



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

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CUSTOMER Doc. No.				NAME	MVK	MVK	SKS
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				GROUP	TBEM		
				W.O. No	87007		
CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED (TANTRANSCO)						
PROJECT	400/230-110 kV Substation at Vellalaviduthi						

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Rev.	Date	Altered	Checked	Approved	REVISION DETAILS		
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CHECKLIST FOR TECHNICAL EVALUATION

Along with the Technical Bids of the offers, the Bidder should submit this checklist confirming the inclusion of the enclosures as listed below. (Shall tick as ✓)

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted as per BOQ OF SECTION-1	
2.	Schedule of Technical Deviation format duly signed.	
3.	Supporting documents as asked in the Technical PQR. (if applicable as per tender requirements)	
4.	Checklist of Technical parameters as per Section-5 duly filled and signed.	
5.	Compliance to Technical Specification	

NOTE:- If the Bidder fails to submit any of the documents as asked in the above check list, their bid is likely to be rejected / not evaluated.

The above checklist is verified for:-

NIT Ref No. :

Name of Equipment :

Name of Project :

Name of Bidder :

Signed with Seal of Bidder.

Date

SECTION-1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 The Illumination System is required for the following project.

Customer : **Tamilnadu Transmission Corporation Limited (TANTRANSCO)**
Project : **400/230-110kV Vellalaviduthi S/s**

The specification comprise of following sections:

- Section-1: Scope, specific technical requirements & Bill of Quantities
- Section-2: Equipment Specification
- Section-3: General technical requirements for all equipment's under the project
- Section-4: Guaranteed Technical Particulars
- Section-5: Check list

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

1.1 SCOPE

This specification covers the specific technical requirements of Illumination system Comprising.

- a) Design, manufacture, testing at works, packing and dispatch of equipment & material to site.
- b) Supervision of Erection, testing & commissioning of complete Illumination and associated electrical auxiliary system, complete with accessories & handing over.

The Illumination System shall be provided for the following areas:

- ☐ Outdoor Switchyard Area
- ☐ Switchyard Control Room Building (Ground and First Floor)
- ☐ Street lighting
- ☐ DG Set area
- ☐ LT Transformer Yard area
- ☐ Illumination around Control Room Building

The roads & the area of the outdoor switchyard to be illuminated are as marked on the enclosed drawings under Annexure-3. Other relevant drawings are also enclosed under Annexure-3.

Complete lighting and illumination for the above shall be provided by the bidder as per BOQ.

Completeness checking of illumination system shall be in Bidder scope. All cable glands, wires, conduits, earth wire, fixing material of illumination system, switchboard, switch, telephone box/sockets, split air-conditioning sockets/ MCB etc. will be in Illumination supplier scope. Switchboard /boxes, receptacles, fan regulator and sockets etc. shall be modular flush mounted type.

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 Contractor shall be responsible for the design and verification of the Illumination system, demonstration of lux levels and other criteria at site.

After placement of order, the bidder has to design the system as per relevant standards/codes, practice to the satisfaction of BHEL/ ultimate Customer i.e. TANTRANSCO.

It is not the intent to specify herein all the details of design and manufacture. 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 Purchaser / Owner, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work and material, which in his judgment is not in full accordance herewith.

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

In case of any deviation, the bidder shall indicate separately the clause wise deviation with respect to the specification in the "Schedule of deviations". Deviations in any other form including clarifications / assumptions etc. will not be considered and it will be construed as the bid conforming strictly to the specification. Deviations pertaining to non-availability of specified equipment / material in the market or pertaining to economy in offer will only be considered.

The term " Owner" appearing in this specification shall refer to ultimate Customer, the term " Purchaser " shall refer to BHEL and the term " Contractor " shall refer to the successful Bidder.

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

2.0 DESIGN CRITERIA

2.1 The illumination System for outdoor Switchyard and road shall comprise of:

- ☐ Normal AC lighting
- ☐ Emergency AC Lighting

The illumination System for Control room building shall comprise of:

- ☐ Normal AC Lighting
- ☐ Emergency AC Lighting
- ☐ Emergency DC Lighting

25% of lighting fixtures shall be connected on AC emergency lighting.

2.2 The lux levels to be maintained in the switchyard shall be as per following:

Sl. No.	Area	Average Lux Level
1.	EE Room, Control Room, Office Rooms	300 Lux
2.	LT Switchgear room, Battery room	200 Lux
3.	Store, Pantry	150 Lux
4.	Toilet Passage, Lobby	100 Lux

5.	Cable Gallery, Stairs	70 Lux
6.	Switchyard lighting - General horizontal	30 Lux
7.	Switchyard lighting - Specific vertical (on disconnects)	30 Lux

- 2.3 The outdoor switchyard shall be illuminated by using 250W/150W Flood lights LED type lighting fixture. The mounting height to install the lighting fixture shall be 25m & 12.5m for LM.
- 2.4 The outdoor switchyard road shall be illuminated using 120W street lights LED type lighting fixture mounted on 8m height tubular lighting pole.
- 2.5 In an area, the lighting fixtures shall be arranged in different phase / LPs such that even in case one lighting panel is faulty complete lighting is not affected. In case of any location the lighting shall be arranged from all three phases for normal as well as normal/emergency supply (as applicable).
- 2.6 Detailed lighting design calculations considering the number of fittings as per BOQ shall be submitted during detailed engineering by contractor for approval of BHEL / ultimate customer.
- 2.7 The minimum lux level to average lux level ratio should not be less than 0.6 (i.e. $E_{min}/E_{av} > 0.6$). The maintenance factor for indoor illumination design shall be considered as 0.8. The surface reflectance for ceiling/wall/floor shall be 50/30/10.
- 2.8 The contractor shall submit detailed calculation for reaching the above Lux level for Employer's approval during detailed engineering.
- 2.9 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.
- 2.10 Earthing of Junction box , lighting pole & Lighting Panels etc. is to be done by 50X8mm MS Flat 50X8mm MS Flat to be supplied by BHEL. 50X8mm MS Flat shall be connected with nearest earthing conductor /40 mm dia. MS rod electrode riser.
- 2.11 All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of I.E. rules.
- 2.12 Refer Section-1, Annexure-2 for further details.
- 2.13 Lighting Transformer: MLDB shall be fed from 150 kVA Lighting Transformer which is, in turn, fed from AC Distribution Board. The Lighting Transformer may, preferable be located inside LDB panel itself. Otherwise, the side of respective LDB shall locate the same. Lighting Transformers shall be dry type, natural air cooled with Class F insulation or better. Impedance of lighting transformer shall be so selected that the fault level of lighting system shall be reduced to 3 to 5 kA. Lighting Transformers shall be tested as per IS: 2026. Off-circuit tap changer with $\pm 2.5\%$ and $\pm 5\%$ tapping shall be provided. In case the transformers are not mounted inside the LDB panels, the same shall be housed in a separate 2 mm thick CR sheet steel enclosure with IP-42 degree of protection as per IS: 13947. However, the transformer terminal box shall be IP-52 degree of protection.

3.0 SCOPE OF SUPPLIES & SERVICES

- 3.1 The equipment / services to be furnished for Substations under this contact are detailed hereunder and shall be read in conjunction with other clauses of this specification. All such items though not specifically mentioned but required to meet specification and for safe and satisfactory operation of equipment/ system will also be treated as included and the same shall be supplied at NO EXTRA COST to Purchaser. Further, in case any item not included below but are required to meet the technical specification, to be brought out by bidder at tender stage itself. Such items may be mentioned and included under separate head in the table below.
- 3.2 Tentative quantities are mentioned in **BOQ under Annexure-1**. Actual quantities to be supplied shall be as per the quantities approved based on design drawings during detailed engineering.
- 3.3 The Following shall be free issue items from BHEL :
- (a) Multicore Power Cables as listed in BOQ
 - (b) 50X8 mm mild steel strip for earthing

Power Cables: Following are the various cable sizes that may be used for project execution. Bidder shall estimate the cables required for successful completion of the full scope of works and furnish the break up of quantity during detailed engineering stage.

- 1) MLDB/ELDB to outdoor lighting panel - 3.5C x 185 /4C x 120 sq.mm Al/XLPE
 - 2) MLDB/ELDB to Indoor lighting panel - 4C x 25 sq.mm Al/XLPE
 - 3) MLDB/ELDB to Street lighting panel - 3.5C x 185 /4C x 120 sq.mm Al/XLPE
 - 4) Tower mounted Junction box to outdoor lighting panel - 4C x 25 sq.mm Al/XLPE
 - 5) Tubular pole Junction box to street lighting panel - 4C x 25 sq.mm Al/XLPE
 - 6) Tower mounted Junction box to LED fixtures - 2C x 2.5 sq.mm Cu/PVC
 - 7) MLDB to 63A switchyard welding receptacles - 4C x 25 sq.mm Al/XLPE
 - 8) MLDB to 63A control room welding receptacles - 4C x 25 sq.mm Al/XLPE
 - 9) Main switchboard to 300A oil filtration receptacles - 4C x 240 sq.mm Al/XLPE
 - 10) Sub ACDB to Split AC Distribution Board located in Control Room - 4C x 25 sq.mm Al/XLPE
- 3.4 **Supply of necessary cable for consumption within the street light/lighting pole assembly, such as pole mounted JB to respective light fittings, battery etc shall be in Contractor's scope.**
- 3.5 LIGHTING JUNCTION BOX - The Contractor shall supply and install junction boxes complete with terminals as required. The brackets, bolts, nuts, screws etc required for erection are also included in the scope of the Contractor.
- 3.6 If trench is not available then illumination Cable will be laid in **Pipe PVC class-4** Pipe. Supply of PVC pipes along with accessories will be in Illumination supplier scope.
- 3.7 Bidder shall indicate in his offer catalogue numbers of all equipment offered.
- 3.8 A continuous ground conductor **14 SWG tinned copper 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 this ground conductor. Supply of 14 SWG tinned copper wire ground conductor is in contractor's scope.
- 3.9 Supply of all other items such as wires, lugs, Cable glands, earthing material etc. required to complete the works are in bidder's scope.

3.10 **WIRING / CONDUITS:**

Wiring of lighting system will be done as follows:

- i) Wiring installation will be by multi-stranded, PVC insulated, colour coded wires laid in PVC conduits of 20 mm dia minimum size.
- ii) Conduits in false ceiling area will be surface mounted on the roof above false ceiling. Wiring shall be through **concealed** conduit for rooms without false roofing. However vertical drops of conduits will be within column flanges and /or concealed in wall, finally covered for better aesthetics.
- iii) Filling area of wires in conduit shall not exceed 40% of the conduit area.
- iv) Wiring for AC Normal, AC Emergency, and DC Emergency services will be run in separate conduits.
- v) Lighting and receptacles will be fed from separate circuits. No two different phase circuits will be run in the same conduit. However, different circuits of same phase may be laid in the same conduit.

- 3.11 Suitable nos. of 1400 mm sweep ceiling fans with stepped electronic regulator and flush mounted on switchboard shall be provided by bidder in following rooms.

LT Switchgear Room, Store Room, Staff Rooms and Office Area.

- 3.12 Split AC shall be provided by BHEL in following rooms of Switchyard Control Room Building.

EE Room (1 nos), Control & Relay Panel Room (15 nos).

- 3.13 Exhaust fans shall be provided by Bidder in Store Room, Cable Gallery, Battery Room, LT Switchgear Room, Pantry and Toilets. Exhaust fans will be provided with their control devices (MCB) & louvers.

- 3.14 **False ceiling with under deck insulation shall be provided by BHEL in EE Room, Control & Relay Panel Room only.**

- 3.15 **5/15 A, 240V Indoor decorative type Receptacle 3-pin type shall be provided in switchyard control room building.**

- 3.16 *Commissioning Spares :*

Contractor shall take commissioning spares required to site to commission the system without delay. The Contractor shall finalize the list with BHEL during detailed engineering stage.

3.17 **SCOPE OF SERVICES**

The bidder shall quote for supervision of ETC, civil works, cable termination & earthing against each item as applicable in BOQ.

SUPERVISION OF ERECTION, TESTING AND COMMISSIONING

- a. The Contractor shall give the offer for supervision of Erection, Testing and Commissioning of the Illumination Equipment at Site.
- b. The scope of ETC shall include receipt of material at site, safe storage of material, handling of equipment/ material at site, erection of equipment / material at site including fabrication, equipment and system testing, commissioning of the entire system.
- c. Conducting lux level measurement as per approved designs to the satisfaction of Owner / Purchaser.
- d. Supervision of Laying and termination of power and control cables from ACDB/DCDB to MLDB/ELDB, MLDB/ELDB to Lighting Panels, Lighting Panels to JB and JB to fittings etc for the equipment under the scope of this specification.
- e. All material and consumables required for erection work shall be in Contractor's scope. Erection material shall cover, but not be limited to, Clamps etc for Luminaries, Connections between Junction Boxes and Luminaries in outdoor area, All cable glands, lugs and ferrules require for cabling/ wiring. Any other material required for erection shall deemed to be in Contractor's scope. Holes shall not be drilled on the Galvanised substation gantry and LM structures.
- f. Supervision of Earthing of all the electrical equipment as per requirement.
- g. Mounting /installation material of 63/300A receptacles shall be in bidder scope.
- h. Contractor shall arrange all machinery tools & tackles, instruments and consumables required for erection, testing and commissioning of the system.
- i. Contractor shall ensure that sufficient quantity of commissioning spares is made available for timely completion of commissioning of the system. The Contractor shall finalize the list with BHEL during detailed engineering stage. The unused commissioning spares shall be returnable to the Bidder.

CIVIL WORKS

- a. Supervision of Civil works such as foundation for street lighting poles and lighting panels etc. shall be done by the bidder. The rates for these supervision civil works shall be deemed included in the supervision erection rates of respective items.
- 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 contractor 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. Supervision of Civil works such as grouting, filling up of crevices/ cut outs etc during installation of equipment shall also be in contractor'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 Contractor at no extra cost to the Purchaser.

4.0 BILL OF QUANTITY - Refer attached Annexure-1

Note -1: Following scope of works shall be in Illumination Contractor scope.

(a) Following scope of work for "Fire Protection System" and "Air Conditioning & Ventilation System" is to be done by illumination contractor in Control Room Building.

Bidder shall supply and supervise laying of conduits in **Control Room Building** for Firefighting detection cables, Air Conditioning & Ventilation System. Supply of

conduits and wire for Split Air Conditioning located in Control Room Building will be in illumination supplier scope.

(b) Scope of work for telephone cables & telephone sets under PLCC package in Control room to be done by Illumination contractor:

Illumination Bidder shall supply and supervise laying of conduits in control room building for telephone cables & telephone sets of PLCC package. Further, it shall be Illumination bidders' scope to provide telephone sockets and its accessories for connection of telephone sets:

SI	PARTICULARS	Unit	Qty
1	2 wire Telephone Set with 4 pair Telephone cables (Tinned Copper) complete upto EPBX	Set	10
	Remark - supply of telephone set and 4 pair cables are under BHEL scope. Tentative quantities of 4 pair's cables is 4kM. Laying of 4 pair cables will be in BHEL scope.		

Note -2 : Price for supply of all applicable illumination erection hardware material shall be included along with above BOQ in offer. List of erection hardware material for illumination works are mentioned below.

(a) For Indoor works: 3 way, G.I., circular J.B. (20mm and 25mm), 4 way, G.I., circular J.B. (20mm and 25mm), 90deg, G.I., Inspection Bend (20mm and 25mm), 90deg, G.I., 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, G.I. 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 M.S. 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 bracket, 20mm, Heavy duty, ball socket, Machine screw (for fixing surface mounting fixtures on circular J.B.), PVC closure (20mm and 25mm), Reducer (20mm and 25mm). PVC conduits, wires, wire for earthing and MS Box.

(b) For Outdoor works: 20x1.5mm Aluminium flat, M12x40mm, G.I. Bolt with nut and washer for fixing outdoor lighting panels, M6x30mm, G.I. Bolt with nut and washer for fixing control gear boxes, M8x30mm, G.I. Bolt with nut and washer for fixing outdoor J.B.s, SLP, M10x35mm, G.I. Bolt with nut and washer for fixing outdoor lighting fixtures, Earth wire from J.B. to lighting fixtures, Mounting brackets for lighting fixtures, wire for earthing.

Note -3: The above quantities (BOQ) are as per preliminary design only. The detail design will be submitted by Vendor 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 $\pm 30\%$ of total value at same unit rate and terms during execution of Contract. The quantity of individual items may however vary upto any extent.**

Note -4: If extra items required for completion of Job 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).

Note -5: Luminaires mentioned as equivalent should have $\pm 15\%$ variation (maximum) in efficiency.

