BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-378-316-017	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	DKS	SKS	RS
TITLE: **Illumination System for GIS Building, Control Room Building & Switchyard**		SIGN			
		DATE	04/01/18	04/01/18	
		GROUP	TBEM		
		WO No.	84007		

CUSTOMER	**Tamilnadu Generation and Distribution Corporation (TANGEDCO)**
CONSULTANT	**Desein Private Limited, New Delhi**
PROJECT	**400kV GIS at 2x660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS**
NOA Ref.	**CE/P/SE/M/P/EE-10/E/P/F.2X660MW ENNORE SEZ STTP/D60/DT 27.02.2014**

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Remarks: Bidder to note that data and details of Guaranteed Technical Particulars shall not be reviewed during Technical Review, hence compliance of Technical Specification shall be bidder's responsibility.

Rev	Date	Altered	Checked	Approved	

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Section 1: Scope, Technical Requirements and Quantities

1.1 SCOPE

1.1.1 This technical specification covers the requirements of design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to project site and unloading, storage, erection, testing & commissioning of complete **Illumination System for GIS Building, Control Room Building & Switchyard** complete in line with specification.

1.1.2 This section covers the specific technical requirements of **Illumination System for GIS Building, Control Room Building & Switchyard.** This constitutes minimum technical parameters for the above system as specified by the customer/TANGEDCO. The offered system shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

1.1.3 The Contract shall be on Bill of Quantity basis for the package. In case of change in scope after award of the contract, the additions/ deletions to the scope shall be as per the breakup unit rates for all the equipment and services furnished by the bidder in his offer. The bidder shall be responsible for the design and verification of the **complete illumination system, demonstration of lux levels and other criterion at site.**

1.1.4 After placement of order, the bidder has to design the system as per relevant standard/codes to the satisfaction of BHEL/TANGEDCO.

1.1.5 It is not the intent to specify herein all the details of design and manufacturing. The equipment and the system 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 BHEL/TANGEDCO, who will interpret the meaning of drawings and specifications and shall be entitled to reject material, which in his judgment is not in full accordance herewith.

1.1.6 The bidder shall have deemed to have understood completely all the tender drawings and documents and quoted accordingly.

1.1.7 It is the responsibility of the successful bidder to obtain necessary approval/clearance from statutory organizations wherever applicable for the equipment/ systems under the scope specified.

1.1.8 The specification comprises of following sections,

Section-1 :	Scope, Project specific technical requirements & Bill of Quantities.
Section-2 :	Specific technical requirements for the equipment under scope of supplies.
Section-3 :	Project Details and General technical requirements for all equipment under the Project.
Section-4 :	Annexures

In case of any discrepancies between the requirements mentioned under different Sections, order of precedence shall be in the same order as listed above.

1.1.9 No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer as per Annexure-B.

1.1.10 The equipment is required for the following project:

Name of the Customer Tamilnadu Generation and Distribution Corporation

(TANGEDCO)

Name of consultant	Desein Private Limited, New Delhi
Name of the Project	400kV GIS at 2x660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

1.1.11 The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 Illumination system requirement

Illumination system, illumination system design, illumination levels for various areas, luminaries type and low voltage power services for following areas shall be required,

(i) Switchyard control room building, GIS building & Ventilation Room.

(ii) Outdoor switchyard area

The illumination system for transformer and reactor yard area shall be under the **scope of power plant package.**

1.2.2 Design criterion for illumination system: The illumination System shall comprise of following,

(i) AC normal lighting system

(ii) AC emergency lighting system

(iii) DC emergency lighting system

(iv) Portable emergency lighting system

(v) Emergency exit lamp/ sign board

1.2.3 The average Illumination levels & type of fixtures for illumination system

The guaranteed average illumination levels (Lux level) & type of fixtures shall be as follows,

Sl. No.	Location/ Area/ Structure	Average Illumination (Lux)	Type of Luminaire	Type of Luminaries
A.	**AC Light Fittings**			
1	Relay and SCADA room	400	Decorative recessed mounted with mirror optic (Dark lighter)	LED lamp fixtures
2	Control and EWS room	400	Decorative recessed mounted with mirror optic (Dark lighter)	LED lamp fixtures
3	Conference room, Maintenance cum office room & Maintenance communication room	300	Decorative mirror optics type	LED lamp fixtures
4	ACDB/ DCDB MCC Room and AHU room	200	Industrial type fluorescent lamp with vitreous enamel reflectors	LED lamp fixtures
5	Cable vault room and	100	Industrial type	T5 fluorescent tube

	Transformer room		fluorescent lamp with vitreous enamel reflectors	with electronic ballast or tri phosphorous tube.
6	Battery room	200	Industrial Corrosion Proof	2X28W T5
7	Pantry & Toilet	70	Industrial type CFL with vitreous enamel reflectors	LED lamp fixtures
8	Passage/ corridor, staircase, landing area & exit area	70	Industrial type CFL with vitreous enamel reflectors	LED lamp fixtures
9	Outdoor switchyard area & road	20	Flood lighting fixture	LEP or 250 W metal halide / LED lamp fixtures
10	GIS building	250	Industrial integral high bay	250 W/400 W HPMV Lamp/ metal halide
B.	**DC Light Fittings**			
1	Control, relay & SCADA Room, conference room, control room, EWS room, maintenance cum office room, maintenance communication room and passage/ Corridor (With false ceiling)	-	Recess mounted down lighter	1x100W GLS lamp
2	ACDB/ DCDB room, AHU room, Cable vault room, LT transformer room, Battery room, pantry, toilet, staircase, landing area, passage/corridor, GIS building ((without false ceiling)	-	Industrial bulk head	1x100W GLS lamp

1.2.4 Reference drawings:

Sl. No.	BHEL Drawing No.	Drawing Title
1.	TB-0-378-607-620	Control room building layout
2.	TB-378-510-005	Conceptual GIS building layout
3.	TB-378-316-101-02	Layout plan and section drawing of 400kV Switchyard

1.2.5 Detailed Illumination Design Calculation shall be submitted by bidder for approval of BHEL/TANGEDCO.

1.2.6 The maintenance factor (MF), which includes the luminaire depreciation factor also (as per IS 3646) shall be considered in design as per following,

Sl. No.	Location/ Area	Maintenance Factor (MF)
1.	Indoor area with air conditioned & false ceiling	0.75
2.	Indoor area without air conditioned (except fluorescent fixture)	0.60
3.	Indoor area without air conditioned (Fluorescent fixture)	0.57

Utilization factor: Clear areas such as switchgear room/control room etc. =70% ceiling, 50% wall and 10% floor.

Working plane - At Building floor level/0.85 meter from floor level.

1.2.7 For outdoor switchyard area, lighting ratio of minimum lux level to average lux level ratio should not be less than 0.3 and for minimum to maximum should not be less than 0.05.

1.2.8 A.C. emergency lighting fixture will account for 20% of the total lighting fixtures provided in control room building, GIS building and outdoor switchyard area.

1.2.9 Lighting level by DC emergency lighting will be provided to meet functional / operational requirements. DC fixtures will be located at strategic locations.

1.2.10 Detailed lighting design calculations considering the number of fittings as per BOQ shall be submitted by contractor for approval of BHEL/TANGEDCO.

1.2.11 The detailed drawings showing lighting layout, disposition and location of lighting fixtures, receptacles, switchboards, ceiling fan points etc., wiring scheme, wiring & conduit layout, fixing details, OGAs of all equipment, Cable schedule for switchyard etc. shall be submitted for approval.

1.2.12 All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of Customer Specification/I.E. rules.

1.3 LIGHTING SYSTEM DESCRIPTION

Illumination system will be provided with AC normal, AC emergency and DC emergency as detailed below,

(i) 415V AC normal (ACN) supply from main lighting distribution panel (MLDB) sourced from ACDB.

(ii) 415V AC normal cum emergency (ACE) supply from AC emergency lighting distribution board (AC ELDB) sourced from DG emergency section of ACDB.

(iii) 220V DC emergency (DCE) supply from DC emergency lighting distribution board (DC ELDB) sourced from DCDB.

1.3.1 AC Normal Lighting System

(i) AC Normal lighting fixtures are fed through a number of conveniently located AC normal lighting panels (AC NLPs) which are fed from main lighting distribution board (MLDB). The main lighting distribution boards will be fed through respective lighting transformer, which forms a part of the MLDB. Normal AC supply thus made available by MLDB is 415V, 3ph, 4W, 50HZ effectively grounded. Both the MLDB and lighting panels shall be provided with at least 20% spare outlets.

(ii) Lighting transformers shall be dry type, indoor type dust and vermin proof having single phase, 415 V/433 V, off load tap-changer with ± 2 x 2.5% on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral

bushing exclusively used for grounding). Rating of each lighting transformer shall be selected to cater to the maximum connected lighting and receptacle load except welding receptacle on that transformer. The casing of the transformer shall be grounded at least at two (2) points. Rating of each transformer shall be decided to limit the fault level within 9kA.

MLDB consisting of dry type lighting transformer with proper separation from distribution panels is envisaged.

(iii) The AC NLPs shall be provided with 3-phase incomer controlled by MCB + ELCB and miniature circuit breakers (MCBs) for outgoing feeders. MCBs will be provided with adequate rating for the expected short circuit current in the circuit. The fault level at AC NLP will be restricted to 3kA.

(iv) Indoor Lighting Panel NLP-1: 415V AC indoor normal lighting panel (NLP-1) with 415V, 3 phase, 4 wire bus with one 63A, TPN MCB with ELCB (earth leakage circuit breaker with 30 mA sensitivity) as incomer and 18 nos. 20A, 240V SPN MCBs as outgoing feeders. Lighting luminaries in indoor areas shall be controlled from the respective switches. Provision of manual control shall be provided in indoor lighting panel.

(v) Outdoor Lighting Panel NLP-2: 415V AC outdoor normal lighting panel (NLP-2) with 415V, 3 phase, 4 wire bus with one 63A TPN MCB as incomer and 6 nos. 20A single pole MCB and 4 nos. 32A triple pole MCB as outgoing feeder. The timer or photocell for automatic ON and OFF shall be provided in outdoor lighting panel. Provision of manual control shall be provided in outdoor lighting panel.

(vi) For lighting system of an area, alternative rows of lighting luminaries shall be fed from different circuits to take care of complete lighting failure.

(vii) All AC normal lighting shall be provided with energy saving system.

(viii) AC MLDB shall have effectively grounding system.

(ix) AC MLDB and NLP shall have 20% spare feeders.

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

(xi) Circuit loading of each Lighting panel shall be done in such a way that almost balance loading in all the phases will be achieved.

(xii) Minimum two phases will be used for Illumination of a particular area.

(xiii) Sub circuit loading of each lighting panel shall be restricted to 2000kW or 12nos fixtures whichever is lower.

1.3.2 AC Emergency Lighting System

(i) AC emergency lighting fixtures shall be fed through suitable numbers of conveniently located AC emergency lighting panel (AC ELPs) which are fed from AC emergency lighting distribution board (AC ELDB). The AC emergency distribution board (AC ELDB) are similar to the MLDB except that lighting transformers in this case are fed from station AC emergency bus having DG system backup. Thus power for AC emergency lighting is 415V, 3ph, 4W, 50HZ, effectively grounded.

(ii) Lighting transformers shall be dry type, indoor type dust and vermin proof having single phase, 415 V/433 V, off load tap-changer with ± 2 x 2.5% on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral bushing exclusively used for grounding.) Rating of

each lighting transformer shall be selected to cater to the maximum connected lighting and receptacle load on that transformer. The casing of the transformer shall be grounded at least at two (2) points. Rating of each transformer shall be decided to limit the fault level within 9kA. Insulation class of lighting transformer shall be class F and limited upto class B. Lighting transformer shall be provided with winding temperature indicator (having contacts for alarm & trip). Further enclosure of lighting transformer shall have safety switches with 1No+1NC auxiliary contacts.

AC ELDB consisting of dry type lighting transformer with proper separation from distribution panels is envisaged.

(iii) Constructional details & technical particulars of AC ELP shall be same as AC NLP as described above. The AC ELPs shall be provided with 3-phase incomer controlled by MCB + ELCB and miniature circuit breakers (MCBs) for outgoing feeders. MCBs will be provided with adequate rating for the expected short circuit current in the circuit. The fault level at AC ELP will be restricted to 3kA.

(iv) Indoor Lighting panels ELP-1: 415V AC indoor emergency lighting panel (ELP-1) with 415V, 3 phase, 4 wire bus with one 63A, TPN MCB with ELCB (earth leakage circuit breaker with 30 mA sensitivity) as incomer and 18 nos. 20A, 240V SPN MCBs as outgoing feeders. Lighting luminaries in indoor areas shall be controlled from the respective switches. Provision of manual control shall be provided in indoor lighting panel.

(v) Outdoor Lighting Panel ELP-2: 415V AC outdoor emergency lighting panel (ELP-2) with 415V, 3 phase, 4 wire bus with one 63A TPN MCB as incomer and 6 nos. 20A single pole MCB and 4 nos. 32A triple pole MCB as outgoing feeder. The timer or photocell for automatic ON and OFF shall be provided in outdoor lighting panel. Provision of manual control shall be provided in outdoor lighting panel.

(vi) For lighting system of an area, alternative rows of lighting luminaries shall be fed from different circuits to take care of complete lighting failure.

(vii) All AC emergency lighting shall be provided with energy saving system.

(viii) AC ELDB shall have effectively grounding system.

(ix) AC ELDB shall have 20% spare feeders.

