



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	SK	SK	RS/DM
TITLE				SIGN	<i>SK</i>	<i>SK</i>	<i>RS/DM</i>
220V/48V BATTERY CHARGER				DATE	21.12.17	22/12/17	<i>Q. M. S.</i>
				GROUP	TBEM	W.O. No	86009 2

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				
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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. 5 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

Project: 765/400kV Ariyalur Substation

Customer: TANTRANSCO

Technical Specification: 220V/48V Battery Charger Rev -00

Bharat Heavy Electricals Limited

Doc. No. TB-394-316-126

SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT AND QUANTITIES

1. SCOPE:

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 220V and 48V DC **Battery Charger** for Lead Acid Battery (Tubular Type).

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-2A & 2B. The offered equipment shall also comply with the general technical requirements for the project as detailed under section-3 of this specification.

220V and 48V DC Battery 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-2A: Technical specification of 220V Charger

Section-2B: Technical specification of 48V Charger

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.

2. SPECIFIC TECHNICAL REQUIREMENTS:

For detailed equipment specification of 220V and 48V DC Battery charger, refer Section -2A and Section -2B respectively of the technical specification.

Each 1 no. 220V or 48V battery charger consist of a separate Float charger and a separate float cum Boost charger.

220V and 48V DC Battery Charger shall be suitable for Lead Acid Tubular Type Battery (535AH for 220V battery and 1250AH for 48V Battery).

Project: 765/400kV Ariyalur Substation

Customer: TANTRANSCO

Technical Specification: 220V/48V Battery Charger Rev -00

Bharat Heavy Electricals Limited

Doc. No. TB-394-316-126

3. BILL OF QUANTITIES :

Sl. No	DETAILS	Unit	Quantity
1.	220V, 100 A Battery charger (1 no. 220V battery charger consisting of a separate Float charger and a separate float cum Boost charger as per specification given in Section -2A)	Nos.	6
2.	48V, 250 A Battery charger (1 no. 48V battery charger consisting of a separate Float charger and a separate float cum Boost charger as per specification given in Section -2B)	Nos.	3
3.	Manual Changeover selector switch panel for 220V DCDB , Battery and Charger system	Set	2
4.	Manual Changeover selector switch panel for 48V DCDB , Battery and Charger system	Set	1
5.	Supervision of testing and commissioning of all 220V battery chargers alongwith Manual Changeover selector switch panel	Lot	1
6.	Supervision of testing and commissioning of all 48V battery chargers alongwith Manual Changeover selector switch panel	Lot	1

Note -1: 1 Set of manual changeover selector switch panel shall be suitable for changeover selection among 3 nos. charger (1 no. main -1 charger , 1 no. main -2 charger and 1 no. stand by charger) , 2 nos. Battery sets (1 no. battery bank -1, 1 no. battery bank -2) and DCDB with bus coupler section.

Note -2 Refer attached Annexure-1 for arrangements of battery bank, charger, manual changeover selector switch panel and DCDB. Manual changeover selector switch panel shall have following operational feature as mentioned below.

- (A) During normal condition following operation take place.
- (i) Main -1 charger in float mode or boost mode is connected with DCDB section -1 and battery bank-1.
 - (ii) Main -2 charger in float mode or boost mode is connected with DCDB section -2 and battery bank-2.
 - (iii) Stand by charger is OFF condition.
 - (iv) Bus coupler of DCDB is OFF.

- (B) During outage of main -1 charger following operation take place.
 - (i) Stand by charger in float mode or boost mode shall be connected with battery bank -1 and DCDB section-1.
 - (ii) Main -2 charger in float mode or boost mode shall be connected with DCDB section -2 and battery bank-2.
 - (iii) Bus coupler of DCDB is OFF.
- (C) During outage of main -2 charger following operation take place.
 - (i) Stand by charger in float mode or boost mode shall be connected with battery bank -2 and DCDB section-2.
 - (ii) Main -1 charger in float mode or boost mode shall be connected with DCDB section -1 and battery bank-1.
 - (iii) Bus coupler of DCDB is OFF.
- (D) During outage of main -1 and main -2 charger following operation take place.
 - (i) Stand by charger in float mode or boost mode may be connected with either battery bank -1 and DCDB section-1 or battery bank -2 and DCDB section-2.
 - (ii) Bus coupler of DCDB is ON
- (E) During outage of main -1, main -2 and stand by charger following operation take place.
 - (i) Individual battery bank shall fed Individual DCDB section.

Note -3: Battery bank has Tap cell arrangement for boost charging of battery and DCDB load.

Note -4: In float mode - Continuous DCDB loads +Trickle charging of battery.

Note -5 In Boost mode – Charging of Battery + Continuous DC loads through tap cell arrangements. It meant that during boost charging mode respective charger charges the battery in boost mode and respective DCDB load is connected by battery with tap cell arrangement.

Note -6: Potential free alarm contacts for following shall be provided in each charger by charger supplier for its use in SAS (Substation automation system).

- (a) AC power failure
- (b) Rectifier /Charger fuse blown
- (c) Over voltage across the battery when boost charging
- (d) Abnormal voltage (high/low)
- (e) Float mode
- (f) Boost mode

Note -7: TB inside charger and mannual Changeover selector switch panel shall be suitable for flowing size of cable.