Note -6: The lighting panel shall conform to IS-8623. Panels shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be of thickness not less than 2.0 mm (cold rolled) smoothly finished, levelled and free from flaws. The indoor lighting panels will be minimum 1.6 mm sheet steel

Note -7: Junction boxes shall be concealed type for indoor lighting and suitable for mounting on columns, lighting poles, structure etc., for outdoor lighting.

5.0 TYPE TESTING

Bidder shall submit valid type test reports (as per relevant IEC/IS Standard) for approval. The type test reports submitted shall be of tests conducted within last 10 years prior to the date of technical bid opening i.e. 21.08.2017. The bidder should have conducted type test on identical or similar equipment/ components to those offered. If these tests have been conducted more than 10 years prior from the date of technical bid opening or type test reports are found to be technically unacceptable to BHEL/TANTRANSCO, the type test shall be conducted without cost and delivery implication to BHEL. The type tests, if conducted shall be witnessed by BHEL/Customer.

6.0 INSPECTION & TESTING:

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per 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 equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and TANTRANSCO in accordance with agreed quality plan with 3 weeks advance information.

7.0 QUALITY PLAN:

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval within 1 week of P.O. placement. It will be the bidder's responsibility to get its QP approved from the ultimate customer.

8.0 LIST OF DRAWINGS ENCLOSED (Refer Annexure-3)

SI No	Drwg. No.	Description
1	TB-0-399-316-002 (Sh.1/2)	Layout Plan for 400/230-110kV Substation
2	TB-0-399-316-002 (Sh.2/2)	Sectional Elevation for 400/230-110kV Substation
3	TB-0-399-316-004	Trench Layout Plan - 400/230-110kV Substation
4	TB-3-399-316-005 (5 Sheets)	Control Room Building Layout for 400/230-110kV Vellalaviduthi Substation

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TECHNICAL QUALIFYING REQUIREMENT FOR ILLUMINATION SYSTEM

1. The bidder should have experience of design & supply 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 the followings (excluding taxes, duties, F&I etc.) during last five years from the original scheduled date of bid opening.

- Rs. 80 Lakhs for single contract or
- Rs. 50 Lakhs each for two contracts

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

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08/07/19

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08/07/19

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PROJECT :- 400 /230/110KV SUBSTATION, VELLALAVIDUTHI, TAMILNADU			
CUSTOMER :- TANTRANSCO			
BOQ for Illumination System			

S. No.	Description	Unit	Qty	Indent BOQ S No
1	Supply of main switch board comprising 415V, 200A, 3-Ph, 4-wire bus, 2 no. 200 A TPN fuse switch and a changeover switch, 1 no. Lighting transformer: 150kVA as incoming and 3 Nos 63 A TPN, 2 Nos. 63 A DP and 32 A DP switch fuse -1 Nos as outgoing (Inclusive of CT, Voltmeter,	No.	1	22
2	Supply of sub-distribution board having 1 No. 63 A , TPN isolator as in comer and 3 Nos. 32 A , DP HRC fuse as outgoing.	Nos	2	16
3	Supply of 80 Amps TPN isolator as incoming and 10 Nos, 10 Amps SP MCBH as outgoing lighting distribution board.	Nos	6	25
4	Supply of power Distribution Board (incoming 63 A TPN isolator - 1 No. switch fuse and outgoing 20 A SPN Switch fuse -12 Nos.	Nos	2	20
5	Supply of 220 V DC 8 way double pole emergency distribution board having 1 NO., 32 DP isolator as incomer and 8 Nos. 5A DP HRC fuse with 10 A DP double pole rotary switch with ON & OFF facilities as outgoing and 1 NO. L& T make ML2 contact having coil voltage of 415 V, including testing etc., complete.	No.	1	32
6	Supply of 20Amps DP plug and socket in sheet enclosure with 32 A DP MCB in flush with wall with earth connection (AC plug) [legrand MDS]/Hager (L&T) make.	Nos	16	67
7	Supply: 150x100x113 mm TW switch box in flush with wall covered with 3mm tk hylum sheet for 15A, 3pin flush type non interlocking C.S Plug including pin top with painting of suitable colour	Pts	2	9
8	Supply of 32 amps ICDP switch of 60 CV with phase and nuetral on suitable TW board with earthing	Nos	4	68
9	Supply of down fall rod for ceiling fan	Nos	20	36
10	Supply of 1400mm sweep (54") AC ceiling fan with regulator with 300mm down rod on the existing clamps of approved quality of Crompton/Rally/ usha/bajaj including cost of all materials lead lift etc complete.	Nos	16	41
11	Supply of 450mm sweep AC exhaust fan heavy duty including providing necessary holes with wall labour, fixing charges lead, lift etc. complete, as per standard specification	Nos	9	30
12	Supply of 5 amps flush type switch with plate and MS box	Nos	16	60
13	Supply of 5 amps flush type switch with plate and MS box	Nos	9	60
14	Supply of SL bracket with EI fancy shade glass approved by the Engineer at site with 18W C FL bulb.	Nos.	4	12
15	Supply of down fall rods (2 nos./fitting) for twin mirror optic fittings including cost of material, labour, lead, lift etc complete.	Sets	20	35
16	Supply of 4x28 W twin mirror optic recessed mounting type fittings (Philips/ Crompton/ Wipro) complete with copper choke and condensers with louvers covers on wall or ceiling with PVC unsheathed copper leads from terminal to the fitting with fluorescent tubes.	Nos	10	24
17	Supply of industrial type light fittings with vitreous enameled reflector with necessary chokes & capacitors with 2x28W fluorescent lamps (HPF) suitable for 220 V AC operation.	Nos	21	26
18	Supply of batten fitting with necessary chokes and capacitors etc with 2x28 W fluorescent lamps (HPF) suitable for 220 V AC operation.	Nos	6	52
19	Supply of decorative type fittings with dished opal cover with necessary chokes and capacitors etc with 4x28W flourescent lamps (HPF) suitable for 220 V AC operation.	Nos	1	37
20	Supply of industrial type fittings suitable for high humidity areas and excessive corrosive vapour area with necessary chokes & capacitors etc with 2x28W fluorescent lamps (HPF) suitable for 220 V AC loperation	Nos	6	27
21	Supply of Decorative type fitting with polystyrene louver assembly with necessary chokes & capacitors etc with 2x28W fluorescent lamps (HPF) suitable for 220 V AC operation.	Nos	16	39
22	Supply of Decorative type fitting with opal acrylic cover with necessary chokes and capacitors etc with 2x28W flourescent lamps (HPF) suitable for 220 V AC operation.	Nos	6	40
23	Supply of basic mounting rail type fittings with necessary choke and capacitors etc with 2x28W fluorescent lamps (HPF) suitable for 220V AC operation.	Nos	18	54
24	Supply of basic mounting rail type fittings with necessary choke with single 28 W fluorescent lamps suitable for 220V AC operation.	Nos	9	53

PROJECT :- 400 /230/110KV SUBSTATION, VELLALAVIDUTHI, TAMILNADU			
CUSTOMER :- TANTRANSCO			
BOQ for Illumination System			

S. No.	Description	Unit	Qty	Indent BOQ S No
25	Supply of Decorative type fitting with polystyrene reversible louver suitable for recessed mounting with necessary chokes & capacitors etc with 2x28 W fluorescent lamps (HPF) suitable for 220 V AC loperation.	Nos	40	38
26	Supply of weather proof bulk head fittings with 18 W CFL lamp suitable for 220V AC operation.	Nos	6	7
27	Suopply of weather proof bulkhead fitting with 18 W CFL lamp suitable for 220 V DC operation	Nos.	2	3
28	Supply of Vari-recessed fitting with 20 W CFL suitable for 220 V DC	Nos.	5	8
29	Supply of Emergency Exit Sign board/lamp with LED	Nos.	10	33
30	Supply of Bell with bell-push switch	Nos.	3	51
31	Supply of Stair case switch, 5A, DP, Double Throw, porcelain base flush type	Nos.	4	11
32	Supply of 5 amps flush type switch with plate and MS box	Nos	275	61
33	Supply of 5 Amps 3 pin plug points with combined switch plug	Pts	46	62
34	Supply of metal clad with cast Aluminium enclosure 20A, 10, 5 pin full inter-locked switches socket	Pts	15	23
35	Supply - Earth electrode of 2 Mtr. Class 'B' GI pipe of dia not less than 32mm complete with necessary masonry work.(SD-228)	Nos	3	34
36	Supply of PVC rigid conduit of 20mm size	m	2500	14
37	Supply of PVC rigid conduit of 25mm size	m	750	13
38	Supply: PVC accessories for Conduiting - All the accessories required for successful installation of work i.e. 3 / 4 way JB, Spacer, Inspection bend, Solid bend, Circular boxes (with gasket as applicable), bends, closer, socket, saddle, Fan box, mounting hardwares, nut, bolt, washer, screw, reducer, U clamp, etc complete material required for complete	Kg	500	15
39	Supply: Accessories for Conduiting work, as above but with Hot dip galvanization (As applicable)	Kg	150	78
40	Supply of 1C, 1.5 sqmm PVC insulated stranded Cu. Wire	m	500	81
41	Supply of 1C, 2.5 sqmm PVC insulated stranded Cu. Wire	m	5000	74
42	Supply of 1C, 4 sqmm PVC insulated stranded Cu. Wire	m	1500	63
43	Supply: Cable Gland suitable for 3.5 core, 185 sq.mm PVC armoured UG cable Cable Gland: The cable glands shall conform to BIS 6121. They shall comprise of heavy duty brass casting, machine finished, double compression type and Nickel plated (coating thickness not less than 10 microns) to avoid corrossion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. The cable gland shall be complete with necessary armour clamp & tapered washer etc. Cable glands are required for the following cables for dust and weather proof terminations.	No	20	47
44	Supply: Cable Gland suitable for 4 core, 16 sq.mm PVC armoured UG cable Cable Gland: The cable glands shall conform to BIS 6121. They shall comprise of heavy duty brass casting, machine finished, double compression type and Nickel plated (coating thickness not less than 10 microns) to avoid corrossion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. The cable gland shall be complete with necessary armour clamp & tapered washer etc. Cable glands are required for the following cables for dust and weather proof terminations.	No	50	50
45	Supply: Cable Gland suitable for 2 core, 16 sq.mm PVC armoured UG cable Cable Gland: The cable glands shall conform to BIS 6121. They shall comprise of heavy duty brass casting, machine finished, double compression type and Nickel plated (coating thickness not less than 10 microns) to avoid corrossion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. The cable gland shall be complete with necessary armour clamp & tapered washer etc. Cable glands are required for the following cables for dust and weather proof terminations.	No	100	49

PROJECT :- 400 /230/110KV SUBSTATION, VELLALAVIDUTHI, TAMILNADU			
CUSTOMER :- TANTRANSCO			
<u>BOQ for Illumination System</u>			

S. No.	Description	Unit	Qty	Indent BOQ S No
46	Supply: Cable Gland suitable for 2 core, 25 sq.mm PVC armoured UG cable Cable Gland: The cable glands shall conform to BIS 6121. They shall comprise of heavy duty brass casting, machine finished, double compression type and Nickel plated (coating thickness not less than 10 microns) to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. The cable gland shall be complete with necessary armour clamp & tapered washer etc. Cable glands are required for the following cables for dust and weather proof terminations.	No	250	48
47	Supply: Cable Lug suitable for 1.5 sq.mm Cu CABLE LUG - Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394. Aluminum Bimetallic lugs for power cables as shall be supplied depending upon type of cables and terminations. The cable lugs shall suit the type of terminals provided. Bidder to submit quantity estimation for cable lug along with cable schedule / wiring diagram.	No	25	46
48	Supply: Cable Lug suitable for 2.5 sq.mm Cu CABLE LUG - Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394. Aluminum Bimetallic lugs for power cables as shall be supplied depending upon type of cables and terminations. The cable lugs shall suit the type of terminals provided. Bidder to submit quantity estimation for cable lug along with cable schedule / wiring diagram.	No	50	44
49	Supply: Cable Lug suitable for 4 sq.mm Cu CABLE LUG - Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394. Aluminum Bimetallic lugs for power cables as shall be supplied depending upon type of cables and terminations. The cable lugs shall suit the type of terminals provided. Bidder to submit quantity estimation for cable lug along with cable schedule / wiring diagram.	No	50	42
50	Supply: Cable Lug suitable for 16 sq.mm Cu CABLE LUG - Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394. Aluminum Bimetallic lugs for power cables as shall be supplied depending upon type of cables and terminations. The cable lugs shall suit the type of terminals provided. Bidder to submit quantity estimation for cable lug along with cable schedule / wiring diagram.	No	25	45
51	Supply: Cable Lug suitable for 25 sq.mm Cu CABLE LUG - Cable lugs shall be tinned copper solderless crimping type conforming to IS-8309 & 8394. Aluminum Bimetallic lugs for power cables as shall be supplied depending upon type of cables and terminations. The cable lugs shall suit the type of terminals provided. Bidder to submit quantity estimation for cable lug along with cable schedule / wiring diagram.	No	20	43
52	Supply of street light fittings with 250W "SON" lamp with necessary built-in control gear and necessary fixing arrangements.	Nos	35	10
53	Supply of MS BOX for peripheral lighting cable termination with suitable terminal blocks	Nos.	7	21
54	Supply of Outdoor power Distribution Board (incoming 63 A TPN isolator - 1 No. and outgoing 20 A SPN Switch fuse -12 Nos and suitable timer and contactor for automatic switching.	Nos	3	18
55	Supply of outdoor power Distribution Board (incoming 63 A TPN isolator - 1 No. and outgoing 20 A SPN Switch fuse-6 Nos and 32 A TPN Switch fuse -3 Nos and suitable timer and contactor for automatic switching.	Nos	8	17
56	Supply of 250W flood light LED type Lighting luminaire with all accessories.	Set	350	73
57	Supply of 150W flood light LED type Lighting luminaire with all accessories.	Set	50	76
58	Supply of 8m Stepped GI Tubular lighting pole	Nos.	70	55

PROJECT :- 400 /230/110KV SUBSTATION, VELLALAVIDUTHI, TAMILNADU			
CUSTOMER :- TANTRANSCO			

BOQ for Illumination System

S. No.	Description	Unit	Qty	Indent BOQ S No
59	Supply of 125W HPMV Post Top Lantern fixture	Nos.	10	78
60	Supply of 4.5m high lighting pole for Post-top Lantern	Nos.	10	65
61	Supply of Outdoor junction box	Nos.	150	19
62	Supply of 75mm dia. PVC class -4 pipes	m	100	57
63	Supply of 110mm dia. PVC class -4 pipes	m	250	80
64	Supply of 35x6 mm GI Flat for earthing	m	250	66
65	Supply of 25x3 mm GI Flat for earthing.	m	150	72
66	Supply of 14 SWG TC Wire (For earthing of Lighting circuits, Fan, 5A sockets, bell push and exhaust fans etc.)	m	2500	77
67	Supply of 8 SWG copper conductor for distribution board and switch board earthing	m	250	56
68	Supply of EXTRA ITEMS REQUIRED FOR COMPLETION OF JOB AS PER SPECIFICATION BUT NOT COVERED ABOVE, SHALL BE QUOTED SEPARATELY. DETAILS TO BE PROVIDED BY BIDDER AT TENDER STAGE. (Price to be quoted on Lumpsum basis)	Lot	1	29
69	Supply of 2'x2' recessed mounted LED Light Fixture (Philips/ Crompton/ Wipro) complete in all respect for wall or ceiling.	Nos	50	83
70	Supply of 2x28 LED batten fitting suitable for 220V AC Operation.	Nos	43	71
71	Supply of 18 W LED Downlighter fitting suitable for 220 V AC Operation.	Nos	21	75
72	Supply of 40 Watt Waterproof integral LED Light Fixture suitable for 220 V AC Operation	Nos	6	64
73	Supply of 1 x28 LED batten suitable for 220V AC Operation	Nos	9	82
74	Supply of Weather Proof Bulk head fittings with 60 Watt GLS lamp suitable for 220 V AC operation	Nos	5	6
75	Supply of Weather Proof Bulk head fittings with 60 Watt GLS lamp suitable for 220 V DC operation.	Nos.	2	5
76	Supply of Weather Proof Recessed mounted Bulk head fittings with 60 Watt GLS lamp	Nos.	5	1
77	Supply of Weather Proof Bulk head fittings with 9 Watt LED suitable for 220 V AC/DC operation.	Nos.	2	4
78	Supply of Weather Proof Recessed mounted 12 Watt LED downlighter fitting with Aluminium Housing	Nos.	5	2
79	Supply of 120 watt LED Street light equivalent to 250 W Conventional light Fixture with necessary built-in control gear and necessary fixing arrangements.	Nos	35	79
80	Supply of 60W LED Post Top Lantern fixture	Nos.	5	59
81	Supply of 3000 CMH AC exhaust fan (single phase) heavy duty as per standard specification	Nos	4	70
82	Supply of 300A, TPN 415V, AC 3 phase 4 wire pin interlocked plug and switch with earthing contacts industrial type Receptacle for oil filtration machine	Nos	1	69
83	Supply of 63A, 415V, 3 phase welding Receptacle (Indoor/Outdoor)	Nos	4	58
84	Service: Lux Level Calculation for indoor & Outdoor area	Lot	1	86
85	Service: Lighting Layout for indoor & Outdoor area	Lot	1	87
86	Service: Conduit Layout for indoor areas	Lot	1	88
87	Service: Cable Schedule, Power Distribution scheme and Control Schemes for complete system	Lot	1	89
88	Service: Bill of Quantity (separate for outdoor area & indoor area in room wise) lighting fixtures, lamps, DBs, Panels, conduits, wires, Switches, Socket, Receptacles, cables, Earthing material, JB, Pole, Fan	Lot	1	90
89	Service: Supervision of Erection Testing & Commissioning for illumination system on per day basis for the days present at site on certification by BHEL site incharge. Price shall be inclusive of charges for lodging, boarding, medical, insurances etc but excluding the followings (1) To & Fro travel charges shall be reimbursed as actual limited to 2nd AC charges for all visits as per site requirement. (2) local transportation between Hotel and site shall be arranged by BHEL.	man-day	30	84
90	Service: Lux Level Measurement and demonstration to customer at site including arrangement of necessary test equipment on returnable basis	Lot	1	85

4.8 ILLUMINATION OF SWITCHYARD :-

The contractor shall design the switchyard lighting for the entire substation area. The recommended levels of illumination is

General horizontal : 30 Lux.

