



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-394-316-132	Rev. No.	00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	SK	SK	RS/DM	
TITLE ILLUMINATION SYSTEM			SIGN	<i>SK</i>	<i>SK</i>	<i>RS/DM</i>
			DATE	12.03.18	13.03.18	
			GROUP	TBEM	W.O. No	86009
CUSTOMER	Tamilnadu Transmission Corporation Limited (TANTRANSCO)					
PROJECTS	765/400kV AIS S/S Ariyalur					

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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 requirements (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 : **765/400kV AIS S/S Ariyalur**

The specification comprise of following sections:

- Section-1: Scope, specific technical requirements & Bill of Quantities.
- Section-2: Equipment specification under scope of supplies.
- Section-3: General technical requirements for all equipment's under the project.
- Section-4: Equipment Data Sheet
- Section-5: Equipment 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, engineering, manufacture, Supply, testing at works, packing and dispatch of equipment & material to site.
- b) Unloading at site and storage.
- c) Erection, testing & commissioning of complete Illumination and associated electrical auxiliary system, complete with accessories & handing over.
- d) Storage space at site shall be provided by BHEL.

The Illumination System shall be provided for the following areas:

- ☐ Outdoor Switchyard Area and road(inside switchyard building)
- ☐ Switchyard Control Room Building(ground and first floor)
- ☐ 765kV Switchyard Panel Room(Total 5 Nos., with individual size 9mx5m)
- ☐ 400kV Switchyard Panel Room(Total 5 Nos., with individual size 7mx5m)
- ☐ DG Set area
- ☐ LT Transformer Yard area
- ☐ Illumination around Control Room Building

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

LED lamp based lighting as per BOQ is envisaged for entire area of illumination.

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 indoor and outdoor switchyard to be illuminated shall be as per enclosed drawings under Annexure –2. Other relevant drawings are also enclosed under Annexure –2.

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 - buildings shall comprise of:

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

The illumination System for Switchyard Panel Room shall comprise of:

- ☐ Normal AC Lighting

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

Conference hall, control room and around control building solar(25kW capacity) based lighting shall be also provided . Indoor changeover panel shall be used for changeover between normal power supply and solar power supply. During normal condition solar power will be used and during outage of solar power normal AC supply will be used for lighting. **Solar system/panel shall be in BHEL scope of supply and erection.** Solar output supply will be 415V, 3 phase AC.

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

Sl. No.	Area	Average Lux Level
1.	Telecom room , Lab room , EE room , conference room , control room , JE & AEE office room	300 Lux
2.	SPR(SWITCHYARD PANEL ROOM)	250 Lux
3.	ACDB room, Battery room , DCDB Room	200 Lux
4.	Store , Pantry, Documentation room	150 Lux
5.	Toilet Passage , Lobby	100 Lux
6.	Stairs	50 Lux
7.	Ground level for switchyard lighting	21.52 Lux
8.	Ground level for street lighting	20.0 Lux

- 2.3 The outdoor switchyard shall be illuminated by using 172W flood lights LED type lighting fixture. The mounting height to install the lighting fixture shall be 25m for 765kV tower and 20m for 400kV tower.
- 2.4 The outdoor switchyard road shall be illuminated using 72W street lights LED type lighting fixture mounted on 6m 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 **Temperature Transducer** - Each switch-yard panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification:
 Sensor: Air temperature sensor (indoor use)
 Output: 4 to 20mA
 Temperature range: - 5°C to 60°C
 Resolution: 0.1°C
 Accuracy: 0.5°C or better

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 – 4C x 50 sq.mm Cu/PVC
- 2) MLDB/ELDB to Indoor lighting panel – 4C x 25 sq.mm Cu/PVC
- 3) MLDB/ELDB to Street lighting panel – 4C x 50 sq.mm Cu/PVC
- 4) Tower mounted Junction box to outdoor lighting panel – 4C x 25 sq.mm Cu/PVC
- 5) Tubular pole Junction box to street lighting panel – 4C x 25 sq.mm Cu/PVC
- 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 50 sq.mm Cu/PVC
- 8) MLDB to 63A control room welding receptacles- 4C x 25 sq.mm Cu/PVC
- 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 Cu/PVC
- 11) Sub ACDB to split AC distribution board located in switchyard panel room — 4C x 50 sq.mm Cu/PVC

3.4 **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.**

- 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 and laying of PVC pipes alongwith 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 415V MLDB (Main lighting distribution board) and ELDB (emergency lighting distribution board) are being supplied and erected by the purchaser.
- 3.11 The cable laying and termination of MLDB, ELDB, Lighting panels, 63A welding receptacles, 300A receptacles for oil filtration and split Air conditioner distribution -board shall be in BHEL scope.
- 3.12 **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.
- 3.13 Suitable nos. of 1200 mm sweep ceiling fans with stepped electronic regulator and flush mounted on switchboard shall be provided by bidder in following rooms.
- ACDB room , DCDB room, documentation room and store .
- 3.14 Split AC shall be provided by BHEL in following rooms of switchyard control building.

Telecom room(3 nos.) , LAB(2 nos.) , conference hall(4 nos.), JE & AEE office room(4 nos.) ,EE office room(2 nos.) , control room(6 nos.) and switchyard panel room(2 nos. in each SPR).

- 3.15 Exhaust fan shall be provided by Bidder in store room , battery room , pantry and toilet. Exhaust fans will be provided with their control devices (MCB) & louvers.
- 3.16 **False ceiling with under deck insulation shall be provided by BHEL in LAB , telecom room, lobby of first floor, conference hall, EE office room , JE & AEE office room and control room only.**
- 3.17 **5/15 A, 240V Indoor decorative type Receptacle 3-pin type shall be provided in switchyard control room building and SPR (each SPR one no.)**
- 3.18 *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.
- 3.19 **SCOPE OF SERVICES**
The bidder shall quote for ETC, civil works, cable termination & earthing against each item as applicable in BOQ.

ERECTION, TESTING AND COMMISSIONING

- a. The Contractor shall give the offer for 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. **Laying and termination of power and control cable from lighting panels to JB and JB to fitting shall be in Bidder scope.**
- e. All material and consumables required for erection for erection work shall be in contractor's scope.
- f. Earthing of all the electrical equipment as per requirement.
- g. **Mounting /installation material of 63/300A receptacles shall be in bidder scope.**

CIVIL WORKS

- a. Civil works such as foundation for street lighting poles and lighting panels etc. shall be done by the bidder. The rates for these civil works shall be deemed included in the 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. 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 BOQ-1

Note -1: Following scope of works shall be in ETC contractor scope.