- (a) Cable between battery and charger shall be 3x 2CX 35 sq mm Cu. (1 cable 2cx35 for positive , 1 cable 2cx35 for negative and 1 cable 2cx35 for tap cell) .
- (b) Cable between DCDB and charger shall be 2x 2CX 35 sq mm Cu. (1 cable 2cx35 for positive and 1 cable 2cx35 for negative) .
- (c) Incoming cables of charger will be 4cx50 sq. mm cu

4. TYPE TESTING

Bidder shall submit valid type test reports (As per relevant IEC/IS standard) for the tests carried out within last ten years **from the date of opening of the tender** (i.e. 30.09.2016). The reports should have been conducted on identical or similar equipment/components to those offered. In case type test reports are more than 10 years old (from the date of opening of the tender i.e. **30.09.2016**) 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.

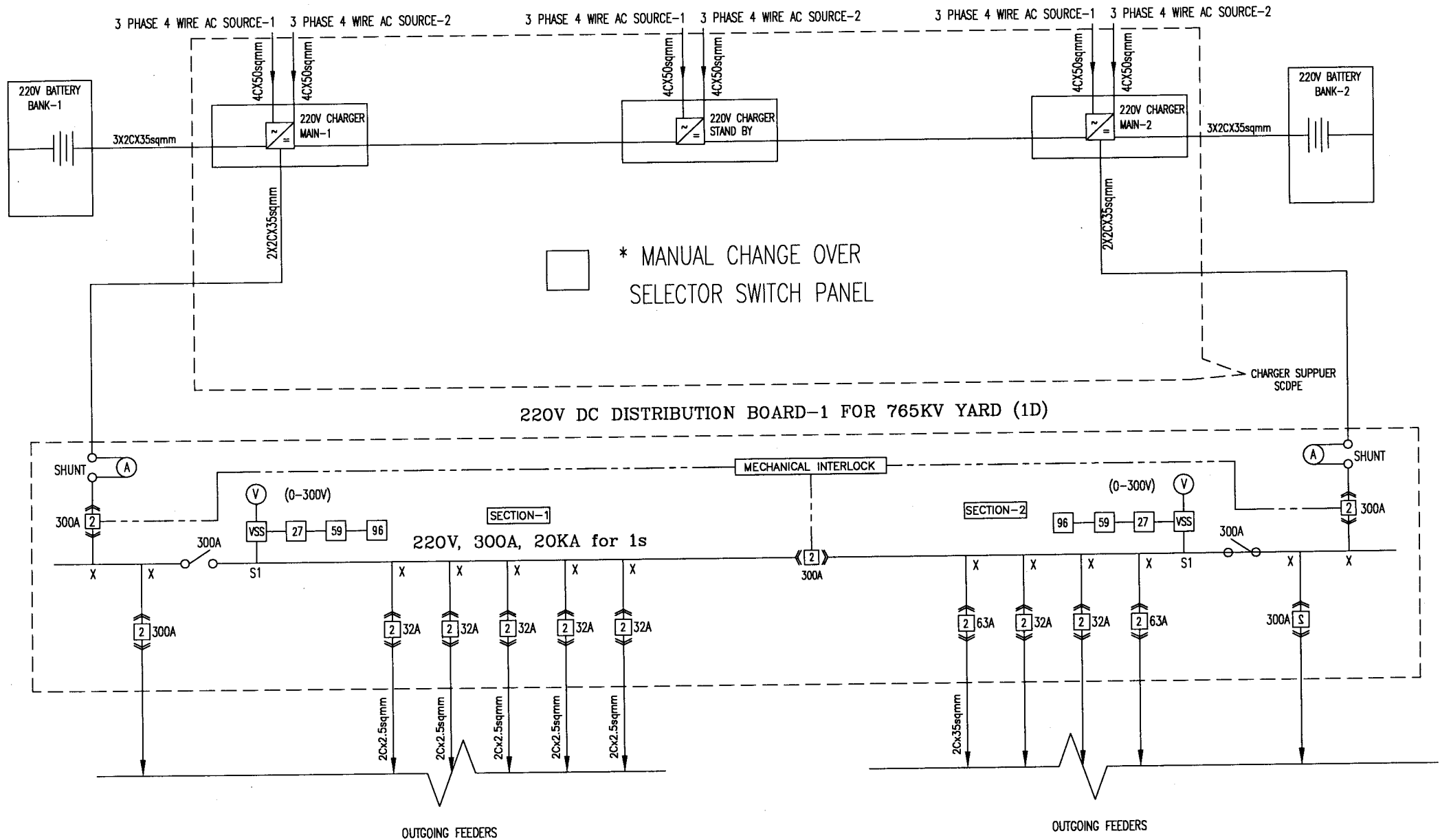
5. TECHNICAL QUALIFYING REQUIREMENT

The manufacturer whose Batteries charger are offered should have designed, manufactured and supplied battery charger generally of the type offered and having a continuous output of at least 10kW for 220V charger and 5kW for 48V charger . Battery charger shall be operating satisfactorily for two years in power sector and/or industrial installations as on date of award of contract (i.e. 31.03.2017).

Note – Bidder should quote for all type of Battery charger, Supervision of testing / commissioning and manual Changeover selector switch panel required in this tender.

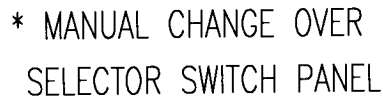
6. QUALITY PLAN

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.