Specific vertical (on disconnects) : 30 Lux.

These levels of illumination shall be designed to be achieved by using LED bulbs. The lighting masts in the substation have lightning platforms for mounting of these lamps at 12.5 metre and 25 metre levels. These platforms have to be made use of for mounting the lightning fixtures. ~~The contractor can propose separate masts for the 110 KV yard~~

~~lights, 230 KV yard lights and where additional masts are required for 400 KV yard lights. These masts shall be designed by the contractor only after detailed discussion with the purchaser regarding the height, location and numbers etc, and the design shall be submitted within 60 days of award of contract.~~

The LED bulb fitting along with fixtures shall be procured by the contractor erected and commissioned with necessary lamp control switches and switch boxes. The brand names of the fittings and lamps should be got approved before ordering. Tentative quantity has been indicated in the schedule.

Illumination for the entire switch yard to be designed as per standard practice and lamps to be erected in the sub station structures, Lightening mast, 8 Mts stepped GI tubular post. Each fitting has to be provided with necessary Vermin proof junction box, HRC fuse carrier and fuse link. The yard light should be grouped in such a way that minimum lights can be switched on by generator set. Necessary main switches to be erected in the yard by grouping and over all control from control room. The LED bulb fitting with fixture, of reputed make with ISI mark and only copper cable to be used from fitting to junction box etc..and testing for burning condition. ~~Lighting Transformer not required for illumination purpose .~~

13.0. CONTROL ROOM BUILDING LIGHTING, CEILING FANS, EXHAUST FANS AND EMERGENCY LIGHTING: The split up details of various requirements have been furnished in the following sections. The entire electrification shall be carried out as per standard PWD practice.

13.1. SPLIT UP QUALITY OF LIGHTS – AREA WISE: The type of fitting are as per the schedule and sample to be approved by Department Engineer at site before actual execution. A electrical circuit diagram shall be prepared by the contractor and got approved before commencement of work.

13.2. SWITCH BOARDS:

13.2.1. MAIN SWITCH BOARD: The main switch Board shall be of indoor, industrial wall mounted, vermin proof, dust proof and suitable for 230 /440 V, 3 phase, 4 wire system with bus bar chamber, interconnections and cable glands with the following ratings of incoming and outgoing circuits bus bars shall be rated for 200 Amps complete with angle iron frame work shall be provided.

INCOMER : ² ~~1~~ No. 200 Amps TPN Fuse switch (with HRC fuse).

OUTGOING : 3 Nos. 63 Amps TPN switch fuse.
: 1 No. 32 Amps DP switch fuse and
: 2 Nos. 63 Amps DP switch fuse and with HRC fuses.

A change over switch for alternate supply shall be installed by the contractor

QUANTITY : 1 No.

13.2.2. SUB DISTRIBUTION BOARD: The sub-distribution Board shall be of indoor, wall mounted, vermin proof, dust proof and suitable for 400/440V, 3 phase, 4 wire operation complete with bus bar chamber, bus bars, interconnections in cable glands etc., with the following incoming and outgoing.

INCOMER : 1 No. 63 A TPN isolator.

OUTGOING : 3 Nos. 32 A Double pole HRC fuse HRC fuse switch

QUANTITY : 2 Nos.

13.2.3. LIGHTING DISTRIBUTION BOARDS: The lighting distribution Boards shall be of Indoor, vermin proof, dust proof and flush mounting type and suitable for operation on 230 V 1 phase, 50 Hz., complete with bus bar chamber, interconnections and suitable knock-outs for 25 mm dia pipe and glands for incoming cable, shrouds with the following incoming and outgoing minimum circuit breakers.

INCOMER : 1 No. ⁸⁰ ~~60~~ A ^{TPN} ~~Double pole.~~

OUTGOING : 10. Nos. ⁵ ~~15~~ A SP, MCBH and 2 Nos. blanking plate

QUANTITY : 6 Nos.

13.2.4. POWER DISTRIBUTION BOARD: The power distribution Board shall be of indoor, wall mounted, vermin proof, dust proof shall be of 230 V 1 phase 50 Hz., with bus bars, interconnections etc., with following incomer and outgoings.

INCOMER : 1 No. ^{TPN} ~~63 A Double pole.~~

OUTGOING : 12 Nos. ¹⁵ ~~15~~ A HRC fuse

QUANRITY : 2 Nos.

13.2.6. Convenient sockets like 20 A, 5A shall be provided for essential requirements.

For earthing the distribution Board/Switch Board, No.8 SWG Copper from existing main earth bus shall be used.

Lighting circuits, Fan, 5 A sockets, bell push and exhaust fans shall be wired with 2 runs of 1.5 sq.mm copper wire in $\frac{3}{4}$ " PVC pipes with 14 SWG T.C. (for earthing). 20 A sockets shall be wired with 2 runs of 6 sq.mm copper wire in $\frac{3}{4}$ " PVC pipe with 14 SWG T.C. (Earthing). Concealed type wiring shall be done.

All the fitting sockets, switch Boards shall be provided only at those places marked in the electrification drawing to be supplied by tenderer.

13.2.7. SOCKETS AND SWITCHES: Totally enclosed, dust and vermin proof, metal clad with cast aluminium enclosure 20 A, 1 phase, 3 pin fully interlocked switch socket suitable for flush mounting. 15 Nos.

5 Amps single pole, single way, porcelain base flush type switch, suitable for flush mounting ~~149~~ Nos. 275

5 Amps, 1 phase 3 pin switched socket suitable for 220 V AC operation with M.S. Box suitable for flush mounting 46 Nos.

Bell with bell-push switch 3 nos.

Staircase switch, 5 Amps, double pole, double throw, porcelain base flush type switch for staircase light control 4 Nos.

52.0. YARD LIGHTING: The contractor shall design the switchyard lighting for the entire substation area. The recommended levels of illumination is

General horizontal : 30 Lux.

Specific vertical (on disconnects) : 30 Lux.

These levels of illumination shall be designed to be achieved by using LED technology (LED bulbs). The lighting masts in the substation have lightning platforms for mounting of these lamps at 12.5 metre and 25 metre levels. These platforms have to be made use of for mounting the lightning fixtures. ~~The contractor can propose separate masts for the 110 KV yard lights, 230 KV yard lights and where additional masts are required for 230 KV yard lights. These masts shall be designed by the contractor only after detailed discussion with the purchaser regarding the height, location and numbers etc, and the design shall be submitted within 60 days of award of contract.~~

The LED bulb fitting along with fixtures shall be procured by the contractor erected and commissioned with necessary lamp control switches and switch boxes.

The brand names of the fittings and lamps should be got approved before ordering.
Tentative quantity has been indicated in the schedule.

SECTION – 28

EARTHING

- 1.1 The earth mat design shall be done by the Contractor as per IEEE-80. The main earthmat shall be laid in the switchyard area in accordance with the approved drawing.

The switchgear equipments shall be designed such a way that their rated short time withstand current is 63 KA (rms)/ 1sec for 400KV system and 40 KA/ 3 sec for 230 KV & 110KV system.

- 1.2 Neutral points of systems of different voltages, metallic enclosures and frame works associated with all current carrying equipments and extraneous metal works associated with electric system shall be connected to a single earthing system unless stipulated otherwise

- 1.3 Earthing and lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the systems in installed.

- a) code of practice for Earthing IS:3043
- b) Code of practice for the protection of Building and allied structures against lightning IS: 2309.
- c) Indian Electricity Rules 1956 with latest amendments.
- d) National Electricity safety code IEEE 80.

1.4 Details of Earthing System

Item	Size	Material
a) Main Earthing Conductor to be buried in ground	40mm dia	Mild Steel rod
b) Conductor above ground & earthing leads (for equipments)	75X12mm M.S. flat	Mild Steel
c) Conductor above ground & earthing leads (for colums & aux. structures)	75X12mm	Mild Steel
d) Earthing of indoor LT panels, Control panels and out door Marshalling boxes, MOM Boxes, junction boxes & Lighting panels etc.	50X8mm	Mild Steel
e) Rod Earth Electrode	40mm dia, 5000mm long	Mild Steel
f) Earthing conductor along outdoor cable trenches	50X8mm MS Flat	Mild Steel
g) Earthing of Lighting Poles	50 x 8 mm MS Flat	Mild steel

The size of the earthing conductor indicated above are the minimum sizes.

Earthing Conductor Layout

- 1.5.1 Earthing conductors in outdoor areas shall be buried at least 800mm below finished ground level and refilled unless otherwise.
- 1.5.2 Wherever earthing conductor crosses cable trenches, underground service ducts, pipes, tunnels, railway tracks etc, it shall be laid minimum 300 mm below them and shall be circumvented in case it fouls with equipment/structure foundations.
- 1.5.3 Tap connections from the earthing grid to the equipment/structure to be earthed, shall be terminated on the earthing terminals of the equipment/structure.
- 1.5.4 Earthing conductor or leads along their run on cable trench, ladder, walls etc. shall be supported by suitable welding/cleating at, intervals of 750 mm. wherever it passes through walls, floors, etc., galvanized iron sleeves shall be provided for the passage of the conductor and both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.
- 1.5.5 Earthing conductor around the building shall be buried in earth at a minimum distance of 1500 mm from the outer boundary of the building. In case high temperature is encountered at some location, the earthing conductor shall be laid minimum 1500 mm away from such location.
- 1.5.6 Earthing conductors crossing the road shall be laid 500 mm below road or at greater depth to suit the site conditions.
- 1.6 Equipment and Structure Earthing
 - 1.6.1 Earthing pads shall be provided for the apparatus/equipment at accessible position. The Connection between earthing pads and the earthing grid shall be made by two short earthing leads (one direct and another through the support structure) free from kinks and splices. In case earthing pads are not provided on the item to be earthed, same shall be provided in consultation with owner.
 - 1.6.2 Whether specifically shown in drawings or not, steel/RCC columns, metallic stairs etc. shall be connected to the nearby earthing grid conductor by two earthing leads. Electrical continuity shall be ensured by bonding different section of hand rails and metallic stairs.
 - 1.6.3 Metallic pipes, conduits and cable tray sections for cable installation shall be bonded to ensure electrical continuity and connected to earthing conductors at regular interval. Apart from intermediate connections, beginning points shall also be connected to earthing systems.
 - 1.6.4 Metallic conduits shall not be used as earth continuity conductor.
 - 1.6.5 Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.
 - 1.6.6 Light poles, junction boxes on the poles, cable and cable boxes/glands, lockout switches etc. shall be connected to the earthing conductor running

along with the supply cable which in turn shall be connected to earthing grid conductor at a minimum two points whether specifically shown or not.

- 1.6.7 Earthing conductor shall be buried 2000 mm outside the switchyard fence. All the gates and every alternate post of the fence shall be connected to earthing grid.

The stone spreading shall also be done 2000 mm outside switchyard fence. The criteria for stone spreading shall be followed in line with requirement specified elsewhere in the specification.

- 1.6.9 Flexible earthing connecting of the moving parts.
- 1.6.10 All lighting panels, junction boxes, receptacles fixtures, conduits etc. shall be grounded in compliance with the provision of I.E. rules.
- 1.6.11 A continuous ground conductor of 16 SWG 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 this 16 SWG ground conductor.
- 1.6.12 50mmX8mm MS flat shall run on the top ties and all along the cable trenches and the same shall be welded to each of the racks. Further this flat shall be earthed at both ends and at an interval of 30 mtrs. The M.S. flat shall be finally painted with two coats of Red oxide primer and two coats of post Office red enamel paint.
- 1.6.13 A 40 mm dia, 5000 mm long MS earth electrode with test link, CI frame and cover shall be provided to connect down conductor of lightning mast and towers with peak.

1.7 Jointing

- 1.7.1 Earthing connections with equipment earthing pads be bolted type. Contact surfaces shall be free from scale, paint, enamel, grease, rust or dirt. Two bolts shall be provided for making each connection. Equipment bolted connections, after being checked and tested, shall be painted with and corrosive paint/compound.
- 1.7.2 Connection between equipment earthing lead and main earthing conductors and between main earthing conductors shall be welded type for rust protections, the welds should be treated with red lead and afterwards coated with two layer bitumen compound to prevent corrosion.
- 1.7.3 Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingress.
- 1.7.4 Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.
- 1.7.5 All ground connections shall be made by electric arc welding. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on it. Artificial cooling shall not be allowed.
- 1.7.6 Bending of earthing rod shall be done preferably by gas heating. All arc welding with large dia, conductors shall be done with low hydrogen content electrodes.
- 1.7.7 All the earth flat shall be clamped with the equipment support structures at least 1000mm interval.

Power Cable Earthing Metallic sheaths and armour of all multi core power cable shall be earthed at both equipment and switchgear end. Sheath and armour of single core power cables shall be earthed at switchgear end only.

1.8 Specific Requirement for Earthing Systems.

1.9.1 Each earthing lead from the neutral of the power transformer/Reactor shall be directly connected to two electrodes in treaded earth pit (as per IS). All the earth pits in the yard to be provided with cement collar and permanent water arrangement to be done. All accessories associated with transformer/reactor like cooling banks, radiators etc. shall be connected to the earthing grid at minimum two points.

1.9.2 Earthing terminal of each lightning arrester & Capacitor voltage transformer shall be directly connected to rod earth electrode which in turn, shall be connected to station earthing grid.

1.9.3 Auxiliary earthing mat comprising of 40mm dia M.S rods closely spaced (300mm x 300mm) conductors shall be provided at depth of 300mm from ground level below the operating handles of the M.O.M box of the isolators. M.O.M boxes shall be directly connected to the auxiliary earthing mat.

1.9.4 All earthing flats connecting to the equipments above the yard levels and upto the equipments to be painted with one coat of red oxide and green paint as per standard.

1.10 The earth electrode to be fabricated for 5 mts length without joints with provision for inter connecting at least two numbers earth flats from main earth mat /structures etc. The electrode to be erected by rigging 140/150 mm dia. bore using power rig and to be filled with mixer of A4 grade Bentonite powder, salt and available site soil.

1.11 Earth spikes to be fabricated for 3 Mts length and to be erected in lightning mast in the 400 KV yard and in 230KV, 110 KV tower structures as per standard and to be connected to the earth mat.

600mm mean dia, 300mm height, 36mm thick cement collar for identification of earth electrode location including 1 primer and 2 coat of colour wash to be provided.

The sizes of flats mentioned in this specifications are only indicative purposes only. The exact sizing should be decided during detailed engineering.

Combined earth resistance should be less than 0.1Ω .

Individual earth rod resistance shall be $< 10 \Omega$

The design value of step, touch, GTR, & TGPR should be measured as per IEEE-80.

The multi layer soil resistivity shall be taken for the earth resistivity calculations and advance softwares like CDEGS shall be used to design the earth grid.

Earthing layout and earthing design calculation prepared as above should be got approved.