1.3.3 DC Emergency Lighting System

(i) DC emergency lighting fixtures shall be fed through suitable numbers of conveniently located DC emergency lighting panel (DC ELPs) which are fed from DC emergency lighting distribution board (DC ELDB). The DC emergency lighting distribution boards (DC ELDB) will be fed from two power sources, namely: (1) Emergency main lighting distribution board (2) 220V DC distribution boards. The emergency DC lights will be ON all the time-normally from AC supply, but on its failure from DC supply through automatic switching.

DC ELDB consisting of dry type lighting transformer with proper separation from distribution panels shall be provided.

(ii) Indoor DC Lighting Panel DCP: 220V DC indoor type change over board and 220V DC 32A two wire bus and one 32A contactor backed up by 32A double pole MCB as incomer. The panels shall have local push button controls. Lighting panels shall have 6 nos. 16A DP MCB unit as outgoing feeder. The panels shall have under voltage relay.

1.3.4 Emergency EXIT Lamp

(i) Emergency exit lamps backed up by battery shall be provided at strategic locations of the GIS Building for safe exit of personnel. These exit lamps will remain ON all the time and normally received power supply from AC ELP.

(ii) Exit lamp unit shall contain maintenance free Ni-Cd battery with 0.5 hrs backup capacity.

1.4 SCOPE OF SUPPLIES & SERVICES

1.4.1 Scope of supply & Services

(i) The main items to be furnished for Substation under this contract are detailed in **Bill of Quantity (Annexure-I)** and shall be read in conjunction with other clauses of this specification.

(ii) All associated items, though not specifically mentioned but required for safe and satisfactory operation of equipment/ system shall also be deemed to be included and the same shall be supplied at NO EXTRA COST to BHEL.

(iii) Further, in case any type of luminaire/ panels etc. not included below but are required to meet the technical specification shall be specifically brought out in the offer/ shall be deemed to be included in offer.

415V MLDB (Main lighting distribution board), 415V AC ELDB (AC Emergency lighting distribution board), 220V DC ELDB (DC Emergency lighting distribution board) and Lighting Transformer shall be supplied and erected by BHEL.

(a) Lighting Panel/ Junction Box: The bidder shall supply and install junction boxes complete with terminals as required. The supports, brackets, bolts, nuts, screws etc. required for erection are also included in scope of the bidder.

(b) Bidder shall indicate in his offer, make and catalogue nos. of all equipment offered.

(c) The continuous conductor of specified GI wire shall be run all along each conduit run. The conductor shall be connected to each panel ground bus. All junction boxes, receptacles, switches, lighting fixtures etc. shall be connected to specified GI wire. Supply of GI ground wire shall be included in bidder's scope.

(d) Supply of all other items such as wires, steel wire, lugs, cable glands, earthing material etc. required to complete the work is in bidder's scope.

(e) Buried cable trench can be used in outdoor area. Bidder shall construct the cable trenches required for directly buried cables. The scope of work shall include excavation, preparation of sand bedding, soil cover, supply and installation of brick or concrete protective covers, back filling and ramming, supply and installation of route markers and joint markers etc.

1.4.2 **Free issue item:** The following shall be free issue items from BHEL,

(i) Multicore cables as mentioned in Bill of Quantities for cabling works

(ii) 75x12/50x6mm GI flat for earthing works, however 25x3mm GI flat, if required, shall be supplied by bidder.

(iii) 110/50mm GI/ PVC pipe for cabling works

(iv) 40mm dia MS rod for earthing works

(a) The sizes of cables indicated are tentative. Actual size required shall be decided at detailed engineering stage. ETC rate quoted shall remain same for cabling works for all sizes.

(b) Erection, testing and commissioning of cabling works, 40mm MS rod & GI flat shall be in bidder's scope. Supply of all other items such as cables, wires, steel wire, lugs, Cable glands, earthing material etc. required to complete the works in all respect shall be in bidder's scope.

1.4.3 **Services:** The bidder shall quote for erection, testing and commissioning of items/ equipment/ system, including activities pertaining to minor civil works of lighting panels, cable termination & earthing against each item, as applicable.

(a) The bidder shall give the offer for erection, testing and commissioning of the Illumination items/equipment/system at site.

(b) The scope of services shall include receipt of material, unloading, storage, handling, erection of equipment/ material at site including fabrication, testing, commissioning of the entire system. Storage area for Illumination material shall be provided by BHEL.

(c) Conducting of lux level measurement as per approved designs to the satisfaction of owner / purchaser shall be under bidder's scope.

(d) All material and consumables required for erection work shall be in bidder's scope. Erection material shall cover, but not limited to, clamps etc. for Luminaries (both indoor and outdoor), connections between junction boxes and luminaries in outdoor area, cable glands, lugs and ferrules required for cabling/ wiring. Any other material required for erection shall deemed to be in bidder's scope. Holes shall not be drilled on the galvanized substation structures.

(e) Earthing of all electrical equipment as per technical requirements.

(f) Bidder shall arrange all machinery tools & tackles, instruments and Consumables required for erection, commissioning and testing of the system.

(g) Bidder shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The bidder shall furnish a list of Commissioning spares that will be brought by him. The unused commissioning spares shall be returnable to the bidder.

(h) Laying & termination of power and control cable from outdoor Lighting panel to JB & from JB to fixtures shall be under scope of this specification. Wherever, cables are to be laid in GI pipe / PVC pipe, excavation, filling etc. deemed to be included in erection cost quoted.

1.4.4 **Civil Works:**

(a) Civil works such outdoor lighting panels etc. shall be done by the bidder. The rates for these civil works shall be deemed to be included in the erection rates of respective items. Wherever cable is to be laid in buried trench, the excavation and filling shall be done by bidder free of cost.

(b) All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grounding of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil works as may be required for erection.

(c) Any cutting of masonry / concrete work, which is necessary, shall be done by the bidder at his own cost and shall be made good to match the original work.

(d) Wall openings at suitable locations for ventilation fans shall be made by the bidder. Civil works such as grouting, filling up of crevices/ cut outs etc. during installation of equipment shall also be in bidder's scope. Any other damage caused to civil works during ETC work of the equipment/ system shall be made good to the original finish by the bidder at no extra cost to the BHEL.

1.5 BILL OF QUANTITIES

Quantities for supply and services for complete Illumination System for GIS Building, Control Room Building, Ventilation Room & Outdoor Switchyard shall be as per **Bill of Quantity, Annexure-I.**

1.6 TECHNICAL QUALIFYING REQUIREMENT

Technical qualifying requirement shall be as per **Annexure for QR** attached.

1.7 TYPE TESTING

The bidder shall submit the type tests reports for the tests conducted on the equipment identical or similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than five (5) years prior to supply under this contract. If any type test report is found to be technically unacceptable, such type test(s) shall be conducted by the bidder without any cost and delivery implication to BHEL/TANGEDCO.

All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bidder's scope.

Additional
~~Optional~~ Type test certificate on equipment, if any, shall be furnished, else the equipment shall have to be type tested, free of cost, to prove design.

1.8 QUALITY PLAN

The successful bidder shall submit the QP for BHEL/ TANGEDCO approval. In case bidder has reference QP agreed with TANGEDCO, same can be submitted for specific project after award of contract for BHEL/ TANGEDCO's approval. There shall be no commercial implication to BHEL on account of QP approval.

All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price.

1.9 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the bidder's factory, provided by the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each item in accordance with the applicable IEC/IS and the material shall be offered for final inspection by BHEL/TANGEDCO in accordance with agreed quality plan with 3 weeks' advance information. The charges for these shall be deemed to be included in the equipment price.

1.10 PACKING

The material shall be packed in such a way to ensure protection against damage during transit, storage for prolonged periods and handling.

1.11 HANDING & TAKING OVER

It is the responsibility of the Bidder to run and maintain the system supplied by them for a period of 3 months and subsequently hand over the same to BHEL/TANGEDCO. Bidder shall assist BHEL to hand over the system commissioned by them to owner.

1.12 UTILITIES AVAILABLE:

Construction water and 415V power shall be available at one point at each substation. Bidder shall be required to make own arrangement for taking supplies from there.

Bill of Quantities for Illumination System			Annexure-I REV00	
Sl. No.	Description	Unit	Qty	
			Supply	ETC
A	**INDOOR LIGHTING FOR CONTROL ROOM BUILDING, GIS BUILDING & VENTILATION HOUSE**			
1	**Lighting Panels**			
1.1	Indoor Lighting Panel	Nos.	9	9
2	**Lighting Fixtures**			
2.1	Lighting fixture, Decorative recessed mounted with mirror optic reflector (Dark lighter)- (PHILIPS TBS088/228W/414W)/ Equivalent with LED lamps	Nos.	39	39
2.2	Lighting fixture type, Decorative recessed mounted with mirror optics- (PHILIPS DN192B)/ Equivalent with LED lamps	Nos.	245	245
2.3	Lighting fixture, Industrial type fluorescent lamp with vitreous enamel reflectors - (PHILIPS TMS122/228W)/ Equivalent with LED lamps	Nos.	50	50
2.4	Lighting fixture, Industrial type fluorescent lamp with vitreous enamel reflectors - (PHILIPS TMS 122/228W)/ Equivalent with 2x28W T5 lamp	Nos.	17	17
2.5	Lighting fixture, Industrial corrosion proof - (PHILIPS TCW450/228W)/ Equivalent with 2x28W T5 lamp	Nos.	17	17
2.6	Lighting fixture, Industrial integral high bay - (PHILIPS HPI BU250W)/ Equivalent with 1x250W metal halide lamp	Nos.	82	82
2.7	Lighting fixture, Recess mounted down lighter - (PHILIPS DN622/100W)/ Equivalent with GLS lamp	Nos.	46	46
2.8	Lighting fixture, Industrial bulk head - (PHILIPS NXC101/100W)/ Equivalent with GLS lamp	Nos.	68	68
2.9	Emergency Exit sign board/ lamp - (No. PEL111 E/NM)/ Equivalent	Nos.	42	42
3	**Receptacles**			
3.1	Decorative Receptacles (Type RA)	Nos.	76	76
3.2	Industrial Receptacles (Type RB)	Nos.	65	65
3.3	Industrial Receptacles (Type RC, 63A, 415V)	Nos.	7	7
3.4	Industrial Receptacles (Type RP, 400A, 415V)	Nos.	1	1
4	**Swichboards**			
4.1	Modular switchboard, 1 no, 10A switch with 5 stepped electronic fan regulator	Nos.	10	10
4.2	Modular switchboard, 3no, 5/10A switch with 5/10A receptacle	Nos.	10	10
4.3	Modular switchboard, 6no, 5/10A switch with 5/10A receptacle	Nos.	10	10
4.4	Air conditioner points, single phase	Nos.	5	5
5	**Fans**			
5.1	Celing Fans (1200mm/ 1400mm sweep)	Nos.	10	10
5.2	Wall Fans	Nos.	32	32
5.3	Exhaust Fans	Nos.	20	20
6	**Point Wiring** (20/32/40mm GI conduit, 2.5/4/6sqmm Cu wire & accessories)	Nos.	817	817
B	**OUTDOOR LIGHTING FOR SWITCHYARD**			
7	**Lighting Panels**			
7.1	Outdoor Lighting Panel	Nos.	3	3
7.2	Outdoor Emergency Lighting Panel	Nos.	1	1
7.3	Outdoor Street Lighting Panel	Nos.	1	1

Bill of Quantities for Illumination System			Annexure-I REV00	
Sl. No.	Description	Unit	Qty	
			Supply	ETC
8	**For Lightning Mast (LM)**			
8.1	Lighting fixture, Flood lighting fixture - (PHILIPS RVP 302/2X250W)/ (PHILIPS BVP410 LED 263 CW HE SY20 FG S4 XTFCL)/ Equivalent with 250W LED Lamps	Nos.	100	100
8.2	Outdoor Junction Box	Nos.	20	20
9	**High Mast**			
9.1	30m High Mast with Lantern Carriage (Double Drum Winch type) including Junction Box	Nos.	4	4
9.2	Lighting fixture, Flood lighting fixture - (PHILIPS RVP 302/2X250W)/ (PHILIPS BVP410 LED 263 CW HE SY20 FG S4 XTFCL)/ Equivalent with 250W LED Lamps	Nos.	30	30
10	**Street Lighting pole**			
10.1	Pole for street lighting including Junction Box	Nos.	10	10
10.2	Lighting fixture - (PHILIPS)/ Equivalent with 70/150W LED Lamps	Nos.	10	10
11	**Portable Emergency Light**			
11.1	Portable emergency lighting unit-(Prolite cat. No. PEL 210 PNM)/ Equivalent	Nos.	2	2
12	**Maintenance Equipment**			
12.1	Free-standing, adjustable aluminium ladder, adjustable from 5m to10m height	Nos.	4	4
12.2	Portable aluminium ladder	Nos.	3	3
13	**Miscellaneous**			
13.1	Earthing (GI Flat 75x12mm/50x6mm/36x3mm)	Mtrs	--	100
13.2	Earthing (40mm Dia rod)	Mtrs	--	50
13.3	Cabling (2cx2.5/5Cx2.5/4Cx16 sqmm Al/PVC)	Mtrs	--	1000
13.4	Cabling (100NB/50NB PVC/GI Pipe)	Mtrs	--	500

Note:

1	Prices for supply & erection of all applicable illumination erection hardware material shall be included along with above BOQ offer. List of erection hardware material for illumination works are mentioned below,
A	**For Indoor works:** 3-way GI circular JB (20mm and 25mm), 4-way GI circular JB (20mm and 25mm), 90deg GI Inspection Bend (20mm and 25mm), 90deg GI Normal Bend (20mm and 25mm), Heavy duty saddle with base (20mm and 25mm), Heavy duty saddle without base (20mm and 25mm), M4X25mm steel screw with nut and washer, GI check nut/ lock nut (20mm and 25mm), PVC Rawl plug (6mm), Wooden screw (35mm), Earth clip/ clamp(20mm and 25mm), Cleat fabrication out of 25x6mm MS flat (for hanging conduit in false ceiling areas, Anchor fastner (M10x75mm for cleats, M12x75mm for lighting panels), Rubber bush (20mm and 25mm), 20mm PVC flexible conduit, 20mm PVC Coupling Swing out braket, 20mm Heavy duty ball socket, Machine screw (for fixing surface mounting fixtures on circular JB), PVC closure (20mm and 25mm), Reducer (20mm and 25mm), GI conduits, epoxy coated conduits for corrosive areas, 1.5, 2.5, 4, 6 & 10sqmm wires GI wire for earthing.
B	**For Outdoor works:** 20x1.5mm Aluminium flat, M12x40mm GI Bolt with nut and washer for fixing outdoor lighting panels, M6x30mm GI Bolt with nut and washer for fixing control gear boxes, M8x30mm GI Bolt with nut and washer for fixing outdoor JBs, SLP, M10x35mm GI Bolt with nut and washer for fixing outdoor lighting fixtures GI Earth wire from JB to lighting fixtures, Mounting brackets for lighting fixtures for 1x400W fixtures/2x250W fixtures, GI wire for earthing.
2	The above quantities (BOQ) are as per preliminary design only. The detailed design shall be submitted by bidder and subject to approval by Customer. The BOQ quantities which are finalised after approval has to be supplied. BHEL reserves the right for quantity variation due to any reason upto ±30% of total value at same unit rate and terms & conditions during execution of contract . The quantity of individual items may however vary upto any extent.
3	Extra items, if required for completion of work but not covered above, shall be quoted separately as a list of items and same shall be submitted with the bid (price of supply and ETC to be quoted on Lumpsum basis).
4	Lux measurement at site shall deemed to be included in bidder's scope.