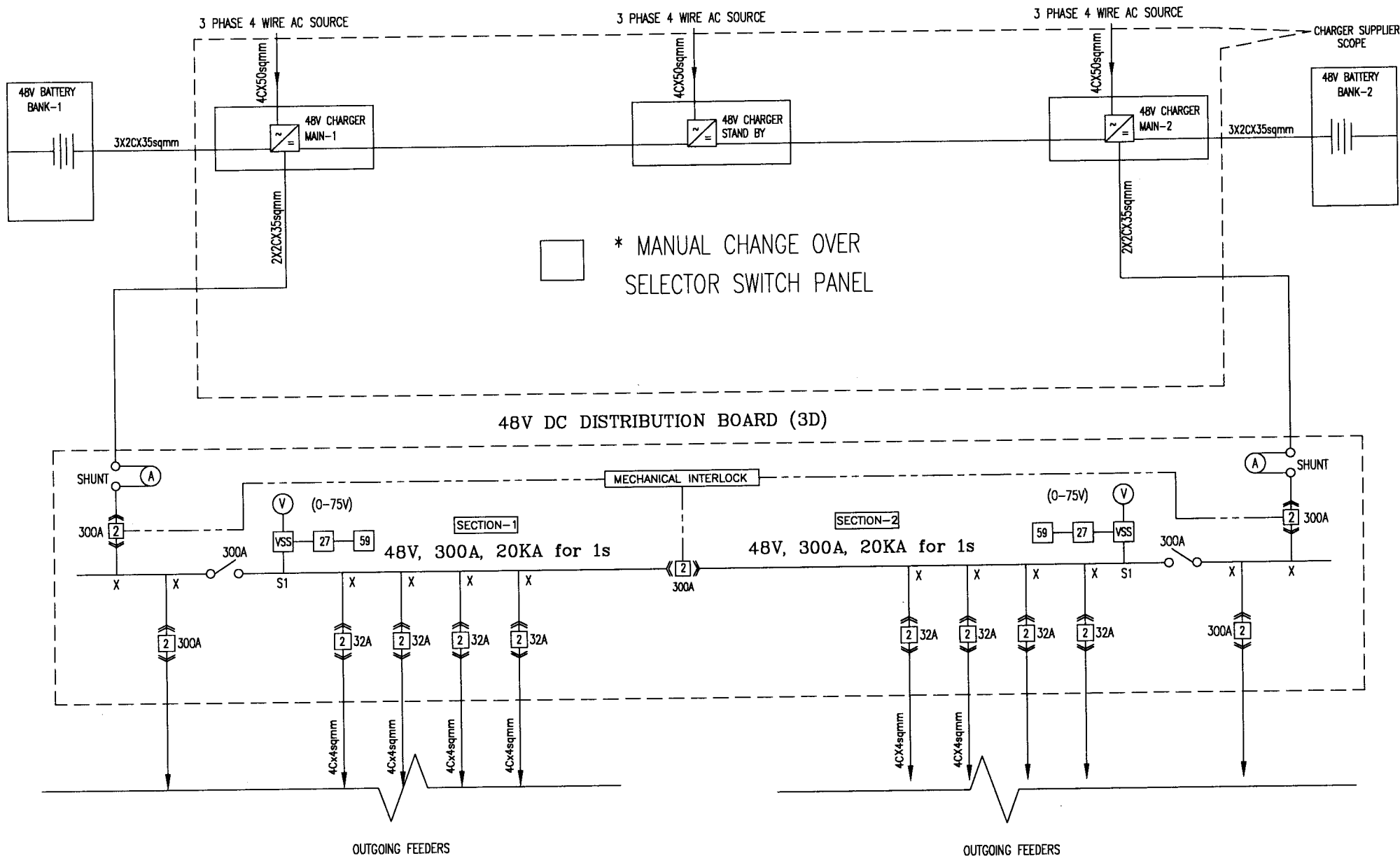


* = MANUAL CHANGE OVER SELECTOR SWITCH PANEL SHALL BE SUITABLE FOR IMPLEMENTING THE CHANGE OVER SCHEME AS MENTIONED IN NOTE -1 AND NOTE -2 OF CLAUSE NO. -3 OF SECTION -1 OF TECHNICAL SPECIFICATION.

Signature



Sarob Um



* = MANUAL CHANGE OVER SELECTOR SWITCH PANEL SHALL BE SUITABLE FOR IMPLEMENTING THE CHANGE OVER SCHEME AS MENTIONED IN NOTE -1 AND NOTE -2 OF CLAUSE NO. -3 OF SECTION -1 OF TECHNICAL SPECIFICATION.

Shoichi Uemura

TECHNICAL SPECIFICATIONS FOR BATTERY CHARGERS FOR 220V/535Ah CAPACITY BATTERIES

1.0 Intent of Specification

This section of the specification covers design, manufacture, testing, supply of battery charger with all materials and accessories required for various Stations for boost, float and trickle charging for 220V/535Ah lead acid battery set for distribution of DC supply with efficient and trouble free operation to various equipments in substations as detailed below.

1.2 Scope

1.2.1 The brief requirement for each station is detailed below :

A Charger panel consisting of a separate boost charger and separate float charger with trickle charging as detailed else where in the specification.

1.2.2 The battery charger together with the battery bank and DC distribution

Board shall constitute a 220V DC source for supply to various equipments in the main receiving stations. In addition to this, the charger shall be capable

of being used for initial charging, trickle charging and equalizing charge as stipulated by battery manufacturer. The arrangement for end cell tapping, if required will be provided, so that while boost charging, the battery AC supply voltage fails or float charger feeding loads develops trouble, at least about 84 cells ($84 \times 2.62 \text{ volts} = 220\text{V}$) are connected across the load and part of battery continue to meet the DC requirement till change over takes place and full battery is put across the load. The detailed circuit arrangement is explained else where in the specification.