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

Bidder shall supply and lay conduits in in Control Room Building and Switchyard Panel Room for firefighting detection cables & Air conditioning system. Conduits and wire for split air conditioning located in SPR and 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 lay 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:

Sl	PERTICULARS	Unit	Qty
1	2 wire Telephone Set with 4 pair Telephone cables (Tinned Copper) complete upto EPBX	Nos.	6
	Remark – supply of telephone set and 4 pair cables are under BHEL scope. Tentative quantities of 4 pair's cables is 2kM. Laying of 4 pair cables will be in BHEL scope.		

(C) Conduit for temperature transducer located in SPR will be in illumination supplier 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 braket,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 $\pm 40\%$ 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 the tests carried out within last ten years **from the date of opening of the tender (i.e. 30.09.2016)**. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 10 years old (from the date of opening of the tender) or the reports of type tests are found to be technically unacceptable , the type test shall be conducted by the vendor without cost and delivery implication to BHEL. The type test 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.

Illumination BOQ of 765/400KV AIS SS at Aryalur in Villupuram Region							Rev -00	Annexure-1
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order					
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
				A	SUPPLY OF INDOOR ILLUMINATION AND PANEL			
86	1	Nos	Supplying and fixing of 20Amps DP plug and socket in sheet enclosure with 5 Nos. 32 A DP MCB in flush with wall with earth connection (AC plug) (Ilegrand MDS)/Hager (L&T) make including cost of wiring as per standard specification.	1	Supply of 32Amps DP socket in sheet enclosure and 32A DP MCB in flush with wall (AC plug) (Ilegrand/ MDS)/Hager (L&T)/BCH/Equ make. Note - 1 set consist 5 nos. 32A Amps DP socket and 5 Nos. 32 A DP MCB .	Set	9	(1) Split AC supply of Control room building and SPR (2) MCB shall be located inside the room at a height of 450mm from bottom and sockets (i.e. Receptacles) shall be placed near the air conditioner on the nearest wall. (3) 21 nos. for control room building and 20 nos. for SPR split AC supply. (4) 5 Nos. 32A DP socket and 5 nos. 32A DP MCB of 1 set shall be located at different location as per requirements . (5) For billing purpose between BHEL and customer 1 no. of contract BOQ sl. no. 86 is equal to 1 set of proposed equivalent BOQ sl no. 1 (This remark is not applicable for Illumination Bidder).
88	20	Nos	Supplying and fixing of down fall rod for ceiling fan including cost of material, labour, lead, lift etc complete as per standard specification.	2	Supply of Down fall rod for ceiling fan	Nos.	8	It is required for extension of fan rod
90	20	Nos	Supplying and fixing of 1200mm sweep AC ceiling fan with electronic 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 as per standard specification.	3	Supply of 1200mm sweep AC ceiling fan with electronic regulator with 300mm down rod on the existing clamps of approved quality of Crompton/Rally/ Usha/Bajaj complete as per standard specification.	Nos.	8	Required in control room building
91	4	No	Supplying and fixing 450mm sweep AC exhaust fan heavy duty including providing necessary holes with wall labour, fixing charges lead, lift etc. complete, as per standard specification	4	Supply of 450mm sweep AC exhaust fan (single phase) heavy duty as per standard specification	Nos.	6	Required in pantry , toilet and store
				5	Supply of 3000CMH AC exhaust fan (single phase) heavy duty as per standard specification	Nos.	3	Required in Battery room

Santhosh

Illumination BOQ of 765/400KV AIS SS at Ariyalur in Villupuram Region					Rev -00		Annexure-1	
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order					
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
				9	Supply of Light fitting LED Batten type fixture, 36 W Suitable for 220 V AC operation, IP20, complete approved quality as per standard specification. Above fitting also includes point wiring i.e conduits , wire , switchboard, earthwire and all applicable accessories as required etc.	Nos.	11	Use in staircase , passage etc.
				10	Supply of Split AC Distribution board for control room - 415V , 3 phase 4 wire ,63A, 10KA Split AC Distribution board having 1 No. 63 A , TPN MCB as incomer and 3 Nos. 32A SPN MCB as outgoing	Nos.	8	(1) Wall mounted distribution board used for split AC supply. (2) 8 nos. for control room building (supply from control room ACDB) (3) Fixing material of board will be in illumination supplier scope.
96	26	Nos	Supply of sub-distribution board having 1 No. 63 A , TPN isolator as incomer and 3 Nos. MCB 32 A (Reputed make), DP HRC fuse as outgoing as per standard specification	11	Supply of Split AC Distribution board for SPR - 415V , 3 phase 4 wire ,63A, 10KA Split AC Distribution board having 1 No. 63 A , TPN MCB as incomer and 3 Nos. 32A SPN MCB and 3 nos. 16A SPN MCB as outgoing	Nos.	10	(1) Wall mounted distribution board used for split AC supply. (3)10 Nos. for SPR (Supply from control room ACDB) - 1 Nos. per SPR . Supply of control and relay panel located in SPR shall be taken from this board of 16A SPN MCB. (3) Fixing material of board will be in illumination supplier scope.
				12	Supply of Indoor lighting panel Power Distribution Board (incoming 63 A TPN - 1 No. and outgoing 20 Amps SP MCB -12 Nos. as per standard specification)	Nos.	4	(1) Indoor lighting panel (2 nos. for normal supply) , and 2 nos. for emergency supply) (2) Wall mounted
99	42	Nos	Supply of power Distribution Board (incoming 63 A DP isolator - 1 No. and outgoing 15 Amps SPN Switch fuse -12 Nos. as per standard specification	13	Supply of Outdoor lighting panel Power Distribution Board Incomer as 63 A TPN MCB - 1 No. and outgoing 20 Amps SP MCB -6 nos and 3 nos 20 A TPN MCB as per standard specification	Nos.	12	(1) Outdoor lighting panel (with timer and contactor feature for auto switch ON/OFF), 8 nos. for normal supply and 4 nos. for emergency supply. (2) Floor/structure mounted

