



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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				GROUP	TBEM	W.O. No	86009

CUSTOMER Tamilnadu Transmission Corporation Limited (TANTRANSCO)

PROJECTS 765/400kV AIS S/S Ariyalur

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	TBMM	TBQM	TBCM	TBTS
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CHECKLIST FOR TECHNICAL EVALUATION

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

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted as per BOQ OF SECTION-1	
2.	Schedule of Technical Deviation format duly signed.	
3.	Supporting documents as asked in the Technical PQR (As per cl. No. 1.4 of section -1 of technical specification)	
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 & BILL OF QUANTITIES

1.1 SCOPE-

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of metal enclosed, indoor floor mounted, compartmentalized , double front construction and free standing type AC and DC Distribution Boards .

This section covers the specific technical requirements, scope and quantities. The specific technical requirements for the above item as specified by the TANTRANSCO are given in Section-2. The offered equipment shall also comply with the general technical requirements for the project as detailed under section-3 of this specification.

LT ACDB & DCDB is required for the following project:

Name of the Customer : **Tamilnadu Transmission Corporation Limited (TANTRANSCO)**
Name of the Project : **765/400kV AIS S/S Ariyalur**

This specification comprises of following sections:

Section-1: Scope, Specific Technical Requirements & Bill of Quantities

Section-2 : Technical Specification of LT ACDB & DCDB

Section-3 : Project Details & General Technical Requirements

Section-4 : Guaranteed Technical Particulars

Section-5 : Technical Checklist

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

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

1.2 SPECIFIC TECHNICAL REQUIREMENTS-

Please refer attached drawing number TB-0-394-316-004(two sheets) , Rev -01 , title Single Line diagram of LT AC & DC System at Ariyalur. For further technical requirements refer Section-2.

1.3 BILL OF QUANTITIES-

Sl. No	Description	Unit	Qty.
1.	415V, 3 phase 4 wire, 1600A, 25kA for 1 sec main switchboard (1A) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
2.	415V, 3 phase 4 wire , 800A, 20kA for 1 sec sub ACDB -1(2A) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
3.	415V , 3 phase 4 wire , 800A, 20kA for 1 sec sub ACDB -2(3A) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
4.	415V, 3 phase 4 wire, 500A, 20kA for 1 sec main lighting distribution board cum 300kVA lighting transformer (4A) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
5.	415V, 3 phase 4 wire , 200A, 20kA for 1 sec emergency lighting distribution board cum 100kVA lighting transformer (5A) ,as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1

6.	300A, 20kA for 1 sec 220V DCDB -1 for 765kV switchyard (1D) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
7.	300A, 20kA for 1 sec 220V DCDB -2 for 400kV switchyard (2D) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
8.	300A, 20kA for 1 sec 48V DCDB (3D) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Set	1
9.	100A, 10kA for 1 sec 220V DCDB source -1 for SPR (4D) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Nos.	12
10.	100A, 10kA for 1 sec 220V DCDB source -2 for SPR (5D) , as per Single Line diagram of LT AC & DC System drawing no. TB-0-394-316-004, Rev -01.	Nos.	12

NOTE:

1. ACJB (i.e. Marshalling Kiosk), split AC distribution board -6A and split AC distribution board -6B , as per SLD drawing no. TB-0-394-316-004, Rev -01 are **not in Bidder scope**.
2. 3 nos. CTs (800/1A, class -1) located in DG set AMF panel for differential protection of DG set shall be in **Bidder scope of supply and same shall be supply in loose** . DG supplier will provide space provision for mounting loose supply CT in AMF panel.
3. Incoming and outgoing cable of switchboard/distribution board indicated in SLD drawing no. TB-0-394-316-004, Rev -01 , shall be in BHEL scope of supply , but suitable TB shall be provided by Bidder .
4. Transducers/aux. contacts required for analogue and digital input as per SLD drawing no. TB-0-394-316-004, Rev -01 shall be an integral part of LT AC/DC boards, and same shall be in bidder scope.
5. All digital /Analogue inputs /outputs required for SAS as per SLD drawing no. TB-0-394-316-004, Rev -01 shall be in bidder scope.
6. Additional spare auxiliary contact for all MCB/MCCB/ACB/switch(i.e. incomer , outgoing and bus coupler) as per SLD drawing no. TB-0-394-316-004, Rev -01 shall be provided for **ON/OFF status and trip alarm in SAS**. These Additional Spare auxiliary contact for group alarm shall be wired up to TB of individual board by the LT ACDB & DCDB supplier.
7. All boards shall be suitable for ground mounted.
8. Bidders must furnish **unit price for all type of module** (defined in section 2) for each board with offer for additions/deletions (if any) at contract stage.
9. Bidders must furnish **unit price for each type and rating of relays, multifunction meter , MCCB, MCB , CTs, PTs, Air circuit breaker, meters & switches with offer for addition / deletion (if any) at contract stage**.
10. All items/module included under dotted boundary of switchboard /distribution board in SLD drawing no. TB-0-394-316-004, Rev -01, shall be in Bidder scope of supply.
11. Section -1 and section -2 of 220V DC distribution board -1(1D) shall be located in same board. Section -1 and section -2 of 220V DC distribution board -2(2D) shall be located in

same board. Section -1 and section -2 of 48V DC distribution board (3D) shall be located in same board.

12. The 300kVA and 100kVA lighting transformer shall be mounted inside sheet steel enclosure, which shall be an integral part of 415V main lighting distribution board(4A) and emergency lighting distribution board(5A) respectively .

13. Total quantity may vary upto $\pm 30\%$.

1.4 TECHNICAL REQUIREMENT OF LT ACDB and DCDB Switchgear -

The Manufacturer whose LT ACDB and DCDB Switchgear are offered, should be a manufacturer of LT Switchboards.

The manufacturer should have designed, manufactured and supplied at least 10 nos. draw out circuit breaker panels , out of which at least 5 nos. should have been with relay and protection schemes with current transformer.

And

LT ACDB and DCDB Switchgear supplied by bidder shall be operating satisfactorily for minimum two years in power plant or switchyard as on date of award of contract (i.e. 31.03.2017).

Note:

* Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remarks.

1.5 TYPE TESTING -

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried **out not before 30.09.2006**. The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are **before 30.09.2006** 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.

1.6 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.

SECTION - 02

AC/DC PANELS

1.1. CONSTRUCTIONAL DETAILS OF SWITCHBOARDS AND DISTRIBUTION BOARDS

1.1.1. All boards shall be of metal enclosed, indoor floor mounted, compartmentalised double front construction and freestanding type.

1.1.2. All board frames, shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness not less than 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness not less than 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Gland plate shall be cold rolled sheet steel having thickness not less than 3 mm in all cases. However, in case of termination of single core power cables, gland plate shall be of non-magnetic material of at least 4mm thickness.

1.1.3. All panel edges and cover/door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

1.1.4. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut-outs shall be true in shape and devoid of sharp edges.

1.1.5. All boards shall be of dust and vermin proof construction and shall be provided with a degree of protection of IP: 52, for category I enclosure as per IS 13947 (Part-1). However, the busbar chambers having a degree of protection of IP: 42, in accordance with IS 13947 (Part-1), are also acceptable where continuous busbar rating exceeds 2500 Amp. Provision shall be made in all draw out Air Circuit Breaker compartments for providing IP: 52 degree of protection, when Circuit breaker trolley, has been removed. Panels with lighting transformers shall have IP 31 degree of protection in accordance with IS 13947 (Part-1). Door frame of panels, meters, relays, Breaker cut-outs shall be provided with neoprene rubber gaskets generally conforming to Type-II, Class 2A as per IS: 11149.

1.1.6. Provision of louvers on boards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating exceeds 2500 Amps. Panels with lighting transformers in lighting distribution boards shall have louvers. (433 V Bus SC rating min 25 KA 1 sec)

1.1.7. All boards shall be of uniform height not exceeding 2450 mm.

1.1.8. Boards shall be easily extendible on both sides, by the addition of the vertical sections after removing the end covers of bus bar chambers.