Pre commissioning test is to be conducted on any equipment installed at this proposed sub station permitted only after the validation of earthing test as per approved earthing design.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

UNLEVELLED

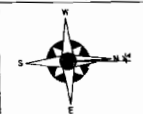
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Annexure-3



400KV BILL OF QUANTITY (MAIN EQUIPMENT)

S.NO	ITEM DESCRIPTION	SYMBOL	QTY	UNIT	SUPPORT	STRUCTURE TYPE		
1.	315MVA, 3-PHASE, 50Hz, 400/230/33 KV, 19800T11 KCT (AUTO TRANSFORMER)		02	-	-	NA		
2.	2000VA, 3-PHASE, 50Hz, 400/110/33 KV, 19800T11 KCT (AUTO TRANSFORMER)		02	-	-	NA		
3.	3000KV, 3-PHASE, 50Hz, 400 KV BUS REACTOR		01	-	-	NA		
4.	3000KV, 3-PHASE, 50Hz, 400 KV LINE REACTOR WITH HCB		01	-	-	NA		
5.	400KV, 3150A, 63KA/1S OUTDOOR SF6 BREAKER WITH PIR (3-PH)		03	-	-	LATTICE		
6.	400KV, 3150A, 63KA/1S OUTDOOR SF6 BREAKER WITH CSD (3-PH)		06	02	-	LATTICE		
7.	420KV, 3000A, 63KA/1S, 3 CORE CURRENT TRANSFORMER (1-PH)		12	-	03	45	PPE/LATTICE	
8.	420KV, 3150A, 63KA/1S, HCB ISOLATOR WITH DOUBLE EARTH SWITCH (3-PH)		06	-	02	06	PPE/LATTICE	
9.	420KV, 3150A, 63KA/1S, HCB ISOLATOR WITH SINGLE EARTH SWITCH (3-PH)		12	-	03	02	27	PPE/LATTICE
10.	420KV BUS EARTH SWITCH (1-PH)		1	06	-	-	06	PPE/LATTICE
11.	300KV LIGHTNING ARRESTER (1-PH)		24	-	-	-	24	PPE
12.	400KV, 4400V CWT (1-PH)		12	-	-	-	12	PPE
13.	420 KV BUS POST INSULATOR		147	-	-	-	147	PPE/LATTICE
14.	300KV LIGHTNING ARRESTER (1-PH)		01	-	-	-	01	PPE
15.	145KV, 2000A, 40KA/3S, HCB ISOLATOR WITH SINGLE EARTH SWITCH (3-PH)		6	-	01	-	01	PPE/LATTICE
16.	33KV KCT (1-PH) (TRANSFORMED SUPPLY)		8	-	01	-	01	PPE/LATTICE

17. ONLY QUANTITY ADDITIONAL TO ORIGINAL CONTRACT AGREEMENT MENTIONED.
18. SUPPLY OF HCB IS IN SCOPE OF TANTANTRACO. SUPPLY OF SUPPORT STRUCTURE, ASSOCIATED CWT & ETC WORKS OF HCB ARE IN SCOPE OF BHEL.

220KV BILL OF QUANTITY (MAIN EQUIPMENT)

S.NO	ITEM DESCRIPTION	SYMBOL	QTY	UNIT	SUPPORT	STRUCTURE TYPE
1.	245KV, 2000A, 40KA/3S OUTDOOR SF6 BREAKER (3-PH)		07	-	-	LATTICE
2.	245KV, 2000A, 40KA/3S, 3 CORE CURRENT TRANSFORMER (1-PH)		21	-	-	PPE/LATTICE
3.	220KV, 3 CORE PT (1-PH)		18	-	-	PPE
4.	245KV, 2000A, 40KA/3S, HCB ISOLATOR WITH SINGLE EARTH SWITCH (3-PH)		04	-	-	PPE/LATTICE
5.	245KV, 2000A, 40KA/3S, HCB ISOLATOR WITHOUT EARTH SWITCH (3-PH)		34	-	-	PPE/LATTICE
6.	216 KV LIGHTNING ARRESTER (1-PH)		18	-	-	PPE
7.	220KV BUS POST INSULATOR		75	-	-	PPE/LATTICE

110KV BILL OF QUANTITY (MAIN EQUIPMENT)

S.NO	ITEM DESCRIPTION	SYMBOL	QTY	UNIT	SUPPORT	STRUCTURE TYPE
1.	145KV, 2000A, 40KA/3S OUTDOOR SF6 BREAKER (3-PH)		08	-	-	LATTICE
2.	145KV, 2000A, 40KA/3S, 3 CORE CURRENT TRANSFORMER (1-PH)		27	-	-	PPE/LATTICE
3.	110 KV SINGLE PHASE 3 CORE PT (1-PH)		12	-	-	PPE
4.	110KV, 2000A, 40KA/3S, HCB ISOLATOR WITH SINGLE EARTH SWITCH (3-PH)		08	-	-	PPE/LATTICE
5.	145KV, 2000A, 40KA/3S, HCB ISOLATOR WITHOUT EARTH SWITCH (3-PH)		44	-	-	PPE/LATTICE
6.	90KV LIGHTNING ARRESTER (1-PH)		24	-	-	PPE
7.	132KV BUS POST INSULATOR		82	-	-	PPE/LATTICE

NOTE:-

1. LINE CWT SHALL BE PROVIDED IN ALL THE PHASES OF 400KV FEEDERS.
2. LINE PTA SHALL BE PROVIDED IN ALL THE PHASES OF 220KV FEEDERS.
3. LINE PTA SHALL BE PROVIDED IN ONE PHASE (Y-PH) OF 110KV FEEDERS.

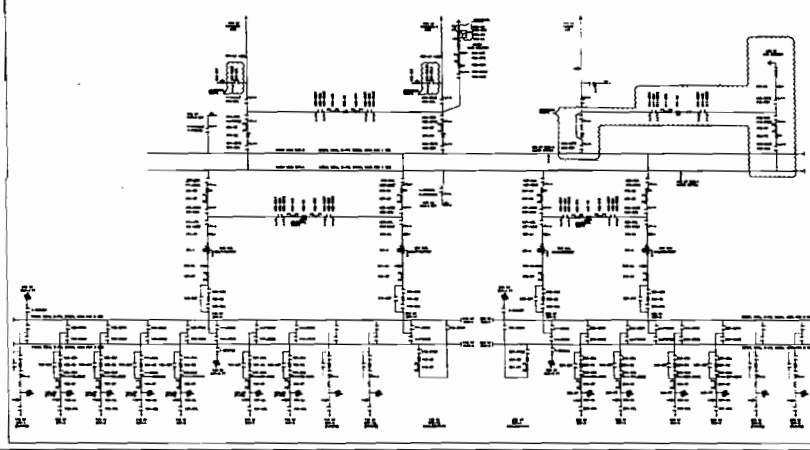
MINIMUM CLEARANCE (AS PER IS 882 & IS 883) AND SPACING	400KV	220KV	110KV
MINIMUM CLEARANCE PHASE TO PHASE (P-P)	4000	3100	1700
MINIMUM CLEARANCE PHASE TO EARTH (P-E)	3000	2100	1100
PHASE TO PHASE SPACING	7000	4000	2500
MINIMUM SECTION CLEARANCE (DC)	6000	3000	1600
TO NEAREST PART OF AN OBSTACLE SUPPORTING LINE CONDUCTOR (AS PER IS 882)	7000	3500	2000
HEIGHT OF TOWER / TOWER CENTER LINE OF FIRST LEVEL FROM PLAIN LEVEL	8000	5000	4000

LEGEND:-

- BHEL SCOPE
- - - NOT IN BHEL SCOPE
- FENCE

Area for Illumination System

400/230/110KV FEEDERS



NOTE:-

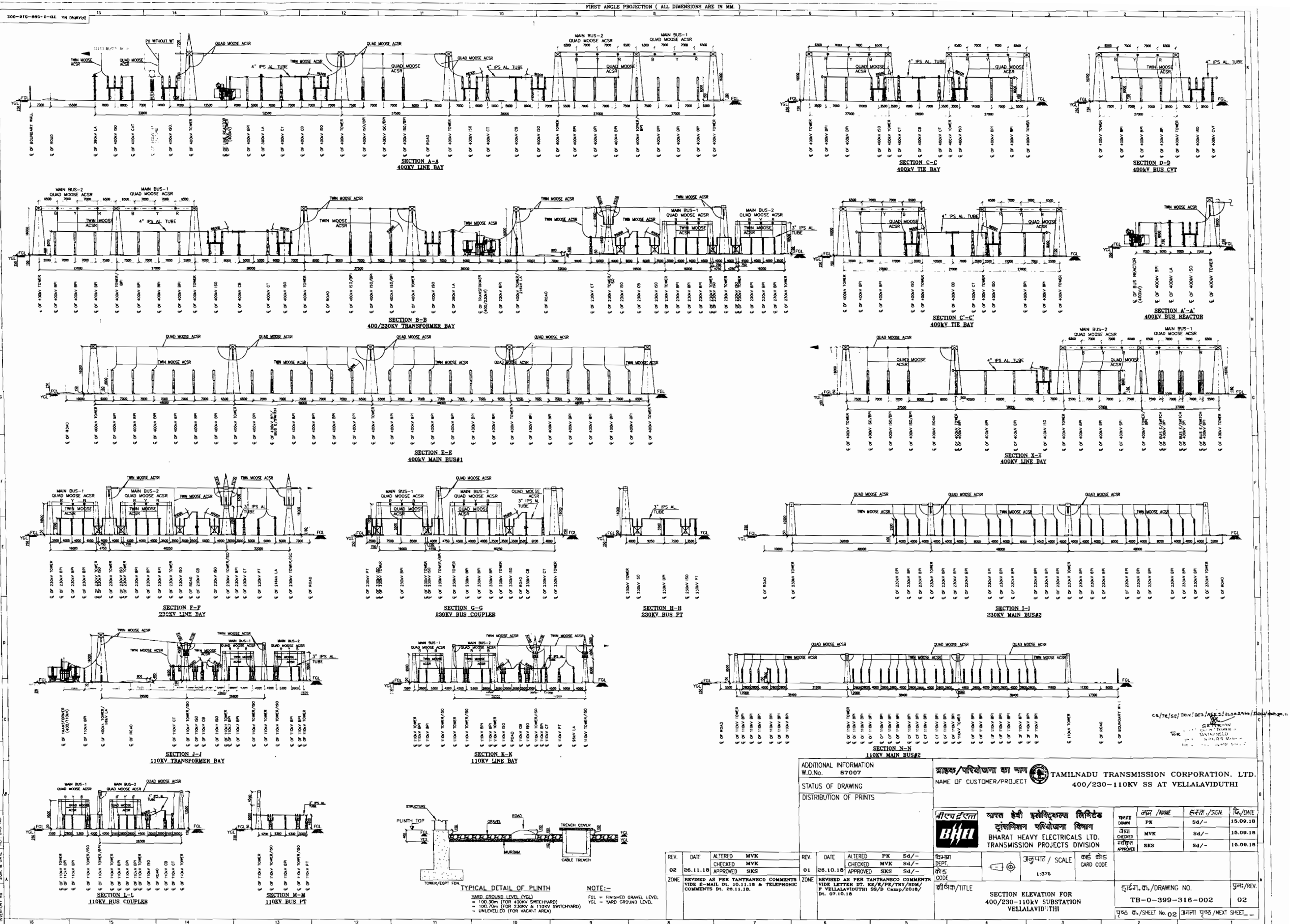
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- SYSTEM PARAMETERS:
 - 1. NOMINAL SYSTEM VOLTAGE: 400, 230, 110
 - 2. HIGHEST SYSTEM VOLTAGE: 400, 230, 110
 - 3. FREQUENCY: 50
 - 4. NO. OF PHASES: 3
- INSULATION LEVELS:
 - 5. FULL WIRE LIGHTNING IMPULSE WITHSTANDING VOLTAGE (1.2/50µs): 1425, 1000, 500
 - 6. SHORT DURATION WITHSTANDING VOLTAGE (0.5/300µs) (1-PH): 1425, 1000, 500
 - 7. 50% SHORT DURATION WITHSTANDING VOLTAGE (0.5/300µs) (3-PH): 1425, 1000, 500
 - 8. CORONA DETECTION VOLTAGE: 220, 150, 100
 - 9. 50% SHORT DURATION WITHSTANDING VOLTAGE (0.5/300µs) (1-PH): 1425, 1000, 500
 - 10. 50% SHORT DURATION WITHSTANDING VOLTAGE (0.5/300µs) (3-PH): 1425, 1000, 500
 - 11. SYSTEM FAULT LEVEL: 1425/1000/500
 - 12. SYSTEM SHORT CIRCUIT CURRENT: 1425/1000/500
 - 13. OVERCURRENT PROTECTION: 1425/1000/500
- CONDUCTOR DETAIL:
 - 1. CONDUCTOR TYPE: 400KV: 400/230/110KV
 - 2. CONDUCTOR TYPE: 230KV: 230/110KV
 - 3. CONDUCTOR TYPE: 110KV: 110KV
- ALL THE DIMENSIONS ARE IN MM.
- LOCATION OF LIGHT SHALL BE AS PER BHEL CALCULATION.
- OVERCURRENTS AND FAULTS SHALL BE AS PER TANTANTRACO INPUT DATA.
- SCHEMATIC DRAWING SHALL BE RETURNED FOR REVIEW KEY SIGNING, TRENCH LAYOUT, LAYOUT, CONTROL ROOM, TOWER, BEAM, FIRE FIGHTING SYSTEM, ILLUMINATION SYSTEM, ARE CONFORMING TO TANTANTRACO SYSTEM, POWER, GATE & GROUND ETC.
- THE HEIGHT OF TOWER AND GATE SHALL BE SHOWN IN THE CONSTRUCTION DRAWING.
- STATIC TENSION ON THE BUSES AND SHIELD WIRE SHALL BE SHOWN IN THE STRUCTURE LAYOUT DRAWING SEPARATELY.
- BOUNDARY WALL LAYOUT IS AS PER CONTOUR LAYOUT SUBMITTED TO TANTANTRACO.
- LOCATION OF DO SET AND OVERCURRENT PROTECTION SHALL BE SHOWN IN THE LAYOUT.
- 3M WIDE ROAD SHOWN IN THE LAYOUT IS FOR MOVEMENT OF MAINTENANCE EQUIPMENT ONLY AND NOT FOR TRAILER/TRUCKS MOVEMENT.

ADDITIONAL INFORMATION
W.O.No. 87007
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

भारत भारी बिजलीकरण लिमिटेड
TAMILNADU TRANSMISSION CORPORATION, LTD.
NAME OF CUSTOMER/PROJECT
400/230-110KV SS AT VELLALVIDUTHI

क्रमांक/NAME	हस्ता/SGN	दि./DATE
PK	Sd/-	14.09.18
MYK	Sd/-	14.09.18
SKS	Sd/-	14.09.18

भारत भारी बिजलीकरण लिमिटेड
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION
लगाव/SCALE
1:625
कॉड कोड
CARD CODE
ड्राइंग/DRAWING NO.
TB-0-399-316-002
पृष्ठ No./SHEET No. 01
पुनः/REV.
02



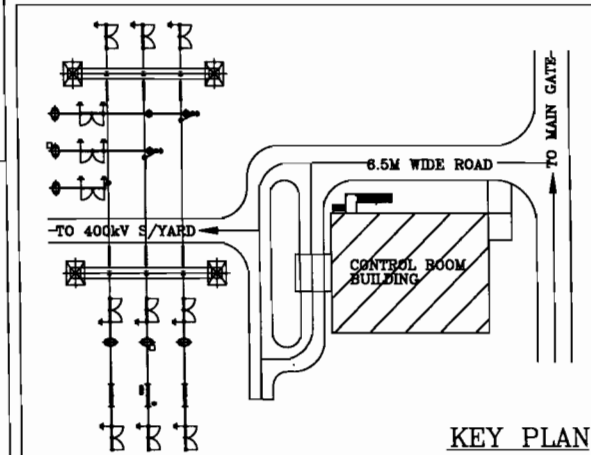
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-3-399-316-005

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COMPUTER DRG. PATH NAME :

INVENTORY No. SIGN. & DATE REF. DRG. No.



GROUND FLOOR - PLAN @ EL+0.50M LVL

REV.	DATE	ALTERED	MVK	Sd/-
03	28.02.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 07.02.19.

REV.	DATE	ALTERED	MVK	Sd/-
02	19.01.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 11.01.19.

ADDITIONAL INFORMATION
W.O.No. 87007

STATUS OF DRAWING
DISTRIBUTION OF PRINTS

REV.	DATE	ALTERED	MVK	Sd/-
01	28.12.18	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 22.10.18, 30.10.18 & 28.11.18.