Sandhu

Illumination BOQ of 765/400KV AIS SS at Ariyalur in Villupuram Region								
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order		Rev -00	Annexure-1		
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
				14	Supply of Outdoor lighting panel for street lighting power distribution Incomer as 63 A TPN MCB - 1 No. and outgoing as 3 nos 20 A TPN MCB as per standard specification	Nos.	5	(1) Outdoor lighting panel for street lighting (with timer and contactor feature for auto switch ON/OFF). 3 nos. for normal supply and 2 nos. for emergency supply (2) Floor/structure mounted
				15	Supply of indoor panel for changeover between solar and normal power supply (incoming 63 A TPN - 1 No. and outgoing 20 Amps SP MCB -6 Nos. as per standard specification)	No.	1	(1) Indoor panel for changeover between solar and normal power supply (2) Wall mounted
102	22	Nos	Supply ,erection and commissioning of 2 KV Inverter with suitable 220 V DC operation including 4 way double pole emergency distribution board having 1 No (Reputed make) as per standard specification	16	Supply of 2 KVA single phase inverter suitable with 220 V DC operation including 4 way double pole emergency distribution board having 1 No (Reputed make) as per standard specification. Distribution board shall be with 1 no 32 A DP MCB as incomer and 9 nos 16A SP MCB as outgoing.	No.	1	
103	163	Pis	Wiring with 2 x 1.5 sq.mm (22/0.3) PVC insulated SC unsheathed multistrand Copper conductor of 1100V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories in flush with wall with 3mm thick nylon sheet cover with steel switch box and 5A F.T switch with continuous earthwire connection of 14 SWG TC wire for making good of the concealed portion with suitable colour for PVC concealed light point / fan point (SD 22) as per standard specification	17	Supply of Point wiring for fan points. Note - Above point wiring includes conduits, Cu wire, switchboard, earthwire and all applicable accessories as required etc.	Pis	17	(1) Point wiring for ceiling and exhaust fans (2) For billing purpose between BHEL and customer. Supply and ETC price of 1 point is equal to contract BOQ price sl. No. 103 (This remark is not applicable for Illumination Bidder).

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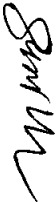
Illumination BOQ of 765/400KV AIS SS at Arvatur in Villupuram Region						Rev -00	Annexure-1	
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order					
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
104	30	Pts	Wiring with 2 x 4 sq.mm (56/0.3) PVC insulated multi strand unsheathed copper conductor cable of 1100 V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories, in flush with wall, with 150 mm x 100 mm x 113 mm steel switch box with 3 mm thick hyem sheet for 15 Amps 3 pin non inter- locking CS plug with continuous earth wire connection of 14 SWG TC wire and making good of the concealed portion, with suitable colour for concealed power plug point. (SD 38) as per standard specification	18	Supply of 5/15 A, 240V indoor decorative type Receptacle 3-pin type. Above 5/15 A, 240V Receptacle also includes point wiring i.e conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Nos.	40	(1) For billing purpose between BHEL and customer price for supply and ETC of 1 no. 5/15A receptacles is equal to 1 point of contract BOQ sl. No. 104 (This remark is not applicable for Illumination Bidder).
105	35	Pts	Wiring with 2x1.5 sq.mm (22/0.3) PVC insulated SC unsheathed Cu conductor of 1100 V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories in flush with wall with 150x100x113mm Tw switch box with 3 mm thick hyum sheet cover for 5 Amps 3 Pin non interlocking CS plug with continuous earth wire connection of 14 SWG TC wire and making good of the concealed portion with suitable colour for concealed PVC plug point, as per standard specification	19	Supply of Point wiring for 32Amps Receptacles(MCB and sockets) points. Note - Above point wiring includes conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Pts	41	(1) Point wiring for 32 Receptacles(MCB and sockets) (2) For billing purpose between BHEL and customer price for Supply and ETC 1 point is equal to contract BOQ price sl. No. 105 (This remark is not applicable for Illumination Bidder).
107	3	Pts	Supplying, fixing and concealed wiring of buzzers with two core PVC insulated copper wire of 1.50 sq.mm size in PVC pipe with 5 Amps flush type button switches etc., complete, as per standard specification	20	Supply of Buzzers with complete, as per standard specification Note - Above Buzzers also includes point wiring , conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Pts	2	Buzzers
110	21	No	Fixing & commissioning of Lighting Switch Board with 1 No. 200 A, TPN fuse switch as incoming and 3 Nos. 63 A TPN, 2 Nos. 63A DP, 1 No. 32A DP switch fuse etc. complete as per standard specification	21	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.	3	(1) For billing purpose between BHEL and customer Supply and ETC price of 1 No 300A Receptacles is equal to contract BOQ price sl. No. 110 (This remark is not applicable for Illumination Bidder). (2) Location - 1 no. in 765KV line Reactor area, 1 no. in 765KV ICT area, 1 no. in 400KV area

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Illumination BOQ of 765/400KV AIS SS at Aryalur in Villupuram Region									
Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and Placement of order				Rev -00	Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark	
115	27	No	Supply and fixing of ELCP including all cost of materials lead lift etc., complete as per standard specification	22	Supply of 63A, 415V , 3 phase welding Receptacle .	Nos.	13	(1) Location - Control room building =1 no., 765KV yard =8 Nos.. 400KV yard - 4 Nos.	
				23	Supply of Temperature Transducer - switch-yard panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification: Sensor : Air temperature sensor (indoor use) Output : 4 to 20mA Temperature range : - 5°C to 60°C Resolution : 0.1°C Accuracy : 0.5°C or better	Nos.	10	(1) Each SPR = 1 no.	
				B					
				SUPPLY OF OUTDOOR ILLUMINATION AND MANDATORY SPARES					
129	20	Set	6No's 160W LED Light with accessories (To be fixed in the lighting mast of 50 mtrs height)	24	Supply of 6 No's 172W flood light LED type Lighting fixtures with accessories including junction box	Set	75	(1) Total tentative Qty. required is 450 nos. (2) 1 Set consist 6 No's 172W flood light LED type Lighting fixtures with accessories (3) The mounting height to install the fixture is considered at 25 m for 765KV tower and 20 m for 400KV tower . (4) Outdoor JB shall be part of lighting fixtures.	
153	150	Nos.	Supply of ISI mark 72 Watts LED fitting fitting with fixture of reputed make (Philips,Crompton / reputed make) providing two core cu cable from fitting to main switch including cost main switch,cable and all other consumables, testing for burning condition as directed by the Engineer	25	Supply of Street light type LED lighting fixtures 72W	Nos.	175	For switchyard road lighting	