1.1.9. Boards shall be supplied with base frames made of structural steel sections, alongwith all necessary mounting hardware required for welding the base frames to the insert plates.

1.1.10. a) All boards shall be of double front construction and shall have :

(i) A completely enclosed busbar compartment for running horizontal busbars and vertical busbars. Busbar chambers shall be completely enclosed with metallic portions. Bolted covers shall be provided for access to horizontal and Vertical busbars for repair and maintenance, which shall be feasible without disturbing feeder compartment. Vertical bus bar chambers shall be accessible from front as well as back side of the panel and shall be of at least 350 mm width. One set of vertical busbars shall be used in between two adjacent sections for switchgear connections. In case of ACB feeders, the panel shall have single front without any vertical busbar chamber, however vertical busbars associated with ACBs shall be located in rear side and shall be additionally covered with metallic perforated/ transparent acrylic or polyvinyl bolted sheets to avoid direct access after opening rear door of chamber.

(ii) Completely enclosed switchgear compartment(s) one for each circuit for housing circuit breaker or MCCB or motor starter.

(iii) A distinct compartment or alley for power and control cables on each side of panel. Cable alley compartment shall have a through metallic partition for segregating cables on both sides. Cable alley door shall preferably be hinged. Cable alley shall have no exposed live parts. Any live terminals shall be fully shrouded/insulated from safety aspects. However, it shall be of atleast 350mm width.

(iv) A compartment for relays and other control devices associated with a circuit breaker.

b) Lighting transformers shall be supplied in separate and distinct panel completely assembled for incoming cable connection from bottom and outgoing connection through busbar with adjacent associated lighting distribution board. Lighting transformers shall have provision of base channel with rollers for taking in and out from the panel in case of maintenance after disconnecting incoming and outgoing connections. Provision of single phase fans at least two (2) numbers of suitable ratings shall be made in the panel for ventilation. These fans shall run in sequential mode at suitable time interval to be controlled by thermostat and timer. The offered design of panel should be such that in no case, temperature rise of lighting transformers shall exceed the permissible limits for the class of insulation of lighting transformer.

1.1.11. Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. Each shipping section shall have full metal sheets at both ends for transport and storage.

1.1.12. All equipments associated with a single circuit except MCB circuits shall be housed in a separate compartment of the vertical section. The Compartment shall be sheet steel enclosed on all sides with the withdrawal units in position or removed. The front of the compartment shall be provided with the hinged single leaf door, with locking facilities. In case of circuits controlled by MCBs, group of MCB feeders can be offered in common compartment. In such case number of MCB feeder to be used in a common compartment shall not exceed 4 (four) and front of MCB compartment, shall have a viewing port of toughen glass sheet for viewing and sheet steel door of module shall be lockable with star knob/panel key.

1.1.13. After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necese-sary shrouding arrangement shall be provided for this purpose over the cable terminations located in cable alley.

1.1.14. The minimum clearance in air between phases and between phase and earth for the entire run of horizontal and vertical busbars, shall be 25 mm. For all other components, the clearance between "two live parts", " A live part and an earthed part" and isolating distance shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal run of busbar minimum clearance of 25 mm should be maintained even if they are sleeved.

1.1.15. The temperature rise of horizontal & vertical busbars when carrying rated current along its full run shall in no case exceed 55°C, with silver plated joints and 40°C with all other type of joints over an outside ambient temperature of 50°C.

1.1.16. All busbar chambers shall be provided with removable bolted covers . The covers shall be provided with danger labels.

1.1.17. All identical circuit breakers and module chassis of same test size shall be fully interchangeable without having to carryout modifications.

1.1.18. All Circuit breaker boards shall be of Single Front type, with fully drawout circuit breakers, which can be drawn out without having to unscrew any connections. The circuit breakers shall be mounted on rollers and guides for smooth movement between SERVICE, TEST and ISOLATED positions and for withdrawal from the Switchboard. Testing of the breaker shall be possible in the TEST position.

1.1.19. Wherever two breaker compartments are provided in the same vertical section, insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

1.1.20. All disconnecting contacts for power circuits shall be of robust design and fully self aligning. Fixed and moving contacts of the power drawout contact system shall be silver plated. Both fixed and moving contacts shall be replaceable.

1.1.21. All AC & DC boards shall be of double Front type.

1.1.22. All module shall be fixed type except air circuit breaker module, which shall be drawout type.

1.1.23. The connections from busbars to the main switch shall be fully insulated/shrouded, and securely bolted. The partition between the feeder compartment and cable alley may be non-metallic and shall be of such construction as to allow cable cores with lugs to be easily inserted in the feeder compartment for termination.

1.1.24. All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to PURCHASER approval. Bidder shall submit dimensional drawings showing complete internal details of Busbars and module components, for each type and rating for approval.

1.1.25. The tentative power and control cable entries shall be from bottom. However, Purchaser reserves the right to alter the cable entries, if required, during detailed engineering, without any additional commercial implication.

1.1.26. Adopter panels and dummy panels required to meet the various busbar arrangements and layouts required shall be included in Bidder's scope of work.

1.2. DERATING OF EQUIPMENTS

1.2.1. The current ratings of all equipments as specified in the Single Line Diagram For AC & DC System are the minimum standards current ratings at a reference ambient temperature as per relevant Indian Standards.

1.3. POWER BUS BARS AND INSULATORS

1.3.1. All AC Distribution Boards shall be provided with three phase buses and a neutral bus bars and the DC Distribution Boards shall be provided with two busbars.

1.3.2. All busbars and jumper connections shall be of high conductivity aluminium/copper of adequate size.

1.3.3. The Cross-Section of the busbars shall be uniform through out the length of Switchgear and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents.

1.3.4. All busbars shall be adequately supported by adequate numbers of high strength type Polyester fibre glass Moulded Insulators to withstand short circuit withstand capability of panel. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided anti-tracking barriers shall be provided between the supports.

1.3.5. All busbars joints shall be provided with high tensile steel bolts. Belleville/spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated Busbars joints shall be thoroughly cleaned at the joint locations and a suitable contact grease shall be applied just before making a joint.

1.3.6. All busbars shall be colour coded as per IS: 11353-1985: Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals.

1.3.7. The Bidder shall furnish calculations, establishing the adequacy of busbar sizes for specified current ratings, On the basis of short circuit current and temperature rise consideration at specified ambient temp.

1.4. EARTH BUS

1.4.1. A galvanised steel earthing shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded/bolted to the frame work of each panel and breaker earthing contact bar vertical bus shall be provided in each vertical section which shall in turn be bolted/welded to main horizontal ground bus.

1.4.2. The earth bus shall have sufficient cross-section to carry the momentary short circuit and short time fault currents to earth without exceeding the allowable temperature rise.

1.4.3. Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Purchaser's earthing conductors. The horizontal earth bus shall project out the switchboard ends and shall have predrilled holes for this connection. A joint spaced and taps to earth bus shall be made through at least two bolts.

1.4.4. All non-current metal work of the Switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosures frame work and the truck shall be maintained even after painting.

1.4.5. The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be

maintained in all positions. SERVICES & ISOLATED, as well as through out the intermediate travel.

1.4.6. Air Circuit Breaker (ACB) module frame shall get engaged to the vertical earth bus, before the disconnecting contacts on these module are engaged to the vertical busbar.

1.4.7. All metallic cases of relays, instruments and other panel mounted equipments shall be connected to earth by independent stranded copper wires of size not less than 2.5 mm². Insulation colour code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors and soldering is not acceptable. Looping of earth Connection which would result in loss of earth connection to the devices when a device is removed is not acceptable. However, looping of earth connections between equipment to provide alternative paths or earth bus is acceptable.

1.4.8. VT and CT secondary neutral point earthing shall be at one place only, on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.

1.4.9. All hinged doors shall be earthed through flexible earthing braid.

1.4.10. Caution nameplate 'Caution-Live Terminals' shall be provided at all points where the terminals are like to remain live and isolation is possible only at remote end.

1.5. AIR CIRCUIT BREAKERS

1.5.1. Circuit breakers shall be three-pole air break horizontal draw out type and shall have inherent fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameter only after provision of releases or any other devices shall not be acceptable.