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
द्वारा नियंत्रित परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

विभाग DEPT.
कोड CODE
422

अनुपात / SCALE
N/A

कार्ड कोड
CARD CODE

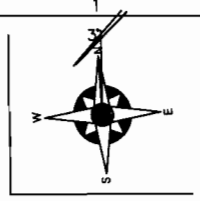
शीट/TITLE
CONTROL ROOM BUILDING LAYOUT FOR
400/230-110kV VELLALAVIDUTHI S/S

क्रमांक DRAWN	नाम /NAME	हस्ता./SIGN.	दि./DATE
01	MVK	Sd/-	17.09.18
02	MVK	Sd/-	17.09.18
03	SKS	Sd/-	17.09.18

ड्राइंग.क्र./DRAWING NO.
TB-3-399-316-005
पृष्ठ क्र./SHEET No. 1 अगला पृष्ठ/NEXT SHEET 2

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-3-399-316-005



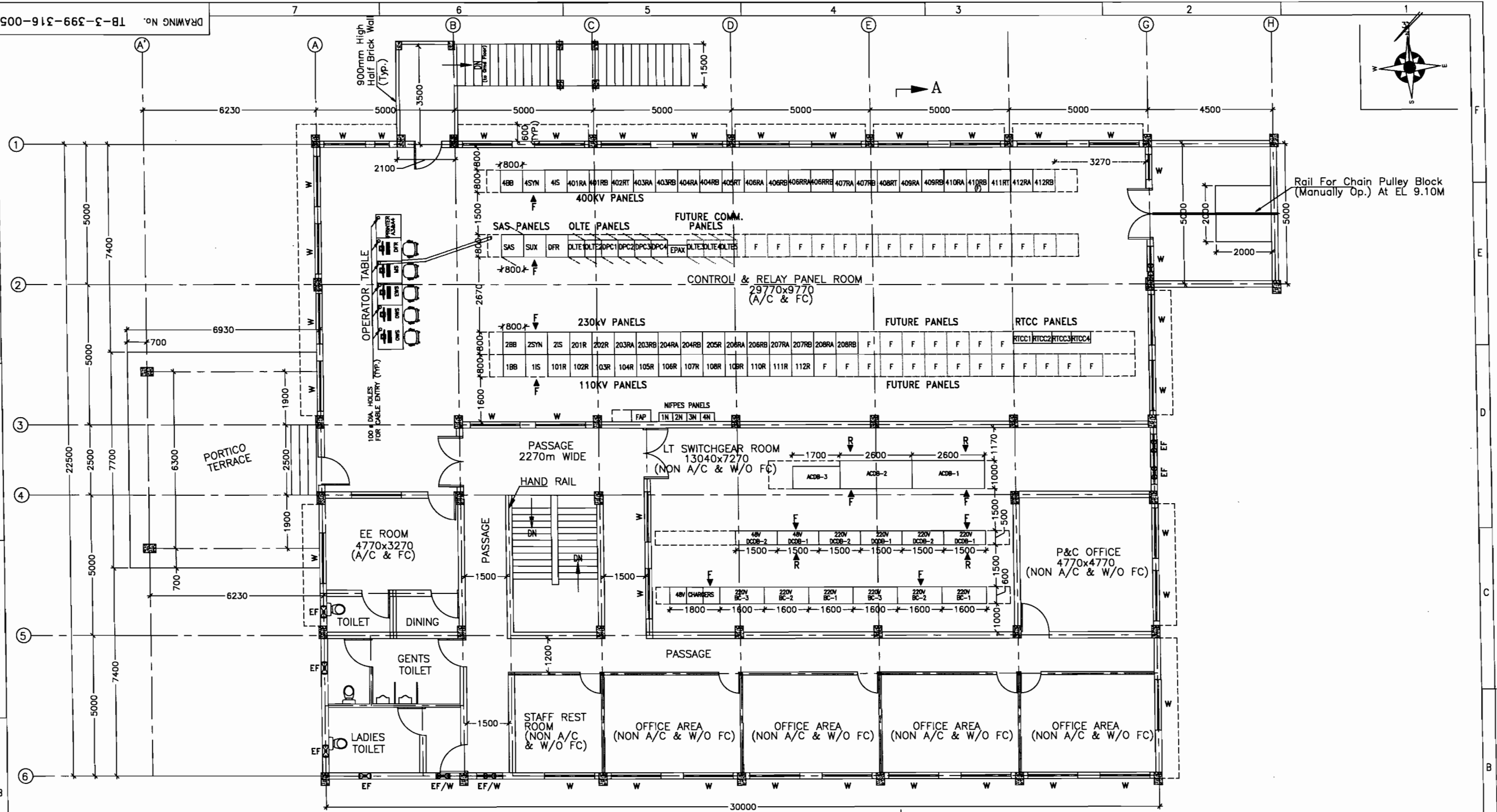
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COMPUTER DRG. PATH NAME :

SIGN. & DATE

REF. DRG. No.

INVENTORY No.



FIRST FLOOR - PLAN @ EL+4.50M LVL

ADDITIONAL INFORMATION
W.O.No. 87007

STATUS OF DRAWING
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT

TAMILNADU TRANSMISSION CORPORATION LTD.
400/230-110KV SS AT VELLALAVIDUTHI



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
द्वारा निरमित परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

क्रमांक DRAWING	नाम / NAME	हस्ता./SIGN.	दि./DATE
01	MVK	Sd/-	17.09.18
02	MVK	Sd/-	17.09.18
03	SKS	Sd/-	17.09.18

REV.	DATE	ALTERED	MVK	Sd/-
03	28.02.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

REV.	DATE	ALTERED	MVK	Sd/-
02	19.01.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

REV.	DATE	ALTERED	MVK	Sd/-
01	28.12.18	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

विभाग
DEPT.

कॉड
CODE

उत्पात / SCALE
N/A

कार्ड कोड
CARD CODE

शीट/TITLE
CONTROL ROOM BUILDING LAYOUT FOR
400/230-110KV VELLALAVIDUTHI S/S

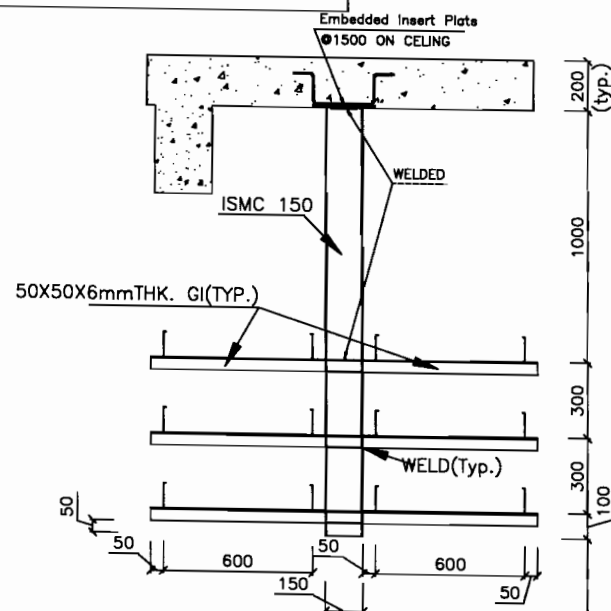
ड्राइंग.क./DRAWING NO.
TB-3-399-316-005

पुनः/REV.
03

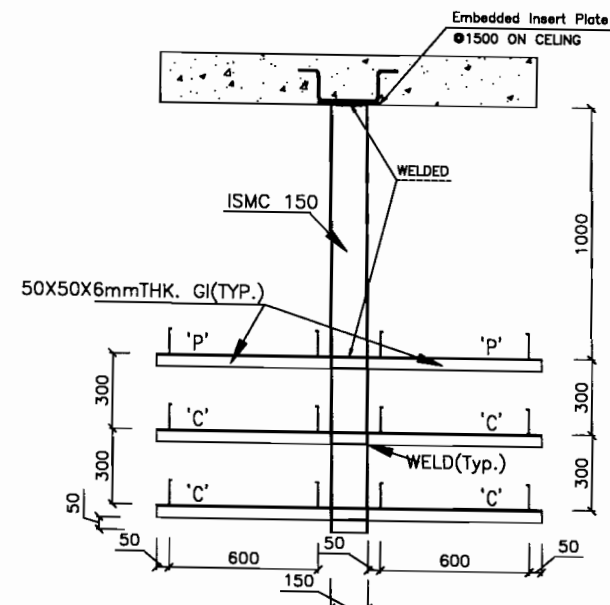
पृष्ठ क्र./SHEET No. 2 अगला पृष्ठ/NEXT SHEET 3

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

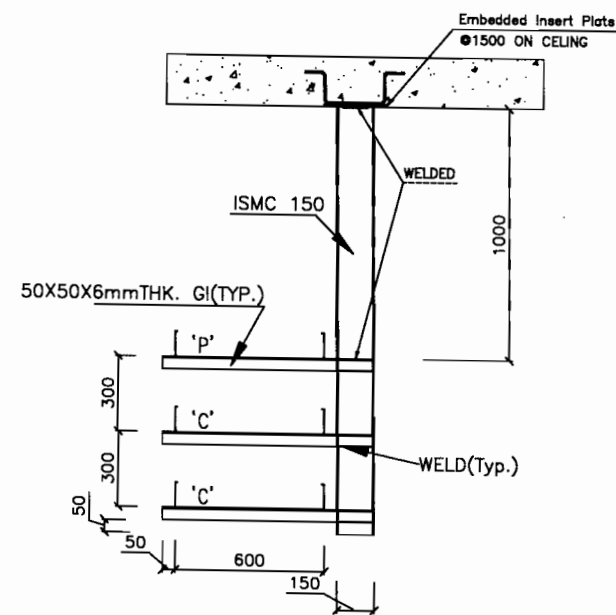
DRAWING No. TB-3-399-316-005



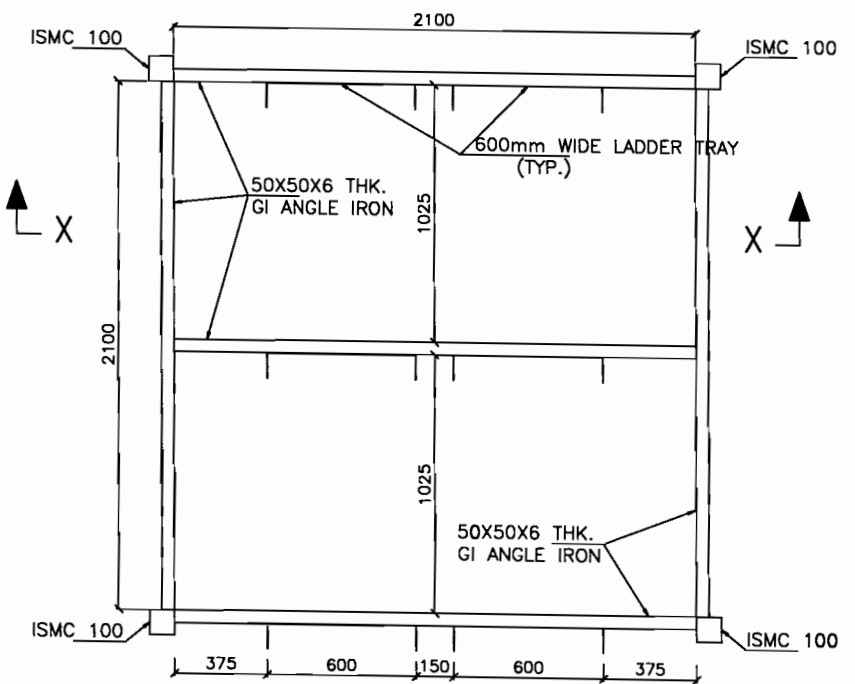
F.F.L. (CABLE GALLERY ROOM FLOOR LEVEL)
TYPICAL DETAIL OF UNDERHUNG CABLE RACK



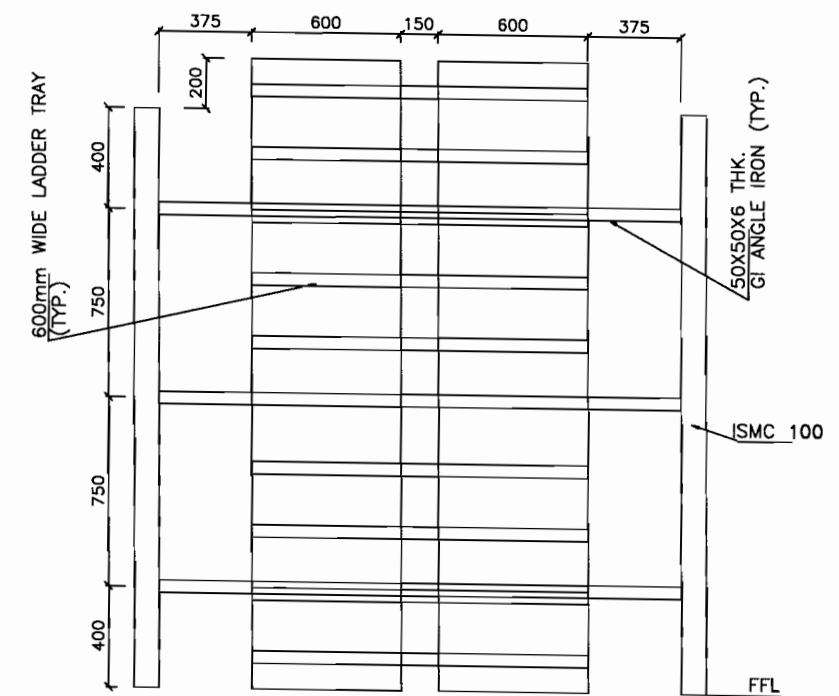
DETAIL-A



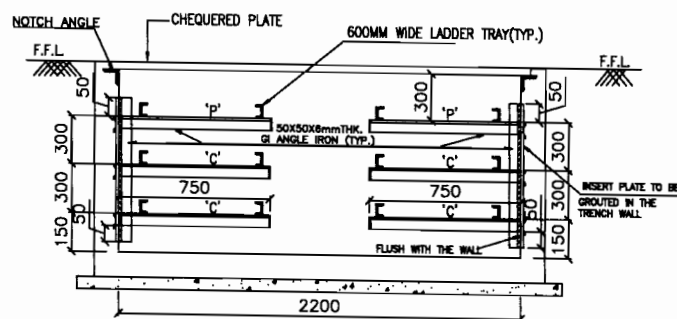
DETAIL-B



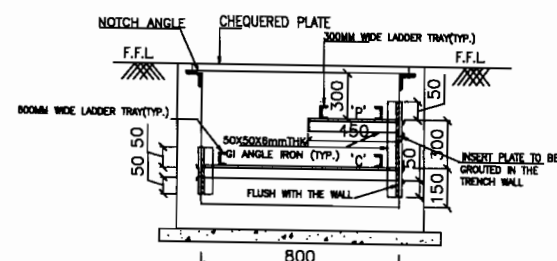
DETAIL-C



SECTION-XX



TR 1A-1A



TR 3A-3A

REV.	DATE	ALTERED	MVK	Sd/-
03	28.02.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 07.02.19.

REV.	DATE	ALTERED	MVK	Sd/-
02	19.01.19	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 11.01.19.

ADDITIONAL INFORMATION
W.O.No. 87007

STATUS OF DRAWING
DISTRIBUTION OF PRINTS

REV.	DATE	ALTERED	MVK	Sd/-
01	28.12.18	CHECKED	MVK	Sd/-
		APPROVED	SKS	Sd/-

ZONE REVISED AS PER CUSTOMER COMMENTS DT. 22.10.18, 30.10.18 & 28.11.18.