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Illumination BOQ of 765/400KV AIS SS at Arivayalur in Villupuram Region					
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order		Rev -00
					Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work
154	100	Nos.	Supply of 6 Mtrs . stepped, tubular yard light pole with single/ Double fitting pipe arrangement . with 1 coat of Red oxide and 2 coat of Alu. paint, and all other consumables as directed by the Engineer	26	Supply of Tubular painted lighting pole-6 m height with GI conduit for L.L.O of cable with accessories
				Nos.	175
					(1) The overall height of the pole shall be 6 mtrs . stepped, tubular with single/ Double fitting pipe arrangement, with 1 coat of Red oxide and 2 coat of Alu. Paint. (Effective height i.e above the ground is 4.5 mtrs.) (2) GI conduit for L.L.O of cabling between junction box and pipe/ cable trench (i.e. cable trench running near bottom of pole shall be in Illumination supplier scope.
155	200	Nos.	Supply of yard light fuse unit mounting box of size 200x200x150mm (BxHxD) out of 18 SWG (1.22mm) M.S Sheet as per Drawing including the Supply of junction Box fixing Flat using 50x8MSF (0.2mx1No), Supply and Painting of Primer ,first finish coat of aluminum paints on to the fixing flats as directed by the field engineer. The box shall be vermin proof, shall be provided with sturdy hinges, with provision for cable entry and locking arrangements. Also the Box should be provided with a 25mm thick wooden piece (country wood) of size 150x150sqmm , ISI mark 16/20A rewirable Porcelain Fuse carrier unit and good quality Bakelite 16A 4 way Strip connectors including its cost and other consumables such as fixing screws etc.	27	Supply of Outdoor junction box for tubular lighting pole
				Nos.	175
					Pole mounted JB with terminal blocks suitable for 25 sq mm cable and 6 A HRC Fuse
117	4	Nos.	Telescopic GI ladder 30 feet height	28	Supply of Telescopic GI ladder 30 feet height
				Nos.	4
152(a)	250	m	Supply and fixing of 75mm PVC pipes of 6kg per sq cm	29	Supply of 75mm dia. PVC class 4 pipes
				m	2500
152(b)	250	m	Supply and fixing of 110mm PVC pipes of 6kg per sq cm	30	Supply of 110mm dia. PVC class 4 pipes
				m	1000
116	4	Nos.	LED bulb -172W	31	Supply of mandatory spare LED bulb -172W
				Nos.	9
					(1) Mandatory spare required
130f	6	Nos.	LED bulb -72W	32	Supply of mandatory spare LED bulb -72W
				Nos.	6
					(1) Mandatory spare



Illumination BOQ of 765/400KV AIS SS at Ariyalur in Villupuram Region									
Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and placement of order				Rev -00	Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark	
				ETC OF INDOOR ILLUMINATION AND PANEL					
86	1	Nos	Supplying and fixing of 20Amps DP plug and socket in sheet enclosure with 5 Nos. 32 A DP MCB in flush with wall with earth connection (AC plug) (Ilegrand/ MDSI/Hager (L&T) make including cost of wiring as per standard specification.	33	ETC of 32Amps DP socket in sheet enclosure and 32A DP MCB in flush with wall (AC plug) (Ilegrand/ MDSI/Hager (L&T) /BCH/lequ make. Note - 1 set consist 5 nos. 32A Amps DP socket and 5 Nos. 32 A DP MCB.	Set	9	(1) Refer above remarks sl. No. 1	
88	20	Nos	Supplying and fixing of down fall rod for ceiling fan including cost of material, labour, lead, lift etc complete as per standard specification.	34	ETC of Down fall rod for ceiling fan	Nos.	8	It is required for extension of fan rod	
90	20	Nos	Supplying and fixing of 1200mm sweep AC ceiling fan with electronic regulator with 300mm down rod on the existing clamps of approved quality of Crompton/Railly/ Usha/Bajaj including cost of all materials lead lift etc complete as per standard specification.	35	ETC of 1200mm sweep AC ceiling fan with electronic regulator with 300mm down rod on the existing clamps of approved quality of Crompton/Railly/ Usha/Bajaj complete as per standard specification.	Nos.	8	Required in control room building	
91	4	No	Supplying and fixing 450mm sweep AC exhaust fan heavy duty including providing necessary holes with wall labour, fixing charges lead, lift etc. complete, as per standard specification	36	ETC of 450mm sweep AC exhaust fan (single phase) heavy duty as per standard specification	Nos.	6	Required in pantry , toilet and store	
				37	ETC of 3000CMH AC exhaust fan (single phase) heavy duty as per standard specification	Nos.	3	Required in Battery room	
93	80	Nos	Supply and Fixing of light fitting LED NON- INTEGRATED WHITE 2 PIN 35W suitable for 220 V AC operation. PVC insulated copperwire of 1.5 sq.mm size in PVC pipes with 5 amps flush type switch including supply of all materials (including supply of light fittings for false ceiling with lamps) etc., complete approved quality as per standard specification	38	ETC of Light fitting LED INTEGRATED WHITE, 35W suitable for 220 V AC operation, 3400 lumen out put, recess mounted, with system efficacy >85, IP20, CRCA housing, complete approved quality as per standard specification . Above fitting also includes point wiring i.e conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Nos.	77	Recess type fitting	

