SINGARENI COLLIERIES COMPANY LTD.

2 X 600 MW SINGARENI, ADILABAD TPP

CONSULTANAT – NTPC LTD.

TECHNICAL SPECIFICATION FOR STATION LIGHTING SYSTEM - SERVICE BUILDING LIGHTING (GREEN BUILDING)

BHEL DOC. NO. : PE-TS-381-558-E002
Revision 0

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA-201301

CONTENTS

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 requirements specific to Contract.

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)

NOTE:- 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-C & D of Section-C: BOQ, as enclosed with the specification) with bidder's signature and company stamp.

   b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.

   c. A copy of previous sheet ("List of Contents"), with bidder's signature and company stamp.

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

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

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

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

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

7. Any changes made by the bidder in the price schedule with respect to the STATION LIGHTING SYSTEM description/ quantities, notes etc. from those given in Annexure- C & D of 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, assembly, inspection and testing at manufacturer's works, proper packing and delivery to 2 X 600 MW SINGARENI, ADILABAD TPP 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).

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 the 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 this 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.	Owner	SINGARENI COLLIERIES COMPANY LTD.(A GOVT. OF INDIA UNDERTAKING), HYDERABAD.
2.	Project	2X600 MW SINGARENI COLLIERIES COMPANY LTD., ADILABAD THERMAL POWER PLANT
3.	No of Units	2
4.	Consultant	NATIONAL THERMAL POWER CORPORATION LTD.
5.	Location	The site is located near Pegadapalli Village, Jaipur Mandal, District- Adilabad of Andhra Pradesh The latitude & longitude of site are 18° 48' 30" to 18° 50' 35" and 79° 34' 00" to 79° 35' 30" respectively. The site is 14 km from nearest town Mancherial and 4.6 km from State Highway. Distance from NH-16 is 500 M.
6.	District	Adilabad (Andhra Pradesh)
7.	Nearest Major Town	Mancherial
8.	Nearest Railway station	The nearest railway station is Mancherial railway station on Nagpur-Kazipet main rail line of South central Railway, located at a distance of about 14.6 kms.
9.	Nearest Airport	The nearest airport is Shamshabad Airport, Hyderabad located at a distance of 250 km.
10.	Vicinity Plan of the project	Refer Annexure-I (section-B)
11.	Meterological Data	Refer Annexure-II (section-B)

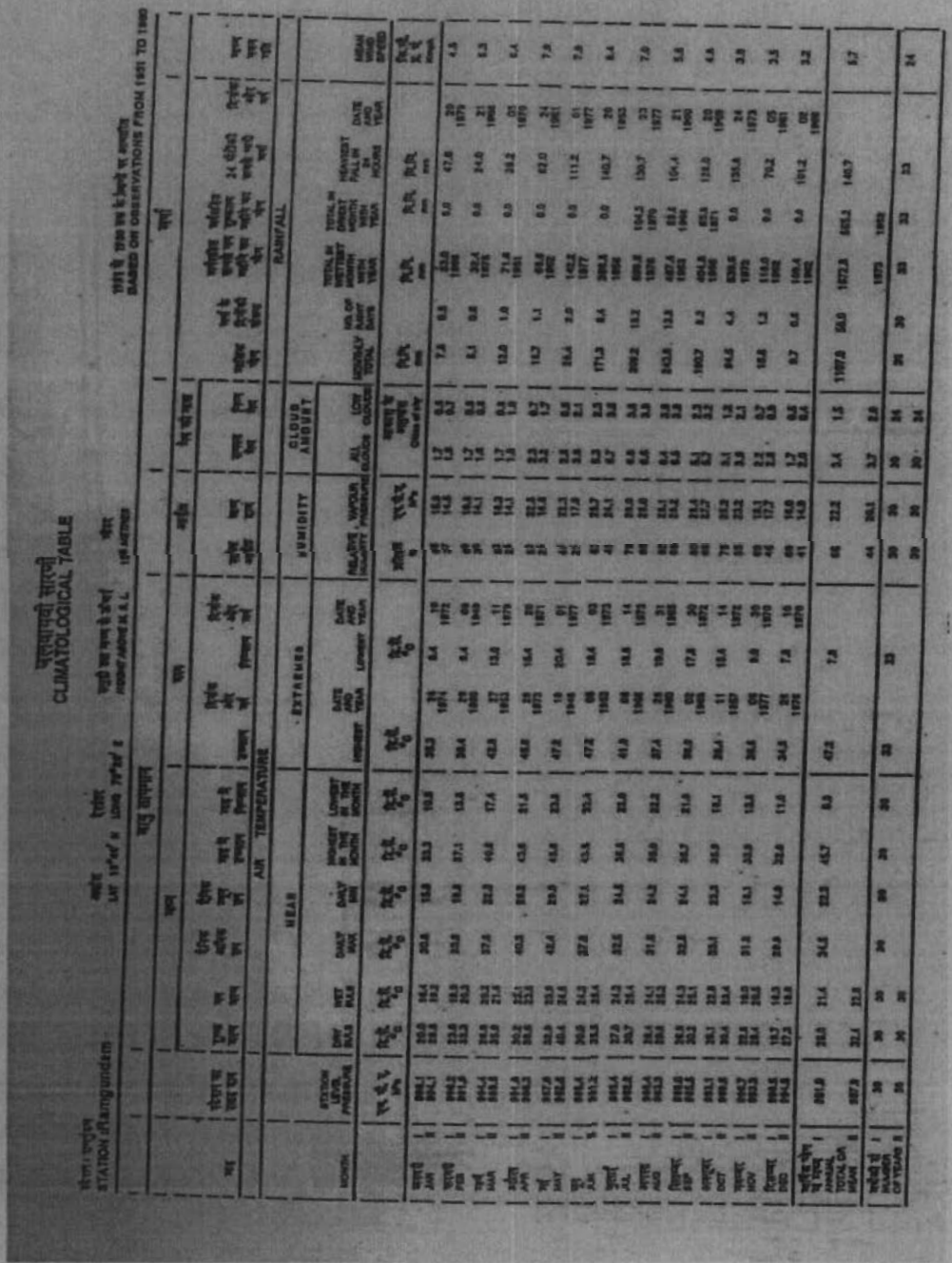
Annexure-II (Section-B)

CLAUSE NO.	PROJECT INFORMATION

CLIMATOLOGICAL TABLE

~~ANNEXURE III~~

(PAGE 1 OF 1)



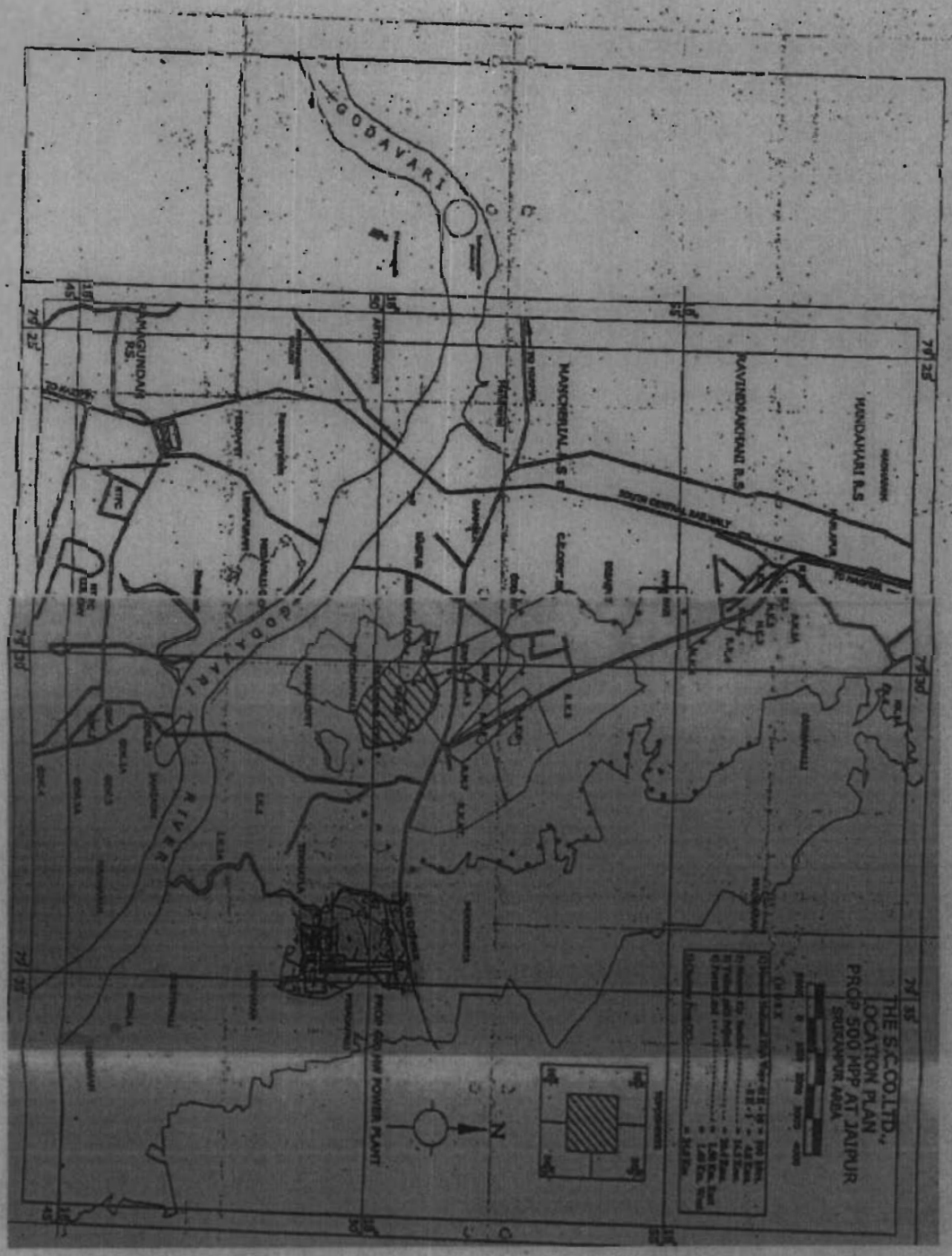
SINGARENI THERMAL POWER PROJECT (2X600 MW) BOILER TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION - VI PART-A	SUB-SECTION-I PROJECT INFORMATION	PAGE 12 OF 12

Annexure - I (Section - B)

CLAUSE NO.	PROJECT INFORMATION

VICINITY PLAN

~~ANNEXURE-I~~



SECTION – 'C'

SPECIFIC TECHNICAL REQUIREMENTS

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

2.0 SCOPE OF SUPPLY AND SERVICES

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

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

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

3.0 TERMINAL POINTS

Terminal point shall be outgoing power supply from lighting panels.