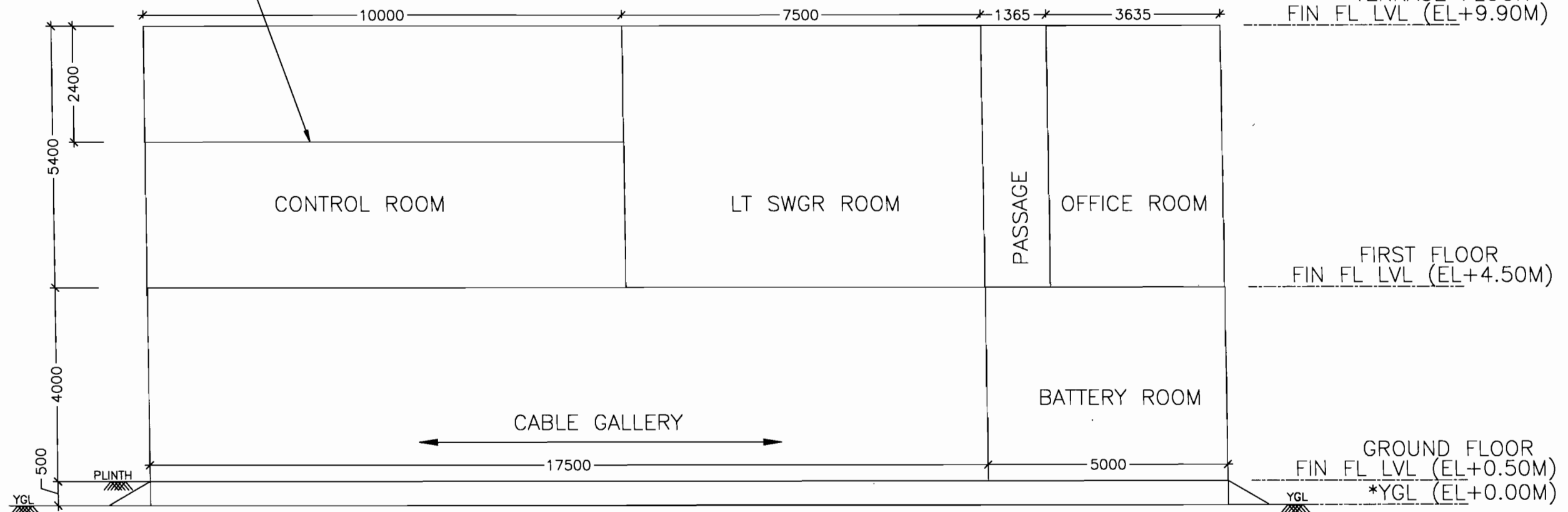
आहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT
TAMILNADU TRANSMISSION CORPORATION LTD.
400/230-110KV SS AT VELLALAVIDUTHI

नाम / NAME	हस्ता./SIGN.	दि./DATE
MVK	Sd/-	17.09.18
MVK	Sd/-	17.09.18
SKS	Sd/-	17.09.18

ड्राईंग.क./DRAWING NO.	पुनः/REV.
TB-3-399-316-005	03
पृष्ठ क्र./SHEET No.	अगला पृष्ठ/NEXT SHEET
3	4

DRAWING No. TB-3-399-316-005

FALSE CEILING



NOTE:-

- ALL DIMENSIONS ARE IN MM UNLESS SPECIFIED OTHERWISE.
- CONTROL ROOM BUILDING IS A DOUBLE STOREY BUILDING WITH TRENCHES BELOW FLOOR LEVEL/UNDER HUNG FOR CABLE LAYING.
- CONTROL ROOM & EE ROOM ON FIRST FLOOR SHALL BE AIR-CONDITIONED (A/C) WITH FALSE CEILING (FC).
OTHER PARTS OF BUILDING SHALL BE NON AIR-CONDITIONED & WITH NO FALSE CEILING.
- LT SWITCHGEAR ROOM, BATTERY ROOM AND TOILETS SHALL BE PROVIDED WITH EXHAUST AIR FANS.
- ALL ROOMS EXCEPT AC EQUIPMENT ROOM SHALL BE PROVIDED WITH WINDOW.
- ALUMINIUM GLAZED WINDOW SHALL BE PROVIDED IN CONTROL ROOM TO HAVE A CLEAR VIEW OF SWITCHYARD EQUIPMENTS.
- ALL THE DIMENSIONS OF THE ROOMS IN PLAN VIEW ARE WALL TO WALL DIMENSIONS.
- SEPARATE DRAWING SHALL BE SUBMITTED FOR DETAILED ARCHITECTURE AND TRENCH LAYOUT OF CONTROL ROOM BUILDING.
- DOOR, WINDOW AND OTHER CIVIL DETAILS SHALL BE AS PER CIVIL/ ARCHITECTURAL DRAWING.
- ELEVATION SHOWN ABOVE IS FOR INDICATION OF HEIGHTS ONLY. ALL OTHER DETAILS SHALL BE AS PER CIVIL/ ARCHITECTURAL DRAWING.
- HEIGHTS SHOWN IN ELEVATION ARE CLEAR HEIGHTS.
- SIZES OF PANELS/ EQUIPMENTS ARE TENTATIVE AND MAY CHANGE AS FINAL OGA DRAWINGS OF EQUIPMENTS.
- DIMENSIONS AND ARRANGEMENT OF PANELS INSIDE CONTROL ROOM BUILDING ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.

ADDITIONAL INFORMATION
W.O.No. 87007

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

आहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT



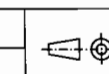
TAMILNADU TRANSMISSION CORPORATION LTD.
400/230-110KV SS AT VELLALAVIDUTHI



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
द्वारा नियंत्रित परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

क्रमांक DRAWING	नाम /NAME	हस्ता./SIGN.	दि./DATE
मंजूर CHECKED	MVK	Sd/-	17.09.18
परिष्कारित REVISED	MVK	Sd/-	17.09.18
अनुमोदित APPROVED	SKS	Sd/-	17.09.18

विभाग TBEM
DEPT.
कोड 422
CODE



अनुपात / SCALE
N/A

कार्ड कोड
CARD CODE

शीर्षक/TITLE
CONTROL ROOM BUILDING LAYOUT FOR
400/230-110KV VELLALAVIDUTHI S/S

डाईग.क्र./DRAWING NO.
TB-3-399-316-005
पृष्ठ क्र./SHEET No. 4
उग्रात पृष्ठ/NEXT SHEET 5

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-3-399-316-005

SAS EQUIPMENT

SN	Panel No.	Description	DIMENSIONS (W X D)
1	SAS	SAS PANEL	
2	SUX	STATION AUXILIARY PANEL	
3	DFR	DISTURBANCE FAULT RECORDER	

400kV PANEL DESCRIPTION

SN	Panel No.	Description	DIMENSIONS (W X D)
1	4BB	400kV BUSBAR PROTECTION PANEL	800 x 800
2	4SYN	400kV SYNCHRONIZING PANEL	800 x 800
3	4IS	400kV ISLANDING PANEL	800 x 800
4	401RA & 401RB	400/230kV AUTO TRAF0 - 1 PROTECTION PANEL (H.V. SIDE)	2 x 800 x 800
5	402RT	400kV TIE PROTECTION PANEL	800 x 800
6	403RA & 403RB	400/230kV AUTO TRAF0 - 2 PROTECTION PANEL (H.V. SIDE)	2 x 800 x 800
7	404RA & 404RB	400kV KARAIKUDI LINE PROTECTION PANEL	2 x 800 x 800
8	405RT	400kV TIE PROTECTION PANEL FOR LINES	800 x 800
9	406RA & 406RB	400kV PUGALUR LINE- 1 PROTECTION PANEL	2 x 800 x 800
10	406RA & 406RB	400kV LINE REACTOR PROTECTION PANEL	2 x 800 x 800
11	407RA & 407RB	400/110kV AUTO TRAF0 - 3 PROTECTION PANEL (H.V. SIDE)	2 x 800 x 800
12	408RT	400kV TIE PROTECTION PANEL	800 x 800
13	409RA & 409RB	400/110kV AUTO TRAF0 - 4 PROTECTION PANEL (H.V. SIDE)	2 x 800 x 800
14	410RA	400kV LINE (FUTURE) PROTECTION PANEL	800 x 800
	410RB	400kV LINE (FUTURE) PROTECTION PANEL	NOT IN BHEL SCOPE
15	411RT	400kV TIE PROTECTION PANEL FOR LINES	800 x 800
16	412RA & 412RB	400kV BUS REACTOR PROTECTION PANEL	2 x 800 x 800

230kV PANEL DESCRIPTION

SN	Panel No.	Description	DIMENSIONS (W X D)
1	2BB	230kV BUSBAR PROTECTION PANEL	800 x 800
2	2SYN	230kV SYNCHRONIZING PANEL	800 x 800
3	2IS	230kV ISLANDING PANEL	800 x 800
4	201R	230kV BUS COUPLER PROTECTION PANEL	800 x 800
5	202R	230kV AUTO TRAF0 - 3 PROTECTION PANEL (L.V. SIDE)	800 x 800
6	203RA & 203RB	230kV LINE - 1 PROTECTION PANEL	2 x 800 x 800
7	204RA & 204RB	230kV LINE - 2 PROTECTION PANEL	2 x 800 x 800
8	205R	230kV AUTO TRAF0 - 4 PROTECTION PANEL (L.V. SIDE)	800 x 800
9	206RA & 206RB	230kV LINE - 3 PROTECTION PANEL	2 x 800 x 800
10	207RA & 207RB	230kV LINE - 4 PROTECTION PANEL	2 x 800 x 800
11	208RA & 208RB	230kV LINE - 5 PROTECTION PANEL	2 x 800 x 800

110kV PANEL DESCRIPTION

SN	Panel No.	Description	DIMENSIONS (W X D)
1	1BB	110kV BUSBAR PROTECTION PANEL	800 x 800
2	1IS	110kV ISLANDING PANEL	800 x 800
3	101R	110kV LINE - 1 PROTECTION PANEL	800 x 800
4	102R	110kV LINE - 2 PROTECTION PANEL	800 x 800
5	103R	110kV LINE - 3 PROTECTION PANEL	800 x 800
6	104R	110kV LINE - 4 PROTECTION PANEL	800 x 800
7	105R	110kV LINE - 5 PROTECTION PANEL	800 x 800
8	106R	110kV AUTO TRAF0 - 1 PROTECTION PANEL (L.V. SIDE)	800 x 800
9	107R	110kV LINE - 6 PROTECTION PANEL	800 x 800
10	108R	110kV LINE - 7 PROTECTION PANEL	800 x 800
11	109R	110kV LINE - 8 PROTECTION PANEL	800 x 800
12	110R	110kV LINE - 9 PROTECTION PANEL	800 x 800
13	111R	110kV AUTO TRAF0 - 2 PROTECTION PANEL (L.V. SIDE)	800 x 800
14	112R	110kV BUS COUPLER PROTECTION PANEL	800 x 800

DESCRIPTION:-

OWS - OPERATOR WORKSTATION
EWS - ENGINEERING WORKSTATION
MS - METERING STATION
DFR - DISTURBANCE FAULT RECORDER

☐ R PRESENT SCOPE PANELS

☐ F FUTURE (SPACE PROVISION)

SAS EQUIPMENT

SN	Panel No.	Description	DIMENSIONS (W X D)
1	SAS	SAS PANEL	
2	SUX	STATION AUXILIARY PANEL	
3	DFR	DISTURBANCE FAULT RECORDER	

STATION AUXILIARY SYSTEM PANELS

SN	Panel No.	Description	DIMENSIONS (W X D)
1	ACDB-1 & 2	415V AC DISTRIBUTION BOARD	
2	ACDB-3	415V EMERGENCY AC DISTRIBUTION BOARD	
3	220V DCDB-1 & 2	220V DC DISTRIBUTION BOARD (400kV)	
4	220V DCDB-1 & 2	220V DC DISTRIBUTION BOARD (230kV & 110kV)	
5	48V DCDB-1 & 2	48V DC DISTRIBUTION BOARD	
6	220V BC-1, 2 & 3	80A FLOAT AND FLOAT CUM BOOST CHARGER (400kV)	
7	220V BC-1, 2 & 3	60A FLOAT AND FLOAT CUM BOOST CHARGER (230kV & 110kV)	
8	48V BC-1, 2 & 3	120A FLOAT AND FLOAT CUM BOOST CHARGER	
9	220V BATT-1 & 2	220V, 400AH, LEAD ACID TUBULAR TYPE BATTERY (400kV)	
10	220V BATT-1 & 2	220V, 300AH, LEAD ACID TUBULAR TYPE BATTERY (230kV & 110kV)	
11	48V BATT-1 & 2	48V, 600AH, LEAD ACID TUBULAR TYPE BATTERY	

MISCELLANEOUS PANELS

SN	Panel No.	Description	DIMENSIONS (W X D)
1	RTCC1	400/110kV AUTO TRAF0 - 1 PANEL	
2	RTCC2	400/110kV AUTO TRAF0 - 2 PANEL	
3	RTCC3	400/230kV AUTO TRAF0 - 3 PANEL	
4	RTCC4	400/230kV AUTO TRAF0 - 4 PANEL	
5	OLTE1	FOTE PANEL	
6	OLTE2	FOTE PANEL	
7	DPC1	DIGITAL PROTECTION COUPLER	
8	DPC2	DIGITAL PROTECTION COUPLER	
9	DPC3	DIGITAL PROTECTION COUPLER	
10	DPC4	DIGITAL PROTECTION COUPLER	
11	EPAX	EPAX PANEL	
12	FAP	FIRE ALARM PANEL	
13	1N	NIPFES - 1 (400/110kV AUTO TRAF0 - 1)	
14	2N	NIPFES - 2 (400/110kV AUTO TRAF0 - 2)	
15	3N	NIPFES - 3 (400/230kV AUTO TRAF0 - 3)	
16	4N	NIPFES - 4 (400/230kV AUTO TRAF0 - 4)	

ADDITIONAL INFORMATION
W.O.No. 87007

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

आहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT



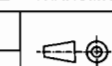
TAMILNADU TRANSMISSION CORPORATION LTD.
400/230-110KV SS AT VELLALAVIDUTHI



भारत हेवी इलेक्ट्रिकल्स लिमिटेड
द्वारा परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

क्रमांक DRAWN	नाम /NAME	हस्ता./SIGN.	दि./DATE
01	MVK	Sd/-	17.09.18
परीक्षा CHECKED	MVK	Sd/-	17.09.18
स्वीकृत APPROVED	SKS	Sd/-	17.09.18

विभाग TBEM
DEPT.
कोड 422



अनुपात / SCALE
N/A

कार्ड कोड
CARD CODE

शीर्षक/TITLE
CONTROL ROOM BUILDING LAYOUT FOR
400/230-110kV VELLALAVIDUTHI S/S

ड्राइंग.क्र./DRAWING NO.
TB-3-399-316-005

पुनः/REV.
03

पृष्ठ क्र./SHEET No. 5 अगला पृष्ठ/NEXT SHEET -

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COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

SECTION -2

GENERAL TECHNICAL REQUIREMENTS

2.0 GENERAL :

2.0.1 The lighting System design shall comply with acceptable norms and the best engineering practices. The lighting shall be designed to provide uniform illumination with minimum glare. The lighting system shall meet all the statutory requirements, local rules etc.

2.0.2 Feeders required for lighting shall be given from Main LVAC /DC boards. Further distribution using lighting DB's panels for Illumination shall be in Illumination contractor scope .Laying & termination of cables from lighting panel onwards shall be in illumination contractor scope.

2.0.3 APPLICABLE CODES AND STANDARDS

All material / work shall conform to the following standards & codes unless otherwise stated. All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of bid opening. In case of conflict between this specification and those (codes, standards etc) referred to herein, the former shall prevail.

(i)	IS:1913	General and safety requirements for electric light fittings
(ii)	IS:418	Tungsten filament lamp for domestic and similar general lighting purposes
(iii)	IS:10322	Luminaires
(iv)	IS:10276	Edison Screw lamp holders
(v)	IS:2418	Tubular fluorescent lamps
(vi)	IS:9974	High pressure sodium Vapour lamps
(vii)	IS:9900	High Pressure mercury vapour lamps.
(viii)	IS:6616	Ballasts for high pressure mercury Vapour lamps
(ix)	IS:1258	Specification for bayonet lamp holders
(x)	IS:3323	Bi-pin lamp holders for tubular fluorescent lamps
(xi)	IS:13021	AC Supplied electronic ballasts for tubular fluorescent lamps
(xii)	IS:1534	Ballasts for use in fluorescent lighting fittings
(xiii)	IS:1569	Capacitors for use in tubular fluorescent high pressure mercury vapour and low pressure sodium Vapour discharge lamp circuit.
(xiv)	IS:2215	Starters for fluorescent lamps
(xv)	IS:3324	Holders for starters for tubular fluorescent lamps
(xvi)	IS:418	GLS lamps
(xvii)	IS:13021	AC supplied electronic ballasts for tubular fluorescent lamps
(xviii)	IS:2713	Tubular steel poles
(xix)	IS:280	MS Wire for general Engg. Purpose.