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Illumination BOQ of 765/400KV AIS SS at Ariviyalur in Villupuram Region								
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order		Rev -00	Annexure-1		
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
94	55	Nos	Supply and Fixing and concealed wiring of LED Non Integrated, Master PLC 2 pin , cool white (13PLC8402P) with 25 Watts lamps for 220 AC operation with PVC insulated copper wire of 2.5 sq. mm size in PVC pipes with 5 amps flush type switch including supply of all materials (including supply of light fittings with lamps)etc. complete approved quality as per standard specification	39	ETC of Light fitting LED INTEGRATED WHITE, 35W suitable for 220 V AC operation, 3400 lumen out put, surface mounted, with system efficacy >85, IP20, CRCA housing, complete approved quality as per standard specification .	Nos.	174	Surface mounted fitting
					Above fitting also includes point wiring i.e conduits , wire , switchboard , earthwire and all applicable accessories as required etc.			
95	5	Nos	Supply and Fixing of LED Dulux T/E Plus, Non- Integrated Internal, 4pin, GX24q-4, 25 W lamps for 220 V AC operation suitable for 220 V AC operation (Reputed make approved by department Engineer at site) as per standard specification	40	ETC of light fitting LED INTEGRATED downlighter, 25W suitable for 220 V AC operation, recess mounted, with system efficacy >85, IP20, CRCA housing, complete approved quality as per standard specification.	Nos.	20	Recess downlighter type fitting
					Above fitting also includes point wiring i.e conduits , wire , switchboard, earthwire and all applicable accessories as required etc.			
				41	ETC of Light fitting LED Batten type fixture, 36 W Suitable for 220 V AC operation, IP20, complete approved quality as per standard specification.	Nos.	11	Use in staircase , passage etc.
					Above fitting also includes point wiring i.e conduits , wire , switchboard, earthwire and all applicable accessories as required etc.			
109	22	Nos	Fixing & commissioning of sub distribution board having 1 No. 63 A, TPN isolator as incomer and 3 Nos. 63 A, DP HRC fuse as outgoing etc., complete sample to be approved by department Engineer as per standard specification	42	ETC of Split AC Distribution board for control room - 415V , 3 phase 4 wire 63A, 10KA Split AC Distribution board having 1 No. 63 A, TPN MCB as incomer and 3 Nos. 32A SPN MCB as outgoing	Nos.	8	Refer remarks above sl. No. 10
				43	ETC of Split AC Distribution board for SPR - 415V , 3 phase 4 wire 63A, 10KA Split AC Distribution board having 1 No. 63 A, TPN MCB as incomer and 3 Nos. 32A SPN MCB and 3 nos. 16A SPN MCB as outgoing	Nos.	10	Refer remarks above sl. No. 11



Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and placement of order				Rev -00	Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark	
111	22	Nos.	Fixing & commissioning of Power Distribution Board incomer,63A DP, isolator 1 No. DP switch fuse as outgoing 15A SPN switch fuse - 12 Nos. etc., complete sample to be approved by department Engineer as per standard specification	44	ETC of Indoor lighting panel Power Distribution Board (incoming 63 A TPN - 1 No. and outgoing 20 Amps SP MCB -12 Nos. as per standard specification)	Nos.	4	Refer remarks above sl. No. 12	
				45	ETC of Outdoor lighting panel Power Distribution Board	Nos.	12	Refer remarks above sl. No. 13	
					Incomer as 63 A TPN MCB - 1 No. and outgoing 20 Amps SP MCB -6 nos and 3 nos 20 A TPN MCB as per standard specification				
				46	ETC of Outdoor lighting panel for street lighting power distribution	Nos.	5	Refer remarks above sl. No. 14	
					Incomer as 63 A TPN MCB - 1 No. and outgoing as 3 nos 20 A TPN MCB as per standard specification				
				47	ETC of Indoor panel for chnageover between solar and normal power ETC (incoming 63 A TPN - 1 No. and outgoing 20 Amps SP MCB -6 Nos. as per standard specification)	No.	1	Refer remarks above sl. No. 15	
102	22	Nos	Supply ,erection and commissioning of 2 KV Inverter with suitable 220 V DC operation including 4 way double pole emergency distribution board having 1 No (Reputed make) as per standard specification	48	ETC of 2 KVA single phase Inverter suitable with 220 V DC operation including 4 way double pole emergency distribution board having 1 No (Reputed make) as per standard specification. Distribution board shall be with 1 no 32 A DP MCB as incomer and 9 nos 16A SP MCB as outgoing.	Nos.	1		

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Illumination BOQ of 765/400KV AIS SS at Ariyalur in Villupuram Region								
Illumination BOQ as per customer contract specification			Illumination BOQ for Bidder and placement of order		Rev -00	Annexure-1		
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
103	163	Pts	Wiring with 2 x 1.5 sq.mm (22/0.3) PVC insulated SC unsheathed multistrand Copper conductor of 1100V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories in flush with wall with 3mm thick nylon sheet cover with steel switch box and 5A F.T switch with continuous earthwire connection of 14 SWG TC wire for making good of the concealed portion with suitable colour for PVC concealed light point / fan point (SD 22) as per standard specification	49	ETC of Point wiring for fan points. Note - Above point wiring includes conduits , Cu wire , switchboard , earthwire and all applicable accessories as required etc.	Pts	17	Refer remarks above sl. No. 17
104	30	Pts	Wiring with 2 x 4 sq.mm (56/0.3) PVC insulated multi strand unsheathed copper conductor cable of 1100 V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories, in flush with wall, with 150 mm x 100 mm x 113 mm steel switch box with 3 mm thick hylum sheet for 15 Amps 3 pin non interlocking CS plug with continuous earth wire connection of 14 SWG TC wire and making good of the concealed portion, with suitable colour for concealed power plug point. (SD 38) as per standard specification	50	ETC of 5/15 A, 240V Indoor decorative type Receptacle 3-pin type. Above 5/15 A, 240V Receptacle also includes point wiring i.e conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Nos.	40	Refer remarks above sl. No. 18
105	35	Pts	Wiring with 2x1.5 sq.mm (22/0.3) PVC insulated SC unsheathed Cu conductor of 1100 V grade in suitable PVC rigid pipe concealed in wall and ceiling with PVC accessories in flush with wall with 150x100x113mm Tw switch box with 3 mm thick hylum sheet cover for 5 Amps 3 Pin non interlocking CS plug with continuous earth wire connection of 14 SWG TC wire and making good of the concealed portion with suitable colour for concealed PVC plug point. as per standard specification	51	ETC of Point wiring for 32Amps Receptacles(MCB and sockets) points. Note - Above point wiring includes conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Pts	41	Refer remarks above sl. No. 19
107	3	Pts	Supplying, fixing and concealed wiring of buzzers with two core PVC insulated copper wire of 1.50 sq.mm size in PVC pipe with 5 Amps flush type button switches etc., complete. as per standard specification	52	ETC of Buzzers with complete. as per standard specification Note - Above Buzzers also includes point wiring , conduits , wire , switchboard , earthwire and all applicable accessories as required etc.	Pts	2	Buzzers