1.5.2. Circuit breakers shall be mounted along with its operating mechanism on a wheeled carriage. Suitable guides shall be provided to minimise misalignment of the breaker.

1.5.3. There shall be 'Service', 'Test' and 'Fully withdrawn' positions for the breakers. In 'Test' position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power Contacts shall be disconnected while the Control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the 'SERVICE', 'TEST' OR FULLY WITHDRAWN' position. It shall be possible to close the door in TEST position.

1.5.4. All circuit breakers shall be provided with 4 NO and 4 NC potentially free auxiliary contacts. These contacts shall be in addition to those required for internal mechanism of the breaker. Separate limit switches each having required number of contacts shall be provided in both 'SERVICE' & 'TEST' position of the breaker. All contacts shall be rated for making continuously carrying and breaking 10 Amps at 240V AC and 1 Amp (Inductive) at 220V DC.

1.5.5. Suitable mechanical indications shall be provided on all circuit breakers to show 'OPEN', 'CLOSE', 'SERVICE', 'TEST' and 'SPRING CHARGED' positions.

1.5.6. Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half cycle of rated frequency.

1.5.7. All circuit breakers shall be provided with the interlocks as explained in further clauses.

1.5.8. Movement of a circuit breaker between SERVICE AND TEST positions shall not be possible unless it is in OPEN position. Attempted with drawl of a closed circuit breaker shall trip the circuit breaker.

1.5.9. Closing of a circuit breaker shall not be possible unless it is in SERVICE, TEST POSITION or in FULLY WITHDRAWN POSITION.

1.5.10. Circuit breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage to cover the stationary isolated contacts when the breaker is withdrawn. It shall however, be possible to open the shutters intentionally, against spring pressure for testing purpose.

1.5.11. A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.

1.5.12. Circuit breakers shall be provided with electrical anti-pumping and trip free feature, even if mechanical antipumping feature is provided.

1.5.13. Mechanical tripping shall be possible by means of front mounted RED 'Trip' push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.

1.5.14. Breaker controlled motors shall operate satisfactorily under the following conditions:

(i) Direct on-line starting of Induction Motors rated 110 kW to 220 kW with a locked rotor current of seven times the rated current, and starting time of up to 30 seconds.

(ii) Breaking on-load, full load and locked rotor currents of Induction Motors for rated 100 kW to 220 kW.

1.5.15. Means shall be provided to slowly close the circuit breaker in withdrawn position. If required for inspection and setting of Contacts, in service position slow closing shall not be possible.

1.5.16. Power operated mechanism shall be provided with a universal motor suitable for operation 220V DC Control supply with voltage variation from 90% to 110% rated voltage. Motor insulation shall be class 'E' or better.

1.5.17. The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring. 1.5.18. Once the closing springs are discharged, after the one closing operation of circuit breaker, it shall automatically initiate, recharging of the spring.

1.5.19. The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.

1.5.20. Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.

1.5.21. All circuit breakers shall be provided with closing and trip coils. The closing coils shall operate correctly at all values of Voltage between 85% to 110% at rated control voltage. The trip coil shall operate satisfactorily under all values of supply voltage between 70% to 110% of rated control voltage.

1.5.22. Provision for mechanical closing of the breaker only in 'TEST' and 'WITHDRAWN' positions shall be made.

1.5.23. PROTECTION CO-ORDINATION

1.5.23.1. It shall be the responsibility of the Contractor to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and down stream circuit breakers/fuses/motor starters, to provide satisfactory discrimination.

1.6. MOULDED CASE CIRCUIT BREAKER (MCCB) and MCB

1.6.1. MCCB shall in general conform to IS: 13947 Part-2. All MCCB offered shall have $I_{cs} = 100\%$ I_{cu} rating. Type test reports for offered model of MCCB shall be submitted during detailed engineering for owner's acceptance.

1.6.2. MCCB shall be flush mounted on the AC/DC distribution boards and shall have extended handle.

1.6.3 MCCBs shall be provided with thermo-magnetic type release for over current and short circuit protection. The setting of the thermal release shall be adjustable between 80% to 100% of the rated current. The MCCB shall have breaking capacity not less than 20kA.

1.6.4 MCCBs used for ACDB incomers and Bus coupler shall be equipped with stored energy mechanism for electrical closing and tripping. All other MCCBs shall be manually operated. The operating handle should give a clear trip indication.

1.6.5 Miniature circuit breaker (MCB) shall conform to IEC: 898-1987 and IS: 8828.

1.7 RELAYS

1.7.1 All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a drawout construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-drawout cases.

1.7.2 All AC relays shall be suitable for operation, at 50 Hz with 110 volts VT secondary and 1 amp or 5 amp CT secondary.

1.7.3 All protective relays and timers shall have at least two potentially free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate number of terminals shall be available on the relay cases for applicable relaying schemes.

1.7.4 All protective relays auxiliary relays and timers shall be provided with hand reset operation indicators (Flags) for analysing the cause of operation.

1.7.5 All relays shall withstand a test voltage of 2 KV (rms) for one minute.

1.7.6 Motor starters shall be provided with three element, ambient temperature compensated, time lagged, hand reset type overload relays with adjustable settings. The setting ranges shall be properly selected to suit the motor ratings. These relays shall have a separate black coloured hand reset push button mounted on compartment door and shall have at least one changeover contact.

1.7.7 All fuse-protected contactor-controlled motors shall have single phasing protection, either as a distinct feature in the overload relays (by differential movement of bimetallic strips), or as a separate device. The single phasing protection shall operate even with 80% of the set current flowing in two of the phases.

1.8 CONTACTORS

1.8.1 Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS:13947 (Part 4).

1.8.2 Contactors shall be double break, non-gravity type and their main contacts shall be silver faced.

1.8.3 Direct on line starter contactors shall be of utilisation category AC2. These contactors shall be as per IS:13947 (Part 4).

1.8.4 Each contactor shall be provided with two (2) normally open (NO) and two (2) normally close (NC) auxiliary contacts.

1.8.5 Operating coils of contactors shall be of 240V AC Unless otherwise specified elsewhere. The Contactors shall operate satisfactorily between 85% to 110% of the rated voltage. The Contactor shall drop out at 70% of the rated voltage.

1.9 INSTRUMENT TRANSFORMERS

1.9.1 All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the outside ambient temperature is 50°C.

1.9.2 All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.

1.9.3 All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

1.9.4 Current transformers may be multi or single core type. All voltage transformers shall be single phase type. The Bus VTs shall be housed in a separate compartment.

1.9.5 All VTs shall have readily accessible MCBs on both primary and secondary sides.

1.10 INDICATING INSTRUMENTS

1.10.1 All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales, and shall have an accuracy class of 2.5 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

1.10.2 All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.

1.10.3 All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

1.10.4 Ammeters provided on Motor feeders shall have a compressed scale at the upper current region to cover the starting current.

1.10.5 Watt-hour meters shall be of 3 phase three element type, Maximum demand indicators need not be provided.

1.11 CONTROL & SELECTOR SWITCHES

1.11.1 Control & Selector switches shall be of rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.

1.11.2 Circuit breaker selector switches for breaker Controlled motor shall have three stay put positions marked 'Switchgear', 'Normal' and 'Trial' respectively. They shall have two contacts of each of the three positions and shall have black shade handles.

1.11.3 Ammeter and voltmeter selector switches shall have four stayput position with adequate number of contacts for three phase 4 wire system. These shall have oval handles Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondaries.

1.11.4 Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

1.11.5 The contact ratings shall be at least the following :

- (i) Make and carry continuously 10 Amp.
- (ii) Breaking current at 220V DC 1 Amp (Inductive)
- (iii) Breaking current at 240V AC 5 Amp (at 0.3 pf lagging)

1.12 AIR BREAK SWITCHES

1.12.1 Air breaker switch shall be of the heavy duty, single throw group operated, load break, fault make type complying with IS:13947,Part-3.

1.12.2 The Bidder shall ensure that all switches are adequately rated so as to be fully protected by the associated fuses during all abnormal operating conditions such as overload, locked motor, short circuit etc.