2.0.4.1 Conduits, Pipes and Accessories

(i)	IS:9537	Rigid Steel conduit for electrical wiring
(ii)	IS:3480	Flexible steel conduits for electrical wiring
(iii)	IS:2667	Fitting for rigid steel conduits for electrical wiring
(iv)	IS:3837	Accessories for rigid steel conduits for electrical wiring.
(v)	IS:4649	Adaptors for flexible steel conduits

2.0.4.2 Lighting panels, Switch boxes, receptacles and junction boxes.

(i)	IS:13947	Specification for LV switchgear and control gear (Parts 1to 5)
(ii)	IS:8828	Circuit breakers for over current protection for house hold and similar installations.
(iii)	IS:5	Colours for ready mixed paints and enamels
(iv)	IS:2551	Danger notice plates
(v)	IS:5133	Steel and cast iron boxes
(vi)	IS:2629	Recommend practice for hot dip galvanizing of iron & steel.
(vii)	IS:3854	Switches for domestic and similar purposes
(viii)	IS:6875	Control switches (Switching devices for Control and auxiliary Circuits including contactor relays) for Voltages upto and including 1000V AC and 1200V DC.
(ix)	IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500V DC
(x)	IS:9224	HRC Cartridge fuse links for voltage above 650V(Part2)
(xi)	IS:5082	Wrought aluminum and Al. alloys, bars, rods, tubes and section for electrical purposes.
(xii)	IS:8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200V DC.
(xiii)	IS:1248	Direct acting electrical indicating instruments .
(xiv)	IS:1293	Plugs & socket outlets of rated voltage upto and including 250 Volts & rated current upto and including 16 amps

2.0.4.3 Lighting Wires / Cables

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

2.0.4.4 Electrical Installation & Miscellaneous :

(i)	IS:2062	Steel for general structural purposes.
(ii)	IS:6665	Code of practice for industrial lighting.
(iii)	IS:374	Electric ceiling fans & regulators
(iv)	IS:5216	Recommendations on safety procedures and practices in electrical work.
(v)	IS:732	Code of practice for electrical wiring installation (System voltage not exceeding 650 Volts)
(vi)	IS:1255	Code of practice for installation and maintenance of power cables upto and including 33kV rating.
(vii)	IS:3043	Code of practice for earthing.
(viii)	IS:3646	Code of practice of Interior Illumination.
(ix)	IS:1944	Code of practice for lighting of public through fares.
(x)	IS:5571	Guide for selection of electrical equipment for hazardous areas.
(xi)	IS:800	Code of practice for use of structural steel in general building construction
(xii)	IS:2633	Methods of testing uniformity of coating on Zinc coated articles.
(xiii)	IS:6005	Code of Practice for phosphating iron and steel.
(xiv)	IS:371	Ceiling roses
(xv)	BS:6121	Mechanical cable glands
(xvi)	IS:6631	Specification for Steel pipes
(xvii)		INDIAN ELECTRICITY ACT
(xviii)		INDIAN ELECTRICITY RULES
(xix)		NATIONAL ELECTRICAL CODE

2.1 TESTS :

- 2.1.1.1** All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years **from the date of opening of the tender (i.e. 30.09.2016)**. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- 2.1.1.2** In case the Contractor is not able to submit report of the type test (s) conducted within last ten year from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the BHEL / Owner and submit the reports for approval.
- 2.1.1.3** All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- 2.1.2** Selection of samples for type test, acceptance test & routine test and acceptance criteria for all the items shall be as per relevant I.S.
- 2.1.3** Type test reports of the following items as per relevant standards shall be submitted for approval.

SI.NO.	DESCRIPTION
i	Lighting fixtures of each type.
ii.	Lamps of each type and rating (life cycle and rating test only)
iii.	Lighting panel of each type (Degree of Protection)
iv.	Junction Box of each type (Degree of protection)
v.	Receptacles of each rating.
vi.	M.C.B. of each rating.
vii.	Ballasts(if applicable)

2.1.4 Acceptance Test and Routine Test :

- 2.1.4.1** All lighting fixtures, lamps and other items shall be subjected to acceptance and routine test, as per relevant specified standards.
- 2.1.4.2** Junction boxes, switch boxes, receptacle enclosure etc. shall be subjected to physical and dimensional checks.

2.1.5 Galvanizing Tests :

- 2.1.5.1** The quality of galvanizing shall be smooth, continuous, free from flux, stains and shall be inspected visually.
- 2.1.5.2** In addition following test shall be conducted as acceptance tests.
- (a) Uniformity of coating – The coating of any article shall withstand four 1 minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic metal.

- (b) The quality of cadmium/ Zinc plating on items with screw threads shall be free from visible defects such as unplated areas, blisters and modules and shall be inspected visually.
- (c) In addition the plating thickness shall be determined microscopically / chemically or electronically.

2.1.6 COMMISSIONING CHECKS :

- 2.1.6.1** On completion of Installation work the Contractor shall request the Project manager for inspection and test with minimum of fourteen (14) days advance notice.
- 2.1.6.2** The Project Manager shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.
- 2.1.6.3** The installation shall be then tested and commissioned in presence of the Project Manager.
- 2.1.6.4** The contractor shall provide all, men material and equipment required to carry out the tests.
- 2.1.6.5** All rectifications, repair or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor without any extra cost.
- 2.1.6.6** The testing shall be done in accordance with the applicable Indian Standards and codes of practices. The following tests shall be specifically carried out for all lighting installation.
 - (a) Insulation Resistance
 - (b) Testing of earth continuity path.
 - (c) Polarity Test of single phase switches
 - (d) Functional checks
- 2.1.6.7** The lighting circuits shall be tested in the following manner :
 - (a) All switches ON and consuming devices in circuit, both poles connected together to obtain resistance to earth.
 - (b) Insulation resistance between poles with lamps and other consuming devices removed and switches ON.
- 2.1.6.8** Lux level measurement to prove guaranteed Illumination levels. The contractor shall submit a document on methodology of measurement for approval of BHEL / ultimate customer . This will become basis for measurements .

2.2 QUALITY PLAN :

Bidder shall submit immediately after award of Contract Manufacturing Quality plan & field Quality plan in prescribed format for approval of BHEL & customer. These approved Quality plans shall be followed for manufacture and ETC. Where standard quality plans of BHEL or customer are available , these shall be followed after written consent of BHEL/ Customer.

2.3 HANDING & TAKINGOVER :

It is the responsibility of bidder to handover the complete system to BHEL/ ultimate customer. Bidder shall assist BHEL to handover the system supplied by them to ultimate customer.

2.4 DOCUMENTATION :

2.4.1. Information / documents to be submitted by the bidder at tender stage shall be as follows :

- (a) Check list
- (b) Technical offer with equipment details & the makes, detailed unpriced schedule of equipment / material & spares .
- (b) Guaranteed technical particulars.
- (c) Activity Schedule.
- (d) Catalogues & technical details of equipment / material offered.

2.4.2. Information / documents to be submitted by the Contractor at contract stage shall be as follows :

- (a) Type test reports
- (b) Manufacturing Quality plan. Where standard Quality plan of BHEL / Customer is available, this shall be followed.
- (c) Field Quality plan for receipt, storage, installation, testing & commissioning with details of tests to be conducted and acceptance values .
- (d) Outline and general assembly drawings of equipment, lighting layout conduit layout, wiring scheme, Catalogues of equipment, fixing details etc.
- (e) Detailed photometric data of luminaires .
- (f) Operation & maintenance manuals
- (e) End documentation.

SECTION – 3

PROEJCT DETAILS & GENERAL TECHNICAL REQUIREMENT

3.0 FOREWORD

The provisions under this section are intended to supplement general requirements for the materials, equipment's and services covered under other sections.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

- a) Customer : M/s Tamil Nadu Transmission Corporation Limited
- b) Project Title : 400/230-110 kV Substation at Vellalaviduthi
- c) Transport facilities : Road/Rail

Physical and other parameters:

- 3.1.1 Location of the substation : Vellala viduthi, Pudukottai district
- 3.1.2 Nearest Railway station : Pudukottai
Railway : Southern Railway
- 3.1.3 Meteorological data
- (i) Maximum ambient temperature : 50°C
 - (ii) Minimum ambient temperature : 20°C
 - (iii) Maximum daily average ambient air temperature : 45° C
 - (iv) Maximum yearly average ambient air temperature : 32° C
 - (v) Maximum Humidity (%) : 100%
 - (vi) Average thunder storm days per annum : 50
 - (vii) Average rainy days per annum : 90
 - (viii) Average annual rainfall (mm) : 1000 mm
 - (ix) No. of months during which tropical monsoon condition prevail : 5
 - (x) Maximum wind pressure : 150 Kgf/Sqmm
 - (xi) Altitude above MSL : 1000M

However for design purpose, ambient temperature should be considered as 50° C and relative humidity as 100%.

MAIN ELECTRICAL PARAMETRS:		
a)	Fault Levels	400kV: 63kA for 1 sec. 230kV: 40kA for 3 sec. 110kV: 40kA for 3 sec.
a)	Creepage Distance	25mm/kV

3.1.4 AUXILIARY POWER SUPPLY :

Auxiliary electrical equipment's, maintenance equipment's etc., shall be suitable for operation on the following supply system.

3 phase AC Supply	415V, 3 phase 4 wire, 50 Hz, neutral grounded AC supply -10% to +10%, Frequency +/- 5%
1 phase AC supply	240V, single phase, 50 Hz, neutral grounded AC supply -10% to +10%, Frequency +/- 5%,
DC supply	220V, 2 wire DC supply + 10% to -15%, Ungrounded 48V, 2 wire DC supply , Positively earthed

3.2 GENERAL REQUIREMENT

3.2.0 ALL THE EQUIPMENTS / MATERIALS TO BE SUPPLIED SHOULD BE IN ACCORDANCE WITH RELEVANT LATEST / AMENDED IS/IEC, WHETHER IT HAS BEEN SPECIFICALLY MENTIONED IN THE SPECIFICATION OR NOT.

3.0.1 The bidder shall also furnish drawings for the following:

All EQUIPMENTS and type of clamps, fittings hardware, insulators, bus bar. These designs/ drawing shall be got approved by the purchaser before commencing the manufacture/ construction/ erection and are to be as per latest IS/ IEC.

3.2.2 GENERAL:

The bidder shall be fully responsible for providing all equipment, materials system and services specified or otherwise which are required to complete the construction and successful commissioning of the substation in all respects.

Any other items not specifically mentioned in the specification but which are required for erection of materials/equipment under the scope of work, testing and commissioning are deemed to be included in the scope of the specification unless specifically excluded.

All items shall be supplied as per schedule and as specified in the relevant Indian standard of latest revision. The Technical specification of the main materials/equipment is furnished. The Technical specification contained herein for the materials are for the guidance of the tenderer.

The bidders are requested to procure the equipment's/materials/component only from reputed /qualified manufacturer as per Technical requirement stipulated in Section-1 of Technical specifications. Approval of make of item shall be taken up by vendor from TANTRANSCO himself.

3.3 SPECIFIC REQUIREMENT

The bidder shall furnish make/manufacturer, catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification and get approval from competent authority before commencement of any work.

All steel materials, other than materials for earthing should be of galvanized if not specified.

3.4 STANDARD:

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standards specified in the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

The Bidder shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC.

When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.5 TEST CERTIFICATE:

Copies of all test certificates relating to material to be procured by the contractor for the works shall be forwarded to the OWNER.

3.6 TESTS :

All the tests as per relevant IS/IEC shall be carried out.

3.7 MATERIALS AND WORKMANSHIP:

All the materials shall be of the best class and capable of satisfactory operation in the tropics with humid atmosphere conditions. Unless otherwise specified, they shall conform to the requirements of the appropriate IS/IEC.

The workmanship shall be of the best grade and the entire construction in accordance with the best modern practice.

The equipment shall be designed to facilitate inspection and repairs and to ensure satisfactory operation under atmosphere condition prevailing at site and under such sudden variation of load and voltage as may be met with under working conditions in the system including those due to faulty synchronizing and short circuit within the rating of the apparatus.

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment.

All the equipments should operate without undue vibration and with the least practicable amount

of noise.

3.8 INSPECTION :

The inspection may be carried out by the TANTRANSCO/BHEL at any stage of manufacture. The supplier shall grant free access to TANTRANSCO's/BHEL representative at a reasonable time when the work is in progress. The TANTRANSCO/BHEL shall have access at all times to the works and all other places of manufacture/fabrication, where the equipments are being manufactured/fabricated and the bidder shall provide TANTRANSCO's/BHEL representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

Inspection and acceptance of any equipment under this specification by the TANTRANSCO/BHEL shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the TANTRANSCO/BHEL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The TANTRANSCO/BHEL , reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

The correct grade and quality of steel shall be used by the supplier. To ascertain quality of steel, the TANTRANSCO/BHEL may at his discretion get the material tested at an approved laboratory.

The bidder shall take an account the fabrication wastage while quoting the rates. The Employer will not accept any liability in connection with the wastage of steel during fabrication or otherwise. Steel shall be procured exclusively from the main producers. However, sections not rolled by main produces can be procured from reroller, provided rerolling of structural steel section is done from billets/ingots of tested quality. Rerolled sections are duly tested as per relevant standards. Supplier should obtain approval of list of primary producers of Steel and Zinc before Proto assembly.

The BHEL/TANTRANSCO or his representative shall have the right to inspect and/or test the goods /works to confirm their conformity to the supplier. BHEL/TANTRANSCO shall notify the supplier in writing of the identity of any representatives authorized for these purposes.

The inspections and tests may be conducted on the premises of the supplier or his Sub vendor at the point of delivery and /or at the goods' final destination. Where tests are conducted in the premises of Supplier, all reasonable facility and assistance including access to drawings and production data shall be furnished at no charge to the BHEL.

Should any inspected or tested goods fail to conform to specifications, the BHEL/TANTRANSCO may reject them and the supplier shall either replace the rejected goods or make all alterations necessary to meet specification requirements free of cost to the BHEL/TANTRANSCO within one week of intimation.

The BHEL/TANTRANSCO's right to inspect, test and where necessary reject the goods after the goods; arrival at the site, shall in no way be limited or waived by reason of the goods having been previously inspected. Tested and passed by the BHEL/TANTRANSCO or his representative prior to the goods dispatch.

Not less than 15 (Fifteen) days advance intimation shall be given about the quantity of materials that will be ready for inspection by the officers of TANTRANSCO/ BHEL/Third agency authorized by the Corporation. The materials should not be dispatched without instruction from the Corporation.

3.9 GUARANTEE:

The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

3.10 PRE COMMISSIONING TESTING (if applicable) :

On completion of erection of equipment's and before charging each item of equipment's shall be thoroughly cleaned and inspected jointly by the TANTRANSCO/ BHEL and the bidder for correctness and completeness of installation and acceptability for charging leading to initial pre commissioning test. The pre commissioning testing to be carried all equipment's in the presence of BHEL/ TANTRANSCO. Necessary tools, testing kits to be arranged by the Supplier.

3.11 DOCUMENTATION :

All drawings shall conform to relevant international standards Organization (ISO) specification. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. units.

3.12 PAINTING, GALVANISING :

All interiors and exteriors of all metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequences).

All metal surfaces exposed to atmosphere shall be given, in addition to the treatment, two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limits specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external paintings shall be as per shade **No.697/631 of IS-5**.

Paint inside the metallic housing shall be of anti condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

All components shall be given adequate treatment of climate proofing as per **IS: 3202** so as to withstand corrosive and several service conditions.

All ferrous parts including all sizes of nuts, bolts, support channel structures, etc. as also the mechanism housing shall be hot dip galvanized conforming to latest version of IS : 2629 or epoxy painted. Spring washers shall be electro-galvanised.

All members of the structure members shall be hot dipped galvanised with a zinc coating of **610 gms. per square metre** . Galvanising shall be done after a work is completed, except that the nuts may be tapped or rerun after galvanization. The zinc coating shall be smooth, clean, of uniform thickness and free from defects. The preparation for galvanising itself shall not adversely affect the mechanical properties of the coated materials. The employer shall be at liberty to have the samples of zinc used, test checked in any laboratory at his own cost and reject the particular supply if it is below standard.

All galvanised material shall withstand test as per IS 2633-1972 or any other equivalent standard. The zinc used for galvanising fabricated material shall be of high grade Electrolytic zinc of 99.99% purity.

All nuts and pins shall be adequately locked. Nuts, bolts and pins used inside the transformer and tap-changer compartment where gaskets are not used shall be provided with spring washers or locknuts. Where galvanizing is specified, it shall be applied by the hot dipped process or by electro-galvanizing process and for all parts, other than steel wires, shall consist of a thickness of zinc coating equivalent to not less than 610gm of zinc per square meter of surface. The zinc coating shall be smooth, of uniform thickness and free from defects.

3.13 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a

suitable preventive compound and suitably wrapped or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.14 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.15 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.16 DEGREE OF PROTECTION

The supplier shall propose following Degree of protection for those equipment/Items for which the degree of protection has not been specified in the specification for the approval of BHEL/TANTRANSCO. The decision of BHEL/TANTRANSCO shall be final. The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes, panels etc to be installed shall provide degree of protection as detailed here under:

- a) Installed outdoor: IP-55
- b) Installed indoor in air conditioned area: IP-42
- c) Installed in covered area IP:52
- d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS: 13947 (Part-1)/ IEC-60947 (Part-1)/ IS 12063 / IEC-60529. Type test report for degree of protection test on each type of the box shall be submitted for approval.

3.17 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation,

shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

3.18 RATING PLATES, NAME PLATES AND LABELS :-

The equipments shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipments (as applicable).

- (a) Manufacturer's name or trade mark.
- (b) Serial number and type design making it possible to get all relevant information from the manufacturer.
- (c) Year of manufacture.
- (d) Rated voltage
- (e) Rated insulation level.
- (f) Rated frequency
- (g) Rated Normal current.
- (h) Rated short circuit breaking current
- (i) First pole to clear factor
- (j) Rated duration of short circuit
- (k) Rated auxiliary D.C. supply voltage of closing and opening devices.
- (l) Rated pressure of SF6 gas for operation and interruption.
- (m) Rated out of phase breaking current.
- (n) Rated supply voltage of auxiliary circuit.
- (o) Rated supply frequency of auxiliary circuits.
- (p) Purchase Order Number and Date.