4.0 EXCLUSIONS

4.1 Civil foundations of lighting distribution boards.

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

4.3 Supply of power cables from LDBs to LPs

4.4 Supply & erection of cable trays.

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

6.0 LIGHTING SYSTEM DESIGN CRITERIA

6.1 Lighting system will be designed to ensure adequate uniform visual performance, safety & reliability and will be free from excessive glare and flicker from discharge lamp. Adequate working light shall be available during door open condition of each & every panel to visualise cards for maintenance.

6.2 All fluorescent fixtures shall have energy efficient 'T5' type fluorescent lamps. The louvers of these fixtures shall be designed for 'T5' type fluorescent lamps. All fluorescent lamps shall have 'cool day light' colour designation. The mirror optics type fluorescent shall have no iridescence effect. Acrylic covers/ louvers will be of non-yellowing type. All outdoor fixtures will be

weatherproof type with DOP-IP55.

6.3 All fluorescent fixtures shall be provided with terminal blocks of ELMEXEP/or Equivalent make inside the fixture for loop in loop out at Fixture. The terminal block shall be suitable for 4 sqmm. wire terminations.

6.4 Recess mounted Occupancy based passive infra-red sensors shall be provided for office area. Sensor shall be programmable type suitable for lighting load of 6A with variable off delay settings. The detection areas shall be minimum 5 meters for standard room height of 3 meters. All the calibrated settings shall be stored in non-volatile memory of PIR sensor which shall be unaffected by power supply fluctuations. Necessary 16A contractor shall be supplied along with each sensor & shall be located inside the switch.

6.5 The ballast to be used in fluorescent fixtures and CFL fixtures installed in false ceiling area shall have the THD of 10% or less.

6.6 Receptacles shall be of following types:

Type	Switch rating	Socket & Plug rating	Terminal Block size
RA	20A, SP240V AC (Industrial)	20A, 3-pin 240V AC	1-4 way, suitable for loop-in loop-out of 10 Sq.mm. Al Conductor
RB	16A, SP240V AC	6A+16A, 6-pin Decorative piano-Key type switch	
RD	20A, SP240V AC (Industrial)	20A, 3-pin 24V AC	1-4 way, suitable for loop-in loop-out of 2Cx10 Sq. mm Al Conductor

6.8 Junction Box : JB-F type shall be made of fire retardant material. Material of JB shall be Thermoplastic or Thermosetting or FRP type. The JB shall be of grey color RAL 7035.

7.0 SERVICE BUILDING LIGHTING DESIGN

7.1 Service building is one of the most prestigious buildings within the power plant area. This building shall be Energy Conservation Building Code (ECBC) compliant (with GRIHA 4 star rating) green building. This building shall be with RCC structure (G+4 storied) having RCC frame with RCC floors and roofs. Floor area of the building shall be approx. 6000 sq. m with central atrium. For the building floor to floor height shall be 4.25m. Approximate size of each floor shall be 42m x 30m.

7.2 The complete scope of supply installation testing, commissioning and performance testing of lighting and low voltage power services as per ECBC are to be included by bidder in their scope.

7.3 Lighting systems and equipment shall comply with all the mandatory provisions and perspective criteria of energy conservation building code (ECBC).

7.4 Lighting controls such as automatic lighting shutoff, space control, control in daylight areas, exterior lighting control and any other additional control shall be there as per requirement of ECBC.

7.5 Internally-illuminated exit signs shall not exceed 5 W per face.

7.6 Responsibility of coordination with civil and mechanical system design agencies required for lighting shall be in bidder's scope.

7.7 Bidder to furnish a separate DATA SHEET for lighting of service building.

7.8 Bidder to quote lighting fixtures which shall meet Light power density requirements for each area in service building as per energy conservation building code (ECBC) requirement.

7.9 Lighting Power Density in w/ft^2 as per ECBC is as given below. Bidders to quote lighting fixtures and lamps which shall meet this requirement :

Sl. No.	Area	Light Power Density Value (w/ft^2)
1	Office	0.77
2	Lobby, Meeting/ Conference Rooms	0.91
3	Labs	0.98
4	Electrical/Mechanical rooms	1.00
5	Toilets	0.63
6	Corridors	0.35
7	Store	0.55

7.10 All exterior lightings more than 100W and doesn't have motion sensor, should have efficacy not less than 60 lumen/Watt. All other exterior lights should meet below mentioned efficacy levels. Bidders to quote suitable lighting fixtures and lamps.

Light Source	**Minimum Allowable Luminous Efficacy (lm/W)**
CFL (Compact Fluorescent Lamp)	50
FL (Fluorescent Lamp)	75
MH (Metal Halide)	75
HPSV (High Pressure Sodium Vapor Lamp)	90
LEDs (Light Emitting Diodes)	50

7.11 Civil Architecture Layout of service building is attached for reference as per Annexure-III. Bidder to refer layout drawing and quote suitable lighting fixtures, lamps, sensors and control system which shall meet ECBC requirements for achieving GRIHA-4 rating.

8.0 ILLUMINATION DESIGN CALCULATION

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

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

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

Where

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

W = Width of room
COU = Coefficient of utilisation
LUMEN = Lumen output of each lamp
MF = Maintenance Factor

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

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

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	70	50	20
For non-air-conditioning area	30	30	10

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

a) Air conditioned areas : 0.8

b) Switchgear / MCC room : 0.7

c) General indoor area : 0.7

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

9.0 LIGHTING SYSTEM DESCRIPTION

a) Lighting system will be provided with AC Normal and AC Emergency lighting.

b) The sources of power supply are as below:

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

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

Normally all AC luminaries (80% on ACN and 20% on ACE) luminaries will be in service. Upon failure of AC normal supply, power supply through DG shall be available to AC Emergency.

9.1 AC Normal Lighting System:

AC Normal lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from Lighting Distribution Board (LDB). Each LDB, consisting of a (max. 100KVA) air-cooled dry type, non-encapsulated isolation transformer & distribution panels, will have TPN switch fuse unit for incoming & outgoing feeders. The ACLPs will be provided with TPN switch fuse unit for incoming and MCBs for outgoing. MCB will be provided with adequate rating for the expected short circuit current in the circuit. The fault level at LP will be restricted to 9kA.

9.2 AC Emergency Lighting System:

AC Emergency lighting fixtures fed through suitable numbers of conveniently located AC Emergency Lighting panel (ACELP) which are fed from AC Emergency Lighting Distribution Board (ACELDB). Each ACELDB, consisting of a 50kVA air-cooled dry type, non-encapsulated isolation transformer & distribution panels will have TPN switch fuse unit for incoming & outgoing feeders. The ACELPs will be provided with TPN switch fuse unit for incoming and MCB for outgoing, MCB will be provided with adequate rating for the expected short circuit current in the circuit. The fault level at LP will be restricted to 9kA.

9.3 All JBs shall be of polycarbonate /FRP/ Di-cast aluminium.

10.0 LOW VOLTAGE POWER SERVICES

10.1 240V, 50 Hz, 3 pin Power Receptacles (5A and 15A) shall be provided. Inside a building, receptacles shall be provided at interval of 30M or part thereof for hand tools, water coolers, exhaust fans etc.

11.0 WIRING / CONDUITS

11.1 Wiring of lighting system will be done as follows:

i) Wiring installation will be by multi-stranded, PVC insulated, colour coded wires laid in GI conduits. Minimum size of wire shall not be less than 1.5 sq. Mm. copper or 4 sq. mm. Aluminium. Wires shall conform to IS: 694 and wiring installation shall be as per IS: 732.

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

iii) Fittings and accessories for conduits shall also be hot dip galvanized. However for corrosive areas accessories and fittings shall have additional epoxy coating.

iv) Lead coated, waterproof, rustproof and heat resistance type flexible conduit will be used where required.

v) Conduits in air-conditioned areas will be surface mounted on the roof above false ceiling, however vertical drops of conduits will be through column flanges, finally covered for better aesthetics.

vi) Conduit fill criteria will be 40%.

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

viii) Lighting and receptacles will be fed from separate circuits. Wires of different phase shall run in different conduits. However wires of same phase of different circuit shall run in the same circuit.

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

11.2 Following sizes of copper conductor wires will be used depending upon the load & voltage drop criteria.

a) 1.5 mm2, 1100 V grade, PVC insulated, single core, stranded copper conductor for lighting fixtures from switch/JB to fixture.

b) 2.5 mm2, 1100 V grade, PVC insulated, single core, stranded copper conductor from panel to fixture, JBs/switches and circuit wiring.

c) 4.0 mm2, 1100 V grade, PVC insulated, single core, stranded copper conductor will be used for 5/15 & 20A receptacles.

12.0 EARTHING

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

i) 14 SWG GS wire for earthing of lighting fixtures, receptacles, conduits, switch boxes and junction boxes.

13.0 STATUTORY & REGULATORY REQUIREMENT

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

14.0 The areas for which lighting design engineering is to be done are listed in Annexure-II.

15.0 Design engineering includes submission of data sheets, GA drawings of equipment, mounting details, various schedules, lighting design calculation sheets, lighting distribution scheme, lighting layout drawings and bill of material drawings. Conduit layout drawings shall be submitted to meet the E&C schedule.

16.0 Basic Design Documents covers: Drawings/ documents schedule, technical data sheets, GA drawings of equipment, quality plan, type test reports & type test proposal (as required) for Station Lighting System.

17.0 INSPECTION & TESTING

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

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

17.3 During detail engineering, the contractor shall submit for 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. 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.

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

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

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

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

20.0 Number of copies of documents/data to be submitted by the successful bidder shall be as per enclosed Annexure-B.

21.0 PRICES

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

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

21.3 The unit rates of supply & installation for all equipment and service quoted by the bidder shall be firm for a variation of quantities limited to

a) ±30% of total order value till finalisation of engineering details & BOQ.

b)+10% of the total order value in addition to (a) above, till the completion of job.