1.3 CODES & STANDARDS:

1.3.1 The material shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereto.

Indian Standard	Title
ISS – 7204/1980	Stabilized Power Supplies D.C. Out put
ISS – 2208/1962	H.R.C cartridge fuse links for voltage above 650 volts

1.4 DESIGN CRITERIA

- 1.4.1 The Battery charger will constitute the DC power supply source for all stations loads.
- 1.4.2 The equipment will be installed indoor in a clean but hot, humid and tropical atmosphere.
- 1.4.3 The battery charger combination shall be such as to ensure continuity of DC supply at load terminals at all times without even momentary interruption.
- 1.4.4 Further, the voltage at load terminals shall never exceed the limits of 10% and -15% of nominal, system concept.
- 1.4.5 For connecting battery and battery charger , 30 meters of 2 core 70 sqmm unarmoured copper cable shall be used including cable for the 84 th cell tapping.

1.5 System Concept

1.5.1 The battery charger panels shall consists of the following for a system envisaged for dual battery with dual charger system such that one battery bank is always in float mode. There must be an interlock in the system such that in the event of failure of one charger, the other charger shall take care of both battery set.

- a) A Charger panel consisting of separate boost and float charger suitable for charging, equalizing charging and trickle charging of battery sets 220V 535Ah besides meeting continuous and emergency DC loads as detailed else where in the specification. The above modes of charging both automatically and manually shall be through manually operated Auto / manual selection switch.

b) The boost charger shall be capable of initially charging of the 220V/ 535AH battery at quick rate after an emergency or after a discharge test or for giving periodical curative charge once or twice a year as per battery manufacturer's recommendations.

c) The float charger shall always be connected to the DC load and shall maintain a steady voltage of 220V, plus or minus 1 % using a constant potential controller.

- d) The float charger shall be provided with an automatic current limiting facility such that when float charger output current exceeds 10% above the rated current, the float charger voltage should be brought down automatically so that the float charger output current does not exceed the set value.

e) The chargers shall have built-in automatic voltage control and loadlimiting features. The voltage regulator shall automatically sense, monitor

and regulate the D.C. voltage to within + or - 1% of the set value from No load to full load and under A.C. input supply voltage and frequency fluctuations. Load limiting features shall automatically reduce the output voltage of the charger on loads more than the rated load.

1.5.2 During normal condition the float charger shall be on and working in parallel with DC load and battery. The rating of the float charger shall be such as to meet the float charge current requirement of the battery plus the continuous DC load, the details of which is given else where in the specification. While boost charging the battery set shall be across boost charger and float charger shall be across the load.

1.5.3 During the boost charging, if there is an AC supply failure, the battery should automatically be connected to the load to maintain continuity of DC supply.

1.5.4 Further, to have battery supply across load even during short interval of change over period and if float charger develops trouble, the 84th cell of the battery should be capable of being connected through a blocker diode to the load so that under boost charging condition the float charger, the continuous DC load and battery up to 84th cell are in parallel.

1.5.5 The charger shall have provision for regenerative discharge of battery bank.

1.6 RATING :

The ratings for boost charger, trickle charger, float charger and emergency lighting change over system shall be as detailed below :

Sl. No.	Particulars	Required value
a.	Boost charger	220V, 535AH
	i) Range of voltage	190V to 300V
	ii) Continuous current rating	100 Amps @ 50 degree temp.

b.	Trickle charger and float charger	
	i) Range of voltage	200V to 280V
	ii) Continuous current rating – float	80 A @ 50 degree temp.
	iii) Trickle charger current	0-3 A

1.7 Detailed specification for charger panel.

The battery charger shall be supplied complete with all devices including but not limited to the following. If any device/components felt is required at the time of approval of drawings, the same shall be provided without any extra cost.

1.7.1 Charger : Float and Float-cum-Boost

1.7.2 Type : Solid-state, full wave, fully controlled.

1.7.3 Enclosure : Sheet steel enclosure

1.7.4 Enclosure degree of protection : IP-42

1.7.5 A.C. Input

a. Supply : 415V, 3 phase, 50 Hz, 4 wire.

b. Voltage variation : $\pm 15\%$ to $+10\%$

c. Frequency variation : $\pm 5\%$

- d. Combined voltage + frequency variation : 10% (absolute sum)
- e. Short-circuit level : 50 KA r.m.s. symmetrical.
- f. System earthing : Solidly earthed.

1.7.6 D.C. Output

- a. Float charger : Continuous D.C. load plus 25% margin plus float charging battery. (values specified)
- b. Boost charger : Restoring fully discharged battery to fullcharge condition in 10-hours with 25% margin over maximum charging rate. (values specified)

1.7.7 Performance Requirements

- a. The output voltage of the charger shall be regulated within $\pm 1\%$ of the set value for any load variation from 0 to 100% and A.C. input voltage and frequency variations as indicated above in 7.5.
- b. The ripple content in charger D.C. output shall be limited to $\pm 1\%$. The percentage efficiency of charger shall be greater than 80% at

0.8 power factor.

1.8.1 Each charger panel shall consists of –

I) Charger Panel For 220V/535Ah

- a) A Boost charger operating on AC input voltage of 415 volts -15% to $+10\%$, three phase, 50hertz, shall be capable of boost charging the battery comprising of 110 Nos. 2V 535AH lead acid cells upto a maximum cell voltage of 2.7V per cell, consisting of the following components.

- i) One No. triple pole and neutral pole ON / OFF AC
input switch of adequate rating or A.C. 3-pole miniature
circuit breaker of suitable capacity
- ii) Required Nos. of HRC fuses with base, fittings etc. for DC
output & AC input.
- iii) Three Nos. of pilot lamps for indicating availability of 3 phase
supply.
- iv) One No. AC contactor triple pole with ON/OFF push
button with O/L relay
- v) One constant potential controller for error detection, load current
detection, amplification etc., so that the Boost charger output
voltage is maintained automatically to the required value, with
input voltage variation detailed above.
- vi) One 3Ph naturally air cooled transformer liberally rated for the
rectifier rating specified with $\pm 2.5\%$ taps on input side for
input voltage correction by means of selection switch mounted
on the front of the panel which can be operated on load for
changing the taping of the input transformer.
- vii) Three Nos. ballast chokes, if required.
- viii) a) One set of 3- phase full wave bridge connected silicon
rectifier, with zener type thyristor with simple smoothing
circuits, liberally rated to meet the continuous current rating
specified with stepless voltage control.
b) One set ripple filtering device to limit the ripple content
to less than 1%.
- ix) One double pole moulded case circuit breaker backed by HRC
fuses on DC output side.

- x) A set of indicating lamps for DC on indication & A.C supply indication.
- xi) One DC ammeter moving coil type with shunt etc., for measuring DC output /charge / discharge current and one ammeter for measuring load current.
 - xii) One moving coil voltmeter with selector switch to read boost charge voltage, float charge voltage, battery tap and off and one volt meter for AC input voltage.
- b) A float charger operating on AC input voltage of 415 V **-15%** to + 10%, three phase 50Hz shall be such as to meet the float charge current requirement of the 110 Nos. 2V, 535AH and 220V/300Ah lead acid cells battery plus the continuous DC load, consisting of the following components.
 - i) One AC input triple pole & neutral pole ON/OFF switch of adequate rating rating or A.C. 3-pole miniature circuit breaker of suitable capacity.
 - ii) Three Nos. of HRC fuses with fittings.
 - iii) Three Nos. of pilot lamps.
 - iv) One No. AC contactor triple pole with ON/OFF push button with O/L relay.
 - v) One constant potential controller for error detection, load current detection, amplification etc., so that the float charger output is adjusted automatically such that the battery voltage is around 220 volts with load current and input voltage variation detailed above (both) occurring simultaneously.
 - vi) One auto manual change over switch.
 - vii) One raise / lower push button for manual operation.
 - viii) One main transformer, 3 phase, natural cooled, liberally rated for the rectifier rating specified with

+ 2.5% taps on input side for input voltage correction by means of selection switch mounted on the front of the panel which can be operated on load for changing the tapping of the input transformer.

- ix) a) One set of 3 phase full wave bridge connected silicon rectifier with zener type thyristor with simple smoothening circuit liberally rated to meet the continuous current rating specified with step less voltage control.
- b) One set of smoothing choke to limit the ripple content to less than 1%.
 - x) One moulded case circuit breaker to control float charger DC output.
 - xi) Required Nos. of HRC fuses with base fittings etc for DC output and AC input.
 - xii) One moving coil ammeter for float charger current.
 - xiii) One center zero milli ammeter to measure trickle charging current to the battery.

1.9. The battery chargers shall also comprise the following equipment.

- i) One set of single pole two way on and off, suitably rated change over switch for selection of Battery Float/ Boost mode (one for each battery bank)
- ii) A suitable volt meter with selector switch shall be provided on the panel to indicate phase to phase and phase to ground voltage of the incoming supply.
- ii) One centre zero D.C. Ammeter to be provided in the negative terminal of the battery for reading charge/ discharge current of the battery. The Ammeter range shall be **100-0-100A** for 535Ah

and 50-0-50A for 300Ah.

- iii) Internal light operated on 230 Volts single phase, 50 C/S, A.C.
system with door opening/closing ON/OFF switch.
- iv) 2 Nos. earthing lugs suitable for receiving 120 sq.mm copper conductors.
- v) Space heaters suitable for operation AC 230 V, 1 Amp, 50 c/s.
- vi) Heater ON/OFF switch.
- vii) Cable glands for all the external cables.
- viii) Single phase preventor
- ix) 1 MCCB triple pole for connection of 110th cell and 84th cell positive and for first cell negative for 110V.
- x) D.C. contactor of suitable rating for connecting 110th cell to the Positive D.C. bus, inter-locked with A.C. contactor provided in the boost charger.
- xi) 1 No. silicon blocking diode connected to 84th cell and the D.C. positive bus to maintain continuity of D.C. supply to the D.C. bus in the event of A.C. failure while boost charger in service and to avoid short circuit of 110th cell positive and the 84th cell positive.
- xii) Suitable no. of earth leakage circuits for annunciation both audible and visual with push button for reset.
- xiii) One set of milli-ammeter to indicate the leakage current when the mid point of the battery is earthed.
- xiv) A set of audible and visual alarm annunciation scheme with all necessary accessories to acknowledge reset and test scheme as also other necessary relays, with the following facia window.

- i. AC Mains fail
- ii. AC Mains fail in any phase.
 - iii. AC input fuse failure for boost charger
 - iii AC input fuse failure for float charger
 - iv Float Charger DC Fail
 - v Boost Charger DC Fail
 - vi. DC Earth Fault
 - vii Rectifier fuse fail
 - viii Rectifier control supply failure
 - ix Filter fuse fail
 - x. Blocking Diode fail
 - xi. Load Bus DC fail
 - xii. Boost charger over load
 - xiii. Float charger overload
 - xiv Under voltage of the battery
 - xv Over voltage of the battery
- xv) Necessary relays for the above shall be provided wherever necessary. Potential free contacts (minimum 3 nos) shall be provided.
- xvi) Necessary provision for self diagnostic alarm for any internal faults in the charger.
- xvii) The D.C. system shall be provided with a continuous earth leakage indicating milli-Ammeter, suitable for operation with an earth fault on either pole together with a relay to give alarm and visual indication for an earth fault on the D.C. system.

- xviii) Necessary relays for annunciation for faults mentioned above shall be provided. They shall be suitable for operation of 220V D.C. supply with + 10% to -15% variation. Necessary circuitry for canceling alarm shall be provided. On canceling the alarm, the sound only should go and lamp should continue till the fault is rectified/cleared.
- xix) Necessary contacts for SCADA operations shall be provided.
- xx) In the event of A.C. supply failure, when the battery is on boost charge, the available battery capacity shall be automatically connected to the D.C bus.
- xxi) All fuses shall be HRC non-deteriorating type. Unless otherwise specified, the fuses shall be of class-4 (80KA prospective breaking current) for A.C. circuits and class-2(33 KA prospective D.C. current) for D.C. circuits.
- xxii) A block diagram to indicate the general protection features provided for the charger shall be furnished along with the Bid.
- xxiii) The float charging equipment and boost charging equipment shall be mounted in a metal enclosed, sheet steel cubicle, indoor floor mounting, free standing type. It shall be totally enclosed, completely dust tight, weather and vermin proof. The cubicle shall be adequately ventilated with louvers to facilitate the cooling of transformers and rectifiers. The ventilating openings shall be less than 3 mm size. The panel shall be complete with internal wiring, terminal Board for internal and external connections. The panel shall be made out of suitable angles and M.S. Sheet of 16 SWG for the front, 18 SWG for the back, top and sides, and 14 SWG for the bottom. The height of the panel shall be 1800 mm and depth 600 mm and panel shall have suitable width to accommodate the charging equipment. i.e., adequate clearance / space should be provided between item to item in the charger, to facilitate easy handling at the

time of attending on repairs. The charger shall be provided with hinged type rear doors.

NOTE :

All MCCB shall be of breaking capacity of 25 KA with over load and short circuit protection.

[c) IMPORTANT NOTE :

- a) Fuses for DC output and AC input shall be brought on the front of the panel and cutouts provided.
- b) Semi conductors devices, Power failure, relay alarms on Ac failure and to disconnect all internal charger loads from battery to prevent unnecessary discharging during power failure.
- c) Printed circuit shall be accommodated in modules, plug in type, and similar modules shall be interchangeable in standard socket chasis.

1.10 INTEREFRENCE AGAINST RF-CIRCUITS:

The equipment shall be efficiently screened against interference to radio as also other communications equipment, which may be installed in the same building. All the sources of noise shall be fitted with Re-suppressors generally in accordance with relevant ISS/IEC.

1.11 Ground Bus :

For ensuring the rigid connection the minimum section of the ground bus shall not be less than 160 Sq. mm. The ground bus shall be earthed solidly and connected to the purchaser's station main earthing system through 50 x 6 mm G.I flat with 2 bolts of M12 size.

1.12 TYPE TESTS :

Type test certificates as per relevant standards shall be furnished by the tenderer. as per latest ISS.

Type tests of battery charger : Radio Frequency interference test.

b) Routine tests on Battery charger :-

All the acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of Corporation's representative. The Test Certificates submitted in triplicate for approval before despatch. Following acceptance tests shall be carried out in the presence of TANTRANSCO's officer.

- i) Insulation resistance test. (HV test)
- ii) Voltage regulation check from 0 to 100% load with $\pm 10\%$ voltage variation.
- iii) Ripple content measurement
- iv) Heat run test on current limiting value

c) Routine testson DC Distribution Panel

- i) Visual examination and Dimensional check.
- (ii) Quantitative check.
- (iii) Functional check of MCCBs, MCBs.
- (iv) Power frequency high voltage withstand test for all wiring and equipments.
- (v) I.R. Value measurement

d) Routine tests on component parts.

- a) Burning test for PCB's. Assembled PCB burning test at 70 Deg.C. for seventy-two (72) hours with loaded condition.

- a) Rapid temperature cycling tests at 70 Deg.C. and 0 Deg.C for thirty (30) minutes at each temperature for (five) 5 cycles.
- b) Routine and type test certificates for components like contactors, relays, instruments, SCR/PWM transistors, Diodes, Condensor, Potentiometer, semi- conductors, push buttons to be furnished for review whenever required.
- c) Immediately after finalisation of the programme of acceptance/routine tests the supplier shall give sufficient advance intimation atleast 15 days in advance to the Corporation to enable to depute its representative for witnessing the tests.

1.13 TENDER DRAWINGS:

Duplicate copies of the relevant drawings shall be submitted along with the tender.

1.14 DRAWINGS TO BE SUPPLIED ALONG WITH TENDER

The successful tenderers shall forward within 15 days from the date of receipt of purchase order, four sets of the drawings for the purchaser's approval. Drawings which are satisfactory for approval on the first submission will be approved and one copy of the approved prints will be returned. The drawing not satisfactory for approval on the first submission will be returned to the supplier for re-submission.

- i) Details of construction of cubicles and complete drawings of the switch Corporation indicating full details of the location switches, instruments, relays, bus bars, cable glands, support etc.
- ii) Wiring and cabling diagram for all the circuits. All devices shall be numbered according to the international convention.
- iii) Details of construction of boost and float charger

Tenders will be liable for rejection if detailed schematic drawings are not submitted.

Any shop work done prior to the approval of drawings shall be at the supplier's risk. Supplier shall make any change in the design which are considered necessary to make the equipment conform to the provisions and indent of the purchase order without any additional cost to the purchaser.

The supplier shall supply the purchaser within 15 days of receiving an approved print, one reproducible master print plus two prints of each of the approved drawings. In case the supplier resubmit a revision or change for approval, such resubmission shall be by four prints.

The supplier shall send 5 copies of approved drawings to each consignee Superintending Engineers (after approval) and also two sets alongwith battery charger while despatch.

All drawings, part lists, assembly procedures etc., shall bear a readily identifiable number etc., drawing number and each subsequent revision or addition to the drawing shall be identified by a revision number.

Checking and approval of the above documents by the purchaser is for the benefit of the purchaser and shall not relieve the supplier from full responsibility for ensuring correct interpretation of design, drawings and specifications or for the completeness and accuracy of the shop drawings and relevant specifications.

Supplier shall record all deviations, corrections, omissions, changes etc., occuring throughout the manufacturing, assembly and testing phases.

All drawings shall be in English language and in Metric System of Units.

Non-supply or part supply of drawings, literature and manuals will be deemed as incomplete supply of switchBoard.

Foundation drawings indicating the details of foundation bolts cable entries and trenches, etc.,

Elementary diagrams of all controls, metering, protection, annunciation

and other circuits, panel wise. All devices shall be according to SA CODE.

Schematic diagram's of PCB's and charger.

Dimensional outline of charger drilling diagram and special mounting arrangement if any of each type of various devices.

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SECTION-2B

48V Charger Specification

TECHNICAL SCHEME

- A. The charger(48 V / 250 A) to be supplied should be fully automatic, solid state, and SMPS Version. It should take care of full variations in the primary A.C. Input voltage. The stability of the set output voltage should be maintained from the no load of the charger to the full load and for all combinations of PLCC and battery loads.
- B. The charger shall work either as constant voltage source with current limit set at 120% of rating or as a constant current source with the compliance of voltage equal to a maximum of 70V. In constant voltage mode (normally used as float charger) output voltage can be set at anywhere within the range. The current limit is at 120% of the rating. In constant current mode (normally used for initial charging of the battery), the current may be set at any value and the charger will adjust its voltage to maintain the set current constant. The constant voltage or constant current operation is selected by means of a switch. In the constant voltage mode (used as float charger) the required number of dropper diodes can be included to boost charge the battery at a higher current while maintaining constant output voltage to PLCC equipments.
- C. The following provisions should be made in the chargers.
 1. Soft-start to avoid any voltage shoot up more than the set voltage at the time of switch on condition, with or without load. The control circuit should be suitable to prevent overshoot or undershoot or voltage spike in the event of steep increase or decrease of input voltage or load current.
 2. Two Potentiometers - one for voltage setting and another for current setting along with a constant current/constant voltage mode selector switch is provided. The voltage drops below 48V when overloading occurs.
 3. Miniature circuit Breaker for the A.C. input side, and separate circuit breakers for the PLCC load and battery should be provided. The CB should be of suitable capacity. The terminals for A.C. supply, PLCC load, battery and Earth should be clearly marked. The external connection to AC input points, PLCC load points, Battery points and earth etc. shall be made by means of sturdy good quality studs provided with washers and hexagonal nuts and not by

screw heads. The circuit breaker should isolate the charger in case of overload and component failure.

4. Selenium surge suppressors along with R.C. circuits or any other suitable device should be provided for adequate protection against transients to IGBTs, diodes and ICs.
5. A Digital voltmeter with first decimal display to indicate the D.C. voltage with a selector switch to read either load or battery voltage should be provided. The meter shall be of reputed make having class of accuracy 1.0.
6. Digital ammeters with first decimal display should be provided with selector switch for indicating the load current and battery current. This meter should have +ve sign for Battery charging and -ve sign for Battery discharging. The meters shall be of reputed make having class of accuracy 1.0.

For measuring Battery Trickle current a suitable "mA" reading Ammeter with second decimal accuracy (Analog/Digital Type) may be provided with a through/bye-pass switch.

7. All transformers and chokes should be wound with properly rated copper conductor on ferrite core and firmly fixed to the main chassis of the charger and will not emanate too much humming noise.
8. For easy replacement, the modules and the charger should be linked using connectors. Alarm annunciation should be operated only in the event of actual failures.
9. Sufficient lugs and suitable size of bolts and nuts for the input and output terminals should be provided.
10. Sufficient space for good circulation of air inside the charger should be provided so that the electronic components are not affected by conduction, convection and radiation of the heat generated by the charger. The temperature inside the charger should not exceed the normal operating ambient temperature of the static components used and should be within the insulation class of materials such as transformers and chokes as specified in the ISS/BSS.
11. When A.C. supply fails, the charger should not draw abnormal load from the battery except where the battery supply is required for control and indication purpose of the charger only. The bleeder resistor should be disconnected immediately by suitable contactor.

12. The D.C. output voltage to the PLCC load should not be beyond 54V under any conditions of load and battery current. Dropper diodes shall be provided accordingly. The number of dropper diodes should be controlled by a front panel switch to adjust the voltage in PLCC load to 54V or less. In case of A.C. failure, the dropper diodes should be automatically cutout by suitably rated power relay and full battery voltage should be available to PLCC load.

On availability of AC supply after a considerable absence period, the battery charging current so resulted shall not exceed the permitted value and this may be specifically ensured.

13. The terminal blocks for external cable connection for A.C. input and D.C. output should be mounted externally so that the side panels need not be removed. The external connection points shall be located one foot from the bottom resting level.
14. Two/Three pole MCB shall be provided in the input side.
15. All electronic components used should be of Industrial grade quality or higher.
16. Each charger should be supplied with one operating manual with details of components used in the chargers and detailed circuitry.
17. The dropper diodes are selected by a rotating switch.
18.
 - a) As the chargers are to be used in the PLCC system, the positive will be earthed. The dropper diodes shall be provided in the negative pole lead.
 - b) For the chargers meant for Microwave communication both positive and negative should not be grounded and should be in float condition.
19. Provision should be made to isolate the charger on the A.C. input side instantaneously by midget breaker, whenever the output voltage to PLCC load exceeds 56V D.C. However, during the isolation, the battery voltage should be available to PLCC load and alarm indication should be given.

20. R.F. filter on the A.C input side shall be provided for arresting Radio Frequency interference. Snubber circuits can also be provided as the equipment will be working in electrical sub-station environment where fault events are very high.
21. Power factor shall be maintained at 0.8 or above.
22. Alarm indication with LED shall be provided for A.C. mains fail, failure of fuses, Under Voltage, Over Voltage, output failure, main on, battery discharge conditions.
23. The wiring should be made with copper conductors of suitable ISS Grade or voltage class of applications. The frame should be powder coated with good quality paint.
24. Mains on/Battery Discharge Alarm Facility:

This circuit should give an alarm in the event of mains supply on but, charger due to fault in the circuit is not supplying the load current fully but the battery discharges and supplies the load current fully or even partially.
25. For over voltage and over current condition, the charger should trip.
26. The components of the chargers should be legibly identified with reference to circuit diagram.
27. IMPORTANT:

A timer circuit with delay shall be incorporated in the AC Mains Input circuit. The contacts shall be sturdy and of high speed operation without any sparking. This is envisaged to avoid dip and transient/switching surges occurring in the sub-station environment and avoid these reflections in the output DC.

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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 Kg/Sqmm
- (xii) Altitude above MSL : <1000M

(xii) Basic Wind Speed

: 39 m/s (Zone -2)

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

3.1.4 System Parameter

SL No	Description of parameters	765kV System	400 kV System
1.	System operating Voltage	765kV	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 PAINING, GALVANISING:

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

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

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

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

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

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.

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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

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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,

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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	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.

SECTION – 4
GUARANTEED TECHNICAL PARTICULARS

S. No.	Particulars	Guaranteed Value
1	Manufacturer s Type Designation	
2	Type of Rectifier and rating	
3	Input AC supply	
a)	Voltage	
b)	Current	
c)	No. of Phases	
d)	Frequency	
e)	Power Factor	
4	Percentage Tap provided on the Transformer +/- & Voltage ratio of Transformer & KVA rating	
i)	For Boost Charger	
ii)	For Float Charger	
5	Boost/Quick charge current	
i)	Minimum	
ii)	Maximum	
6	Float Charge Current	
i)	Minimum	
ii)	Maximum	
7	Trickle Charge Current	
i)	Minimum	
ii)	Maximum	
8	Rated D.C. output voltage for	
i)	Boost charger (Volts)	
ii)	Float charger (Volts)	
9	Rated D.C. output current for	
a)	Boost charger (Amps)	
b)	Float charger (Amps)	
10	Rate of D.C. voltage control for	
a)	Boost charger (Volts)	
b)	Float charger (Volts)	
11	Whether Auto/Manual feature is provided.	
12	Whether Voltage across Load is constant while Boost/Quick	

	Charging the Battery	
13	Whether Automatic change over from boost charging mode to float charging is provided when AC failure takes place.	
14a)	Allowable limits to voltage variation on A.C. side for satisfactory charging of DC side.	
14b)	Type of device on AC side	
15	Instantaneous forward voltage drop versus instantaneous current at rated service (a graph to be enclosed)	
16	Type of voltage control for Boost Charger, Float charger & Trickle Charge	
17	Instantaneous reverse current versus instantaneous reverse volts at rated service (a graph to be enclosed)	
18	Range of variation of DC voltage and device used for the same.	
19	Rated DC output for	
a)	Boost Charger	
b)	Float Charger	
20	D.C. output voltage regulation from no load to full load.	
21	Maximum ripple content in %	
22	Maximum permissible temperature rise over an ambient temperature	
23	Whether the charger is tropicalised	
24	Over load capacity.	
25	Duration of overload.	
26	Efficiency	
27	Dimensions of the charger width x Height x depth in mm	
28	Weight of the charger in Kgs	
29	Load limiting feature (please attach characteristics showing variation of voltage with increase in load)	
30	List of major accessories provided	
31	Rating & make of Thyristor	
32	Meters: Ammeter /Voltmeter	
i)	Type & Make	
ii)	Size	
iii)	Scale Range	
iv)	Accuracy	
33	Heat Sink for Boost Charger & Float Charger Whether provided	

SECTION - 5

CHECK LIST FOR 220V/48V LEAD ACID TUBULAR BATTERY

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.

Sl. No.	Parameters	220 V	48V	YES/NO	Remarks
1.	Type of battery charger	Float and float cum boost charger		YES/NO	
2.	Charger shall be suitable for lead acid tubular battery of capacity	535AH	1250AH	YES/NO	
3.	Rating of charger	100A	250A	YES/NO	
4.	1 No. of 220V or 48V charger consist	separate Float charger and a separate float cum Boost charger		YES/NO	
5.	Manual changeover selector switch panel feature to be provided	As per note sl. No. -2 of cl. No. 3 of section -1 of technical specification		YES/NO	
6.	Potential free alarm contact to be provided	As per note sl. No. -6 of cl. No. 3 of section -1 of technical specification		YES/NO	
7.	Whether OGA drawing and scheme of charger and Manual changeover selector switch panel enclosed	Enclosed		YES/NO	
8.	Bidder to comply requirements as per Technical Specification	Complied		YES/NO	
9.	Bidder will be responsible of getting approval from customer	Yes		YES/NO	
10.	All valid Type test reports as per clause no. 4 of section -1 available as on 30.09.16	Yes, available		YES/NO	
11.	Conduction of type test (if any)	Free of cost		YES/NO	

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