1.12.3 Switch operating handles shall be provided with padlocking facilities to lock them in 'OFF' position.

1.12.4 Interlocks shall be provided such that it is possible to open the cubicle door only when the switch is in 'OFF' position and to close the switch only when the door is closed. However suitable means shall be provided to intentionally defeat the interlocks explained above.

1.12.5 Switches and fuses for AC/DC control supply and heater supply wherever required shall be mounted inside and cubicles.

1.13 PUSH BUTTONS

1.13.1 Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 240V and 0.5A (inductive) at 220V DC.

1.13.2 All push-buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

1.13.3 All push-buttons shall be provided with integral escutcheon plates marked with its function.

1.13.4 The colour of the button shall be as follows :

(i) GREEN : For motor START, Breaker CLOSE

(ii) RED : For motor TRIP, Breaker OPEN

(iii) BLACK : For overload reset.

1.13.5 All push-buttons on panels shall be located in such a way that Red-push-buttons shall always be to the left of green push-buttons.

1.14 INDICATING LAMPS

1.14.1 Indicating lamps shall be of the panel mounting cluster LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.

1.14.2 Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :

(i) RED : For motor ON, Breaker CLOSED

(ii) GREEN : For motor OFF, Breaker OPEN

(iii) WHITE : For motor Auto-Trip

(iv) BLUE : For all healthy conditions (e.g. control supply, and also for 'SPRING CHARGED'

(v) AMBER : For all alarm conditions (e.g. overload) Also for 'SERVICE' and 'TEST' positions indicators.

1.14.3 Lamps shall be easily replaceable from the front of the cubicle.

1.14.4 Indication lamps should be located just above the associated push buttons/control switches. Red lamps shall invariable be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along with the centre line of control switch/push button pair. Blue and Amber lamps should normally be located above the Red and Green lamps.

1.14.5 When associated with push-buttons, red lamps shall be directly above the green push button, and green lamps shall be directly above the red push-button. All indicating lamps shall be suitable for continuous operation at 90 to 110% of their rated voltage.

1.15 FUSES

1.15.1 All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC Circuits shall be of class 2 type, 20 kA (RMS) breaking current at 415 AC, and for DC circuits Class 1 type 4 kA breaking current.

1.15.2 Fuses shall have visible operation indicators.

1.15.3 Fuses shall be mounted on fuses carriers, which are mounted on fuse bases, wherever it is not possible to mount fuses on carriers fuses shall be directly mounted on plug in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

1.15.4 Fuse rating shall be chosen by the Bidder depending upon the circuit requirements and these shall be subject to approval of PURCHASER.

1.16 TERMINAL BLOCKS

1.16.1 Terminal blocks shall be of 750 volts grade and have continuous rating to carry the maximum expected current on the terminals. It shall be complete with insulating barriers, clip-on-type/stud type terminals for Control Cables and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring on diagrams. It shall be similar to 'ELEMEX' standard type terminals, cage clamp type of Phoenix or WAGO or equivalent

1.16.2 Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall be provided with short circuiting and earthing facilities. It shall be similar to 'Elem.' 'CATD' - Type.

1.16.3 In all circuit breaker panels at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available.

1.16.4 All terminal blocks shall be suitable for terminating on each side, two (2) Nos. of 2.5 mm square size standard copper conductors.

1.16.5 All terminals shall be numbered for identification and grouped according to the function. Engraved white-on-black labels shall be provided on the terminal blocks.

1.16.6 Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

1.16.7 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal block. The minimum clearance between the first row of terminal block and the associated cable gland plate shall be 250 mm.

1.17 NAME PLATES AND LABELS

1.17.1 All switchgears, AC/DC distribution boards, shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also.

1.17.2 All name plates shall be of non-rusting metal or 3-ply lamicaid with white engraved lettering on black back ground. Inscriptions and lettering sizes shall be subject to PURCHASER approval.

1.17.3 Suitable plastic sticker labels shall be provided for easy identification of all equipments, located inside the panel/module. These labels shall be positioned so as to be clearly visible and shall give the device number as mentioned in the module wiring drawings.

1.18 SPACE HEATER

1.18.1 Space heater shall be provided in all the boards for preventing harmful moisture condensation.

1.18.2 The space heaters shall be suitable for continuous operation on 240V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary isolating switches and fuses shall also be provided.

1.19 CONTROL AND SECONDARY WIRING

1.19.1 All switchboards shall be supplied completely wired internally upto the terminal blocks ready to receive Purchaser's control cables.

1.19.2 All inter cubicle and inter panel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the bidder.

1.19.3 All internal wiring shall be carried out with 1100 V grade, single core, 1.5 square mm or larger stranded copper wires having colour coded, PVC insulation. CT circuits shall be wired with 2.5 square mm copper wires. Voltage grade and insulation shall be same as above.

1.19.4 Extra-flexible wires shall be used for wiring to device mounted on moving parts such as hinged doors.

1.19.5 All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminals blocks.

1.20 POWER CABLES TERMINATION

1.20.1 Cable termination compartment and arrangement for power cables shall be suitable for stranded aluminium conductor, armoured XLPE/PVC insulated and sheathed, single core/three core, 1100 V grade cables.

1.20.2 All necessary cable terminating accessories such as Gland plates, supporting clamps and brackets, power cable lugs, hardware etc. shall be provided by the successful bidder, to suit the final cable sizes which would be advised later.

1.20.3 The gland plate shall be of removable type and shall cover the entire cable alley. Bidder shall also ensure that sufficient space is provided for all cable glands. For all single core cables, gland plates shall be of non-magnetic Material.

1.21 TYPE TESTS

1.21.1 Type tests reports on Panels (Switchgear and Control gear assemblies) as per IS 8623 Part-I shall be submitted for the following tests ~~in line with clause 9.0 of Section GTR :~~

- i) Verification of temperature rise limits
- ii) Verification of the dielectric properties
- iii) Verification of short circuit strength
- iv) Verification of the continuity of the protective circuit

v) Verification of clearances and creepage distances

vi) Verification of mechanical operation

vii) Verification of degree of protection

1.21.2 Contractor shall submit type test reports for the following Switchgear and Control gears before the fabrication of switchgear is started:

1. Circuit breakers/MCCB as per IS 13947 Part-II
2. Protective Relays as per IEC: 60255.
3. Lighting transformers as per IS:2026

1.22 ERECTION, TESTING AND COMMISSIONING *-(NOT IN BIDDER SCOPE)*

1.22.1 The Contractor shall unload, erect, install, test and put into commercial use all electrical equipment included in this specification.

1.22.2 Equipment shall be installed in a neat, workman like manner so that it is level, plumb, square and properly aligned and oriented. Tolerance shall be as established in Contractor's drawings or as stipulated by purchaser. No equipment shall be permanently bolted down to foundations until the alignment has been checked and found acceptable by the purchaser.

1.22.3 Contractor shall furnish all supervision, labour tools equipment rigging materials, bolts, wedges, anchors, concrete inserts etc. in proper time required to completely install, test and commission the equipment.

1.22.4 Manufacturer's and purchaser's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.

1.22.5 Contractor shall move all equipment into the respective room through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Purchaser.

1.22.6 All boards shall be installed in accordance with relevant code of practices and at Purchaser's instructions. All boards shall be installed on finished surfaces, concrete or steel stills. Contractor shall be required to install and align any channel sills which form part of foundations. In joining shipping sections of switchboards together adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed. Power bus, enclosures ground and control splices of conventional nature shall be cleaned and bolted together being drawn up with torque spanner of proper size or by other approved means.

1.22.7 All boards shall be made completely vermin proof.

1.22.8 Contractor shall take utmost care in holding instruments, relaying and other delicate mechanism wherever the instruments and relays are supplied separately they shall be mentioned only after the associated panels have been erected and aligned. The packing materials employed for safe transit of instrument and relays shall be removed after ensuring that panel have been completely installed and to further movement of the same should be necessary. Any damage shall be immediately reported to Purchaser.

1.22.9 Equipment furnished with finished coats of paint shall be touched by up Contractor if their surface is specified or marred while handling.