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

21.5 Engineering, Supply and E&C schedule: As per NIT (Notice Inviting Tender).

ANNEXURE - I

AVERAGE LUX LEVEL FOR DIFFERENT AREAS IN SERVICE BUILDING

Average lux levels envisaged for the various areas, as applicable in the service building, are as follows:

Sl No.	Area	Average Illumination Level In Lux.
A	Service Building	
1	Office, Conference rooms, Labs, Meeting rooms, Workstations	300
2	VIP Lounge, Model room, MCC room, Store, Record room	200
3	Corridors, fire escape, toilets, lift lobby	70
4	Electrical Room, AHU Room, Server, pantry	150

ANNEXURE - II

TYPE OF FIXTURES FOR SERVICE BUILDING (GREEN BUILDING)

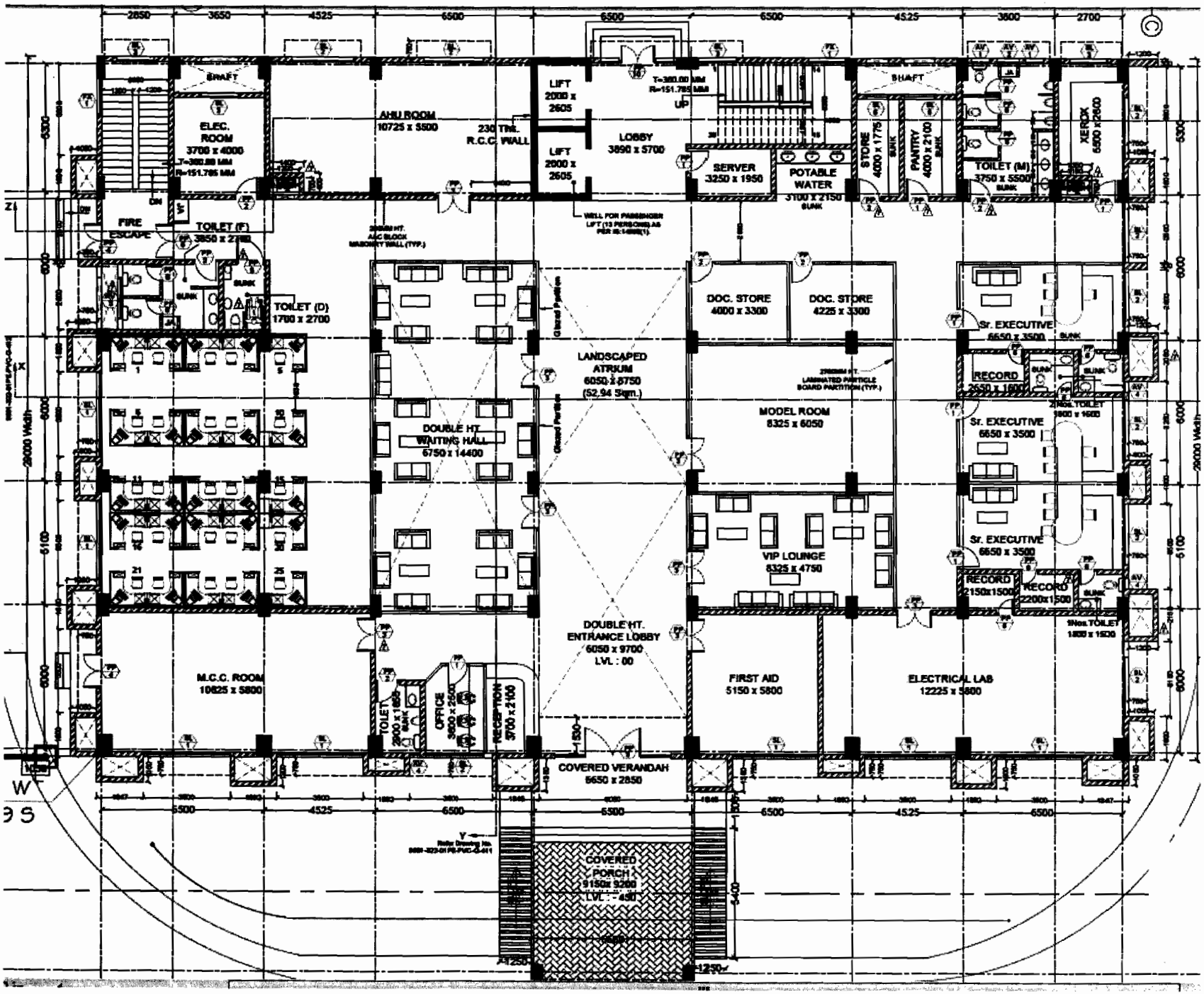
SL. No	FIXTURE TYPE	DETAILS
1	FC02	Twin 28 watts T5 type fluorescent fixture of rail type comprising CRCA coated, CRCA cover plate powder coated electronic ballast, etc.
2	FC01	Single 28 watts T5 type fluorescent fixture of rail type comprising CRCA channel powder coated, CRCA cover plate powder coated, electronic ballast, etc.
3	FC32	Twin 28 W T5 type decorative type mirror optic fluorescent fixture comprising extruded aluminium powder coated body, with mirror optic high purity aluminium side reflector/louvre, electronic ballast.
4	FC06	Twin 28 W T5 type industrial trough type, fluorescent fixture comprising single piece CRCA channel, CRCA cover plate powder coated & with MS reflector powder coated, electronic ballast, etc.
5	FC05	Single 28 W T5 type industrial trough type, fluorescent fixture comprising single piece CRCA channel, CRCA cover plate powder coated & with MS reflector powder coated, electronic ballast, etc.
7	CLI	2x18WCFL down lighters with CRCA housing, bright Aluminium reflector, white powder coated ring
9	CL1-D	Same as CL1 but with dimmable ballast instead of normal ballast
10	FC-30	4X13W Fluorescent lamp, decorative, recessed type, 600 x 600 size, High gloss aluminium, high gloss optic double parabolic, high efficiency and high Light output ratio, suitable to meet Light power density requirement as per ECBC.
11	CLIA	1x18WCFL down lighters with CRCA housing, bright Aluminium reflector, white powder coated ring
12	CLIA-D	Same as CL1A but with dimmable ballast instead of normal ballast
13	LED-18W	LED down light 18W rating with high lumen output.
14	LED–6W	LED down light 6W rating with high lumen output.

NOTE :

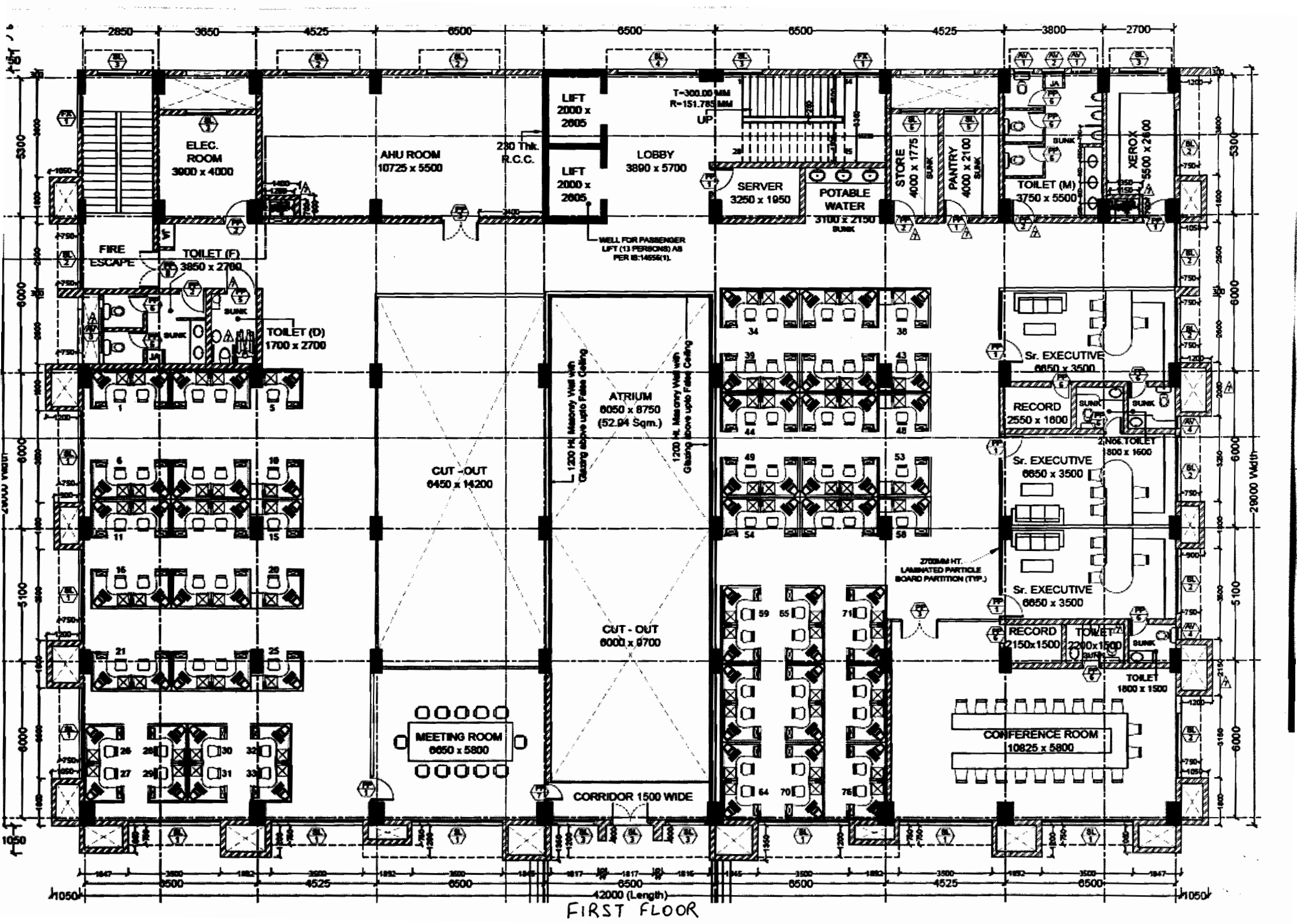
1. Bidder to quote suitable fixtures and lamps which shall meet light power density requirements and other requirements as per Energy Conservation Building Code (ECBC) in order to achieve GRIHA-4 rating for Service building (Green Building).