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Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and placement of order				Rev :00	Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark	
110	21	No	Fixing & commissioning of Lighting Switch Board with 1 No. 200 A, TPN fuse switch as incoming and 3 Nos. 63 A TPN, 2 Nos. 63A DP, 1 No. 32A DP switch fuse etc. complete as per standard specification	53	ETC 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.	3	Refer remarks above sl. No. 21	
115	27	No	Supply and fixing of ELCP including all cost of materials lead lift etc., complete as per standard specification	54	ETC of 63A, 415V , 3 phase welding Receptacle	Nos.	13	Refer remarks above sl. No. 22	
				55	ETC of Temperature Transducer - switch-yard panel room shall be provided with temperature transducer to monitor the temperature of the panel room. The Temperature transducer shall have the following specification: Sensor : Air temperature sensor (indoor use) Output : 4 to 20mA Temperature range : - 5°C to 60°C Resolution : 0.1°C Accuracy : 0.5°C or better	Nos.	10	Refer remarks above sl. No. 23	
				ETC OF OUTDOOR ILLUMINATION					
98	20	Set	6No's 160W LED Light with accessories (To be fixed in the lighting mast of 50 mtrs height)	56	ETC of 6 No's 172W flood light LED type Lighting fixtures with accessories including junction box	Set	75	Refer remarks above sl. No. 24	
51	150	Nos.	Erection of 120 Watts LED fitting With BULB with fixture in the existing Structure / Towers with suitable clamps , wiring and testing for burning condition, erection of main switches for each other consumables necessary as directed by the field Engineer.	57	ETC of Street light type LED lighting fixtures 72W	Nos.	175	Refer remarks above sl. No. 25	
52	100	Nos.	Erection of 6 Mtrs. stepped, tubular yard light polewith single/ Double fitting pipe arrangement , with 1 coat of Red oxide and 2 coat of Alu. paint, and all other consumables as directed by the Engineer	58	ETC of Tubular painted lighting pole-6 m height with earthing material and GI conduit for L.L.O of cable with accessories	Nos.	175	Refer remarks above sl. No. 26	

illumination BOQ of 765/400KV AIS SS at Arivalur in Villupuram Region

			Rev -00	Annexure-1
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Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and placement of order				
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark
53	200	Nos.	Erection of yard light fuse unit mounting box of size 200x200x150mm (BxHxD) out of 18 SWG (1.22mm) M.S Sheet as per Drawing including the junction Box fixing Flat using 50x8MSF (0.2mx1No), Supply and Painting of Primer , first finish coat of aluminum paints on to the fixing flats as directed by the field engineer. The box shall be vermin proof, shall be provided with sturdy hinges, with provision for cable entry and locking arrangements. Also the Box should be provided with a 25mm thick wooden piece(country wood) of size150x150sqmm , ISI mark 16/20A rewirable Porcelain Fuse carrier unit and good quality Bakelite 16A 4 way Strip connectors including its cost and other consumables such as fixing screws etc.	59	ETC of Outdoor junction box for tubular lighting pole	Nos.	175	Refer remarks above sl. No. 27
40(i)	220	km	up to 8 core	E	ETC of common items	KM	11	Cabling including laying, tagging , dressing, ferruling, lugging, installation of cable gland ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, supports, underground, buried in ground or through /PVC pipe over/under ground, through wall etc. All erection materials viz. ferrules, glands , copper lugs, cable ties / straps, Al. tags, markers, GI / PVC wall sleeves with rubber / nylon bushes and flexible steel conduits shall be supplied by bidder. Fixing arrangement of cable on tower support shall be in Bidder scope. Cable Gland shall be Nickel Plated (coating thickness not less than 10 microns) brass cable glands, double compression heavy-duty type complete with necessary armour clamp & tapered washer etc.
40(ii)	220	km	up to 8 core	61	ETC of 4 C X 25 Sq mm cable Cu/PVC	KM	9	

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Illumination BOQ of 765/400KV AIS SS at Arivalur in Villupuram Region									
Illumination BOQ as per customer contract specification				Illumination BOQ for Bidder and placement of order				Rev -00	Annexure-1
Sl.No	Total Qty	Unit	Description of work	Sl.No	Description of work	Unit	Qty.	Remark	
152(a)	250	m	Supply and fixing of 75mm PVC pipes of 6kg per sq cm	62	ETC for Laying of 75mm PVC class -4 pipe.	m	2500	laying of PVC pipes at a depth of 300mm including excavation, backfilling, making and repairing of walls in trenches, cutting, threading, fixing of sockets/ bends where required etc. complete. Both ends of PVC pipe shall be closed . If route length is more than required pull pit shall be constructed by Illumination supplier (Payment will be made for the as erected pipe length)	
152(b)	250	m	Supply and fixing of 110mm PVC pipes of 6kg per sq cm	63	ETC for Laying of 110mm PVC class -4 pipe.	m	1000		
35	1600	MT	Earthing : Labour, Machinery and consumables for the Erection of Earthenmat,earth connection,earth electrode,earths spike (including sharpening & painting of earth spike)	64	ETC of 50 x 8 mm MS Flat	m	1000		
								MS strip including cutting, bending, welding with 40 mm dia MS rod rser/earth strip, applying zinc rich paint, clamping to structure/building wall etc. to complete. Hardware required for connecting flat on pads of structure & equipment included in scope.	

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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

Bharat Heavy Electricals Limited, Doc No. TB-394-316-132, Rev -00
Technical Specification of Illumination System for 765/400kV Ariyalur S/S
Section -2

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.

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

Indian Water Closet, Orissa type white in colour, pan of size 630 x 450 mm with "S" or "P" trap with flushing system of approved quality shall be provided E.W.C. and uninals may also be provided with suitable flushing system in some of the toilets as decided by the field Engineers. Wash Basin of Superior quality with all accessories with mirror shall be provided at places as directed by the field Engineer. The sewer connections shall be taken to the outside main sewer for connection to septic tank.

10.0. WATER SUPPLY:

Water Supply lines shall be provided within the building with all necessary fittings as per requirement and as directed by field Engineer. Water supply for the building shall be from the overhead tank of suitable capacity as per specification to be constructed as part of the building.

11.0. FALSE CEILING:

The false ceiling shall be with Gypsum Board 12.5 mm thick using suitable required size of Anodized Aluminium section / other materials perforated gypsum Board. False ceiling material shall be supported with Aluminium "T" / "L" sections of size 25 mm x 1.6 mm. the "T" section shall be placed at 0.5 x 0.5 m spacing. The false ceiling together with Aluminium "T" frame work shall be supported from the ceiling of the building with ¼ inch GI/SS rod hangers at suitable spacing.