1.22.10 After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switch-boards/panels and correctness of all equipment in each and every respect. The cable opening and cables entries for cables terminating to the panels shall be sealed with fire sealing materials.

1.23 COMMISSIONING CHECK TESTS *-(NOT IN BIDDER SCOPE)*

The Contractor shall carry out the following commissioning checks, in addition to the other checks and tests recommended by the manufacturers.

1.23.1 General

1.23.1.1 Check name plate details according to the specification.

1.23.1.2 check for physical damage.

1.23.1.3 Check tightness of all bolts, clamps, joints connecting terminals.

1.23.1.4 Check earth connection.

1.23.1.5 Check cleanliness of insulators and bushings.

1.23.1.6 Check all moving parts for proper lubrication.

1.23.1.7 Check settings of all the relays.

1.23.2 Circuit Breakers

1.23.2.1 Check alignment of breaker truck for free movement.

1.23.2.2 Check correct operation of shutters.

1.23.2.3 Check control wiring for correctness of connections, continuity and IR values.

1.23.2.4 Manual operation of breaker completely assembled.

- 1.23.2.5 Power closing/opening operation, manually and electrically.
- 1.23.2.6 Breaker closing and tripping time.
- 1.23.2.7 Trip free and anti-pumping operation.
- 1.23.2.8 IR values, minimum pick up voltage and resistance of coils.
- 1.23.2.9 Contact resistance
- 1.23.2.10 Simultaneous closing of all the three phases.
- 1.23.2.11 Check electrical & mechanical interlocks provided.
- 1.23.2.12 Check on spring charging motor, correct operation of limit switches, and time of charging.
- 1.23.2.13 All functional checks.
- 1.23.3 Current Transformers
 - 1.23.3.1 Megger between winding and winding terminals to body.
 - 1.23.3.2 Polarity test
 - 1.23.3.3 Ratio identification checking of all ratios on all cores by primary injection of current.
 - 1.23.3.4 Spare CT cores, if available, to be shorted and earthed.
- 1.23.4 Voltage Transformer
 - 1.23.4.1 Insulation resistance test
 - 1.23.4.2 Ratio test on all cores.
 - 1.23.4.3 Polarity test.
 - 1.23.4.4 Line connections as per connection diagram.
- 1.23.5 Cubicle Wiring
 - 1.23.5.1 Check all switch developments.
 - 1.23.5.2 Each wire shall be traced by continuity tests and it should be made sure that the wiring is as per relevant drawing. All interconnections between panels/equipment shall be similarly checked.
 - 1.23.5.3 All the wires shall be meggered to earth.
 - 1.23.5.4 Functional checking of all control circuit e.g. closing, tripping control, interlock, supervision and alarm circuit.

1.23.6 Relays

1.23.6.1 Check connections and wiring.

1.23.6.2 Megger all terminals to body.

1.23.6.3 Megger AC to DC terminals.

1.23.6.4 Check operating characteristics by secondary injection.

1.23.6.5 Check minimum pick up voltage of DC coils.

1.23.6.6 Check operation of electrical/mechanical targets.

1.23.6.7 Relays settings.

1.23.6.8 Check CT and VT connections with particular reference to their polarities for directional relays, wherever required.

1.23.7 Meters

1.23.7.1 Check calibration by comparing it with a sub-standard.

1.23.7.2 Megger all insulated portions.

1.23.7.3 Check CT and VT connections with particular reference to their polarities for power type meters.

1.24 SPECIAL TOOLS AND TACKLES

1.24.1 The Bidder shall include in his proposal any special tools and tackles required for erection, testing commissioning and maintenance of the equipments offered.

1.24.2 The list of these special tools and tackles shall be given in the bid proposal sheets alongwith their respective prices.

1.24.3 The total price of the special tools and tackles shall be included in proposal sheets.

1.25 EQUIPMENT TO BE FURNISHED

1.25.1 The Bidder shall quote for various AC/DC distribution boards in accordance with this specification.

1.25.2 Standard scheme of interconnection of switchboards and distribution boards alongwith tentative feeder disposition for each board is indicated in ~~Standard~~ SLD of AC & DC system enclosed alongwith bid documents. The bidder shall quote board prices on the basis of ~~standard SLD and their estimation of feeders for entire present and future bays requirement. Any other feeder required as per system~~

~~requirement for efficient and reliable operation shall be deemed to be included in bidder's scope.~~

1.25.3 The Bill of Materials for each type of module shall be as under. These are minimum indicative requirement of the system. The necessary auxiliary relays, push buttons and indicating lamps shall be provided as per scheme requirement. Any other item/component required with in a module for efficient and reliable operation shall be deemed to be included in bidder's scope.

1.25.4 Module Type AE (Electrically controlled circuit breaker for incoming and Bus Coupler Circuit).

(i) One (1) Triple pole air circuit breaker complete with all accessories and power operated mechanism as specified.

(ii) Two (2) Neutral link.

(iii) Three (3) Current Transformer for metering.

(iv) One (1) Ammeter with selector switch.

(v) Three (3) Current Transformer for relaying.

(vi) One (1) Triple pole instantaneous over-current relay having the setting range of 200-800% or 500-2000% of CT secondary and adjustable definite minimum time.

(vii) One (1) Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20 - 80% of CT secondary current and adjustable definite minimum time. The earth fault relay shall be provided with a stabilising resistor.

(viii) One(1) set Current and Voltage transducers.

(ix) One(1) set High speed tripping relays.

1.25.5 Module Type - M1 (Circuit Breaker Controlled Motor Feeder) *→ NOT APPLICABLE*

(i) One (1) Triple pole Air Circuit Breaker complete with accessories, and power operated mechanism as specified.

(ii) One (1) Three position 6 pole selector switch 'SWITCHGEAR/NORMAL /TRIAL'.

(iii) Three (3) Current Transformer for metering.

(iv) One (1) Ammeter with Ammeter Selector Switch

(v) Three (3) Current Transformer for relaying.

(vi) One (1) Triple pole instantaneous over-current relay for providing positive sequence current protection in all the three phases. The relay setting range shall

be continuously adjustable between 200-800% or 400-1600% of CT secondary rated current as required.

(vii) One (1) Double pole inverse definite minimum time over current relays connected in R & B phases for over current protection of motor rated 110 kW - 200 kW. The relay shall have an adjustable setting range of 50% - 200% of CT Secondary current and time setting range of 0-30 Second. The relay shall be CDGM-22 of EE or equivalent.

(viii) One (1) Single pole adjustable definite time delay relay for motor overload alarm connected in Y-phase only. The relay shall have resetting ratio of not less than 90%. The relay shall have continuously adjustable time delay range of 2.5 to 25 Sec.

(ix) One (1) Instantaneous earth fault relay having an adjustable setting range of 10-40% or 20-80% of CT secondary current. The earth fault relay shall be provided with a stabilising resistor.

(x) One(1) set Current and Voltage transducers.

(xi) One(1) set High speed tripping relay.

1.25.6 Module Type E

(i) One (1) Four pole MCCB

1.25.7 Module G-1 (VT Module with under Voltage Relay)

(i) Three (3) 415 / 110 volts single phase voltage transformer
----- / -----
 $\sqrt{3}$ $\sqrt{3}$

star/star connect with star point solidly earthed mounted on common draw out chassis. Accuracy Class 0.5 for protection and metering with 50VA Burden.

(ii) Six (6) HRC Fuses mounted on the above chassis.

(iii) One (1) Four position voltmeter selector switch.

(iv) One (1) Voltmeter (0-500V)

(v) One (1) Double pole instantaneous under voltage relays with continuous variable setting range of 40-80% of 110 Volts.

(vi) One (1) Time delay pick up relay having a time setting range of 0.5 to 3 secs. with 3 'NO'. Self reset contacts, suitable for 220V DC.

(vii) One (1) Auxiliary relay 220V DC with 2 NO. self reset contacts.

(viii) Three (3) Indicating lamps with series resistor and colour lenses (Red, Blue & Yellow).