Annexure for QR

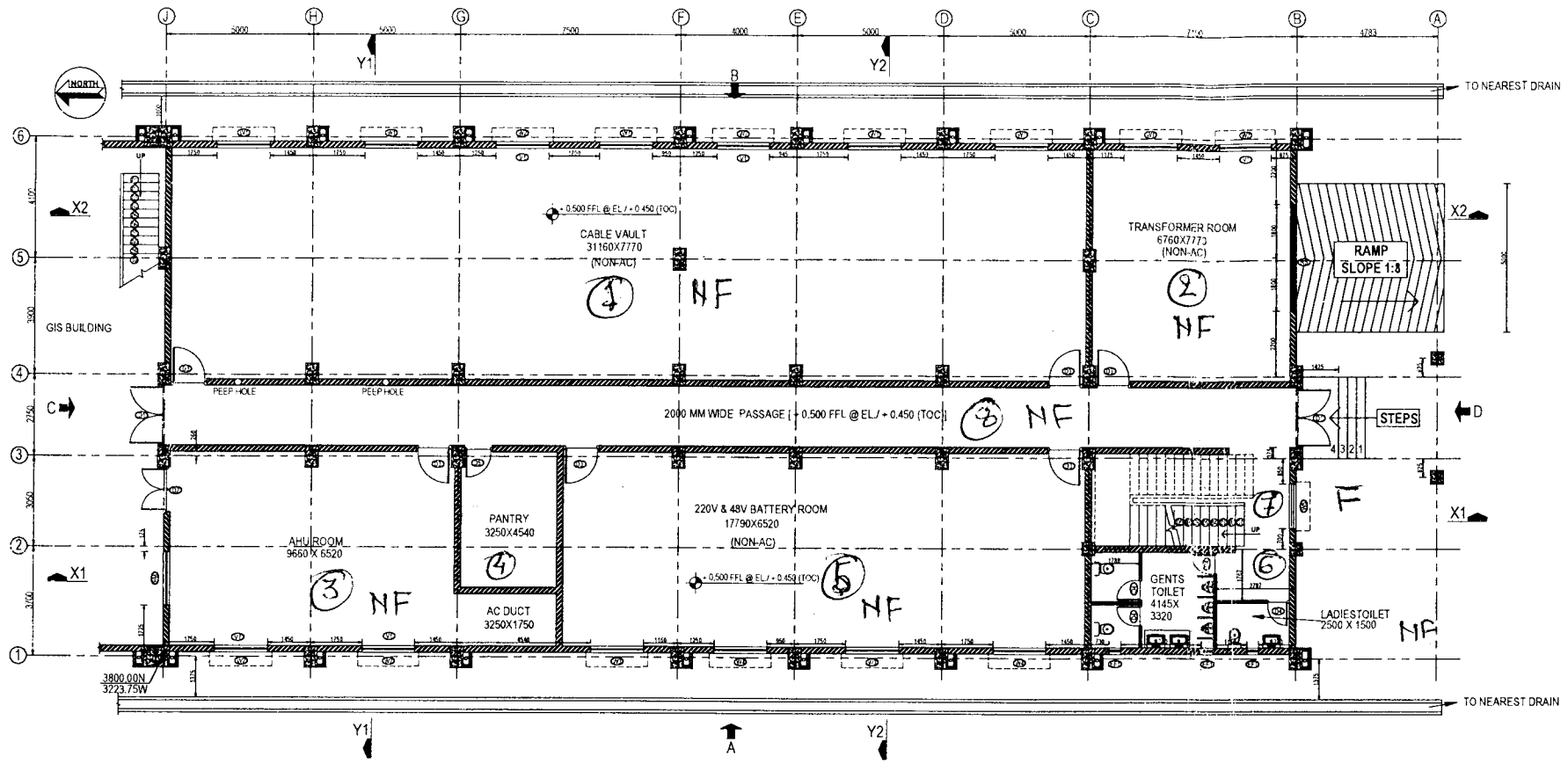
TECHNICAL QUALIFYING REQUIREMENT

(1). The bidder should have experience of design, supply, installation, testing and commissioning of Illumination System for at least one project of State Electricity Boards/ Central Utilities/State or Central Transmission Utilities/ Industrial Installations, and

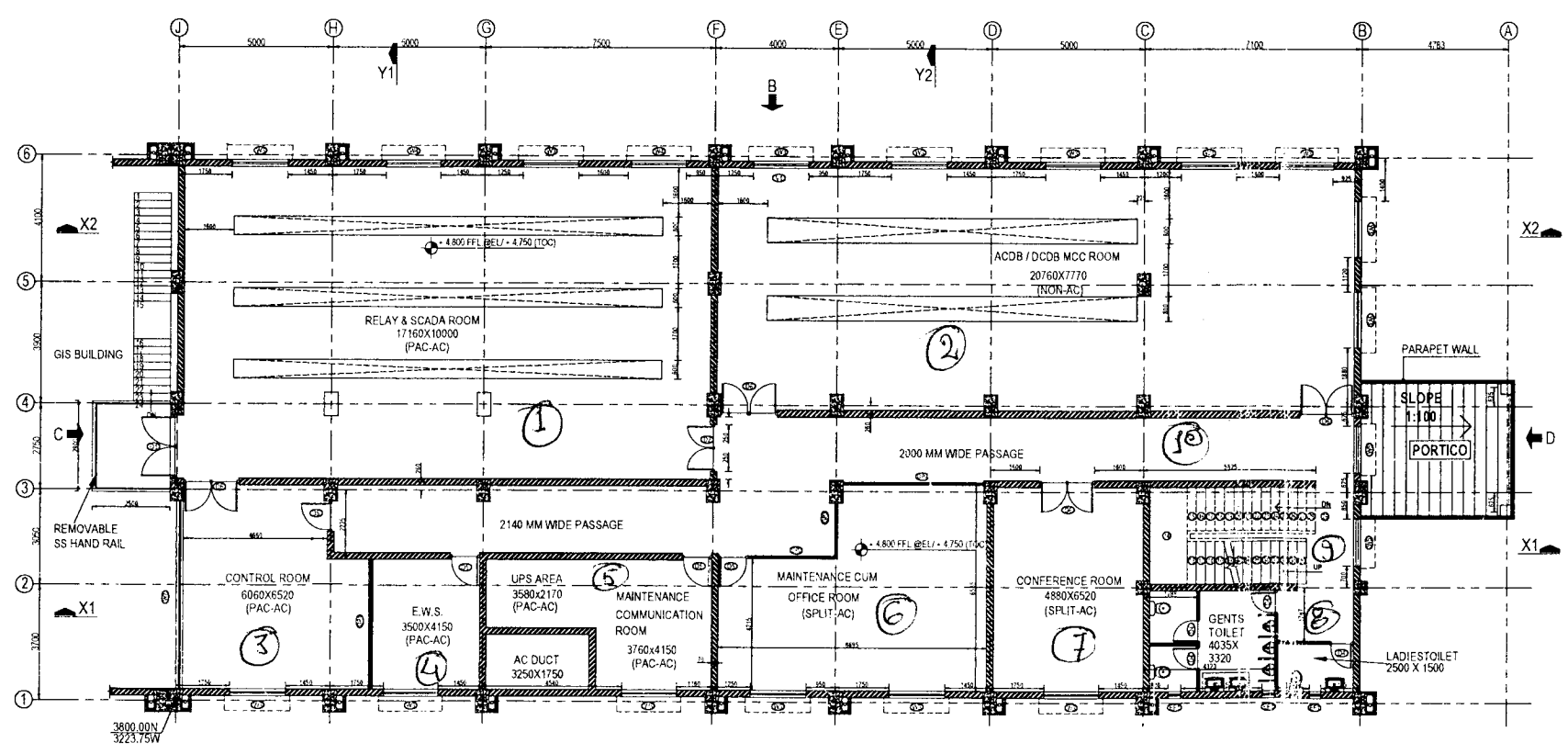
(2). Bidder should have successfully executed similar works with order value not less than Rs. 60 Lakhs for single contract or Rs. 35 Lakhs each for two contracts (excluding taxes, duties, F&I etc.) during last five years from the original scheduled date of bid opening.

(3). Bidder has to submit the certificate/ relevant documents for completion of works as to meet the requirement as mentioned in point no. (1) & (2).

TB-0-378-607-620-1



GROUND FLOOR PLAN :- + 0.500 FFL @ EL./ + 0.450 (TOC)
SCALE 1:75



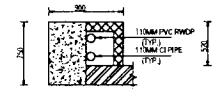
FIRST FLOOR PLAN :- + 4.800 FFL./@EL + 4.750 (TOC)
SCALE 1:75

SCHEDULE OF DOORS, WINDOWS & OPENING OF GROUND FLOOR

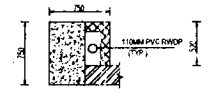
S.NO.	TYPE.	SIZE	SILL LVL.	LINTEL LVL.	QTY.	DESCRIPTION
1.	RB	3600X2400	---	3000	1	ROLLING SHUTTER AS PER SPECIFICATION
2.	D1	2000X2400	---	2400	2	ALUMINUM GLAZED DOUBLE LEAF DOOR AS PER SPECIFICATION
3.	D2	1500X2400	---	2400	1	ALUMINUM GLAZED DOUBLE LEAF DOOR AS PER SPECIFICATION
4.	D3	1200X2100	---	2100	5	SINGLE PANEL STEEL DOOR AS PER SPECIFICATION
5.	D4	750X2100	---	2100	3	SINGLE PANEL STEEL DOOR AS PER SPECIFICATION
6.	D5	1000X2100	---	2100	4	SINGLE PANEL ALUMINUM GLAZED AS PER SPECIFICATION
7.	W1	1800x1200	2400	3700	6	ALUMINUM GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
8.	W2	1800X1200	900	2100	5	ALUMINUM GLAZED SLIDING AS PER SPECIFICATION
9.	V1	1800X300	3100	3700	5	FIXED ALUMINUM FRAMED AS PER SPECIFICATION
10.	W3	1800X1200	900	2100	2	ALUMINUM - GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
11.	W4	1800X1200	900	2100	2	ALUMINUM GLAZED SLIDING AS PER SPECIFICATION
12.	W5	1500X1200	900	2100	1	ALUMINUM - GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
13.	W6	1800X1500	900	2400	1	ALUMINUM - GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
14.	EF1	500 ID	3200	3700	3	EXHAUST FAN AS PER SPECIFICATION

SCHEDULE OF DOORS, WINDOWS & OPENING OF FIRST FLOOR

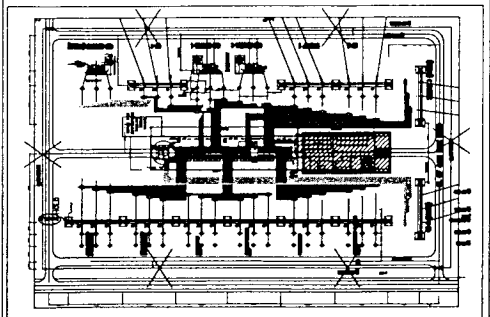
S.NO.	TYPE.	SIZE	SILL LVL.	LINTEL LVL.	QTY.	DESCRIPTION
1.	D1	2000X2400	---	2400	2	ALUMINUM GLAZED DOUBLE LEAF DOOR AS PER SPECIFICATION
2.	D2	1500X2400	---	2400	2	ALUMINUM GLAZED DOUBLE LEAF DOOR AS PER SPECIFICATION
3.	D4	750X2100	---	2100	3	SINGLE PANEL STEEL DOOR AS PER SPECIFICATION
4.	D5	1000X2100	---	2100	4	SINGLE PANEL ALUMINUM GLAZED AS PER SPECIFICATION
5.	D6	1500X2400	---	2400	3	ALUMINUM GLAZED DOUBLE LEAF DOOR AS PER SPECIFICATION
6.	W2	1800X1200	900	2100	11	ALUMINUM GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
7.	W4	1800X1200	900	2100	2	ALUMINUM GLAZED SLIDING AS PER SPECIFICATION
8.	W5	1500X1200	900	2100	2	ALUMINUM - GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
9.	EF1	500 ID	3200	3700	2	EXHAUST FAN AS PER SPECIFICATION
10.	W7	6000X2250	150	2400	1	ALUMINUM GLAZED FIXED TYPE HERMETICALLY SEALED AS PER SPECIFICATION
11.	GP1	6150X3000	---	---	1	GLASS PARTITION AS PER SPECIFICATION
12.	GP2	2965X3000	---	---	1	GLASS PARTITION AS PER SPECIFICATION
13.	GP3	1735X3000	---	---	1	GLASS PARTITION AS PER SPECIFICATION
14.	GP4	6550X3000	---	---	1	GLASS PARTITION AS PER SPECIFICATION