ANNEXURE – III

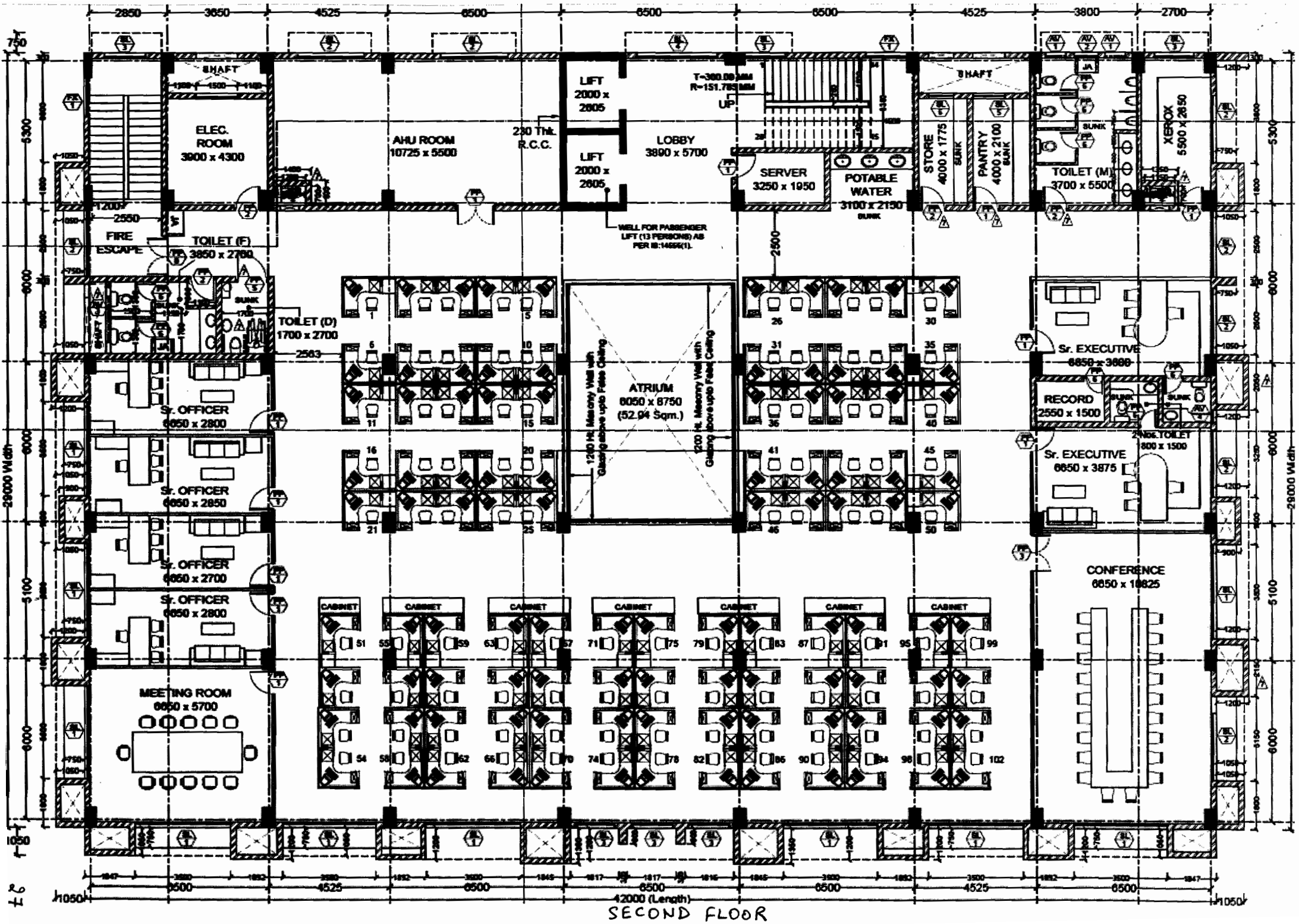
CIVIL ARCHITECTURE LAYOUT OF SERVICE BUILDING (FOR REFERENCE)



GROUND FLOOR


ELEC. ROOM 3000 x 4000
AHU ROOM 10725 x 5500
230 Thk. R.C.C.
LIFT 2000 x 2605
LIFT 2000 x 2605
LOBBY 3890 x 5700
T=300.00 MM R=151.785 MM UP
SERVER 3250 x 1950
POTABLE WATER 3100 x 2150
STORE 4000 x 1775
PANTRY 4000 x 2100
TOILET (M) 3750 x 5500
XEROX 5500 x 2600
FIRE ESCAPE
TOILET (F) 3850 x 2700
TOILET (D) 1700 x 2700
WELL FOR PASSENGER LIFT (13 PERSONS) AS PER IS:14856(1).
ATRIUM 6050 x 8750 (52.94 Sqm.)
1200 Ht. Masonry Wall with Glazing above upto False Ceiling
CUT -OUT 6450 x 14200
CUT - OUT 6000 x 8700
Sr. EXECUTIVE 6650 x 3500
RECORD 2550 x 1600
2 NOS. TOILET 800 x 1600
Sr. EXECUTIVE 6650 x 3500
2700MM HT. LAMINATED PARTICLE BOARD PARTITION (TYP.)
Sr. EXECUTIVE 6650 x 3500
RECORD 2150x1500
TOILET 2200x1500
TOILET 1800 x 1500
MEETING ROOM 6650 x 5800
CONFERENCE ROOM 10825 x 5800
CORRIDOR 1500 WIDE
42000 (Length)
29000 Width

FIRST FLOOR



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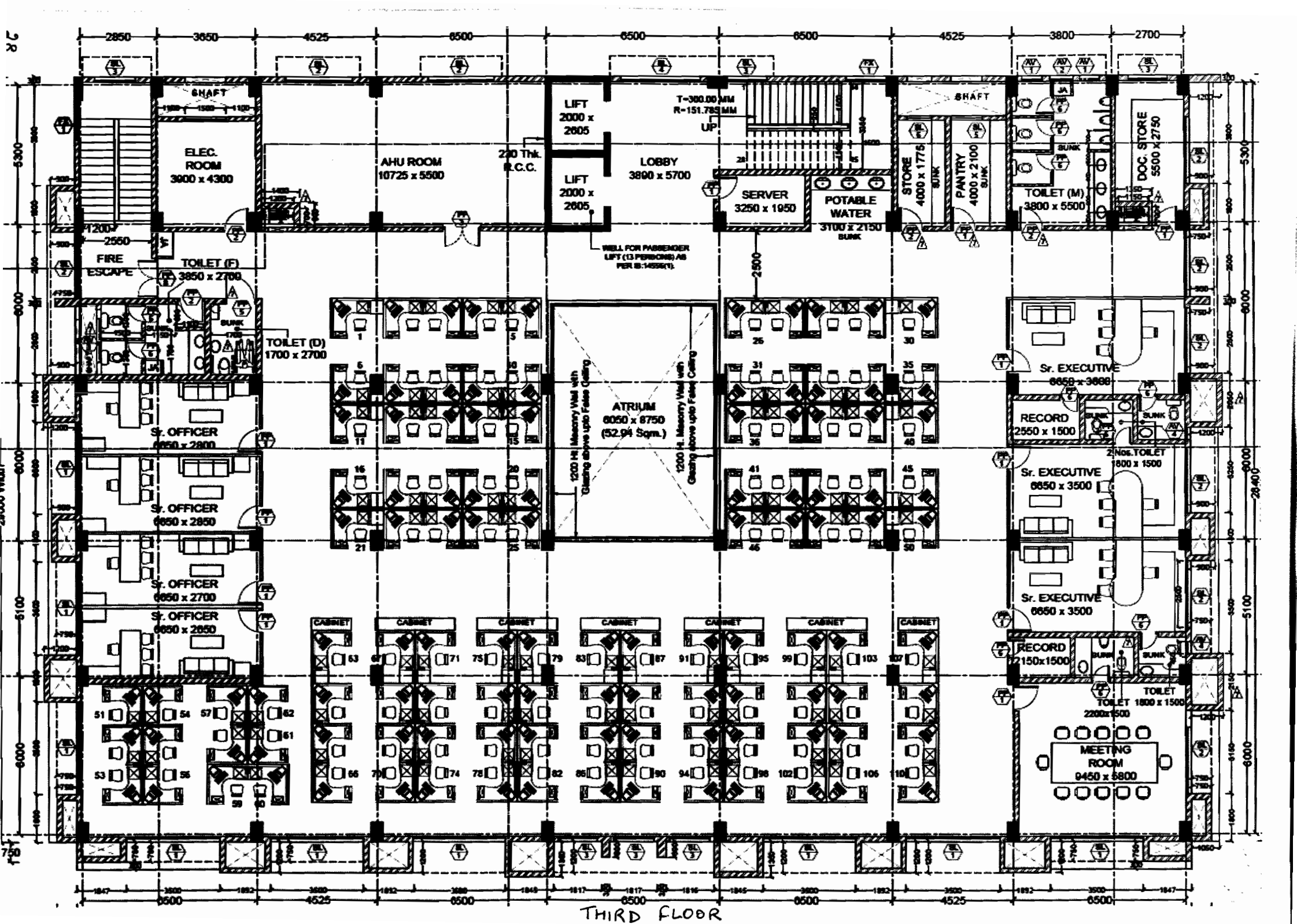
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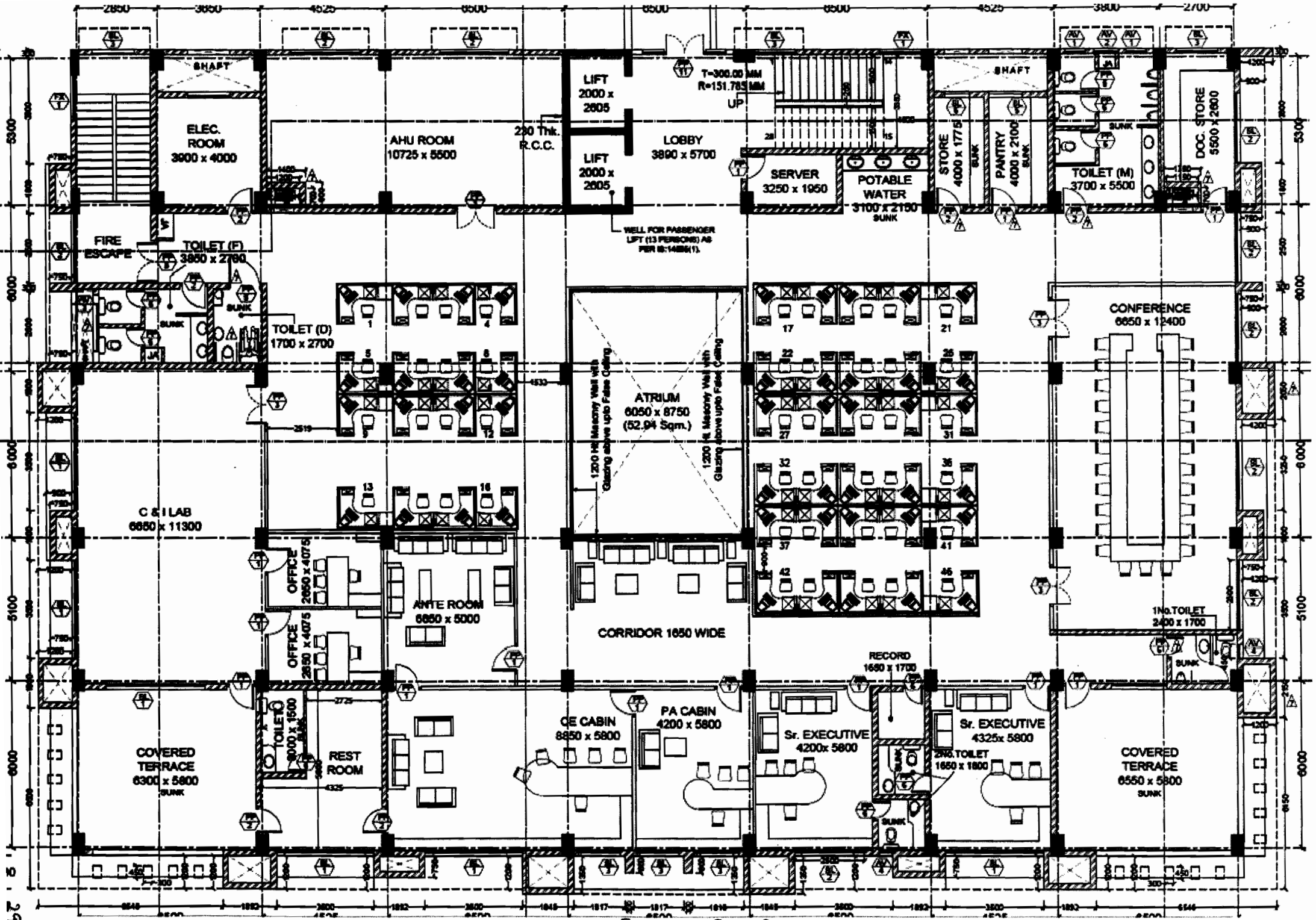
AHU ROOM 10725 x 5500
200 Thk. R.C.C.
LIFT 2000 x 2605
LIFT 2000 x 2605
LOBBY 3890 x 5700
T=380.00 MM R=151.78 MM UP
SERVER 3250 x 1950
POTABLE WATER 3100 x 2150
STORE 4000 x 1775
PANTRY 4000 x 2100
SHAFT
TOILET (M) 3800 x 5500
DOC. STORE 5500 x 2750
FIRE ESCAPE
TOILET (F) 3850 x 2700
TOILET (D) 1700 x 2700
WELL FOR PASSENGER LIFT (13 PERSONS) AS PER IS:14594(1).
ATRIUM 6050 x 8750 (52.94 Sqm.)
1200 Ht. Masonry Wall with Glazing above upto False Ceiling
1200 Ht. Masonry Wall with Glazing above upto False Ceiling
Sr. OFFICER 6650 x 2800
Sr. OFFICER 6650 x 2850
Sr. OFFICER 6650 x 2700
Sr. OFFICER 6650 x 2650
Sr. EXECUTIVE 6650 x 3600
RECORD 2550 x 1500
2 Nos. TOILET 1800 x 1500
Sr. EXECUTIVE 6650 x 3500
Sr. EXECUTIVE 6650 x 3500
RECORD 2150x1500
TOILET 1800 x 1500
TOILET 2200x1500
MEETING ROOM 9450 x 5800
CABINET
BUNK
2850
3650
4525
6500
6500
6500
4525
3800
2700
28400