1.25.8 Module Type G-2

(i) Three (3) HRC Fuse

(ii) One (1) Voltmeter (0-500V)

(iii) One (1) Voltmeter selector switch four position (R-Y, Y-B, B-R OFF).

(iv) Three (3) Indication lamps (Red, Blue & Yellow)

1.25.9 Module Type H & H (BC) (Isolating Switch Controlled Incoming Circuit)

(i) One (1) Four pole MCCB

(ii) One (1) Red Indicating lamp to indicate isolating switch closed position.

1.25.10 Module Type S : (DC Metering and Protection Module)

(i) One (1) Voltmeter 300-0-300V DC for 220V DC DB/Voltmeter 0- 75V DC for 50V DCDB

(ii) One (1) Three (3) position voltmeter selector switch

(iii) One (1) Instantaneous under voltage relay with 95% of 220V DC. The resetting ratio of relay of relay should not be more than 1.25. The relay shall be provided with a series resistor and a push button across if for resetting (pick up) the relay at about 105% of the drop out voltage.

(iv) One (1) Instantaneous over voltage relay with setting range of 110% of 220V DC. The resetting ratio of relay should not be less than 0.8. The relay shall have a push button in series of resetting the relay at about 95% of the operating voltage.

(v) One (1) Earth leakage relay only for 220V DC system having adjustable pick up range between 3 to 7 milliamps the relay shall be suitable for 220V DC/240V AC Auxiliary supply.

1.25.11 Module Type X

One (1) Double pole 250 V MCB

1.25.12 Module Type-DC (Incomer from Battery & Chargers)

(i) One (1) Double pole 250V DC MCCB for incomer from Battery.

(ii) One (1) DC ammeter with shunt and range of 90-0-400 Amps. For 220V DC DB and 90-0-200 Amp for 50V DC DB.

(iii) Two (2) Double pole 250V DC MCCB/MCB

(iv) One (1) Double pole single throw 250V DC air break switch connecting battery & charger sections to DC DB.

(v) One (1) set Voltage and Current Transducers

1.25.13 Module Type DG-1 (Electrically Controlled Circuit Breaker for Incomer from DG Set)

a) One (1) Triple pole circuit breaker complete with all accessories and power operated mechanism as specified.

b) One (1) Frequency meter.

c) One (1) Voltmeter with selector switch.

d) One (1) Remote/Local Selector switch.

e) Three (3) Current transformer for metering.

f) Six (6) Current Transformers for differential protection (out of this 3 Nos. will be supplied loose for mounting in DG set panel).

g) Three (3) Current transformer for relaying.

h) One (1) Ammeter Selector Switch.

i) One (1) Ammeter

j) One (1) Wattmeter of range ~~0-300 kW~~ *For 500kVA DG set*

k) One (1) Three pole voltage controlled definite time delay relay having current setting range of 50-200% of CT secondary current and adjustable time delay 0.3 to 3 secs.

l) One (1) Watt hour meter with six (6) digits and minimum count of one (1) kwh.

m) One (1) Single pole definite time over current relay having a continuous setting range of 50-200% of CT secondary current and a time delay of 2.5-25 secs connected in CT of Y phase for overload alarm. The relay shall have a setting ratio of not less than 90%.

n) One (1) Three pole differential protection relay having an operating current setting range of 10-40% of generator full load current. The relay shall be of high impedance type, with necessary stabilizing resistors.

- o) Two (2) Push buttons for Remote starting & stopping of DG Set (Red, Green).
- p) One(1) set Current and Voltage transducers.
- q) One(1) set High speed tripping relays.

1.25.14 Module Type H1

One (1) Double pole DC Switch with pad locking facility in off position.

1.25.15 Module Type EL

- (i) One (1) Four pole MCCB
- (ii) One (1) Contactor
- (iii) Electronic Timer suitable for continuous operation, push button and selector switch be as per scheme requirement

1.26 PARAMETERS

1.26.1 Power Supply

1.26.1.1 AC System 3 phase, 4 wire, solidly earthed

- a) Voltage 415 Volts, $\pm 10\%$
- b) Frequency 50 Hz $\pm 5\%$
- c) Combined variation $\pm 10\%$ Absolute Sumin Voltage & frequency
- d) Fault Level ~~25 kA (rms) for 1 sec - AS per SLD~~ *dra no - TB-0-394-316-004, Rev-01*

1.26.1.2 DC System 2 Wire, unearthed

- a) System 220V $\pm 10\%$ voltage
- b) Fault Level ~~4 kA~~ *- AS per SLD dra no - TB-0-394-316-004, Rev-01*
- c) System 48 V $\pm 10\%$ Voltage
- d) Fault Level -- *AS per SLD drawing no TB-0-394-316-004 - Rev-01*

1.26.2 Control Supply Voltage

- a) Trip and closing 220V DC Unearthed coils
- b) Spring charging 220V DC Unearthed

1.26.3 Cubicle Data

1.26.3.1 Busbar Rating

a) Continuous As specified in ~~Standard~~ SLD for Vertical panels. For AC & DC system.

b) Short time (1 sec. 25 kA (rms)

c) Momentary (kA) 45 kA PEAK

d) Ambient Temperature 50°C

e) One Minute Power Frequency Withstand

I. Power Circuit 2500 Volts (rms)

II. Control Circuit 2500 Volts (rms)

1.26.3.2 Cubicle Colour Finish

a) Interior Smoke Grey shade No.692 of IS:5

b) Exterior Smoke Grey shade No.692 of IS:5

1.26.4 Circuit Breaker

a) Type Air Break

b) No. of poles 3

c) Voltage & Frequency 415 $\pm$ 10%, 50 HZ + 5%

d) Rated Operating Duty As per IS

e) Rated service short-circuit

Breaking capacity (Ics)

20 kA (RMS)

f) Short Circuit 45 kA (Peak)

making current

g) Short time withstand 25 kA (RMS) for 1 sec.

current for 1 sec. duration.

h) Operating Mechanism 25 kA (RMS) for 1 sec.

current for 1 sec.duration.

i) No. of auxiliary 4 NO & 4 NC contacts for Purchaser's contacts use on fixed portion of the cubicle

j) Short Circuit

breaking current

I. AC Component 20 kA (RMS)

II. DC Component As per IS: 13947 (Part 2)

1.26.5 MOULDED CASE CIRCUIT BREAKER

AC System

DC System

a) No. of poles 4 2

b) Voltage & Frequency 415 $\pm$ 10%, 250V

50 HZ $\pm$ 5%

c) Rated Operating Duty As per IS

d) Rated service short-circuit 25 kA (RMS) 4 kA - As per SLD drg. no - TB-0-394-316-004, Rev 01

Breaking capacity (Ics)

e) Short Circuit 45 kA (Peak) -

making current

f) No. of auxiliary 1 NO & 1 NC 1 NO & 1 NC

Contacts (only for incomer And bus-coupler MCCBs)

g) Rated Ultimate Short Circuit

breaking capacity

I. AC Component 25 kA (RMS) As per IS

II. DC Component As per IS 13947 As per IS 13947

1.26.6 Meters

a) Accuracy class 0.5

b) One minute power 2.0

frequency withstand

test voltage in KV

1.26.7 Current Transformers

- a) Type Cast resin, Bar primary
- b) Voltage class and frequency 650V, 50 Hz
- c) Class of Insulation E or better
- d) Accuracy Class 0.2s, VA adequate for application
class metering CT but not less than 7.5 VA.
- e) Accuracy class 5 P 15, VA adequate for application,
protection CT but not less than 7.5 VA.
- f) Accuracy class PS, KPV = 300V
differential protection
- g) Short Time Current Rating
(for CTs Associated with
circuit breakers)
- I. Current 25 kA (RMS)
- II. Duration One Second
- III. Dynamic Rating 45 kA (Peak)
- IV. One minute power 2.5 kV (rms)
frequency withstand
test voltage.