TYPICAL DETAIL OF RAIN WATER AND SEWAGE PIPE DETAILS (NEAR TOILET)
(SCALE 1:30)



TYPICAL DETAIL OF RAIN WATER PIPE DETAILS.
(SCALE 1:30)



KEY PLAN

NOTES
1. ALL THE DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METER UNLESS SPECIFIED OTHERWISE.
2. (±) 0.000M CORRESPONDS TO FGL AT RL 9.50M
3. ALL THE LEVELS ARE FROM FGL.
4. DRAWINGS ARE NOT TO BE SCALED, ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
5. IN THE EVENT OF ANY DISCREPANCIES OR DIFFERENCE BETWEEN ANY ARCHITECTURAL DRAWINGS AND STRUCTURAL ENGINEERING DRAWINGS OR SITE CONDITIONS OR OTHERWISE, DRAWINGS OR ANY OTHER IMMEDIATE REF. SHOULD BE MADE TO THE ARCHITECT FOR CLARIFICATIONS PRIOR TO EXECUTION OF WORK.
6. CONTRACTOR SHALL CHECK ALL LEVELS & DIMENSIONS WITH RESPECT TO EXISTING STRUCTURE LEVELS & DIMENSIONS BEFORE CASTING.
7. M.S RAILING SHALL BE PROVIDED 32MM DIAMETER.
8. FALSE CEILING SHALL BE PROVIDED OF LIGHT WEIGHT MINERAL FIBRE TILE TYPE FALSE CEILING.

Control Room Building

LEGENDS :-

	230 THK. BRICK WALL
	115 THK. BRICK WALL
	COLUMN
	PROJECTION
EF	EXHAUST FAN
FGL	FINISHED GROUND LEVEL
FFL	FINISHED FLOOR LEVEL
THK	THICKNESS
TOP	TOP OF PARAPET WALL
TOC	TOP OF CONCRETE
PAC-AC	PRECISION AIR CONDITIONER
SPLIT-AC	SPLIT A/C CONDITIONER

PROJECT: 2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI – 120

CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION

OWNER'S CONSULTANT: DESEIN PRIVATE LIMITED, DESEIN HOUSE, GREATER KAILASH II, NEW DELHI

CONTRACTOR'S CONSULTANT: DESIGN SOLUTIONS INC. SCO 43, 2nd FLOOR, SECTOR 4, PANCHKULA, HARYANA – 134112

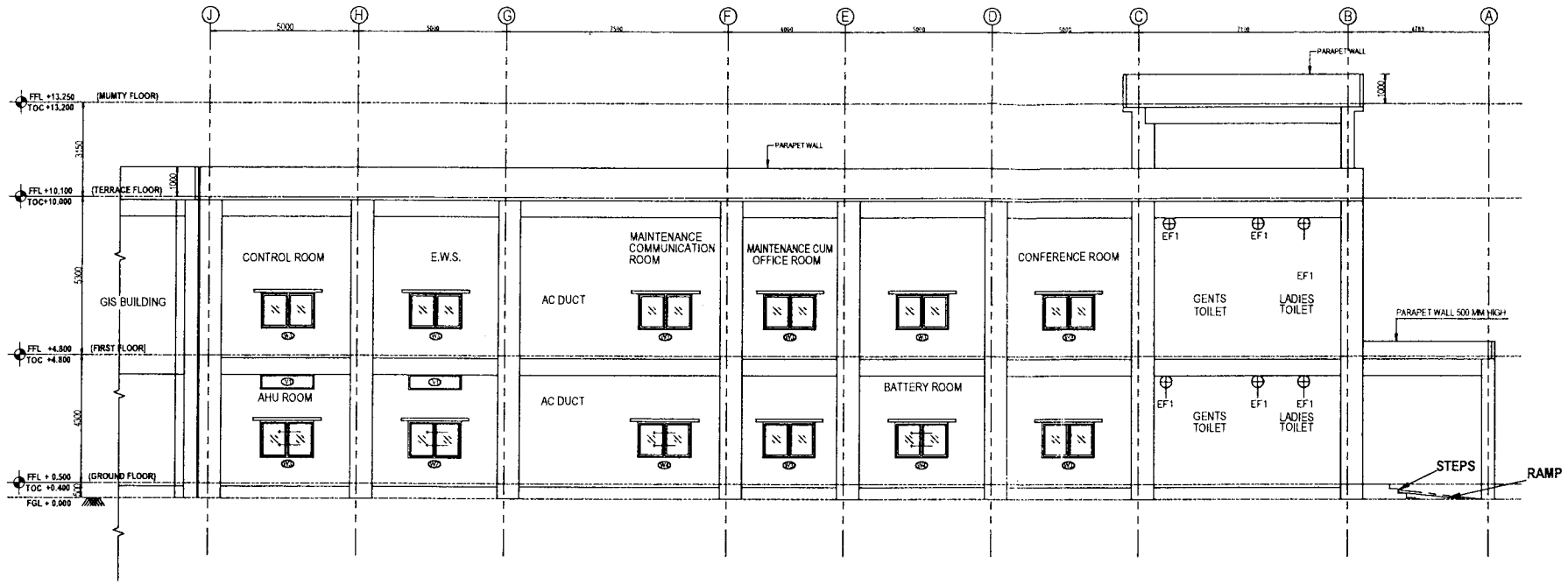
BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

03

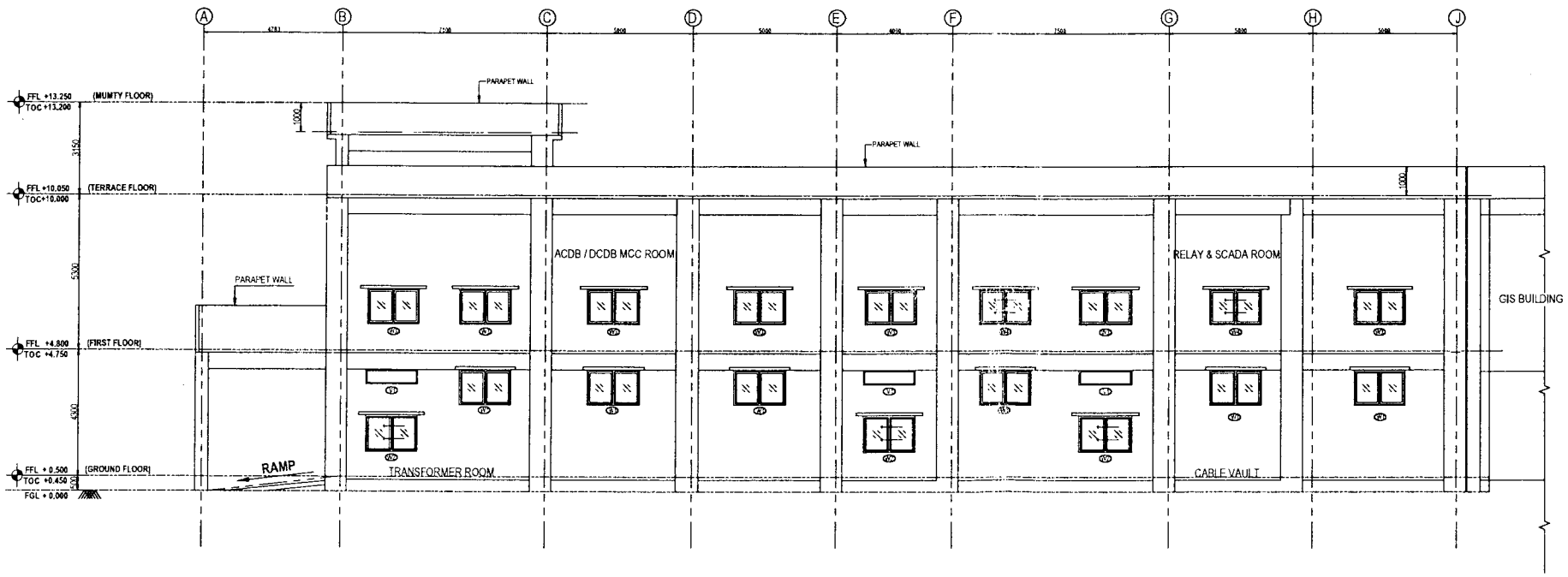
TB-0-378-607-620-1

ARCH DRAWINGS- GROUND & FLOOR PLAN CONTROL ROOM BUILDING

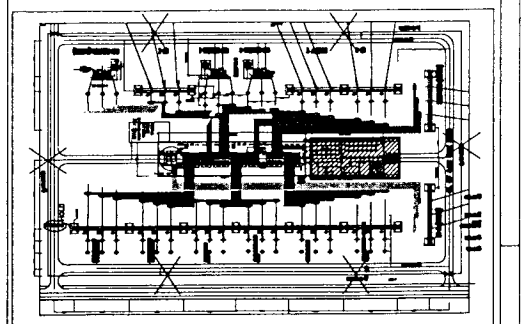
TB-0-378-607-620-2



ELEVATION- A



ELEVATION- B



KEY PLAN

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	115 THK. BRICK WALL
	COLUMN
	PROJECTION
EF	EXHAUST FAN
FGL	FINISHED GROUND LEVEL
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THK	THICKNESS
TOP	TOP OF PARAPET WALL
TOC	TOP OF CONCRETE
PAC-AC	PRECISION AIR CONDITIONER
SPLIT-AC	SPLIT AIR CONDITIONER

PROJECT: 2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI – 120

CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION

OWNER'S CONSULTANT: DESEIN PRIVATE LIMITED, DESEIN HOUSE, GREATER KAILASH II, NEW DELHI

CONTRACTOR'S CONSULTANT: DESIGN SOLUTIONS INC. SCO 43, 2nd FLOOR, SECTOR 4, PANCHKULA, HARYANA – 134112

BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION

1:200

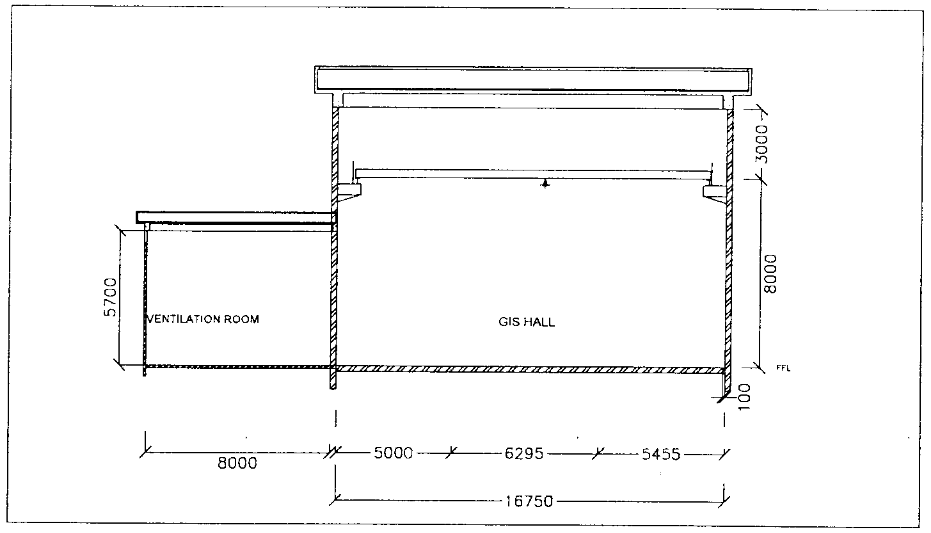
TB-0-378-607-620-2

ARCH DRAWINGS– ELEVATIONS CONTROL ROOM BUILDING

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

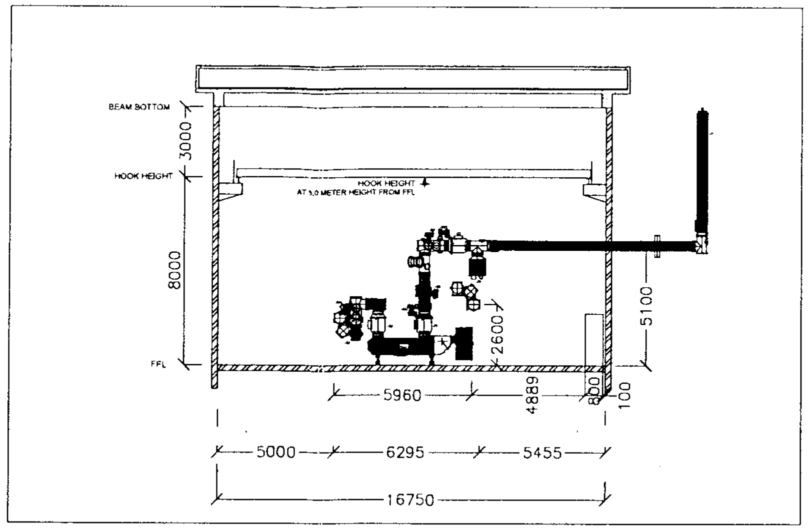
INVENTORY No.	SIGN. & DATE	REF. DRG. No.	COMPUTER DRG. PATH NAME :

DRAWING No.
DRN.