THIRD FLOOR



FOURTH FLOOR

ANNEXURE-A : LIST OF MAKES (SUB-VENDOR ITEMS)

NTPC	PROJECT:SCCL 2X600 MW ADILABAD	LIST OF ITEMS REQUIRING QUALITY PLAN		REF NO.:9596-108			
	PACKAGE: TG	AND SUBCONTRACTOR APPROVAL		REV NO.:00			
	CONTRACTOR: BHEL PEM	SUB SYSTEM: TG & AUX - ELECTRICAL					
	CONTRACT NO.:CS-9596-108			DATE:10.05.2011			
		SPACEAGE SWTGR. LTD	BAWAL	A	I		
		KGS ENGINEERING	CHENNAI	A	I		
26	GALVANISED FLEXIBLE CABLE TRAYS SUPPORT SYSTEM	INAR PROFILE	VISHAKHAPATNAM	A	I		GALV. AT VISKHA STEEL
		VATCO	MUMBAI	A	I		GALV. AT SIGMA GALV
		AMTECH ENGINEERING	PUNE	A	I		GALV AT B G SHIRKE, PUNE
		INDIANA GRATINGS	PUNE	A	I		GALV AT GALV. AT POONA GALV
		INDUSTRIAL PERFORATION	KOLKATA	A	I		GALV. AT UNISTAR GALV
27	HT CABLE TERMINATION KITS & STRAIGHT THROUGH JOINTING KIT	3 M ELECTRO & COMMUNICATION	PUNE	A	III		STRAIGHT THROUGH JOINTS TAPEX TYPE ONLY. TERMINATION KIT TAPEX/PUSH ONE TYPE
		HARI CONSOLIDATED PVT LKTD.	DELHI	*A	III		UPTO 11 KV FOR HEAT SHRINKABLE TYPE; * CONDITIONS APPLY
		RAYCHEM	MUMBAI	A	III		HEAT SHRINKABLE TYPE
28	FIRE SEALING SYSTEM (I) TYPE-A MATERIAL SUPPLIER (Sub-QR Item)	3 M INDIA	BANGALORE	A	III		LOT ALONGWITH MANUF.TC
		DOW CORNING	USA	A	III		DO
29	TYPE-B MATERIAL SUPPLIER (Sub-QR Item)	LLOYDS	DELHI	A	III		DO
		SIGNUM	NAGPUR	A	III		DO
		VIJAY SYSTEM ENGINEERING PVT. LTD.	MUMBAI	A	III		DO
30	EXECUTION AGENCY FOR ABOVE	3M,LLOYDS, SIGNUM, VIJAY FIRE, DOW					
31	CATHODIC PROTECTION	RAYCHEM	MUMBAI	A	I		
		MIT CORR	MUMBAI	A	I		
		CAPITAL TEST	DELHI	A	I		
32	BATTERY CHARGER (Sub-QR Item)	AMARA RAJA	TIRUPATI	A	I		
		HBL-POWER	HYDERABAD	A	I		
		CHHABI ELECTRICAL	JALGAON	A	I		
		CALDYNE	KOLKATA	A	I		
		STATCON	NOIDA	A	I		
		DUBAS	BANGALORE	A	I		
33	GI PIPES	BIS LICENSEE					
34	GI CONDUIT/EPOXY COATED CONDUIT	BIS LICENSEE					
35	FLEXIBLE CONDUITS	PLICA	GHAZIABAD	A	I		
36	JUNCTION BOXES	BHEL APPROVED SOURCES		A	I		
37	FRP JUNCTION BOXES	BHEL APPROVED SOURCES		A	I		
38	CABLE GLAND	SUNIL & CO	KOLKATA	A	III		
		ARUP ENGINEERING	KOLKATA	A	III		
		COMET	MUMBAI	A	III		
		QUALITY PRECISION	KOLKATA	A	III		
		STANDARD METAL INDUSTRIES	MUMBAI	A	III		
39	CABLE LUG	DOWELL	MUMBAI	A	III		
		3D	UMBERGAON	A	III		
		CHETNA	NASIK	A	III		
40	ALUMINIUM LADDER	BHEL APPROVED SOURCES			III		

VIJAY KR VERMA
PEM-V.D

NTPC	PROJECT:SCCL 2X600 MW ADILABAD	LIST OF ITEMS REQUIRING QUALITY PLAN		REF NO.:CS-9596-108			
	PACKAGE: TG	AND SUBCONTRACTOR APPROVAL		REV NO.:00			
	CONTRACTOR: BHEL PEM	SUB SYSTEM: TG & AUX - ELECTRICAL					
	CONTRACT NO.:CS-9596-108			DATE:10.05.2011			
41	LIGHTING POLE	BIS LICENSEE AS PER IS 2713& Bajaj - Pune			I		Part of station lighting packg.
42	LUMINARIES	CROMPTON	MUMBAI	A	I		
		BAJAJ ELECTRICALS	MUMBAI	A	I		Part of station lighting packg
		PHILIPS	KOLKATA	A	I		
		WIPRO	MUMBAI	A	I		
43	LAMPS	CROMPTON	MUMBAI	A	III		Part of station lighting packg
		BAJAJ ELECTRICALS	MUMBAI	A	III		
		PHILIPS	KOLKATA	A	III		
		WIPRO	MUMBAI	A	III		
44	LIGHTING PANELS	POSITRONICS	VADODARA	A	I		Part of station lighting packg
		MIMIC & CONTROL	KOLKATA	A	I		
		L&T	COIMBATOR/MUMBAI	A	I		
		MAKTEL	VADODARA	A	I		WALL MOUNTED TYPE ONLY
		JAKSON	NOIDA	A	I		
		SWITCHING CIRCUIT	KOLKATA	A	I		WALL MOUNTED TYPE ONLY
		SARVANA SWITCHGEAR	BANGALORE	A	I		
		ERA ELECTRICALS	MURTHAL(SONEPAT)	A	I		
		C&S	NOIDA/HARDWAR	A	I		
		GEII	BANGALORE	A	I		
		ICA	MUMBAI	A	I		
		ISC	MUMBAI	A	I		
		SIEMENS	MUMBAI	A	I		
		AVAIDS TECHNOVATORS	GURGAON	A	I		
		JASPER	GURGAON	A	I		
		VIDYUT CONTROL	GHAZIABAD	A	I		
		ANAND POWER	NOIDA	A	I		
		UNILEC	GURGAON	A	I		
		PYROTECH	UDAIPUR	A	I		
45	DG CONTROL PANEL	PYROTECH	UDAIPUR	A	I		
		JAKSON	GR.NOIDA	A	I		
		SARVANA SWITCHGEAR	BANGALORE	A	I		
		POSITRONICS	BARODA	A	I		
		Power Control Equipment	BANGALORE	DR	I		
		Powerica	MUMBAI	DR	I		
		Sterling generators Pvt ltd	SILVASA	DR	I		
46	LIGHTING WIRE	BIS LICENSEE			III		Part of Station Lighting Package
47	INDUSTRIAL RECEPTACLES & BOXES	SCHNEIDER	NASIK	A	III		
		BCH	FARIDABAD	A	III		
		AJMERA	MUMBAI	A	III		
		SAKTHI & CROWN	CHENNAI	A	III		
48	LIGHTING MAST WITH RAISE & LOWER TYPE LANTERN CARRIAGE	BAJAJ ELECTRICALS	PUNE	A	I		Part of Station Lighting Package
		CGL	MUMBAI	A			

ANNEXURE - B

NOS. OF DRAWINGS/ DOCUMENTS REQUIRED FROM VENDOR

1.0 Document distribution schedule for the project shall be as below after award of contract for All Documents / Drawings.

