		a) TYPE / RATING	CR	VISUAL	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		b) WIND. RESISTANC	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		c) V. RATIO /VECTOR	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		d) Z VOLT/ Z SCKT	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		e) LOAD LOSS/ CURREN	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		f) NO LOAD LOSS	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		g) SOURCE WITHSTAND	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		h) INDUCED O/V	CR	TEST	100%	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	INSPT. REPORT	3	2,1	-	
		2. TYPE TEST	MA	TEST	1/RATING	IS 11171 / BHEL SPE	IS 11171 / BHEL SP	TEST REPORT	3	2	1	TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER
4.0	CONDUITS	1.MATERIAL	MA	VISUAL,MECH, & CHEMICAL	AS PER SPEC./ IS 9537	IS:9537	IS:9537	INSPT. REPORT	3	2	1	
		2.DIMENSIONS	MA	MEASUREMENT	AS PER SPEC./ IS 9537	IS:9537	IS:9537	INSPT. REPORT	3	2	1	FOR SAME MANUFACTURER, 1st LOT WILL BE WITNESSED BY BHEL, SUBSEQUENT LOT CAN BE CLEARED BASED ON TEST WITNESSED BY MAIN VENDOR.
		3. MECH. PROPERTIES										
		a) BENDING TEST	CR	TEST	IS 9537-II	IS-9537	IS-9537	INSPT. REPORT	3	2,1	-	
		b) COMPRESSION	CR	TEST	IS 9537-II	IS-9537	IS-9537	INSPT. REPORT	3	2,1	-	
		c) BEND	CR	TEST	SPEC.	SPEC.	SPEC.	INSPT. REPORT	3	2,1	-	
		4. GALVANISATION TEST										
		a) ZINC COATING	CR	TEST	IS 9537-II	IS-2633	IS-2633	INSPT. REPORT	3	2,1	-	
	BHEL		**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE	3X660MW NORTH KARANPPURA STATION LIGHTING		SPECIFICATION : NUMBER :			PE-TS-507-558-E002 R01	
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02			SPECIFICATION : TITLE				
		SHEET 3 OF 4	SYSTEM			ITEM :ILLUMINATION			SECTION			VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS	
1	2	3	4	5	6	7	8	9	10			11	
		b) MASS OF ZINC COAT.	CR	TEST	IS 9537-II	IS-6745/4759/SPEC	IS-6745/4759/SPEC	INSPT. REPORT	3	2,1	-		
		c) COATING THICKNESS	CR	TEST	IS 9537-II	IS-9537/ SPEC	IS-9537/ SPEC	INSPT. REPORT	3	2,1	-	BY ELCOMETER	
		d) EPOXY THICKNESS	MA	VISUAL/PHYSICAL	IS 9537-II	50 MICRONS	50 MICRONS	INSPT. REPORT	3	2,1	-		
5.0	ELECTRIC POLES												
5.1	MATERIAL	1.CHEMICAL COMP.	MA	CHEM. ANALYSIS	SAMPLE	IS-2713 IS:228 & IS:1894	IS-2713 IS:228 & IS:1894	-DO-	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	BHEL DRG./ IS:2713	BHEL DRG./ IS:2713	-DO-	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	-DO-	3/2	2,1	-		
6.0	JUNCTION BOXES & RECEPTACLES	1.DIMENSIONS	MA	MEASUREMENT	100%	BHEL DRG.	BHEL DRG.	INSP. REPORT	3	-	2	COMPONENTS TO BE OF APPROVED MAKE	
		2.PAINT SHADE/ THICKNESS	MA	VISUAL/MEAS.	SAMPLE	BHEL SPEC/DRG	BHEL SPEC/DRG	-DO-	3	-	2		
		3.HV/IR/HV	MA	ELECT.TESTS	100%	2KV AC FOR 1 MINUTE	2KV AC FOR 1 MINUTE	-DO-	3	-	2		
		4.DEGREE OF PROTECTION	MA	TEST	1/SIZE	IS:2147	IS:2147	TEST CERT.	3	-	2,1		
		5.SPECIAL TESTS IF ANY,EXPLOSION PROOF ETC.	MA	TEST	1/SIZE	IS:2148	IS:2148	TEST CERT.	3	-	2,1		
		6. OPERATION CHECK	MA	TEST	SAMPLE	BHEL DRG	BHEL DRG	INSP. REPORT	3	-	2		
		7. MECHANICAL INTERLOCK	MA	TEST	SAMPLE	BHEL DRG	BHEL DRG	INSP. REPORT	3	-	2		
	BHEL		**PARTICULARS**		**BIDDER/VENDOR**								
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		CUSTOMER :			PROJECT TITLE	3X660MW NORTH KARANPPURA STATION LIGHTING		SPECIFICATION : NUMBER :			PE-TS-507-558-E002 R01	
	QUALITY PLAN	BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02			SPECIFICATION : TITLE				
	SHEET 4 OF 4	SYSTEM			ITEM :ILLUMINATION			SECTION			VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
7.0	PVC WIRES	1.SURFACE DEFECTS	MA	VISUAL	SAMPLE	BHEL SPEC. IS:694 IS:1554	BHEL SPEC. IS:694 IS:1554	INSPN. REPORT & TEST REPORT FROM MANUFACTURER	3/2	2	1	TO BE PROCURED FROM BIS APPROVED SOURCE
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-DO-	-DO-	-DO-	3/2	2	1	
		3.TYPE TESTS	CR	ELEC.TESTS	ONE/TYPE & SIZE	BHEL SPEC. IS:694 IS:1554	BHEL SPEC. IS:694 IS:1554	TEST CERT.	3	2	1	
		4.ACCEPTANCE TESTS	MA	-DO-	SAMPLING	-DO-	-DO-	-DO-	3	2	1	
		5.ROUTINE TESTS	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2,1	
		6.FRLS PROPS.	CR	FRLS TESTS	SAMPLES	BHEL SPEC	BHEL SPEC	-DO-	3	2	1	
		NOTES:										
		1. IN CASE TYPE TEST CERTIFICATE FOR DEGREE OF PROTECTION/EXPLOSION PROOFNESS FROM INDEPENDENT LAB. IS NOT AVAILABLE, THE ITEM SHALL BE TESTED AT AN INDEPENDENT LAB.										
		2. ITEMS LIKE CEILING FANS, EMERGENCY LIGHTING UNIT, FLEXIBLE CONDUIT, EARTHING WIRE & FLATS, 24V SUPPLY MODULE, LADDERS, HUME PIPE, SWITCHBOXES, EXIT SIGNS, STRUCTURAL STEEL ETC. WILL BE CLEARED BASED ON COC (CERTIFICATE OF COMPLIANCE).										

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	
	DATE	BIDDER'S/VENDORS COMPANY SEAL