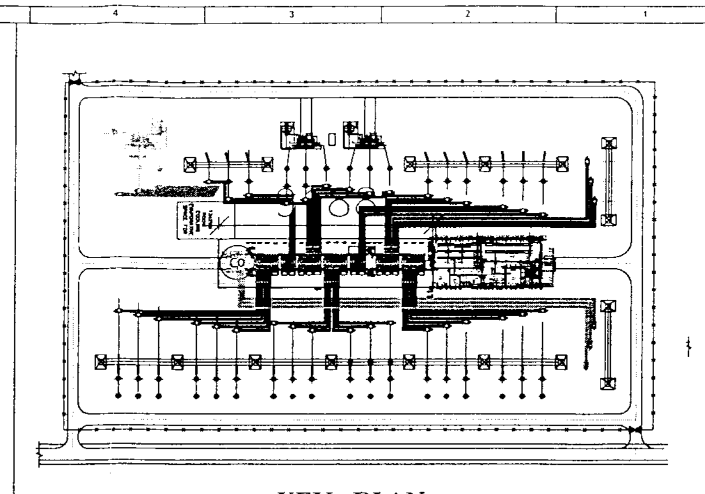
GIS BUILDING & VENTILATION ROOM

SECTION B-B

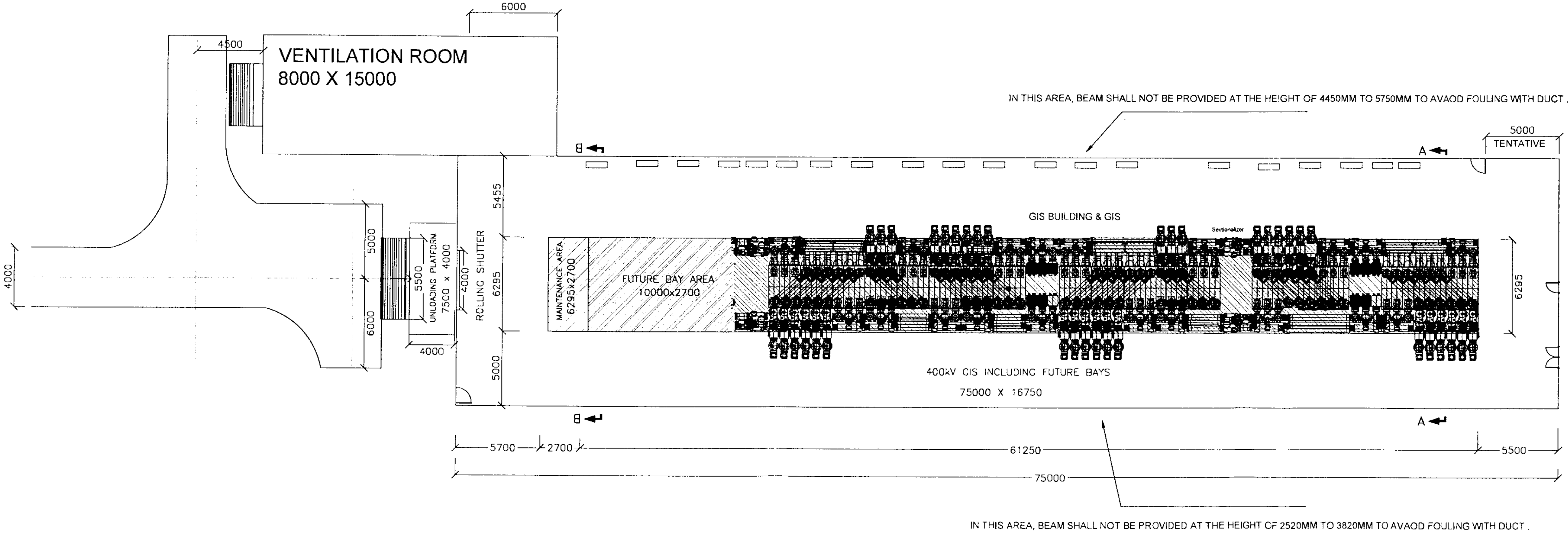


GIS BUILDING SECTION

SECTION A-A



KEY PLAN



GIS BUILDING PLAN

NOTE:-

1. ALL DIMENSIONS ARE IN MM AND MINIMUM CLEAR DIMENSIONS.
2. GIS ROOM SHALL BE PROVIDED WITH DUCTED VENTILATION .
3. FINAL LOCATION OF CABLE TRENCH ENTRY SHALL BE AS PER APPROVED TRENCH LAYOUT.
4. DOOR SHALL BE 2500(H)X1500(W) IN SIZE.
5. ROLLING SHUTTER FOR SHALL BE 5000(H)X4000(W) IN SIZE.

REV.	DATE	ALTERED / CHECKED / APPROVED
ZONE		

ADDITIONAL INFORMATION
W.O.No. 84007

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम / NAME OF CUSTOMER/PROJECT: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
400KV GIS AT 2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS

NAME OF CONSULTANT: DESEIN PRIVATE LIMITED, NEW DELHI.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण व्यापार समूह
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	नाम /NAME	हस्ता./SIGN.	दि./DATE
DRAWN	JK		17.11.17
CHECKED	SB		
APPROVED	RB		

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

शीर्षक/TITLE: CONCEPTUAL GIS BUILDING LAYDUT - 400KV SWITCHYARD ENNDRE

ड्राइंग क्र./DRAWING NO. TB-378-510-005 | पुनः/REV. 0

पृष्ठ क्र./SHEET No. 01 | अगला पृष्ठ/NEXT SHEET —

THIS IS ZOOM VIEW OF DRAWING NUMBER
TB-0-378-316-002 REV 04
400KV GIS POTHEAD YARD LAYOUT PLAN
ENNORE

LM-1

LM-2

LM-3

LM-4

LM-5

LM-6

Tentative locations of LM

NORTH

GIS BUILDING

GIS BUILDING PLAN

℄ OF FENCE

℄ OF ROAD

℄ OF SAB

℄ OF BPI

℄ OF BPI

℄ OF TOWER

℄ OF LA

Section-2 : Specific technical requirements for the equipment under scope of supplies.

ILLUMINATION SYSTEM

1.00.00 SCOPE OF WORK

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

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

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

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

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

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

2.00.00 CODES AND STANDARDS

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

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

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

3.00.00 DESIGN CRITERIA

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

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

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

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

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

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

i) Normal A.C. Lighting

a) This will be provided by A.C. lighting fixtures distributed throughout the plant. These lights will be ON as long as the A.C. supply is available.

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

ii) Emergency A.C. Lighting

a) On failure of normal A.C. Supply, emergency A.C. lighting will be provided in service building, areas of the powerhouse, boiler area, boiler galleries etc for general visibility, safe movements and operation of important auxiliaries.

b) The emergency LDBs (ELDB) are similar to the MLDB except that lighting transformers in this case are fed from station A.C. Emergency bus having D.G. System backup. Thus power for A.C. emergency lighting is 415V-3ph-4W, 50HZ, effectively grounded.

c) At least 20% of the fixtures shall be fed from AC emergency source.

iii) Emergency D.C. Lighting

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

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

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

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

iv) Remote Emergency Lighting

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

v) Street/Area Lighting

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

vi) Receptacles

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

4.00.00 SYSTEM PARTICULARS

System particulars are as follows:

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

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

5.00.00 METHOD OF CALCULATION

a) Standard Lumen method shall be adopted for interior & exterior lighting in order to determine the number of lighting fixtures for obtaining the desired average level of illumination.

b) The coefficient of utilization shall be considered to take care of Lumen loss due to:

1. Effect of room dimensions
2. Absorption of light in luminaries
3. Absorption of light at various room surfaces in ceiling, wall etc.
4. Floor cavity, ceiling cavity
5. Mounting height

c) Additionally, a maintenance factor shall also be considered to account for the fall of illumination due to ageing, pollution like dust deposit etc. Maintenance factors to be considered for various areas shall be as follows :

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

d) Utilization Factor

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

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

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

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

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

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

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

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

6.00.00 GENERAL REQUIREMENTS

6.00.01 Equipment and material shall comply with description, rating, type and size as detailed in this Specification. All equipment and accessories shall be designed for continuous operation under site conditions without exceeding permissible temperature rise as stipulated in relevant standards.

6.00.02 Equipment and materials furnished shall be complete and operative in all details.

6.00.03 All accessories, control devices, internal wiring, fittings, supports, hangers, anchor bolts etc. which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.

6.00.04 All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable.

6.00.05 All equipment and accessories shall have proper enclosure to suit the site conditions. Hazardous areas shall have flame-proof enclosure

6.01.00 Lighting Transformers

a) Lighting transformers shall be dry type, indoor type dust and vermin proof having single phase, 415 V/433 V, off load tap-changer with ± 2 x 2.5% on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral bushing exclusively used for grounding.) Rating of each lighting transformer shall be selected to cater to the maximum connected lighting and receptacle load on that transformer. The casing of the transformer shall be grounded at least at two (2) points. Rating of each transformer shall be decided to limit the fault level within 9kA.

b) Lighting Transformer shall be 2 x 100% for TG Building , Service building , Water treatment plant, ESP and Fuel oil pump house

c) If necessary, apart from the main lighting transformers, separate small additional lighting transformers may be used at distance lighting points.

6.02.00 Lighting Fixtures

a) Lighting fixtures shall be designed for minimum glare. The surface finish shall be smooth, unobtrusive and scratch resistant.

b) Reflector shall be of sheet steel or aluminium, minimum 20 SWG thick, securely fixed by fastening device of captive type.

c) Fixture shall be suitable for 20 mm conduit entry and 16 SWG G.I. earth-wire connections. Fixture shall also be suitable for case coupling entry wherever required.

d) High bay fixtures shall have provision for vibration damper to ensure rated lamp life.

e) Fixture shall be furnished complete with lamps and integrally/non-integrally or separately mounted control gear & accessories or applicable for different types of fixtures. These shall include holders, ballast, capacitor, starter, igniters (separate type) etc.

f) Fixtures shall be fully wired up to respective terminal blocks, suitable for loop in and loop one connection of PVC wires of following sizes:-
   1. Lighting fixture : 2.5 Sq.mm Copper
   2. Flood Light fixture : 2x2.5 Sq.mm Copper

g) The distribution of lighting fixtures/receptacles shall be such that the loading on each phase of the LDB is approx. equal.

h) In indoor areas fixtures with suitable mounting accessories shall be used and shall not be directly mounted on walls.

i) Search lights having adequate coverage shall be provided in watch towers

6.03.00 Lamps

a) General lighting service (GLS) lamps shall be with clear glass and screwed caps.

b) All fluorescent lamp shall be bi-pin rotary type and cool daylight.

c) Lamps shall be suitable for use in position and capable of withstanding small vibrations. Restrictions and special features, if any, shall be clearly indicated in the bid.

d) CFL and T5 fluorescent tube with electronic ballast or tri phosphorous tube.

e) Latest energy saving LED type lighting fixture/ lamps

f) Light Emitting Plasma (LEP)

6.04.00 Ballast

a) Ballasts shall be heavy duty, low loss, and polyester-filled type with copper winding.

b) Ballasts shall be free from hum. Ballasts which produce humming sound shall be replaced without any implication.

c) In multi-lamp fixture, each lamp shall be provided with individual ballast.

d) Ballast windings shall have maximum operating temperature of 120 Deg.C without rated temperature rise marking.

e) Ballast for Control Room Area shall be heavy duty, low loss, high-grade silicon steel stampings; vacuum impregnated polyester resin filled with copper winding. Ballast for other area shall be electronic type, flicker free pre heat lamp start type having power consumption less than 3-watts per ballast, power factor less than 0.98 and THD less than 10%. Ballast shall operate at operating frequency of more than 40 kHz. Power consumption of ballast for 36W Fluorescent Tube shall be less than 9.5W.

6.05.00 Lighting Panel/Distribution Boards

a) Lighting Distribution Boards/panels shall be Fibre reinforced plastic (FRP) type, suitable for either wall/column mounting on brackets or floor mounting on channel sills.

b) Indoor Lighting Distribution Boards & Lighting Panels shall be dust and vermin-proof, IP-54. Outdoor panels shall be weather-proof with canopy, IPW-55 or better. The cubicle housing transformer shall be minimum IP-42.

c) Lighting Distribution Boards and Lighting Panels shall be so constructed as to permit free access to the terminal connections and easy replacement of parts. Front access doors shall have padlocking arrangements.

d) Lighting Distribution Boards shall have provision of cable entry from bottom and, panels shall have provision of cable entry from top and bottom, as required, with removable gland plates. Necessary double compression type brass cable glands, tinned copper/Aluminium cable lugs are to be furnished.

e) Two ground pads with M10 G.I. bolts and nuts shall be provided on each Lighting Distribution Board and Lighting Panel for connection to 25 x 3 mm G.I. flat.

f) Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed on front cover and a directory plate fixed on inside of the front cover. This directory Plate shall contain details of the Lighting Panels being fed from the Distribution Board including their designation, location, loading etc. Each Lighting Panel shall be complete with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of each circuit. The plates shall be of anodized aluminium with inscriptions indelibly etched on it.

g) Bus bar shall be electrolytic grade hard drawn aluminium, colour coded for easy identification and designed for a maximum temperature of 85°C. Minimum size shall be 25 x 6 mm.

h) Board / Panel shall be fitted with phase barriers such that it is not readily possible for personnel to touch the phase busbars. Insulation barriers shall preferably be fitted around the circuit breakers such that only the surface and the toggle of the circuit breaker are available on the front.

i) Incoming and outgoing circuits shall be terminated in suitable terminal blocks.

j) In lighting and receptacle panel 3-phase and 1-phase MCB should not be mixed.