S. NO.	DESCRIPTION	HARD COPY (NO.)	SOFT COPY (AUTOCAD/PDF)	CD
1	All drawings / documents – first submission / resubmission	4	YES	-
2	Final drawings / documents after approval for distribution purpose	10	YES	-
3	As built drawings / documents	10	YES	1
4	Instruction manual (erection, O&M),commissioning procedure, data books/plant handbooks / catalogues etc.	7	-	-
5	Performance and guarantee test report	11	YES	1

2 X 600 MW SINGARENI, ADILABAD TPP

BOQ CUM PRICE SCHEDULE FOR SERVICE BUILDING (GREEN BUILDING) LIGHTING - SUPPLY

ANNEXURE - C

A. MAIN ITEM

SL. NO.	ITEM CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE (EX-WORKS)	TOTAL PRICE (EX-WORKS)
1	558-11255-A	GREEN BUILDING LIGHTING - ECBC COMPLIANCE	LOT	1		
1.1		LUMINAIRE TYPE FC-30 (WITH DIMMABLE BALLAST)	NOS	250		
1.2		LUMINAIRE TYPE FC-30 (WITHOUT DIMMABLE BALLAST)	NOS	50		
1.3		LUMINAIRES TYPE FC-06 (WITH DIMMABLE BALLAST)	NOS	5		
1.4		LUMINAIRES TYPE FC-06 (WITHOUT DIMMABLE BALLAST)	NOS	75		
1.5		LUMINAIRE TYPE LED - 18W	NOS	200		
1.6		LUMINAIRE TYPE LED - 6W	NOS	200		
1.7		LUMINAIRE TYPE FC-32 (WITH DIMMABLE BALLAST)	NOS	5		
1.8		LUMINAIRE TYPE FC-32 (WITHOUT DIMMABLE BALLAST)	NOS	10		
1.9		LUMINAIRE TYPE SS-62	NOS	20		
1.10		DOWNLIGHTER- 1X18W CFL/FLOURESCENT (WITH DIMMABLE BALLAST)	NOS	5		
1.11		DOWNLIGHTER- 1X18W CFL/FLOURESCENT (WITHOUT DIMMABLE BALLAST)	NOS	5		
1.12		DOWNLIGHTER- 2X18W CFL/FLOURESCENT (WITH DIMMABLE BALLAST)	NOS	5		
1.13		DOWNLIGHTER- 2X18W CFL/FLOURESCENT (WITHOUT DIMMABLE BALLAST)	NOS	30		
1.14		LUMINAIRE TYPE METAL HALIDE - 150W	NOS	10		
1.15		LUMINAIRES TYPE FC-05	NOS	5		
1.16		LUMINAIRE5 TYPE FC-01	NOS	5		
1.17		LIGHTING LAMP 13W, T5, FL TUBE	NOS	1200		
1.18		LIGHTING LAMP 28W, T5, FL TUBE	NOS	200		
1.19		LIGHTING LAMP 18W	NOS	80		
1.20		LIGHTING LAMP 150W HPSV (SON-T)	NOS	20		
1.21		LIGHTING LAMP 150W METAL HALIDE	NOS	10		
1.22		LIGHTING CONTROL SYSTEM	LOT	1		
1.23		OCCUSWITCH STANDALONE OCCUPANCY SENSOR WITH SAMPS RELAY	NOS	200		
1.24		EXIT SIGN - 5W PER FACE	NOS	5		
2	558-11027-A	FLEXIBLE CONDUITS,LEAD COATING 20MM DIA	MTR	500		
3	558-11029-A	GI CONDUITS 1.6MM THK EPOXY 25MM DIA	MTR	100		
4	558-11030-A	GI CONDUITS,1.6MM THICK, 20MM DIA	MTR	5000		
5	558-11031-A	GI CONDUITS,1.6MM THICK, 25MM DIA	MTR	3000		
6	558-11034-A	GI WIRE 14 SWG WIRE	MTR	10000		
7	558-11038-A	JUNCTION BOXES TYPE JB-F	NOS	800		
8	558-11121-A	RECEPTACLES TYPE RA	NOS	20		
9	558-11123-A	RECEPTACLES TYPE RB	NOS	200		
10	558-11124-A	RECEPTACLES TYPE RC	NOS	5		
11	558-11143-A	WIRES 1X1.5 MM2 CU PVC	MTR	9000		
12	558-11145-A	WIRES 1X2.5 MM2 CU PVC	MTR	7500		
13	558-11146-A	WIRES 1X4.0 MM2 CU PVC	MTR	1500		

NOTE :

1. Lighting of Service building shall be designed as per ECBC (Energy Conservation Building Code) compliant building achieving energy efficiency. In addition Green Building concept shall be incorporated in the lighting design of Service building to achieve GRIHA-4 rating.

2. Lighting Control system shall include all items (like Dali controlller, feed through controller, network getway, master/ manual lighting control, universal sensor,manual user control panel, BMS interface, control cables etc.) required for control of lighting in service building to achieve GRIHA- 4 rating as per technical specification. LOT indicated above shall mean all items required for completion of the control system in all respects.

3. Bidder to quote suitable fixtures and lamps which shall meet light power density requirements and other requirements as per Energy Conservation Building Code (ECBC) in order to achieve GRIHA-4 rating for Service building (Green Building).

4. All Fluorescent fixtures shall have electronic ballast. All fluorescent fixtures shall be with 28W, T5 fluorescent fittings.

5. The unit rates of supply & installation for all equipment and services quoted by the bidder shall be firm for a variation of quantities limited to:
a) ±30% of total order value till finalization of engineering details & BOQ.
b) +10% of the total order value in addition to (a) above, till the completion of job.

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

2 X 600 MW SINGARENI, ADILABAD TPP

BOQ CUM PRICE SCHEDULE FOR SERVICE BUILDING (GREEN BUILDING) LIGHTING - E&C

ANNEXURE - D

B. ERECTION AND COMMISSIONING						
SL. NO.	ITEM CODE	DESCRIPTION	UNIT	QTY	UNIT PRICE (EX-WORKS)	TOTAL PRICE (EX-WORKS)
1	558-11255-C	GREEN BUILDING LIGHTING - ECBC COMPLIANCE	LOT	1		
1.1		LUMINAIRE TYPE FC-30 (WITH DIMMABLE BALLAST)	NOS	250		
1.2		LUMINAIRE TYPE FC-30 (WITHOUT DIMMABLE BALLAST)	NOS	50		
1.3		LUMINAIRES TYPE FC-06 (WITH DIMMABLE BALLAST)	NOS	5		
1.4		LUMINAIRES TYPE FC-06 (WITHOUT DIMMABLE BALLAST)	NOS	75		
1.5		LUMINAIRE TYPE LED - 18W	NOS	200		
1.6		LUMINAIRE TYPE LED - 6W	NOS	200		
1.7		LUMINAIRE TYPE FC-32 (WITH DIMMABLE BALLAST)	NOS	5		
1.8		LUMINAIRE TYPE FC-32 (WITHOUT DIMMABLE BALLAST)	NOS	10		
1.9		LUMINAIRE TYPE SS-62	NOS	20		
1.10		DOWNLIGHTER- 1X18W CFL/FLOURESCENT (WITH DIMMABLE BALLAST)	NOS	5		
1.11		DOWNLIGHTER- 1X18W CFL/FLOURESCENT (WITHOUT DIMMABLE BALLAST)	NOS	5		
1.12		DOWNLIGHTER- 2X18W CFL/FLOURESCENT (WITH DIMMABLE BALLAST)	NOS	5		
1.13		DOWNLIGHTER- 2X18W CFL/FLOURESCENT (WITHOUT DIMMABLE BALLAST)	NOS	30		
1.14		LUMINAIRE TYPE METAL HALIDE - 150W	NOS	10		
1.15		LUMINAIRES TYPE FC-05	NOS	5		
1.16		LUMINAIRES TYPE FC-01	NOS	5		
1.17		LIGHTING CONTROL SYSTEM	LOT	1		
1.18		OCCUSWITCH STANDALONE OCCUPANCY SENSOR WITH 5AMPS RELAY	NOS	200		
1.19		EXIT SIGN - 5W PER FACE	NOS	5		
2	558-11027-C	FLEXIBLE CONDUITS,LEAD COATING 20MM DIA	MTR	500		
3	558-11029-C	GI CONDUITS 1.6MM THK EPOXY 25MM DIA	MTR	100		
4	558-11030-C	GI CONDUITS,1.6MM THICK, 20MM DIA	MTR	5000		
5	558-11031-C	GI CONDUITS,1.6MM THICK, 25MM DIA	MTR	3000		
6	558-11034-C	GI WIRE 14 SWG WIRE	MTR	10000		
7	558-11038-C	JUNCTION BOXES TYPE JB-F	NOS	800		
8	558-11121-C	RECEPTACLES TYPE RA	NOS	20		
9	558-11123-C	RECEPTACLES TYPE RB	NOS	200		
10	558-11124-C	RECEPTACLES TYPE RC	NOS	5		
11	558-11143-C	WIRES 1X1.5 MM2 CU PVC	MTR	9000		
12	558-11145-C	WIRES 1X2.5 MM2 CU PVC	MTR	7500		
13	558-11146-C	WIRES 1X4.0 MM2 CU PVC	MTR	1500		

NOTE :

1. Lighting of Service building shall be designed as per ECBC (Energy Conservation Building Code) compliant building achieving energy efficiency. In addition Green Building concept shall be incorporated in the lighting design of Service building to achieve GRIHA-4 rating.

2. Lighting Control system shall include all items (like Dali controlller, feed through controller, network getway, master/ manual lighting control, universal sensor,manual user control panel, BMS interface, control cables etc.) required for control of lighting in service building to achieve GRIHA- 4 rating as per technical specification. LOT indicated above shall mean all items required for completion of the control system in all respects.

3. 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.

4. The unit rates of supply & installation for all equipment and services quoted by the bidder shall be firm for a variation of quantities limited to:
a) ±30% of total order value till finalization of engineering details & BOQ.
b) +10% of the total order value in addition to (a) above, till the completion of job.

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

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

7. Cost of E&C for lighting fixture shall be inclusive of cost of lamp installation.

TECHNICAL SPECIFICATION FOR

LIGHTING SYSTEM (SUPPLY)

SPECIFICATION NO. PE-TS-381-558-E002

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 purchaser to the successful bidder shall furnish the responsibility of vendor if indicated in Data Sheet A. Engineering inputs.

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 The requirements given in 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.

1.4 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 service building (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 and AC Emergency.

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) 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. AC Emergency lighting requirement

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

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.

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

4.2.4 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.

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.

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.

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). 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 orientation of luminaires. Type of luminaires, source of power supply (AC Normal, AC 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 14 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 Street Lighting Luminaires (Other than Fluorescent Luminaire)

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

5.2.2.2 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.

5.2.2.3 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.