12.0 UNDER DECK INSULATION:

The portion of the roof slab above false ceiling in control room area and PLC room shall be insulated with 50 mm thick thermocole. This under deck insulation is to be carried out for purpose of air-conditioning work. The design for arriving at the size of the air-conditioning units shall be based on the assumption that the inside portion of the roof slab in these areas are provided with under deck insulation.

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 400/440 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 with ELCB.

INCOMER : 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

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

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, inter connections 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. 60 A Double pole.

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

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. 63 A Double pole.

OUTGOING : 12 Nos. 15 A HRC fuse

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. 5 Amps single pole, single way, porcelain base flush type switch, suitable for flush mounting. 5 Amps, 1 phase 3 pin switched socket suitable for 220 V AC operation with M.S. Box suitable for flush mounting. Bell with bell-push switch. Staircase switch, 5 Amps, double pole, double throw, porcelain base flush type switch for staircase light control.

14.0. SWITCH YARD PANEL ROOM:

The switch yard panel room shall be of RCC framed structure with slopped roof covered by pressed tiles. All the surfaces inner and outer wall including roof slab bottom and top to be plastered after covering with chicken mesh for earthing arrangement. The building shall be earthed diagonally connected with yard main earthmat and as per the site requirements and as directed by the Engineer at site. Inside cladding with glazed joints free tiles upto roof level.

- f) Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanized surfaces.
- g) Check cleanliness of insulator and bushings
- h) All checks and tests specified by the manufacturers in their drawings and manuals as well as all tests specified in the relevant code of erection.
- i) Check for surface finish of grading rings (corona control ring)
- j) Pressure test on all pneumatic lines at 18.5 times the rated pressure shall be conducted.

4.3 STATION EARTHING

- a) check soil resistivity
- b) check continuity of grid wires
- c) check earth resistance of the entire grid as well as various sections of the same
- d) check for weld joint and application of zinc rich paint on galvanized surfaces.
- e) Dip test on earth conductor prior to use.

4.4 AAC/ACSR STRINGING WORK, TUBULAR BUS WORK AND POWER CONNECTORS.

- a) physical check for finish
- b) electrical clearance check
- c) testing of torque by torque wrenches on all bus bar power connector and other accessories.
- d) millivolt drop test on all power connector
- e) sag and tension check on conductors

4.5 ALUMINIUM TUBE WELDING

- a) physical check
- b) millivolt drop test on all joints
- c) dye penetration test & Radiography test on 10% sample basis on weld joints.
- d) Test check on 5% sample joints after cutting the weld piece to observe any voids etc.
- e) Necessary inner sleeves to be provided for all joints in addition to welding.

4.6 INSULATOR

Visual examination for finish, damage, creepage distance etc.

- 4.7 All pre/ commissioning activities and works work for substation equipment shall be carried out in accordance with owner's pre commissioning procedure and formats for substation equipments" by the contractor.

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	: 21.52 Lux.
Specific vertical (on disconnects)	: 21.52 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 765 KV yard lights, 400 KV yard lights and where additional masts are required for 765 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 LED lamps to be erected in the sub station structures, ~~Lightening mast~~, 6 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 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.

4.9 OTHERS :-

Sand drum made out of oil drum of Size 580mm dia and 420 mm height with conical cover made out of tin sheet provided with handle including the cost barrel, sand and consumables as directed by the field Engineer. Supply of different sizes of identification Boards for Equipments, Earth pits, Fire stand etc, duly painted and writing details as directed by field engineer.

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1 General

Unless otherwise stipulated, all equipment together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

2 Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3 Test Methods for RIC:

3.1 RIV tests shall be made according to measuring circuit as per International Special – Committee on Radio Interference (CISPR) Publication 16-1 (1993) part-1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard publication No. 107-1964, except otherwise noted herein.

		coil, supply air Plenums.
13.	General	Air distribution shall system consist of galvanized steel sheet ducting, supply air diffusers, return air grilles, acoustic insulation for ducting complete supports and wooden frame work for mounting diffuser and grilles. Thermal insulation shall be provided for drain line from drain pan of air handling units to floor drain and refrigerant piping.
14.	Calculations	The contractor shall submit detailed calculation for the capacity (Tonnage) offered. Tentative quantities of material and labour are provided in the schedules.

52.0. YARD LIGHTING:

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

General horizontal : 21.52 Lux.

Specific vertical (on disconnects) : 21.52 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 765 KV yard lights, 400 KV yard lights and 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.

53. BUS STRINGING:

53.1. INSULATOR ASSEMBLY:—

SECTION – 3

GENERAL TECHNICAL REQUIREMENTS

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 : 765/400KV AIS SUB STATION AT ARIYALUR
- c) Transport facilities : Road/Rail

Physical and other parameters:

- 3.1.1 Location of the substation
- 3.1.2 Nearest Railway station : Tindivanam
Railway : Southern Railway
- 3.1.3 Meteorological data
 - (i) Atmosphere : Polluted
 - (ii) Maximum ambient temperature : 50°C
 - (iii) Minimum ambient temperature : 20°C
 - (iv) Maximum daily average ambient air temperature : 45° C
 - (v) Maximum yearly average ambient air temperature : 32° C
 - (vi) Maximum Humidity (%) : 100%
 - (vii) Average thunder storm days per annum : 50
 - (viii) Average rainy days per annum : 65
 - (ix) Average annual rainfall (mm) : 750 mm
 - (x) No. of months during which tropical monsoon condition prevail : 3
 - (xi) Maximum wind pressure : 150 Kgf/Sqmm
 - (xii) Altitude above MSL : <1000M

(xii) Basic Wind Speed : 39 m/s (Zone -2)