6.06.00 Receptacles

a) Receptacles shall be heavy duty, complete with individual plug and switch.

b) The conduit box of the receptacle shall be provided with earthing screws with washer and nuts welded on the surface for grounding with 16 SWG G.I. wire.

Arrangement shall be provided inside the conduit box for grounding of third pin.

c) Shrouded type plug shall be provided with corresponding matching arrangement at sockets to prevent accidental contact with finger during plug insertion.

d) Receptacles shall be of following types:

1. Type RA-5A, 240V, 2 pole, 3 pin type with third pin grounded, suitable for flush mounting in MCC Room, office areas, control rooms, store rooms, cabins etc. The switch shall be of piano-key type, also flush mounted and decorative non-industrial type.

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

2. Type RB-15A, 240V, 2 pole, 3 pin Industrial type with third pin grounded, metal clad with gasket having 19mm conduit entry and a metallic screwed cover tied to it with a metallic chain and suitable for installation in clean/dusty areas. The receptacles located in switchgear rooms, MCC rooms and control room shall have IP-42 degree of protection and those located in other dusty areas shall have IP-62 degree of protection. These receptacles shall be located at an interval of 50M along length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper. Minimum one (1) no shall be provided in all equipment floor, feeder floor, boiler drum level, TPs Crusher House, Sub-station, Control Room, Pump House, Transformer Room, various levels of service building, RO plant, and at suitable location in all other areas as required. In fuel oil area receptacles will be of flameproof type.

3. Type RC-63A, 415V, 3 phase, 4 pin Industrial type interlocked plug and switch with earthing contact. Other requirements shall be same as Type RB. Interlocking shall be so selected that the switch can be put to `ON' position only when all the four (4) pins of the plug are housed with complete alignment. In `OFF' position of the switch the socket outlet shall be completely dead and outgoing terminals isolated. Welding receptacles shall be connected with each other in loop-in loop-out connection to the extent of 4 Nos., located at an interval of 50 M. along the length of conveyor gallery/tunnel starting from one end and both sides of Track Hopper and minimum one (1) no. shall be provided in all equipment floor, T.Ps, crusher house (2 nos. on each floor of crusher house) , wagon tippler, stacker

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

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

6.07.00 Fans & Regulators

a) Ceiling fans shall be provided in non-air conditioned cabins and in various areas inside the administration building canteen, security building etc. The number of such fans shall be decided based on room size.

b) The fan shall have three well balanced blades and shall be reasonably free from noise. Pedestal fans shall also be provided as per Owner's requirement.

c) Fan motor shall be totally enclosed type with copper winding & class E insulation.

d) Regulator shall have minimum five steps. Electronic regulator with smooth control is preferred.

e) Fans and accessories shall be provided for the Local control rooms in addition to the Air Conditioning

6.08.00 Switch & Switch Board

a) Modular Switches, miniature circuit breakers (MCB), bus bars shall be fully rated for short circuit level at the point of application. MCB shall have back-up HRC fuse if its rating is less than the available short circuit current.

b) All switch boards/boxes shall be of bent steel construction, fabricated of 14 SWG M.S. sheet with 6 mm thick Bakelite cover.

c) Switch boards/boxes located in control room and office areas shall be flush mounted type on brick wall with only the switch knob projecting outside.

d) Switch boards / boxes shall have conduit knock outs on the sides. Adequate provision shall be made for ventilation of these boxes.

e) Flush type receptacles where provided shall be so located that only the plug projects outside.

f) Switches shall have quick-make and quick-break mechanism operated by a suitable external handle complete with position indicator.

g) Occupancy switches shall be provided in service building.

6.09.00 Maintenance Equipment

a) The Contractor shall supply one (1) no. mini truck mounted adjustable hydraulic lift for the maintenance of street lights.

b) For the maintenance of lighting fixtures within the high bay areas, the contractor shall also supply four (4) nos. free standing adjustable aluminium ladder, adjustable from 5m. To 10m.

c) Three (3) nos. portable aluminium ladders of various sizes suitable for main control room, switchyard control room, etc

6.10.00 Special Requirement

a) All outdoor illumination fixtures, unless it is fed from photo cell time switch controlled lighting panel, has to be provided with outdoor type local switches.

b) In all the air filtration units and air handling units, one marine type lamp (of 100 Watt approx.) shall be supplied the wiring and fixing of the same has to be done by the contractor.

6.11.00 Conduits and Accessories

a) Conduits shall be rigid steel, hot-dip galvanized, furnished in standard length of 3 metres, threaded at both ends.

b) Conduits upto and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.

c) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushings at both ends.

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

6.12.00 Junction Box

a) Junction boxes shall be of 16 SWG sheet steel hot-dip galvanized, dust and damp proof, generally conforming to IP-66.

b) Junction boxes shall be complete with gasket inspection cover, conduit knock out/threaded hub and terminal blocks.

c) Junction boxes for outdoor use shall be FRP weatherproof IPW-66 and those for hazardous location shall be flame-proof type.

d) Junction boxes shall have following indelible markings :

1. Circuit nos. on top
2. Circuit nos. with ferrules (inside) as per drawing
3. DANGER sign in case of 415V circuit

6.13.00 Lighting Cables & Wires

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

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

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

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

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

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

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

6.13.05 Wire size shall be as follows:

For point wiring beyond lighting panel i.e. from lighting Panel to junction box (main run)	:	10 Sq.mm. Aluminium. Stranded conductor
From Junction box to lighting fixture	:	2.5 Sq.mm. Copper. Stranded conductor.

6.14.00 Terminals

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

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

7.00.00 ENERGY SAVING SYSTEM

7.01.00 Panels

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

7.02.00 Lamps

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

7.03.00 Board/Panel Equipment

a) Each board shall consist of 2 x 100% dry type transformer housed in the different cubicles voltmeter with selector switch, C.T. operated ammeter and incoming triple pole switch. Outgoing feeder from the Lighting Distribution Board shall have MCCB.

b) Each lighting panel shall have an incoming triple pole switch with neutral link and a number of outgoing miniature circuit breakers (MCB).

c) Board/Panel access door shall be interlocked with incoming switch unit such that the door can be opened only when the switch is in OFF position. Means shall be provided to defeat this interlock.

d) Contactors shall be air-break electromagnetic type. Push buttons shall be push to actuate type.

e) MCB shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.

f) Time switch in street lighting panels shall be photocell type with automatic voltage stabilizer and necessary electronic unit with provision for sensitivity adjustment depending on external light intensity. When the exterior illumination level shall fall below a preset value for a considerable period of time (adjustable 30 sec. to 180 secs.) the electronic unit shall generate signal for the output relay to pick-up and potential-free contact of the same shall be used for control of contactor for lighting system. Sustained normal illumination level being restored (adjustable 30 sec. to 180 sec.) the lights shall switch off.

g) Voltmeter / Ammeter shall be of accuracy class 2.0 or better as per IS: 1248 Voltmeter / Ammeter selector switch shall be of reputed make.

h) Each lighting panel shall be provided with adequate number of outgoing LCBs/MCBs for controlling fixtures. 5A, 3Pin sockets shall be fed from the lighting panel through separate circuits.

8.00.00 LIGHTING POLES/TOWERS

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

pile, and other necessary outdoor areas.

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

8.01.00 Street Light Poles

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

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

8.02.00 Flood Light Tower

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

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

8.03.00 Lighting High Masts

a) Applicable standards

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

b) Structure

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

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

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

9.00.00 CHIMNEY LIGHTING

9.01.00 Electrical System

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

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

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

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

9.02.00 Lighting system

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

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

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

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

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

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

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

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

10.00.00 Portable Emergency Lighting Unit

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

11.00.00 24V AC Maintenance Lighting System

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

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

12.00.00 Nameplate

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

13.00.00 Painting

All sheet steel enclosures shall be chemically cleaned, rinsed, phosphated, rinsed and dried. After the treatment, steel surfaces shall be given undercoats of primer and finished with two coats of sprayed-on enamel or lacquer of approved shade.

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

All steel fabrication shall be given two coats of red-oxide primer followed by two coats of Siemens gray (RAL-7032).

All equipment shall be given touch-up paint as required after installation

14.00.00 Samples

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

15.00.00 SPECIFIC REQUIREMENTS-SERVICES

15.01.00 Consumables and Hardware

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

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

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

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

15.02.00 Erection Tools & Tackles

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

15.03.00 Street Lighting Poles

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

15.04.00 Flood Lighting Tower

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

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

15. 05.00 Lighting High Masts (winch operated)

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

15.06.00 Wiring

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

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

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

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

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

15.06.06 A.C. and D.C. circuits shall not be run in the same conduit and junction boxes. Circuits fed from different transformers shall be run through different conduits and Junction boxes.

15.06.07 Receptacle circuits shall be kept separate and distinct from lighting and fan circuits.

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

15.06.09 Wires of different phases shall run in separate conduits wires of lighting and power receptacles shall be run in separate conduits and on separate circuits.

15.07.00 Cabling

15.07.01 In outdoor areas, main runs from lighting panels shall be by means of cables, directly buried in ground or laid in trenches for the underground portion and through conduit for the above ground portion.

15.07.02 Buried cables shall be laid and covered with sand/riddled earth, and protected from damage by bricks at sides and precast concrete stab at top. Buried cables shall have cable markers at 50M interval and projecting 150 mm above ground. At cable bends and joints markers shall be provided.

15.07.03 When buried cables cross road/railway track, additional protection to be provided in form of G.I. pipe.

15.08.00 Grounding

15.08.01 All lighting panels, junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. Rules.

15.08.02 Ground connections shall be made from nearest available ground grid. All connections to ground grid shall be done by arc welding.

15.08.03 Panels/Boards shall be directly connected to ground grid by two nos.35 x 6 mm G.I. flats. (for panels/two nos. 50x6 mm G.I. flats (for distribution boards).

15.08.04 All junction boxes, receptacles, lighting fixtures etc. shall be grounded with 8 SWG G.I. wire.

15.08.05 Each street lighting Pole shall be grounded at two points by two nos. 50x6 mm G.I flat risers from two (2) nos. earthing spike 40 mm dia & 3m long directly driven into ground at a depth of 1m from ground level. The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 16 SWG GI wire. One 16 SWG G.I wire shall be taken upto the junction box from lighting fixtures and connected to grounding point.

15.08.06 Two (2) nos. earthing spike 3m long & 40 mm dia directly driven into ground at a depth of 1m from ground level shall be provided for each flood lighting tower.

The sheet steel cubicle housing the power supply Isolator at base of flood lighting tower shall be connected at two (2) points from these earthing risers by 16 SWG G.I. wire – The flood lighting fixtures shall be grounded by one (1) 16 SWG G.I wire running through the lighting conduct upto the distribution box.

Two (2) nos. separate spike of 3m long & 40 mm dia directly driven into ground at a depth of one (1) m from ground level shall be provided for connection of the lighting must on top of flood lighting tower through two (2) nos. 50x6 mm G. I. flat down conductor.

15.08.07 A continuous ground conductor of 12 SWG G.I. wire shall be run all along each conduit run and bonded to it every 600 mm by not less than two turns of the same size of wire. This conductor shall be connected to each panel ground bus.

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

15.09.00 Foundation & Civil Works

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

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

15.10.00 Excavation and Back Filling

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

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

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

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

15.11.00 Steel Fabrication

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

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

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

15.12.00 Cleaning up of Work Site

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

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

16.00.00 INSPECTION & TESTING

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

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

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

17.00.00 LIST OF TESTS TO BE CONDUCTED

17.01.00 Shop Tests

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

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

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

17.01.03 The tests on lighting fixtures shall include:

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

b) Rain-proof test for outdoor type luminaries and respective control gearbox as type test.

c) Temperature rise test on ballast/choke as type test. Dust proof test as type test.

17.02.00 Site Tests

17.02.01 Contractor shall thoroughly test and meggar all cables, wires and equipment to prove the same are free from ground and short circuit.

17.02.02 If any ground or short circuit is found, the fault shall be rectified or the cable and/or equipment replaced.

17.02.03 All equipment shall be demonstrated to operate in accordance with the requirements of this specification.

17.02.04 Illumination in different areas are as per designed lux level generally confirming with Indian Standards. The lux level shall be verified by photometer at site location.

18.00.00 DRAWINGS, DATA & MANUALS

18.01.00 To be submitted with the Bid

18.01.01 Make, type and catalogue number of lighting fixtures, lamps and accessories along with technical leaflets, data sheets, polar curves etc.

18.01.02 Typical outline drawings, showing constructional features, cable / conduit entry, fixing arrangements etc. of:

a) ~~General Arrangement Drawing of Lighting Transformer.~~

b) Lighting Distribution Board & Panel/receptacles/junction boxes.

c) Street light pole.

d) Flood light towers.

18.01.03 Technical leaflets and data sheet on each piece of equipment/device such as M.C.B., switch fuse, receptacle etc.

18.01.04 Technical Particulars Sheets.

18.01.05 Type test certificates on lighting fixtures and lighting panels, transformer, ballast, power cables.

18.02.00 To be submitted for Approval and Distribution

18.02.01 Detail dimensional drawing showing constructional features, cable/ conduit entry, grounding, fixing arrangement etc. of :

a) Lighting Transformer.
b) Lighting panels & distribution boards.
c) Receptacles & Junction boxes.
d) Street light poles & towers.
e) Lighting fixture complete with lamps and accessories.
f) Non-integral/separate type control gear box for lighting fixtures, as applicable.