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

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

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

5.2.3 Flood Lighting Luminaires

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

5.2.3.2 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.

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

5.2.3.4 Luminaire shall be provided with special lamp centering and focussing device ensuring good beam control.

5.2.3.5 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"

5.2.3.6 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.

5.2.3.7 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.

5.3 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, minimum 20SWG thick, securely fixed by fastening device of captive type.

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. Ballast windings shall have maximum operating temperature of 120°C without rated temperature rise marking.

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.

5.7.11 It shall be Flicker-free warm start, ideal for areas with high switching frequency.

5.7.12 Electronic Ballast shall be of such design that minimum 25% reduction in energy consumption at constant luminous flux compared with conventional gear.

5.7.13 Electronic Ballast shall not be caused to high harmonic distortion.

5.7.14 Electronic Ballast shall provide constant light independent of mains voltage fluctuation.

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 JUNCTION BOXES

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

6.0.2 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.

The boxes and cover shall be hot dip galvanised.
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.

6.0.3 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.

6.0.4 The junction boxes shall be of following type:

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.

6.1 FUSE BOXES

6.1.1 Boxes shall be suitable for accommodating fuses, neutral links and termination of cables on each side.

6.1.2 Boxes shall be of rectangular shape and fabricated out of sheet steel, hot dip galvanised and of weather proof construction.

6.1.3 Sheet steel thickness shall be 1.6 mm, unless mentioned otherwise in Data Sheet A.

6.1.4 Unless specified otherwise in Data Sheet A, degree of protection of fuse boxes shall be IP:55.

6.1.5 Galvanisation shall be done corresponding to the sheet thickness and as per the applicable standard.

6.1.6 Boxes shall be provided with a hinged lockable door with neoprene gasket lining all over. Lock shall be operable with an allen key.

6.1.7 Terminals shall be stud type suitable for ring type lugs. The size of cable shall be intimated during detailed engineering.

6.1.8 Boxes shall be provided with suitable knock outs for conduit / cable connections.

6.1.9 Two earthing terminals suitable for GI earthing wire shall be provided for each box.

6.1.10 Boxes shall be suitable for mounting on walls, structural members etc. Suitable welded fixing brackets shall be provided for this purpose.

6.1.11 Fuse boxes shall be provided with a danger plate for the rated line to line voltage.

6.1.12 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

6.2 RECEPTACLES

6.2.1 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.

6.2.2 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.

6.2.3 Steel boxes shall be hot dip galvanised as per the requirements of applicable standard corresponding to the sheet thickness.

6.2.4 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.

6.2.5 The boxes shall be provided with neoprene rubber gaskets to make them moisture and dust proof.

6.2.6 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.

6.2.7 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.

6.3 LIGHTING CONTROL SWITCH-BOXES

6.3.1 The switch-boxes shall be of bent steel construction, fabricated of 14SWG MS steel, with 6 mm thick decorative bakelite or 3 mm thick perspex sheet cover. The boxes shall be hot-dip galvanised.

6.3.2 The switch-boxes shall be suitable for surface mounting as well as flush mounting in brick walls. In the office areas where false ceiling is provided, they shall be flush mounted type on the walls with only the switch knob projecting outside.

6.3.3 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.

6.3.4 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.

6.3.5 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.

6.3.6 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 INSPECTION & TESTING

7.1 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.

7.2 All the components and completely assembled equipment shall be tested as per the latest edition of standards indicated in Annexure-I.

7.3 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.

7.4 Functional testing shall be carried out for Lighting Distrbution Boards.

7.5 All manufacturing processes viz. machining, sheet forming, electroplating, wire routing, cleating & crimping, assembly, surface preparation shall conform to good manufacturing practices.

7.6 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.

7.7 Safety interlocking verification shall be done.

7.8 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.

7.9 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.

8.0 QUANTITY VARIATION

8.1 Quantities of various items are indicated in BOQ as part of Section C, Volume IIB for the purpose of bidding.

8.2 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.

8.3 Unless stated otherwise in Data Sheet A, the unit rates quoted by the bidder for various equipment shall be firm for a variation of quantities limited to as follows :

a) +30% of the total order value till the finalisation of engineering details and Master BOQ.

b) +10% of total order value till the completion of works at site.

9.0 TOOLS AND TACKLE

9.1 Tools & tackle which are essential to facilitate assembly, adjustments, erection, maintenance & dismantling of equipment shall be provided as part of equipment supplied.

9.2 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.

9.3 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.

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

10.0 DOCUMENTATION

10.1 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.

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

a) Complete technical literature on luminaires, accessories and lamps.
b) Catalogues / technical leaflets of all major components.
c) Deviations from the technical specification, if any, brought out in the enclosed "Schedule of Deviations" (Volume III).
d) Unpriced Price Schedules enclosed in Vol.III.

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

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

10.4 Documents to be submitted during detailed engineering of contract

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

a) Lighting calculations for indoor areas.
b) SLD of power distribution upto LPs.
c) Layout drawings for indoor areas
d) Conduit layout drawings.
e) Master Bill of Material.

10.4.2 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. Receptacles

f) Field Quality Plan as per General Technical Conditions.

g) Control Scheme for fluorescent, HPMV and HPSV luminaires.

h) Type test certificates.

i) Catalogues / leaflets

10.4.3 Operation and maintenance (O&M) manual :

10.4.3.1 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.

10.4.3.2 Draft O & M manual shall be submitted for approval

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

10.5 AS BUILT DRAWINGS

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

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

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

10.6 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

SOCKETS AND OTHER MISCELLANEOUS

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 28 Fluorescent, industrial box type base without any cover.

1.2 FC02 2 x 28 Fluorescent, industrial box type base without any cover.

1.3 FC05 1 x 28 Fluorescent, industrial box type base and vitreous enamelled side reflectors.

1.4 FC06 2 x 28 Fluorescent, industrial box type base and vitreous enamelled side reflectors.

1.5 FC30 4 x 13 Fluorescent, decorative, recessed type, 600 x 600 size high gloss aluminium, high gloss optic double parabolic.

1.6 FC32 2 x 28 Fluorescent, decorative, surface mounted with mirror optic reflector.

2.0 **High Pressure Sodium Vapour (HPSV) Lamp Luminaire**

2.1 SS62 1 x 150 Sodium, street light with one piece cast aluminium body.

STATION LIGHTING SYSTEM

ANNEXURE-III : LIST OF MAKES (SUB-VENDOR ITEMS)

SL. NO.	NAME OF ITEM / COMPONENTS	NAME OF SUB-VENDOR
1	LUMINAIRES & LAMPS	BAJAJ ELECTRICALS
		PHILIPS INDIA LTD.
		CROMPTON GREAVES
		SPACEAGE SWITCHGEAR LTD.
		SURYA ROSHNI LIMITED.
		WIPRO LTD.
		HAVELLS INDIA LTD.
		HPL ELECTRIC & POWER PVT. LTD.
2	DICHORIC SPOT LIGHT FIXTURES	PHILIPS INDIA LTD.
		GEMINI WITH OSRAM LAMP
3	DECORATIVE RECEPTACLES, SWITCH BOXES	ANCHOR KENWOOD ELECTRICAL
		ELLORA
		FLEXPRO ELECTRICALS PVT. LTD.
		BAJAJ ELECTRICALS LTD.
		S.B. ELECTRICAL ENGG. CORP.
		AJMERA INTERNATIONAL
4	MODULAR SWITCH BOARD	ANCHOR KENWOOD ELECTRICAL
		ELLORA
		FLEXPRO ELECTRICALS PVT. LTD.
		HAVELLS
5	JUNCTION BOXES	JASPER ENGINEERS PVT. LTD.
		BOSE CORPORATION
		SHRENIK & COMPANY
		S B ELECTRICAL ENGG. CORPN
		BAJAJ ELECTRICALS LTD.
		AJMERA INTERNATIONAL
		POWERTECH SWITCHGEARS (INDIA) PVT. LTD.
		ELECTRO CONTROLS & DEVICES
6	INDUSTRIAL RECEPTACLES & HAND LAMPS	AJMERA INDUSTRIES & ENGG. WORKS
		CROMPTON GREAVES
		CYCLO ELECTRIC DEVICE & SERV. CO.
		BCH
		BEST & CROMPTON
		SHRENIK & COMPANY
7	PVC WIRES	BIS APPROVED MAKES
8	EARTHING GI WIRE / FLAT / ROD / STRUCTURAL STEEL	A.V. ENGINEERING
		APT ENGINEERING WORKS
		ARUN ENGG WORKS
		GRAM ENGINEERING
		INDIANA CABLE TRAYS CORPORATION
		M.J. WORKS
		METTALITE INDUSTRIES
		NATIONAL GALVANISING CO.
		PRESS METAL CORPORATION
		JAMNA METAL COMPANY
		SYSTEM ENCL. ENTERPRISES
		PARCO ENGINEER
9	GI / EPOXY CONDUIT	BIS CERTIFIED SOURCES
10	FLEXIBLE LEAD COATED CONDUIT	PLICA
11	ELECTRO-GALVANISED FLEXIBLE CONDUIT	REPUTED MAKE
12	EXIT SIGN	REPUTED MAKE
13	TERMINALS BLOCK(FIXED/DRAWOUT)	PHOENIX
		CONNECT WELL
		ELEMEX
		WAGO
		ESSEN DEINKI
		TECHNOPLAST
14	SELECTOR SWITCH	KAYCEE
		ALSTOM LTD.
		GE-POWER
		SALZER
15	PHOTOELECTRIC SWITCH	REPUTED MAKE

NOTE : Sub vendor list is for reference only. Makes of sub-vendor and equipment/components shall be subject to Customer/BHEL approval during detailed engineering without any implication on cost and delivery.

TECHNICAL SPECIFICATION FOR

LIGHTING SYSTEM (INSTALLATION)

SPECIFICATION NO. PE-TS-381-558-E002

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.
Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.

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. The Battery Room installation shall be made with acid fume proof conduits.

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 (if applicable)

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 The unit rates of supply & installation (E & C) for all equipment and service quoted by the bidder shall be firm for a variation of quantities limited to

a. ±30% of total order value till finalisation of engineering details & BOQ.

b. +10% of the total order value in addition to (a) above, till the completion of job.

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

6.5 The bidder shall furnish unpriced price schedule of all equipment and services inclusive of E & C and recommended spares alongwith the technical bid.