1.26.8 Voltage Transformer

- a) Type Cast Resin
- b) Rated Voltage Primary $415/\sqrt{3}$ V
Secondary $110/\sqrt{3}$ V
- c) Method of connection Primary Star
Secondary Star
- d) Rated voltage factor 1.1 continuous, 1.5 for 3 seconds

- e) Class of insulation E or better
- f) One minute power 2.5 KV (RMS)
frequency withstand
voltage
- g) Accuracy class 0.5, not less than 20VA

1.26.9 Relay

- a) One minute power 2 kV (rms)
Frequency withstand test

1.26.10 Transducers (1 phase) Current Voltage

- a) Operating Voltage 220 V DC 220V DC
- b) I/P 1A. 110V AC
- c) O/P 4-20 mA 4-20 mA
- d) Type Analogue Analogue

1.26.11 Lighting Transformers

Lighting transformers shall be of 300 KVA ^{and 100 kVA} rating , 415/415 V, 3 phase, 50 Hz Dry type natural air cooled type. The technical parameters of these lighting transformers are as follows:

Technical Parameters of Lighting Transformer

Type of transformer : Dry type natural air cooled

Rating : 300 KVA , 100 kVA

Voltage ratio : 415/415 volts

No. of phases : Three

Frequency : 50 Hz

Winding connection : Dyn-1 Dyn-11

Class of insulation : 'B' class

Impedance : $4\% \pm 10\%$

No. of taps & steps : 5, $\pm 5\%$ in steps of 2.5%

Ref. standard : IS:2026

1.27 AUTOMATIC CONTROL OF OUTDOOR LIGHTING

1.27.1 EL-type module of 415V Main lighting distribution board and Emergency lighting distribution board and shall be controlled by timer and contactor module to facilitate its operation automatically.

1.28 AUTOMATIC SUPPLY CHANGEOVER

Automatic changeover between Incomer I, Incomer II, and DG set is to be carried out during the failure of supply in one/or both the incomers. After the restoration of the supply, system shall be restored to normal condition automatically. The requirement of changeover under various conditions are as below:

(i) Under normal conditions i.e. when supply is available in both the incomers, incomers I&II of 415 V Main switchboard, ACDB shall be in closed condition and Bus couplers and DG set breaker shall be in open condition.

(ii) In case of failure of either of the sources, the incomer of that source shall trip and Bus coupler shall get closed. On restoration of supply, normal conditions described above are to be established automatically.

iii) In case of failure of supply in both the sources, both incomers, incomers of ACDBs and ACDB Bus coupler shall trip and DG set breaker switched on.

On restoration of one or both sources, DG set breaker shall trip, DG set stopped and conditions described in paragraph (i) /(ii) shall be restored.

To avoid unnecessary operation of switchgear for momentary disturbances all changeovers from one state to another shall be initiated after a time delay, after the conditions warranting such change has been detected.

1.29 ANALOGUE INPUTS

LT System shall have provision of following analogue inputs to the substation automation purpose. These analogue inputs shall be generated by distinct transducers to be provided in respective modules. These inputs shall be wired up to respective terminal blocks.

ANALOGUE INPUTS:

- i) Voltage R-Y, Y-B, B-R of Main Switch Board section-I
- ii) Voltage R-Y, Y-B, B-R of Main Switch Board section-II
- iii) Current from LT transformer-I
- iv) Current from LT transformer-II
- v) Voltage of 220V DCDB-I
- vi) Voltage of 220V DCDB-II
- vii) Current from 220V Battery set-I
- viii) Current from 220V Battery set-II
- ix) Voltage of 48V DCDB-I
- x) Voltage of 48V DCDB-II
- xi) Current from 48V Battery set-I
- xii) Current from 48V Battery set-II

*AS per single line
diagram of LT AC & DC
system drawing no.
TB-0-394-316-004, Rev-01*

1.30 DIGITAL (Potential Free) INPUTS:

LT System shall have provision of following digital inputs to the substation automation system. These digital inputs shall be made available in the form of potential free contacts to be provided in respective modules. These potential free contacts shall be wired up to respective terminal blocks.

- i) Main (MSB) Incomer-I breaker On/Off
- ii) Main (MSB) Incomer-II breaker On/Off
- iii) Main(MSB) 415V Bus-I/II U/V
- iv) Main (MSB) bus coupler breaker on/off
- v) DG set breaker on/off
- vi) LT transformer-I Buchholz Alarm & trip
- vii) LT transformer-II Buchholz Alarm & trip
- viii) LT transformer-I WTI Alarm & trip
- ix) LT transformer-II WTI Alarm & trip

*AS per single line
diagram of LT AC & DC
system drawing no - TB-0-394-
316-004, Rev-01*

x) LT transformer-I OTI Alarm & trip

xi) LT transformer-II OTI Alarm & trip

xii) 220 V DC-I earth fault

xiii) 220V DC-II earth fault.

} As per single line diagram of LT AC
& DC system drawing no. TB-D-394-316
- 004, Rev-01

The above quantity is for indicative purpose only. The actual quantity required may be decided during detailed Engineering.

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 |

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(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	400kV
2.	Maximum operating voltage of the system(rms)	800kV	420kV
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 produces can be procured from reroller , provided rerolling of structural steel section is done rom 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 PAINTING, GALVANISING:

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

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

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

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

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

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

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

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

3.12 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 within one week from the date of approval of drawings.
- 3) The spares for the Equipment's ordered under the scope of the Contract should also be supplied to the consignee circle along with initial supply of the 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.

Technical Specification - LT ACDB & DCDB
AC & DC BOARD , Dbl No - TB-394-316-1241 Rev-0

SECTION IV

GUARANTEED TECHNICAL PARTICULARS FOR AC-DC DISTRIBUTION BOARDS

For each type and rating of board proposed, the bidder shall provide the following information.

S.No.	PARTICULAR	Unit	AC BOARD	DC BOARD
1.00	GENERAL			
	a) Manufacturer's Designation			
	b) Type Designation			
1.1	Rated Voltage			
1.2	a) Symmetrical Short Circuit withstand current at rated voltage of switchgear/ MCC cubicle			
	b) Peak short circuit withstand current			
	c) Rated current at 50°C			
1.3	Degree of protection as per IS 13947 (IS 13947)			
	a) Breaker / MCC Cubicle			
	b) Busbar Chamber			
1.4	Cubicle sheet metal details			
	a) Cold rolled/ hot rolled			
	b) Thickness, structural & load bearing members			
	c) Thickness front and rear			
	d) Thickness, sides and top			
	e) Thickness of gland plates			
1.5	Painting shade and thickness of as per IS 5			
	a) External Surface			
	b) Internal Surface			
1.6	Minimum clearance in air (busbars)			
2.0	POWER BUSBARS & INSULATORS			
2.1	Material & applicable standards			
2.2	Bare/ painted/ epoxy/ insulated/ sleeved			
2.3	Bus joints silver faced			
2.4	Minimum Clearance			
	a) Phase to Phase			
	b) Phase to Earth			
2.5	Continuous Current Rating			
	a) at 40 deg C ambient			

Technical Specification
AC & DC BOARD

	b) at 50 deg C ambient			
2.6	Temperature rise over design ambient temperature of 50 deg C for continuous current rating (deg. C)			
2.7	Cross sectional area per phase for different ratings			
	a) Horizontal Busbars			
	b) Vertical Busbars			
2.8	Material of the Support Insulators			
2.9	Tracking Index of Insulators			
2.10	One Second Current rating			
3.0	AIR BREAK SWITCHES			
3.1	Make			
3.2	Type			
3.3	Applicable Standards			
3.4	Rated current at design ambient temperature			
3.5	Design Ambient temperature in deg C			
3.6	Derating factor for use under site ambient conditions			
3.7	Rated breaking current			
3.8	Maximum through fault withstand current			
3.9	Maximum size of fuse recommended			
3.10	Temp. rise of contacts when carrying continuous rated current			
3.11	Door interlock as specified has been provided			
3.12	No. of auxiliary contacts and its rating			
4.0	CONTACTOR			
4.1	Make			
4.2	Type and applicable standards			
4.3	No. of poles			
4.4	No. and configuration of auxiliary contacts			
4.5	Rated Voltage of coils			
4.6	Limits of operation			
	a) Supply Voltage Variation ($\pm$) %			
	b) Supply frequency variation ($\pm$) %			
	c) Drop off Voltage %			
4.7	Rated (thermal) current			
4.8	Rated Duty			
4.9	Rated Utilization Category as per IS 2459 (IS 13947)			