18.02.02 Data sheets for lighting fixture, lamps, accessories with light distribution curves, coefficient of utilization charts etc. Type and routine test certificates of transformer, cables, lighting fixture, lighting panels, ballast, etc.

18.02.03 Control schematic and wiring diagram of 415V AC/220V DC lighting panel with automatic changeover from AC to DC and vice-versa, 415V normal AC Street/area lighting panel with automatic ON/OFF feature.

18.02.04 Technical Particulars Sheets and Calculations

18.02.05 Technical leaflets and data sheet on each piece of equipment/ device such as MCB, switch, fuse, receptacle etc. Type and routine test certificates of transformer and cables.

18.02.06 Lighting layouts showing the disposition of fixtures, lighting panels/boards, circuit distributions, conduit & wire rolling.

18.02.07 Key Single Line Diagram for lighting distribution, board-wise single line diagram with feeder loading, cable schedule and interconnection chart, design calculation for lighting.

18.02.08 AS-BUILT lighting layout and erection drawings, properly incorporating the changes/alterations/field modifications, if any, as carried out at field alongwith circuit distribution schemes of all lighting panels, conduit and cable routing and as acceptable to the Owner.

18.02.09 Any other relevant drawings, data and manuals necessary for satisfactory installation, operation and maintenance.

18.02.10 The Contractor may note that the drawings, data and manuals listed are minimum requirement only. The Contractor shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.

ANNEXURE – 1

ILLUMINATION LEVELS (In line with Section-1)

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

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

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

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

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

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

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

Note:

1. The lux level and type of fitting for any area not specified shall be finalized during detailed engineering without any price implication.

2. N/E AC lighting and DC lighting shall be identified with suitable colour code.

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

ANNEXURE B: FITTINGS AND ACCESSORIES OF LIGHTING TRANSFORMER

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

1. 150 mm dia. winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.

2. Handling and lifting lugs both for enclosure and core-coil assembly.

3. Jacking pad for core-coil assembly.

4. Inspection covers for cable and box.

5. Door handle operated safety limit switch with 1NO + 1NC contact.

6. Ground bus.

7. IP-55 junction box.

8. Rating and terminal marking plates.

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

SECTION – 3

PROJECT INFORMATION AND GENERAL TECHNICAL REQUIREMENTS

INDEX

S.No	Chapter	Sheet No.
1.0	Project Synopsis	1
2.0	General Technical Requirements	4
3.0	Drawing Document Submission	10

CHAPTER 1

PROJECT SYNOPSIS

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

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

1.2 Location

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

1.3 NA

1.4 PROJECT INFORMATION

Project Title : **2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS**

Owner : **TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

LOCATION

The site is located near Vayalur Village, Ennore

Latitude	:	$13^0$17' N to $13^0$18' N
Longitude	:	$80^0$18' E to $80^0$19' E
Distance from Chennai City	:	35 km
Nearest Airport is at Chennai at a Distance of	:	60 km
Nearest Seaport is	:	Ennore
Nearest Railway Station is	:	Athipattu Pudunagar (approx 5 kms)

Meteorological Condition

Climate : Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

Climatological data	:		
Ambient temp. (^{0}C)	:	Annual Maximum Mean Temp	41.5(^{0}C)
		Annual Minimum Mean Temp	24(^{0}C)
		Design Ambient temperature	**50(^{0}C)**
Relative Humidity	:	Maximum 100% Minimum 36% Design 75%	
Annual Rainfall	:	Maximum 2540 mm Average 1600 mm Minimum 1175 mm	
Prevailing Wind Direction	:	Nov to Jan – From NW & NE Feb to Mar – From East & SE Apr to May – From South & SE June – From SW July to Aug – From NW Sept to Oct – From SE & SW Wind Speed 11.8 kmph (avg) 50 kmph (max)	
Seismic Zone	:	Seismic Zone III as per IS:1893-2002	

		minimum 0.16 g horizontal	

1.5
1.7 **Access to Site**

Site is well connected to all weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

CHAPTER – 2

GENERAL TECHNICAL REQUIREMENTS

1.00.00 ELECTRICAL SYSTEM PARTICULARS

1) Standard voltage levels

The standardized voltage levels as shall be adopted as specified elsewhere in this specification.

2) Permissible variations:

The system unit/plant equipment shall be designed suitable for continuous operation with variation in voltage and frequency as indicated below:

3) Variation in voltage and frequency

	Voltage	Frequency
Permissible variation for power supply with rated Performance /rated current and control effectiveness maintained	+/- 10%	-5% to +3%
Permissible variation for control and regulation equipment with rated Performance and control quality maintained		

4) Basic insulation levels

Equipment shall be designed suitable for basic insulation levels as given below:

Nominal Voltage (kV)	BIL kV (peak)
400 kV	1425
33 kV	170
11 kV	75
3.3 kV	40

5) Symmetrical short circuit ratings

The three phase symmetrical short circuit ratings of the switchgear at different voltage levels shall be as indicated in the Table below:

S. No.	Voltage level	Symmetrical Breaking Capacity	Making Capacity
1.	400 kV	63 kA for 1 sec	163 kA
2.	33 kV	25 kA for 3 sec	62.5 kA
3.	11 kV	50 kA for 3 sec	125 kA
4.	3.3 kV	40 kA for 3 sec	100 kA
5.	415 V	50 kA for 1 sec	125 kA
6.	220 V DC	25 kA for 1 sec	-
7.	48 V DC	10 kA for 1 sec	

6) Criteria for selection of voltage levels for motors

Sr. No	Rating	Voltage Level
1	LV Motors- Up to 160 kW	415 V, 3 phase, 50 Hz
2	MV Motors- More than 160 kW and up to 1500 kW	3.3 kV, 3 phase, 50 Hz
3	HV Motors- Above 1500 kW	11 kV, 3 phase, 50 Hz

7) System Earthing

i. 33kV/11 kV and 3.3 kV : Resistance grounded.
ii. 415 V : Solidly grounded.

8) Degree of Protection:

Degree of protection for various electrical equipment shall be as follows:

S.No.	Equipment	Degree of Protection
1.	Marshalling Boxes, Panels, Motors located outdoor	IP55
2.	Electrical Equipment of CH System	IP55 with dust proof enclosure
3.	HV Switchgear	IP-4X for bus bar chamber, IP-6X for other compartments
4.	LV Switchgear	IP52 up to 1600 A and IP42 above 1600 A

2.00.00 GENERAL TECHNICAL PARTICULARS FOR EHV SYSTEM

(a)	Rated voltage	400 kV
(b)	Rated frequency	50 Hz
(c)	Rated short time current withstand capacity	63 kA rms for one (1) second
(d)	Rated one minute power frequency withstand voltage	650 kV rms between live terminals and earth b) 815 kV rms across isolating distance
(e)	Rated lightning impulse withstand voltage	a) 1425 kVp between live terminals b) 1425 (+240) kVp across isolating distance & earth.
(f)	Rated Switching Impulse withstand voltage	a) 1575 kVp (between phases) b) 900 (+345) (across isolating distance)
(g)	Phase to phase spacing	4000 mm
(h)	Rated terminal load	Adequate to withstand 100 kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capacity.
(i)	System neutral earthing	Effectively earthed
(j)	Support structure height	Adequate so that lowest part of support insulator of equipment is 2550 mm (minimum) from ground and/or plinth level.
(k)	**Creepage distance**	**Minimum 31 mm / kV**
(l)	Electrical Clearances	

Clearances shall be as given below and as per relevant statutory rules/codes.		
1.	Phase to earth	3500 mm
2.	Phase to phase	4000 mm
3.	Sectional clearance	6500 mm
4.	Ground clearance	8000 mm

3.00.00 NA

4.00.00 COMPLETENESS

4.01.00 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.02.00 All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.00.00 CODES & STANDARDS

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

(a.) Bureau of Indian Standards (BIS)

(b.) Indian electricity act

(c.) Indian electricity rules

(d.) Indian Explosives Act

(e.) Indian Factories Act and State Factories Act

(f.) Indian Boiler Regulations (IBR)

(g.) Regulations of the Central Pollution Control Board, India

(h.) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

(i.) Pollution Control Regulations of Department of Environment, Government of India

(j.) State Pollution Control Board.

(k.) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(l.) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

(a.) Japanese Industrial Standards (JIS)

(b.) American National Standards Institute (ANSI)

(c.) American Society of Testing and Materials (ASTM)

(d.) American Society of Mechanical Engineers (ASME)

(e.) American Petroleum Institute (API)

(f.) Standards of the Hydraulic Institute, U.S.A.

(g.) International Organisation for Standardization (ISO)

(h.) Tubular Exchanger Manufacturer's Association (TEMA)

(i.) American Welding Society (AWS)

(j.) National Electrical Manufacturers Association (NEMA)

(k.) National Fire Protection Association (NFPA)

(l.) International Electro-Technical Commission (IEC)

(m.) Expansion Joint Manufacturers Association (EJMA)

(n.) Heat Exchange Institute (HEI)

5.03.00 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, alongwith the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned else

where in the specification together with the complete word to word translation of the standard that is normally not published in English.

~~5.04.00 NA~~

~~5.05.00 NA~~

5.06.00 NA

5.07.00 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Owner shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Bidder to bring to the notice of the Owner such changes and advise Owner of the resulting effect.

6.00.00 EQUIPMENT FUNCTIONAL GUARANTEE

6.01.00 The Equipment and Auxiliaries shall be capable of continuous operation in frequency range of 47.5 to 51.5 Hz.

DRAWING DOCUMENT SUBMISSION

4.1 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

Should there be any discrepancy between the specifications and/or schedule of prices and/or drawings or any inconsistency, error or omission in either of them, reference must be made to the BHEL/CUSTOMER for an explanation and the Supplier will be held responsible for any errors that may occur in the work through neglect of this precaution. The explanation of the BHEL/CUSTOMER shall be final and binding on the Supplier.

4.2 APPROVAL PROCEDURE

The scheduled dates for the submission of drawings as well as for, any data/information to be furnished by the Employer would be as per the following schedule. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	First Submission	Within 7 days from the date of LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The supplier may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

4.3 TITLE BLOCK

Following Title Blocks to be used in drawings at the time of drawing approvals

Project:	400kV GIS at 2 x 660 MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Chennai-120
NOA No:	CE/P/SE/M/P/EE-10/E/P/F.2X660MW ENNORE SEZ STTP/D60/DT 27.027.2014
Customer :	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
Consultant	DESEIN PRIVATE LIMITED,NEW DELHI
Contractor	BHARAT HEAVY ELECTRICALS LIMITED

4.4 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

1) **Drawings**
2) **Guaranteed Technical Particulars**
3) **Type Test Reports**
4) **List of Part Supplies with rating**

Drawings & Documents submitted at the time of offer shall be subject to review at contract stage.

4.5 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	**CONTRACT STAGE FOR APPROVAL**	FINAL DOCUMENTATION	
			Hard Copy / Prints	**Hard Copy / Prints**	CDs
1	Drawings and Data Sheets	1	**7**	10	5
2	Drawings "As Built "	-	-	10	
3	Type Test Reports	1	**7**	10	
4	Erection Manuals	-	**7**	10	
5	Operation and Maintenance Manuals	-	**7**	10	
6	Manufacturing Quality Plan	-	**7**	10	
7	Field Quality Plan	-	**7**	10	

8	Inspection Test Reports	-	**7**	10	

Supplier to submit Hard copies of the drawing to following address

To,
<Name of BHEL's concerned engineering official>
Bharat Heavy Electricals Limited
Transmission Business Group- Engineering Management
Advant Navis IT Business Park
Plot No.-7, Greater Noida Expressway,
Sector 142, **NOIDA**, Uttar Pradesh 201305

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD version or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

Annexure-A: Schedule of Technical Deviations

Bidder shall list out all technical deviation(s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason / Justification

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

ANNEXURE-B: COMPLIANCE CERTIFICATE

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

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the 'schedule of deviations'.

3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.