TECHNICAL SPECIFICATION FOR

LIGHTING SYSTEM (CONDUIT)

SPECIFICATION NO. PE-TS-381-558-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

1.0 SYSTEM DESIGN DATA

1.1 Design Ambient : 50^0C

1.2 Details of Operating Parameters

a) AC Supply

i. Rated Voltage : 415 V

ii. Rated Frequency : 50 HZ

iii. Voltage variation: (Permissible) ± 10%

iv. Frequency variation (Permissible) : +5% to - 5%

v. Combined voltage & frequency variation (sum of absolutes permissible) : 10 %

vi. System fault level at rated voltage : 50 KA for 1sec

b) DC Supply

i. Rated Voltage : 220 V

ii. Voltage variation (Permissible) : 192-242 V

iii. System fault level at rated voltage : 20 KA

2.0 APPLICABLE STANDARDS : As per specification

3.0 LIGHTING CONCEPT

3.1 Areas

a) Location : [ ] Indoor [ ] Outdoor [√] Both

3.2 Types of supplies considered (other than AC Normal)

a) 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 : IP55

5.5 Non-Integral control gear box

a) Sheet thickness : 2 mm

b) Degree of protection : IP-55

c) Surface treatment : [ ] Painted [√] Galvanised

d) If galvanised

i. Wt. of Zinc : as per spec.
ii. Process : Hot dip

e) If painted

i. Colour to IS : N/A

ii. Minimum paint thickness : N/A

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

5.7 Tap setting for Ballasts

a) HPSV luminaires : 220 V

b) HPMV Luminaires : 220 V

5.8 Lamps

a) Type of Fluorescent Lamps : [√] Cool Daylight, energy efficient T5
[ ] White Light

b) Type of cap for incandescent lamp : [√] Screw Type [ ] Pin type

c) Type of HPMV lamp : [√] Clear
[ ] Fluorescent powder coated

d) Type of lamp cap for HPMV & HPSV : [√] Screw Type

e) Type of beam for

i. HPMV lamps : [ ] Short beam [ ] Long beam
[√]Both

ii. HPSV lamps : [ ] Short beam [ ] Long beam
[√]Both

6.0 DESIGN PARAMETERS OF MAIN EQUIPMENT

6.1 Receptacles

6.1.1 Material : Die cast Aluminium alloy

6.1.2 Sheet thickness : 2.5 mm

6.1.3 Galvanization : NA

a) Process : Hot dip

b) Wt. of zinc deposited : As per spec.

6.1.4 Degree of protection : IP-55

7.0 COMPONENT OF LIGHTING SYSTEM EQUIPMENT

7.0 Conduit (Rigid)

7.1 Rigid Conduit

7.1.1 Duty : Heavy duty type

7.1.2 Application standard : IS: 9537 Part I & II

7.1.3 Material : Cold rolled mild steel to IS: 226

7.1.4 Sheet thickness (minimum) : 1.6 mm upto and including 32 mm dia,
2.0mm above 32 mm & upto 50 mm dia

7.1.5 Surface treatment : Hot dip galvanizing inside & outside as per IS:2629

7.1.6 Min. Weight of zinc coating (gm/m^2) : 340 upto 32 mm dia,
460 above 32 mm & upto 50 mm dia

7.1.7 Min. Thickness of zinc coating (microns): 48 upto 32 mm dia, 65 above 32 mm & upto 50 mm dia
[By Elcometer]

7.1.8 Standard length approximate : 3 – 5 meters

8.0 **LABELING**

Requirement of Specification complied : [√] Yes [ ] No

9.0 **PAINTING** : As per spec.

9.1 Shade (As per IS:5) Outside/Inside : As per spec.

9.2 Finish

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

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

9.3 Paint Thickness(min) : As per spec.

10.0 **MAKE** : As per spec.

11.0 QUANTITY VARIATION (Limited to the value of the Contract)

a) Till the "Engineering" is complete : ± 30 % (As per spec.)

b) Till the "Erection" is complete : + 10 % (As per spec.)

1.0 SYSTEM DESIGN DATA

1.1 Design Ambient : °C

1.2 Details of Operating parameters

a) AC Supply

i. Rated voltage : V

ii. Rated frequency : Hz

iii. Voltage variation (Permissible) : %

iv. Frequency variation (Permissible) : %

v. Combined voltage & frequency variation (sum of absolutes permissible) : %

vi. System fault level at rated voltage :

b) DC Supply

i. Rated voltage : V

ii. Voltage variation (Permissible) : %

iii. System fault level at rated voltage :

2.0 APPLICABLE STANDARDS : As per Annexure-I

3.0 LIGHTING CONCEPT

3.1 Areas

a) Location : [ ] Indoor [ ] Outdoor [ ] Both

3.2 Types of supplies considered (other than AC Normal)

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 :

5.1.7 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

6.0 DESIGN PARAMETERS OF MAIN EQUIPMENT

6.1 Receptacles

6.1.1 Material :

6.1.2 Sheet thickness : mm

6.1.3 Galvanization

a) Process :

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

6.1.4 Degree of protection : IP :

7.0 **LABELING**

Requirement of specification : complied with [ ] Yes [ ] No

8.0 **PAINTING**

8.1 Shade (as per IS:5)

	Interior	Exterior
a) Receptacles :		

8.2 Finish

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

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

8.3 Paint thickness (min.) : microns

BHEL	QUALITY PLAN		CUSTOMER :			PROJECT TITLE	2X600MW SINGARENI TPP		SPECIFICATION : NUMBER :			
			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 P	AGENCY W	AGENCY V	REMARKS
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 DONE 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 2X600MW SINGARENI TPP	SPECIFICATION : NUMBER :
	SHEET 2 OF 4	BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02	SPECIFICATION : TITLE
		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
		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 2X600MW SINGARENI TPP	SPECIFICATION : NUMBER :
	SHEET 3 OF 4	BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02	SPECIFICATION : TITLE
		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
		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

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE 2X600MW SINGARENI TPP	SPECIFICATION : NUMBER :
	SHEET 4 OF 4	BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-558-00-Q-001, REV-02	SPECIFICATION : TITLE
		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	10	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

INSTRUCTIONS FOR QUALITY PLAN

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/component/assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The following guide lines may be noted:

Column 1- Serial Number

Column 2- Component/Operation- The component and/or operation being checked shall be given here.

Column 3- Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc..

Column 4- Category -'CR' stands for critical characteristic - affecting safety of equipment and personnel
'MA' stands for major Characteristic - affecting safety of equipment and personnel
'MI' stands for minor characteristic - affecting appearance etc.

Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.

Column 6- Extent of check, such as, 100, 10, 1 percent etc.

Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.

Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.

Column 9- Format of Record - Formats, log shets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.

Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'
The agency which verifies test certificates/inspection records and carries out audit check of the components/operation shall be written in sub-column 'V'

The agencies are codified as 1,2 & 3

'1' stands for (BHEL)

'1' * means the operation shall be cleared by BHEL before the start of the next operation.

'2' Stands for Vendor

'3' stands for sub-Vendor of the Vendor and so on.

Example :

Entry '3' in column 'P' means test./inspection to be performed by sub-Vendor's QC

Entry '2' in column 'W' means test./inspection to be witnessed by Vendor's QC

Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL

Column11l- Remarks - Any special remarks shall be given here.

NOTES :

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn bgy BHEL and all tests as per relevent specifications shall be carried out in their presence or in recognized Government Laboratory.
2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be presserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless other wise agreed.
3. For castings and forgings integral test specimens shall be provided, When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.
4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.
5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.
6. Wherever inspection by BHELs Purchaser/Third Party/Statutory authorities are mandatory, this shall be compiled with.
7. Inspection reports, log sheets, test reports/certificate. etc. shall be furnished to BHEL at the approproate stages or at the time of final inspection, as required.
8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.
9. The quality plan shall be submitted in minimum 4 copies with a soft copy of the same or in line with contract requirements.

Format of Memorandum of Understanding (MOU) between bidder (who is not a manufacturer of lighting fixtures) and bidders associate's(who is a BHEL approved Lighting fixtures manufacturer) for Station Lighting System Package on turnkey basis. To be executed on non judicial paper of Rs.100/- between the bidder and his associate.

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding is made in.....on.....of..... 20..

BETWEEN

(Bidder Name) having its registered Office at.....(hereinafter referred as 'Contractor' which expression shall unless excluded by or repugnant to the context, means and include its successors-in-interest and assigns)

AND

(name of associate) having its registered Office at.....(hereinafter referred as 'Associate' which expression shall unless excluded by or repugnant to the context, means and include its successors-in-interest and assigns)

Whereas Project Engineering Management, Bharat Heavy Electricals Ltd. (PEM-BHEL) Noida (hereinafter referred to as 'Employer') has issued invitation for bids bearing No..... dated..... for Station Lighting System package and requires that bidders who are not manufacturers of lighting fixtures are required to associate with BHEL approved lighting fixtures manufacturer for support for design of lighting system and supply of lighting fixtures.

Now this MOU witness and it is hereby agreed by the Contractor and Associate hereto as follows:

Whereas the Contractor and Associate hereto and interested to share their capabilities, strength and resources and co-operate for Station Lighting System package involving design, procurement, supply, erection, testing and commissioning of complete indoor and outdoor illumination system.

Balance engineering documents / drawings for the illumination system such as conduit layout etc. may be done by Contractor. Associate agrees to review these drawings on need base and where specifically desired by the Employer.

Detailed BOQ for the luminaries & lamps shall be worked out by Associate who will also be responsible to obtain approval for the same from the Employer and their customer. For this purpose Associates agrees to depute technical experts to Employer's and Employer's Customer's offices as and when required. Further Associate undertake coordination with inspection authority for supplies under his scope. Contractor is responsible for preparation of Detailed BOQ, Data Sheets etc. for all other items. Inputs whereas required for the same will be provided by the Associate who agrees to review the documents/data prepared by the contractor on a need base and where specifically desired by the Employer.

Contractor will be responsible for contract planning, site mobilization, storage, erection, commissioning and performance testing as per contract specification and project schedule. Associate shall provide engineering site support when found essential by Contractor and / or by Employer.

Contractor & Associate undertake to keep secret and confidential all information exchanged between themselves in connection with the agreement herein contemplated and not disclose any such information to any third party or person, except as required by the Employer for the successful execution of the project.

In the event of the contractor ordering the above agreed part on the Associate, we, the aforesaid Contractor and Associate do hereby undertake that we shall be jointly and severally responsible to the Employer for the successful completion and performance of the station Lighting System package. This is without the prejudice to any rights of the Employer against the contractor under the contract and / or guarantee.

This agreement shall be effective from the date of its execution by the contractor and Associate and shall terminate by mutual agreement only after obtaining prior written permission from the Employer who will have the sole discretion to reject such permission in the interest of the project.

VERIFICATION

The Contractor and his Associate fully endorse to the above statements made on this date, ... 20.. and verify to the true to the best of their knowledge and belief.

Signature & official Seal of (Contractor) (Associate)

Witnessed by (name, address and signature)

1.
2.