The rating plate shall be visible in position of normal service and installation. The rating plate shall be weather proof and corrosion proof.

Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the BHEL/TANTRANSCO. The rating plate of each equipment shall be according to IEC requirement.

All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided. During approvals drawings of Rating/name plates/labels shall also be submitted.

3.19 TERMINAL CONNECTORS :

The terminal connectors shall meet the following requirements.

- a. Terminal connectors shall be manufactured and tested as per IS : 5561.
- b. All castings shall be free from blow holes, surface blisters, cracks and cavities.

-
- c. All sharp edges and corners shall be blurred and rounded off.
 - d. No part of a clamp shall be less than 10mm thick.
 - e. All ferrous parts shall be hot dip galvanized conforming to IS: 2633.
 - f. For bimetallic connectors, copper alloy liner of minimum thickness of 2mm shall be cast integral with Aluminium body. Flexible connectors shall be made from tinned copper.
 - g. All current carrying parts shall be designed and manufactured to have a minimum contact resistance.
 - h. Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS : 5561.
 - i. Terminal connectors shall be for Twin Moose Conductor with a spacing of 450mm between the conductor.

3.20 EARTHING :

The operating mechanism housing, control cabinets, support structure etc. shall be provided with two separate earthing terminals suitable for bolted connection to 50x8mm mild steel flat to be provided for connection to station earth mat.

Circuit breakers, LA, Isolator, CVT, CT, BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat of Size 75x12 mm. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.21 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be 1100 V grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be non-disconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent

its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm.copper flexible.
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All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible.
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The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment. TB sizes for incoming power supply shall be informed/confirmed during drawing approval stage.

3.22 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel. Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled Neoprene /EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.23 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment.

3.24 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

Delivery of goods shall be made by the supplier in accordance with the terms specified by the BHEL in its schedule of requirements.

3.25 INCIDENTAL SERVICES:

The Supplier is required to provide any or all the services broadly outlined in the Technical specification. Any other minor incidental service related to the scope of work like providing necessary assistance whether specifically mentioned or not must be carried out by the Supplier at his own cost. All tools, Tackles Plant etc., required for completion of above works shall be brought by the Supplier.

3.26 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/TANTRANSCO 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/TANTRANSCO shall be final and binding on the Supplier.

3.27 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO/BHEL shall be followed strictly by the bidder while designing. For the rest of the equipments, the design is in the scope of the bidder and the same got approved by the TANTRANSCO/BHEL.

The bidder shall furnish one set of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the Offer (as applicable). (Drawings, GTP, type test reports, list of past supplies etc. Drawings & documents submitted at the time of offer shall be subject to review at contract stage)

- (i) General outline drawings showing dimensions and shipping weights, quantity of insulating media, etc.
- (ii) Sectional views showing the general constructional features of the equipment (eg. Breaker drg includes operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance).
- (iii) Schematic diagrams of equipment (eg. Breaker drg includes for control supervision and re-closing.)
- (iv) Structural drawing, design calculations and loading data for support structures.
- (v) Foundation drilling plan and loading data for foundation design.
- (vi) The Type Test Reports
- (vii) Bill of materials shall be furnished along with drawings.

The supplier shall, within 1 week of placement of order submit six sets of final version of all the above drawings for TANTRANSCO/BHEL approval. The TANTRANSCO/BHEL shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit six copies of the modified drawings for TANTRANSCO/ BHEL approval within one week from the date of comments. After receipt of TANTRANSCO/BHEL approval, the supplier shall, within two weeks, submit 8 prints and two good quality reproducible of the approved drawings for TANTRANSCO/BHEL use. However the drawing approval does not absolve the supplier from complying with the terms of the specification.

The following should be supplied to each consignee circle along with the initial supply of equipments ordered.

- 1) Five copies of printed and bound volumes of operation, maintenance and erection manual in English along with the copies of approved drawings and type test reports etc.
- 2) Three sets of manuals detailed in item (1) shall be supplied to the TANTRANSCO/BHEL within one week from the date of approval of drawings.
- 3) The spares for the Equipment's ordered under the scope of the Contract should also be supplied to the consignee circle along with initial supply of the equipments.
- 4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

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

Following Documentation schedule to be followed

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1	Drawings and Data Sheets	1	6	10	5
2	Drawings "As Built "	-	-	10	

3	Type Test Reports	1	6	10	
4	Erection Manuals	-	6	10	
5	Operation and Maintenance Manuals	-	6	10	
6	Manufacturing Quality Plan	-	6	10	
7	Field Quality Plan	-	6	10	
8	Inspection Test Reports	-	6	10	

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later 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.

3.28 QUALITY ASSURANCE PLAN :

The bidder shall invariably furnish following information along with his offer.

- (i) Statement giving list of important raw materials including but not limited to:
 - (a) Contact material
 - (b) Insulation
 - (c) Porcelain
 - (d) Sealing material
 - (e) Contactor, limit switches, etc. in control cabinet.

Name of sub-supplier for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representative, copies of test certificates.

- (ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
- (iii) List of areas in manufacturing process, where such inspections are normally carried out for quality control and details of such tests and inspections.
- (iv) Special features provided in the equipment to make it maintenance free.
- (v) List of testing equipment available with the Bidder for final testing of equipments vis-à-vis, the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements.

The supplier shall submit following information to the TANTRANSCO/BHEL.

- 1) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
- 2) Type test certificates of the raw material and bought out accessories.
- 3) Quality assurance plan (QAP) withhold points for TANTRANSCO/BHEL inspection. The quality assurance plan and hold points shall be discussed between the TANTRANSCO/BHEL and supplier before the QAP is finalized.

The supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled equipment.

3.29 TEMPERATURE RISE :

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of the sun shall not exceed 30(/25) deg. C over an ambient of 45(/50) deg. C limits specified in relevant IEC. When the standard specify the limit of temperature rise these shall be exceeded when corrected for the difference between ambient temperature at site and that specified in the approved specifications.

No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

3.30 FITTINGS AND ACCESSORIES :

Following is a partial list of some of the major fittings and accessories to be furnished by contractor as an integral part of the equipment.

Operation mechanism housing complete with:

- (a) Locking arrangement.
- (b) Heaters equipped with automatic thermostatic control and control switch.
- (c) Cable glands.
- (d) Local/Remote change over switch.
- (e) Operation Counter.
- (f) Terminal Blocks.
- (g) Control switches to cut off control power supply.
- (h) MCCBs/MCBs are required with permanent identification marks for protection of D.C. circuits and A.C. circuits.
- (i) Two earthing terminals.

3.31 PACKING AND FORWARDING:

The equipment shall be packed in crates suitable for vertical/horizontal Transport, as the case may be and suitable to withstand handling transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit to their final destination as indicated in the Contract and exposure to extreme temperatures, salt and precipitation etc., during transport and open storage. Packing case size and weights shall be taken into consideration wherever appropriate, the remoteness of the 'goods' final destination and absence of heavy mechanized handling facilities, at all points in transit.

The packing, marking and documentation within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract or in any subsequent instructions issued by BHEL.

3.32 SPECIFICATION FOR NITRYL BUTYL RUBBER

The gaskets are to be used in tanks exposed to Transformer mineral oil/SF6 at about 110° C.

1. Hardness should be Shore A 70 ± 5 .
2. Tensile Strength should be min. 10.8N/sq.mm (Minimum)
3. Elongation strength should be 270% (Minimum)

AFTER AGEING

1. Change in weight should not be more than 10% and change in Hardness should not be more than Shore A ± 10 after 7 days aging in transformer oil.
2. There should not be any visible damages after accelerated aging of 24 hours in transformer oil of temperature 110° C.

SECTION - 4
GUARANTEED TECHNICAL PARTICULARS

(A)	Lighting Fixtures & Accessories (Data to be submitted separately for each type and Size)	
1.	Manufacture's Name and country of manufacture a) Fixture b) Accessories	
2.	Applicable Standards for a) Fixture b) Accessories	
3.	Manufacturer's type and Catalogue no. for a) Fixture b) Accessories	
4.	Nominal working Voltage (Volts)	
5.	Maximum permissible supply Voltage Variation for satisfactory operation of : a) Fixture (+ / -) b) Accessories (+ / -)	
6.	Power factor at nominal working Voltage and frequency	
7.	Full load input current at Nominal working voltage (Amps)	
8.	Power loss per ballast at nominal working voltage and frequency (Watts)	
9.	Maximum hot spot temperature of ballast case (°C)	
10.	Maximum average ballast winding temperature (°C)	
11.	Ambient temperature within the fitting in continuous operation at the design ambient air temperature (°C)	
12.	Insulation class of ballast winding (°C)	
13.	Average life expectancy of : a) Ballasts b) Capacitors c) Lamps	
14.	Lamp output at the design temperature a) After 100 burning hours (lumens) b) After 1000 burning hours (lumens)	
15.	Lamp output at the end of the expected Life period (lumens)	
16.	Average light output of the fitting as a percentage of lamp output. a) Downwards (%)	

	b) Upwards (%)	
17.	Beam angle for flood lights in a) Horizontal plane (Degrees) b) Vertical plane (Degrees)	
18.	Cable / conduit entry size	
19.	Earthing terminal a) Material b) Size and type of cable	
20.	Weights of Fixtures (Kg.)	
21.	a) Starting Current & PF for lamp (Amps) b) Operating current (Amps) c) Time Vs mains current & PF Characteristics during starting to be enclosed. d) Reference cat. No.	
B.	Junction Boxes (for each type and size)	
1.	Manufacturer's name and country of manufacture	
2.	Manufacturer's type designation	
3.	Material Specification	
4.	Type of enclosure	
5.	Terminals a) Make b) Current rating (Amps) c) Voltage rating (Volts) d) Stud type (yes /no) e) Provision of insulated Barriers (yes /no)	
6.	Whether descriptive pamphlet is enclosed (yes/no)	
C.	Lighting Panels (For each type & size)	
1.	General	
	a) Manufacture's name and country of manufacture	
	b) Indoor /outdoor application	
	c) Design ambient air temp (°C)	
	d) Thickness of sheet steel(mm)	
	e) Degree of protection provided (as per IS:2147 or equivalent)	
	f) Bill of material for various equipment giving make, type, rating etc enclosed.	
	g) Colour of finish paint i) Outside ii) Inside h) Busbar i) Material ii) Temp. rise at rated current over specified ambient (50 ° C)	

	iii) Continuous current rating at 50 ° C ambient temp. iv) Whether suitable for one second current rating of 5 kA, AC or 4kA D.C as applicable . v) Cross Section vi) Applicable Standard	
	<i>l) Control Wing</i> i) Material of conductor ii) Size of conductor /dia of wire (mm2)	
	<i>j) Conductor - Solid / Stranded</i>	
	<i>k) Terminal Block</i> i) Make ii) Current rating a) Power terminals (Amps) b) Other terminals (Amps)	
	<i>l) All tests as specified in specifications will be carried out (yes/no)</i>	
2.	Air Break Switches (For each type & size) a) Manufacturer's name and country of manufacture b) Manufacturer's type, description c) Applicable Standard d) Rated voltage (Volts) & Frequency (Hz) e) Rated current (Amps) f) Rated Breaking Current (Amps) g) Maximum through fault current withstand . Derating factor for use under site ambient conditions h) Temperature rise of contacts when carrying continuous rated current under site conditions (°C)	
3.	Fuses (For each type & size) a) Manufacturer's name and country of manufacture b) Manufacture's type, description c) Applicable Standard d) Rated Voltage (Volts)	
	e) Rated current (Amps) f) Whether fuse is mounted on an insulated carrier (yes / no) g) Whether fuse carrier has an aperture for fuse failure indication(yes/no) h) Category of duty (IS:2208) i) Rupturing capacities (Prospective current)(kA) j) Maximum let through current for 1 sec. (kA) k) Whether time/ current characteristics are	

	enclosed (Yes/No.)	
4.	Miniature Circuit Breakers (For each type and rating) a) Manufacturer's name and country of manufacture b) Type c) Rated voltage d) No. of poles e) Frequency f) Current Rating i) Continuous at 50°C ambient (Amps) g) Breaking Capacity (Single pole/Double pole / Tripple pole) i) Symmetrical (kArms) ii) Asymmetrical(kArms) h) Total interrupting Cycle time i) Type of SC Tripping j) Type of overload (thermal/magnetic) k) Terminal Suitable for cable size l) Upto what fault current discrimination between incomer fuse & M.C.B will be obtained m) Miniature breaker conform to	
5.	Contactors for each type(DC/AC) & Size a) Manufacturer's name and Country of manufacture b) Rated voltage & permissible Variation(Volts) c) Rated Burden (kA) d) Rated current (thermal) of main contacts e) No. & type of Aux. Contacts (if any) f) Rated Voltage of coil (Volts) g) Pick up voltage h) Rated duty class i) Drop off voltage j) Applicable standard	

D)	Lighting Poles (For each type and size)	
1	Manufacturer's name and country of Manufacturer	
2.	Standards applicable	
3.	Dimensions	
4.	Painting / galvanisation details	
5.	Whether descriptive	
	Pamphlet is enclosed ?	
E)	Lighting Wires (For each type and Size)	
1.	Manufacturer's name and country of Manufacturer	

2.	Standard applicable	
3.	Rated Voltage (Volts)	
4.	Continuous current rating when laid in conduit in an ambient temperature of 50°C (Amps)	
5.	Conductor	
	a) Material	
	b) Nominal Cross sectional area	
	c) Number and diameter of wires	
6.	Insulation	
	a) Composition of insulation	
	b) Thickness of insulation	
	c) Tolerance on thickness of insulation	
	d) Specific insulation resistance at 60 deg.C.	
7.	Colors scheme for identification of wires	
8.	Whether descriptive Pamphlet is enclosed ?	
G.	Painting , Prime , Finish Coat	
1.	Paints (For each type)	
	a) Manufacturer's name and country of manufacture	
	b) Manufacturer's type designation/ brand name	
	c) Shade	
2.	Number of coats provided & Microns	
3.	Applicable Standards	

SECTION - 5
CHECK LIST FOR ILLUMINATION SYSTEM

TO BE FILLED AND RETURNED WITH THE OFFER DULY SIGNED

Please mark "YES" if the specified requirement is met or put a mark "NO" if the specified requirement is not met and give reason in column 4

BHEL Enquiry no:

Bidder offer reference:

SI. no	Parameter	Bidder's confirmation	Reason for non- compliance
(1)	(2)	(3)	(4)
1.	Provision of illumination for specified areas as per spec.	YES / NO	
2.	Guaranteeing the illumination levels specified as per spec.	YES / NO	
3.	Type of lighting luminaries included as per spec.	YES / NO	
4.	Lighting DBs & LPs included as per spec.	YES / NO	
5.	Scope of works for fire protection system, air conditioning system, telephone set and as per clause no. 4, Section-1 of Technical Specification are included in illumination supplier scope.	YES / NO	
6.	Lighting poles included as per spec.	YES / NO	
7.	Sockets, Plugs & other items included as per spec.	YES / NO	
8.	Supervision of ETC of Package included in the Offer	YES / NO	
9.	Supply & supervision of ETC of all wires / Cables / earthing material required for the package other than the items supplied by BHEL included in the package.	YES / NO	
10.	Supervision of ETC of BHEL supplied Cables included in the offer	YES / NO	
11.	Supervision of ETC of BHEL supplied earthing strip included in the offer	YES / NO	
12.	PVC conduit for LILO of cabling between junction box and cable trench/pipes (i.e. cable trench running near bottom of pole shall be in Illumination supplier scope.	YES/ NO	
13.	Type and lumen output of lamps included in the offer are as per specification.	YES / NO	
14.	Whether any new item other than the BOQ given required to meet the specification requirement.	YES/ NO	
15.	If new item is required whether these are listed with quantities in the offer	YES/ NO	
16.	Equipment included suitable for operation on voltage & frequency Variation limits specified in the specification without effecting their performance	YES/ NO	

17.	Power factor of lamp circuit is as per specification	YES/NO	
18.	Fully filled in GTP shall be submitted during detailed engineering stage	YES/NO	
19.	All cable glands, wires, conduits, earth wire, fixing material of illumination system, switchboard, switch, telephone box/sockets, split air-conditioning sockets/ MCB etc. will be in Illumination supplier scope		
20.	Auto switching arrangement for outdoor flood lighting / street lighting through Timer / Photo cell included	YES / NO.	
21.	Spares included in the offer (a) Commissioning	YES/ NO	
22.	Activity Schedule enclosed	YES /NO	
23.	Switchboard /boxes, receptacles, fan regulator and sockets etc. shall be modular flush mounted type.	YES /NO	
24.	Supply of necessary cable for consumption within the street light such as pole mounted JB to respective light fittings shall be in contractor's scope.	YES /NO	

Bidder's

Sign :

Date :

Name :

Design :

SECTION - 6
SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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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:

Tenderer's Stamp & Signature