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

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

Annexure-C: Guaranteed Technical Particulars

(To be submitted by the supplier at the contract execution stage)

1 Lighting Fixtures

1.1 Fixture	Make	Cat. No.	IS Ref.	Degree of Protection	Finish				Sheet Steel thickness of Reflector	Control Gear Type		
					Outside		Inside			Integral (Yes/No)	Non-Integral (Yes/No)	Cat. No. (if non-integral type)
					Colour	Shade No. (As per IS:5)	Colour	Shade No. (As per IS:5)				
(i) Type-A												
(ii) Type-B												
(iii) Type-C												
(iv) Type-D												
(v) Type-E												

1.2 Catalogue for all the fixtures furnished ? :

1.3 Electrical and Optical Characteristics given in Catalogue guaranteed ? :

1.4 If not, furnish guaranteed characteristics. Attach separate sheets, if required :

1.5 Polar curve/ light distribution diagram for all fixtures furnished :

1.6 Utilisation factors for different room index for each fixture furnished ? :

1.7 Isolux diagram for street lighting fixture furnished ? :

1.8 Nominal working voltage :

1.9 Power factor at nominal working voltage and frequency :

1.10 Full load input current at nominal working voltage :

1.11 Power loss per ballast at nominal working voltage and frequency :

1.12 Maximum permissible supply voltage variation for satisfactory operation of fixture :

1.13 Characteristics of fixture furnish for all types of luminaires -

a) Starting current and power factor :

b) Operating current and power factor :

c) Operating time

1.14

Lamps	Make	Average Life-Hrs	Lumen Output	Temo. Voltage	Cat. No.	Type of Lamp Base/ Cap
(a) Incandescent lamp						
(b) Fluorescent tube						
(c) High Pressure Sodium Vapour						
(d) CFL						
(e) LED Lamps						

1.15

Control Gear	Make		Cat. No.		Rating		Max. operating temp		Average Life-hrs	
	Fluorescent	HPSV & HPMV	Fluorescent	HPSV & HPMV	Fluorescent	HPSV & HPMV	Fluorescent	HPSV & HPMV	Fluorescent	HPSV & HPMV
(a) Ballast										
(b) Capacitor										
(c) Starter										
(d) Ignitor (Separate type)										

1.16 General:

Any other items which is not indicated in sheet

Annexure-C: Guaranteed Technical Particulars

(To be submitted by the supplier at the contract execution stage)

2.0 **LIGHTING PANELS (INDOOR/ OUTDOOR)**

2.1 Make :

2.2 Type :

2.3 Reference Standard :

2.4 Enclosure

a) Sheet metal thickness (mm):

b) Degree of protection for

i) Indoor Panel :

ii) Outdoor Panel :

2.5 Bus-Bars

a) Material :

b) Size :

2.6 Bus Rating

a) Continuous at 50 Deg.C Amp. :

b) 1Sec Current KA rms :

c) Maximum temperature rise over 50 Deg.C. ambient Deg.C. :

2.7 Cable gland furnished ? :

2.8 Finish

a) Colour :

b) Shade IS-5 # :

2.9 Ground Bus

a) Ground Bus furnished ? :

b) Material :

c) Size :

2.10 Dimension & Weight LxBxH(mm) Weight (Kg)

a) LP (Indoor) :

b) LP (Outdoor):

c) LP (Outdoor emergency):

2.11 Switch

a) Make :

b) Type :

c) Referenee Standard :

d) Rating Amps :

2.12 Miniature Circuit Breaker (MCB)

a) Make :

b) Type :

c) Referenee Standard :

d) Rated Voltage :

e) No. of Poles :

f) Frequency :

g) Current Rating :

i) Continuous at 50 Deg.C Amps :

ii) 1 Second KArms :

h) Breaking Capacity :

i) Symmetrical KArms :

ii) Asymmetrical KArms :

i) Interrupting time mS :

j) Type of Blow out device :

k) Type of overload :

l) Terminal suitable for cable size :

m) Catalogue furnished ? :

2.13 Timer Switch
a) Make :
b) Type :
c) Reference Standard :
d) Rating/ Range :
e) Catalogue furnished ? :

2.14 Fuse
a) Make :
b) Type :
c) Reference Standard :
d) Rupturing capacity (Sym.) Karms :
e) Continuous current at 50 Deg.C ambient and within cubicle :
f) Cut off current KA peak :
g) Fuse characteristics furnished for various fuse ratings :

2.15 Magnetic Contactor 240V AC 220V DC
a) Make :
b) Type :
c) Reference Standard :
d) Rating :
e) Duty class :
f) Utilisation category :
g) Operating Coil :
i) Rated Voltage :
ii) Drop-out Voltage :
h) Catalogue furnished ? :
i) No. of contacts furnished :
i) Normally open (N.O) :
ii) Normally closed (N.C) :
j) Rating of N.O/N.C contacts :
i) Make and continuous Amps :
ii) Break (Inductive) Amps :

2.16 Indicating Lamps (LED Type)
a) Make :
b) Type :
c) Cat. no. :
d) Voltage :

2.17 Push Button
a) Make & Type :
b) Contact Rating :

2.18 Meter Ammeter Voltmeter
a) Make :
b) Type :
c) Reference standard :
d) Size :
e) Scale :
f) Accuracy Class :

2.19 Current Transformer, If applicable
a) Make :
b) Type :
c) Reference standard :
d) C.T. Ratings :
i) Current Ratio :
ii) Accuracy Class :

iii) Rated Burden :

3.0	**RECEPTACLES (With Plug)**	240V AC			415V		
		5A	15A		63A	125	
	a) Make :						
	b) Type :						
	c) Reference Standard :						
	d) Catalogue furnished ? :						
4.0	**CEILING FAN**	Fan	Regulator				
	a) Make :						
	b) Type :						
	c) Reference Standard :						
	d) Sweep of the Fan mm :						
	e) Regulator control smooth or step :						
	f) Catalogue furnished ? :						
5.0	**OUTDOOR LIGHTING WITH LIGHTENING MAST**	With LM					
	a) Make :						
	b) Type :						
	c) Reference Standard :						
	d) Height – Overall m :						
	'-Fixture mounting m :						
	e) Catalogue sheet furnished ? :						
6.0	**LIGHTING TRANSFORMER**						
6.1	General						
	a) Make :						
	b) Type :						
	c) Reference Standard :						
6.2	Rating						
	a) Rated output KVA :						
	b) Type of Cooling :						
	c) Rated Voltage Volt						
	i) Primary :						
	ii) Secondary :						
	d) Rated Current Amps.						
	i) Primary :						
	ii) Secondary :						
	e) No. of phases :						
	f) Rated Frequency Hz :						
	g) Vector Group reference :						
6.3	Temperature						
	a) Reference ambient temperature 50 Deg. C :						
	b) Temp. rise over reference ambient :						
	i) On enclosure by thermometer Deg.C :						
	ii) In winding by resistance Deg.C :						
6.4	Tappings						
	a) Type :						
	b) Capacity :						
	c) Range - Steps x % Variation :						
	d) Taps provided on H.V. winding :						
6.5	Insulation Level KV/KVp						
	a) Primary :						
	b) Secondary :						
	c) Secondary neutral :						

6.6	Impedance at principal tap rated current & frequency %	
	a) Impedance :	
	b) Reactance :	
	c) Resistance at 75 Deg.C :	
	d) Zero sequence Impedance :	
	e) Zero sequence capacitance of H.V. winding uf/ph :	
6.7	Guaranteed losses at Principal tap, full load and 75 Deg.C KW	
	a) No load losses :	
	b) Load losses :	
6.8	Efficiency at 75 Deg.C and 0.8 power factor lag %	
	a) At full load :	
	b) At 3/4 full load :	
	c) At 1/2 full load :	
	d) Maximum Efficiency :	
	e) Load and power factor at which it occurs :	
6.9	Regulation at full load and 75 Deg.C %	
	a) At unity power factor :	
	b) At 0.8 power factor lagging :	
6.10	No load current referred to HV Amps.	
	a) At 90% rated voltage :	
	b) At 100% rated voltage :	
	c) At 110% rated voltage :	
6.11	Approximate maximum flux density	Web/Sq.m
	a) At 90% rated voltage :	
	b) At 100% rated voltage :	
	c) At 110% rated voltage :	
6.12	Maximum current density Amps/Sq.cm	
	a) Primary winding :	
	b) Secondary winding :	
6.13	Withstand time without injury for	Sec.
	a) Three phase dead short circuit at terminal with rated voltage maintained on the other side :	
	b) Single phase short circuit at terminal with rated voltage maintained on other side :	
6.14	Details of Enclosure	
	a) Material :	
	b) Thickness (mm) :	
	c) Degree of protection :	
	d) Padlocking provisions :	
6.15	Core	
	a) Type - Core or Shell :	
	b) Core material :	
	c) Thickness of lamination (mm) :	
	d) Insulation of lamination :	
6.16	Coils	
	a) Type of coil :	
	i) Primary :	
	ii) Secondary :	
	b) Conductor material :	
	c) Insulating material :	

d) Separate encapsulation for Primary and Secondary Primary and Secondary windings provided ? : Yes/No

6.17 Tap-Changer

a) Tap-changer operable at standing height from ground ? :

b) Provided with arrangement to ensure that same tap is set on all three phases at a time ? :

c) All contacts silver plated ? :

6.18 Bushings Primary Secondary

a) Make :

b) Type :

c) Reference Standard :

d) Voltage class KV :

e) Creepage distance mm/KV :

f) Weight :

g) Free space required for bushing removal :

6.19 Minimum Cleaances Primary Secondary

a) Between phases mm :

b) Between phase & earth mm :

6.20 Terminal Connections

a) Primary :

b) Secondary :

c) Secondary Neutral :

6.21 Junction Box

a) Provided with removable gland plate/conduit knock out :

b) Degree of protection :

6.22 Terminal Blocks

a) Make :

b) Type :

c) 20% Spare terminals furnished ? :

6.23 Wiring

a) Cable type :

b) Voltage grade Volt :

c) Conductor size - Sq.mm :

6.24 Trip & Alarm Contacts Ratings

a) Voltage Volt D.C. :

b) Rated/Making Current Amps. :

6.25 Accessories Each transformer furnished with fittings and accessories as per Annexure-F to Section VII of Volume II E/2 :

6.26 Approximate Overall Dimension

a) Length mm :

b) Breadth mm :

c) Height mm :

d) Crane lift for untaking core and coil assembly (including sling) mm :

6.27 Approximate Weights

a) Core and Coil Kg. :

b) Enclosure & fittings Kg. :

c) Total weight Kg. :

6.28 Shipping Data

a) Weight of the heaviest package Kg. :

b) Dimension of the largest package (LxBxH) mm :

7.00 **PORTABLE EMERGENCY LIGHTING UNIT**

a) Make :

b) Type :

c) Reference Standard :

d) Catalogue no. :

e) Overall dimension and weight (LxBxH) (mm x mm x mm) (Kg.) :

f) Lamp

i) Type :

ii) Make :

iii) Voltage Watts :

g) Storage Cell

i) Make :

ii) Type :

iii) Voltage Volts D.C :

h) Duration of lamp glowing after failure of AC supply :

8.00 **EMERGENCY EXIT SIGN BOARD**

a) Make :

b) Type :

c) Reference Standard :

d) Catalogue no. :

9.00 **MISCELLANEOUS ITEMS**

9.1 Maintenance Ladder Car wheel Freemounted standing

a) Make :

b) Material :

c) Reference Standard :

d) Height m :

e) Catalogue furnished ? :

9.2 Conduits	For general use	For use battery room (corrosive environment)
a) Make :		
b) Type/material :		
c) Reference Standard :		
d) Gauge upto 25mm dia :		
e) Gauge above 25mm dia :		
f) Catalogue furnished ? :		

9.3 Junction Box

a) Make :

b) Type/material :

c) Reference Standard :

d) Degree of protection Indoor/Outdoor :

e) Catalogue furnished ? :

f) Material thickness :

9.4 Terminal Block

a) Make :

b) Type :

c) Reference Standard :

d) Current Rating :

e) Voltage grade :

f) Catalogue furnished ? :

9.5 Wires (1 core)

a) Make :

b) Type :

c) Reference Standard :

d) Voltage grade :

e) Wire Sizes 2.5 Sq.mm 10 Sq.mm

f) Conductor

i) Material :

ii) No. & dia of wires/strands :

g) Insulation

i) Material :

ii) Thickness mm :

Annexure-D: Technical Checklist for Illumination System

(Checklist for information to be furnished with offer. Return this technical checklist as a part of technical offer duly signed. The offer may not be considered if the following information, if this checklist is not enclosed with this offer)

1. Illumination System

Sl. No.	Parameter	Data	Bidder's conformation	Reason for non-compliance
1.	Scope and provision of illumination for specified areas as per specification.	(i) Switchyard control room building, GIS building & Ventilation Room, (ii) Outdoor switchyard area	YES / NO	
2.	Responsible for the design and verification of the **complete illumination system, demonstration of lux levels etc.**		YES / NO	
3.	Type of luminaire and luminaries included as per specification.		YES / NO	
4.	Lighting panels & junction box etc. included as per specification		YES / NO	
5.	Receptacles, switchboards & other items included as per specification.		YES / NO	
6.	Services for erection, testing & commissioning included in the offer		YES / NO	
7.	Supply & ETC of all wires / Cables / earthing material required for the package (Other than the items supplied by BHEL) included in the package.		YES / NO	
8.	ETC of BHEL supplied Cables included in the offer		YES / NO	
9.	ETC of BHEL supplied earthing strip included in the offer		YES / NO	
10.	Type and lumen output of lamps included in the offer are as per specification.		YES / NO	
11.	Whether any new item other than the BOQ given required to meet the specification requirement.		YES / NO	
12.	If new item is required whether these are listed with quantities in the offer		YES / NO	
13.	Equipment included suitable for operation on voltage & frequency Variation limits specified in the specification without effecting their performance		YES / NO	
14.	Power factor of lamp circuit is as per specification .		YES / NO	

15.	GTP duly filled & signed enclosed		YES / NO	
16.	Auto switching arrangement for outdoor flood lighting through Timer / Photo cell included		YES / NO	
17.	Spares included in the offer (a) Mandatory (b) Commissioning		 YES / NO YES / NO	
18.	Activity Schedule enclosed		YES / NO	
19.	Type test reports	Type test reports furnished shall be in line with clause 1.7 of Section-1.	YES/ NO	
20.	Type test	If type test reports are not acceptable to BHEL/ TANGEDCO, then above tests shall be conducted by the bidder free of cost	YES/ NO	
21.	Mandatory spares in line with BOQ included in offer.		YES/NO	
22.	Bidder to confirm that it will offer approved make of components & fitments at Contract stage. In case the offered make is not approved by the Customer, then alternate make shall be supplied without any commercial implication to BHEL.		YES/NO	

2. Type Tests

Whether Type test reports as per clause no. 1.7 of section-1 has been submitted. **YES/NO**

If yes, kindly indicate report number.

If the valid type test reports are not available as per clause no. 1.7 of section -1 of technical specification with the bidder, then the type tests shall be conducted by the bidder without any price implication

YES/NO

Date: Bidder's Stamp & Signature