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

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 kV System
1.	System operating Voltage	765kV	400k V
2.	Maximum operating voltage of the system(rms)	800kV	420k V
3.	Rated Frequency	50HZ	50H
4.	Number of Phases	3	3
5.	Rated Insulation Levels (i)Full wave impulse withstand voltage.(1.2 to 50 micro sec) (ii)Switching impulse withstand voltage(250/2500 micro sec) dry and wet. (iii) One minute power frequency dry withstand voltage (rms)frequency dry withstand voltage (rms)	2100kVp 1550kVp 830kV	1550kVp 1050kVp 630kV
6.	Corona extinction voltage	508kV	320kV
7.	Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 508 kV rms for 765kV, and 266kV rms for 400kV system	2500 microvolts	1000 microvolts
8.	Minimum creepage distance (25mm/kV)	20000 mm	10500 mm
9.	Rated short circuit current for 1 sec. Duration	50kA	63kA
10.	System neutral earthing	Effectively earthed	Effectively earthed
11.	Seismic acceleration	0.3g horizontal	0.3g horizontal
12.	Plinth level of switchyard	300mm above FGL	300mm above FGL

3.1.5 **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
DC supply	220, 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.**

3.2.1 The bidder shall also furnish drawings for the following:

All EQUIPMENTS and type of clamps, fittings hardware's, 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 - I 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 each section.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment 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 TYPE TEST:

The Type Test for all the equipments/materials used for this project should have been conducted in any approved Government/Govt. recognized laboratories conforming to latest IS/IEC. The above type test certificates should accompany the drawings of the materials equipments, duly signed under seal by the Institution, who have issued the type test certificate. The above type test should have been conducted not earlier than Ten years , subject to no change in design as on the originally scheduled date of technical bid opening i.e. **30.09.2016**

In case the type tests were conducted earlier than 10 (ten) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test (s) at no extra cost to the purchaser.

However, in case of instrument transformers, the following type tests should have been conducted within 5 (five) years prior to the originally scheduled date of bid opening.

- i) Lightning Impulse Test
- ii) Switching Impulse Test
- iii) Multiple Chopped Impulse Test (For CT)
- iv) Chopped Impulse Test (For CVT)

In case the test reports are of these tests (for instrument transformers) as mentioned above are conducted earlier than 5 (five) years prior to the originally scheduled date of bid opening, the contractor shall repeat these test(s) at no extra cost to the BHEL. The original type test certificates shall be furnished for verification on request.

TANTRANSCO/BHEL reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative at no extra cost.

Non furnishing of type test certificates by the tenderers, will be liable for rejection.

3.6 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 ISS/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 equipment's should operate without undue vibration and with the least practicable amount of noise.

3.7 **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 producers 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.

3.8 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.

3.9 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 and the BHEL 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.

3.10 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.

3.11 PAINING, 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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 be provided with 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-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.16 RATING PLATES, NAME PLATES AND LABELS :-

The equipment's shall be provided with a rating plate or plates marked with but not limited to following data whatever needs to that particular equipment's.

- (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.

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may be required by the BHEL/TANTRANSCO. The rating plate for each equipment shall be according to IEC requirements.

Alternately two separate plates one with Hindi and other with English inscriptions may be provided. During approvals drawings of Rating/name plates/labels shall also be submitted.

3.17 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.

3.18 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.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

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.

3.19 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.

3.20 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.

3.21 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.

3.22 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.

3.23 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.

3.24 LIST OF DRAWINGS AND DOCUMENTS :

The drawings for the equipments provided by the TANTRANSCO 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

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same got approved by the TANTRANSCO.

The bidder shall furnish One sets of relevant descriptive and illustrative published literature pamphlets and the following drawings/documents for preliminary study along with the offer.

- (i) General outline drawings showing dimensions and shipping weights, quantity of insulating media, etc.
- (ii) Sectional views showing the general constructional features of the circuit breaker including operating mechanism, arcing chambers, contacts with lifting dimensions for maintenance.
- (iii) Schematic diagrams of breaker offered 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 weeks of placement of order submit Six sets of final version of all the above drawings for BHEL/TANTRANSCO's approval. The TANTRANSCO shall communicate its comments/approval on the drawings to the supplier within reasonable period. The Supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for TANTRANSCO's approval within two weeks from the date of comments.. 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 equipment's 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 with in 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 breakers.
- 4) It should be noted that if the above conditions are not fulfilled the initial payment will not be released.

3.25 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 breakers 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.

- 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 inspection. The quality assurance plan and hold point shall be discussed between the employer 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 breaker.

3.26 **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 deg. Cover an ambient of 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.

3.27 **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.

3.28 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.

3.29 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)

3.30 APPROVAL PROCEDURE

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

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

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

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer below mention Title block for Submission of Documents.

Title Block

Customer	M/s Tamil Nadu Transmission Corporation Limited
Project:	765/400KV Air Insulated substation Ariyalur
Contractor	BHEL

3.31 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER
Drawings, GTP ,Type Test Reports and List of Past Supplies. Drawings & Documents

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

3.31 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

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

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.

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	
	l) <i>Control Wing</i> i) Material of conductor ii) Size of conductor /dia of wire (mm2)	
	j) <i>Conductor - Solid / Stranded</i>	
	k) <i>Terminal Block</i> i) Make ii) Current rating a) Power terminals (Amps) b) Other terminals (Amps)	
	l) <i>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	

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:

Sl. no	Parameter	Bidder's confrmation	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 temperature transducer as per clause no. 4 of section -1are 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.	ETC of Package included in the offer	YES / NO	
9.	Supply & ETC of all wires / Cables / earthing material required for the package other than the items supplied by BHEL included in the package.	YES / NO	
10.	ETC of BHEL supplied Cables included in the offer	YES / NO	
11.	ETC of BHEL supplied earthing strip included in the offer	YES / NO	
12.	GI 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	

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Section -5

16.	Equipment included suitable for operation on voltage & frequency Variation limits specified in the specification without effecting their performance		
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) Mandatory (b) Commissioning	YES/ NO 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 :

**ANNEXURE-2 (DRAWINGS LIST) FOR ILLUMINATION SYTEM OF ARIYALUR
PROJECT**

Sl. No.	Description of drg./doc.	Drg./doc. No.	Rev no.
1.	Layout for 765kV/400kV Ariyalur S/s	TB-0-394-316-002	02
2.	Section and elevation for 765kV/400kV Ariyalur S/s	TB-0-394-316-003	02
3.	Outdoor trench layout for 765kV/400kV Ariyalur S/s	TB-0-394-316-005	01
4.	Conceptual switchyard panel room drawing	TB-3-394-316-017	00
5.	Conceptual control room building layout for 765kV/400kV Ariyalur S/S	TB-3-394-316-010	01
6.	Single line diagram for LT AC & DC sytem	TB-0-394-316-004	00