Technical Specification
AC & DC BOARD

4.10	Rated breaking capacity			
4.11	Rated making capacity			
4.12	Coil winding insulation			
4.13	Rated making capacity			
4.14	Max. Recommended back up HRC fuse size			
4.15	Coil VA burden			
5.0	AUXILIARY CONTACTOR			
5.1	Make			
5.2	Type			
5.3	Coil Burden (VA)			
5.4	Operating Time (ms)			
5.5	No. of contacts			
	a) Normally Open			
	b) Normally Closed			
5.6	Contact rating			
6.0	FUSES (FOR EACH TYPE & RATING)			
6.1	Make			
6.2	Type			
6.3	Applicable Standards			
6.4	Rated Voltage			
6.5	Prospective Breaking Current			
6.6	Peak cut-off current			
6.7	Whether mounted on an insulated carrier			
7.0	SPACE HEATER			
7.1	Make			
7.2	Type Designation			
7.3	Rated Voltage			
7.4	Heater Output (W)			
7.5	Thermostat - Type , Make and Setting range (°C)			
8.0	WIRING & TERMINAL BLOCKS			
8.1	Voltage grade of wires			
8.2	Insulation of wires			
8.3	Minimum size of conductor for			
	a) Power Wiring (sq. mm)			
	b) Control wiring (sq. mm)			
8.4	Type of control wiring terminal blocks on			

Technical Specification
AC & DC BOARD

	a) fixed portion and draw-out portion of draw-out MCC modules			
	b) switchgear panels			
	c) for CTs			
8.5	Make & type of terminal blocks			
8.6	Minimum current rating of terminal blocks			
8.7	Suitable for 2x2.5 sq. mm cable termination on each side			
9.0	MCB/ MCCB/			
9.1	Maker's name & country of manufacture			
9.2	Applicable standards			
9.3 a)	Nominal voltage class			
b)	Rated maximum voltage			
9.4	Number of poles			
9.5	Rated normal current			
a)	Under normal conditions			
b)	Under site conditions			
9.6	Rated frequency			
9.7	Rated short circuit breaking current			
a)	RMS value of a. c. component			
b)	Duration of short circuit			
c)	Rated short circuit making current			
9.8	Rated operating sequence			
9.9 a)	Opening time at 100% rated breaking current			
b)	Arcing time at 100% rated breaking current			
c)	Closing time			
9.10	Maximum rise of temperature over ambient for current rating under item 5 (b) above.			
9.11	No of auxiliary contacts provided for owner's use			
9.12	Number of breaks in series per pole			
9.13	Type of main contact			
9.14	Type of arcing contacts / or arc control device			
9.15	Material of contacts			
a)	Main			
b)	Arcing			
c)	If silver plated, thickness of coating			
9.16	Insulation level of breaker One minute power frequency withstand voltage			

Technical Specification
AC & DC BOARD

9.17	Clearances			
a)	Between phases			
b)	Between live part and earth			
c)	Centre to centre distance between phases			
d)	Safety boundaries during the breaking operation			
9.18	Whether circuit breaker is fixed trip or free			
9.19	Method of closing			
a)	Normal			
b)	Emergency			
9.20	Type of closing mechanism			
9.21a	Normal voltage of closing coil			
b)	Pick up range			
9.22a	Auxiliary power at normal voltage of closing mechanism			
b)	Power at 85% of normal voltage			
9.23	Type of tripping mechanism			
9.24	Normal voltage of tripping coil			
9.25a	Power at normal voltage for tripping coils			
b)	Power at 85% of normal voltage for tripping coils			
10.0	INSTRUMENTS			
10.1	Make			
10.2	Type			
10.3	Dial Size			
11.0	INSTRUMENT TRANSFORMERS			
11.1	Make			
11.2	Type			
11.3	Rated Voltage			
11.4	Ratio			
11.5	Accuracy and Limit factor			
11.6	Rated Burden			
12.0	RELAYS			
12.1	Make			
12.2	Type			
12.3	Rated Voltage			
12.4	Accuracy and Limit factor			
12.5	Rated Burden			
12.6	1 min power frequency withstand voltage			

Technical Specification

AC & DC BOARD

12.7	Power supply required			
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Project: 765/400kV Ariyalur Substation
Customer: TANTRANSCO
Technical Specification: LT ACDB & DCDB

Bharat Heavy Electricals Limited
Doc. No. TB-394-316-124 , Rev -00

SECTION 5

CHECK LIST FOR LT ACDB & DCDB

Put a tick mark (√) on 'YES' if the specified requirement is met, or put a tick mark on 'NO', if the specified requirement is not met and give comments in the "Remarks" column.

S. No.	Parameters	Data	YES/NO	Remarks
1.	Applicable Standards	IS 8623, IS 13947 PART II , IEC 60255 , IS 2026	YES/NO	
2.	Type of Boards	Metal enclosed , indoor floor mounted , compartmentalized double front construction and free standing	YES/NO	
3.	Module type	All modules shall be fixed type except air circuit breaker module ,which shall be draw out type	YES/NO	
4.	Ingress Protection requirement	Shall be as per clause 1.1.5 of Section 2	YES/NO	
5.	Lightning Transformer	Shall meet requirements mentioned in clause 1.1.10 b, 1.26.11 of section -2 and as per LT AC & DC System SLD drawing no. TB-0-394-316-004, Rev -01.	YES/NO	
6.	Special tools & tackles	List of special tools and tackles (which are proprietary in nature) is attached	YES/NO	
7.	Addition / deletion	Bidder has quoted addition/ deletion prices for each and every type of complete module (defined in section 2)	YES/NO	
8.	Addition / deletion	Bidder has quoted addition/deletion prices for each and every type rating of relays, multifunction meter , MCCB, MCB , CTs, PTs, Air circuit breaker, meters & switches as per SLD drawing no. TB-0-394-316-004, Rev -01 and section -2	YES/NO	
9.	Analogue Input for SAS interface	Bidder shall offer in line with clause 1.29 of Section-2	YES/NO	
10.	Digital Input for SAS interface	Bidder shall offer in line with clause 1.30 of Section-2	YES/NO	
11.	Confirmation to the Minimum indicative requirement of Analog signals, Potential Free contacts & Command signals. Refer Signal Chart mentioned in SLD drawing TB-0-394-316-004, Rev - 01.	This should be available at respective equipment for remote indication & control from Auxiliary BCU located in S/s control room.	YES/NO	

Project: 765/400kV Ariyalur Substation

Bharat Heavy Electricals Limited

Customer: TANTRANSCO

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SECTION 5

12.	Loose supply of CT for DG set AMF panel	3 nos. CTs (800/1A, class -1) located in DG set AMF panel for differential protection of DG set shall be in Bidder scope of supply	YES/NO	
13.	Additional spare auxiliary contact	Additional spare auxiliary contact for all MCB/MCCB/ACB/switch(i.e. incomer , outgoing and bus coupler) as per SLD drawing no. TB-0-394-316-004, Rev -01 shall be provided for <u>ON /OFF status and trip alarm in SAS</u> . These Additional Spare auxiliary contact for group alarm shall be wired up to TB of individual board by the LT ACDB & DCDB supplier.	YES/NO	
14.	Un-priced BOQ	As per cl. No. 1.3 of section -1 of technical specification	YES/NO	
15.	Whether OGA drawing and scheme of LT AC & DC board enclosed	Enclosed	YES/NO	
16.	Bidder to comply requirements as per technical specification	Complied	YES/NO	
17.	Bidder will be responsible of getting drawing approval from customer	Yes	YES/NO	
18.	All valid Type test reports as per clause no. 1.5 of section -1 and clause 1.21 of Section-2 are available	Yes, available	YES/NO	
19.	Conduction of type test (if any)	If type test reports are not acceptable to Customer/BHEL then above tests shall be conducted by the bidder free of cost	YES/NO	

Date:
Place:
Phone:
Fax:
E-mail:
Mobile: