



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

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TITLE DATE 04.06.19 04.06.19 04.06.19

48V BATTERY CHARGER

GROUP **TBEM**

W.O. No **87007**

CUSTOMER **TAMIL NADU TRANSMISSION CORPORATION LIMITED (TANTRANSCO)**

PROJECT **400/230-110 kV Substation at Vellalaviduthi**

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Rev. Date Altered Checked Approved REVISION DETAILS

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CHECKLIST FOR TECHNICAL EVALUATION

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

Sr No	Documents to be enclosed	Bidder to check & confirm
1	Copy of Unpriced BOQ as enclosed in the Technical Specification to confirm that bidder has quoted as per BOQ OF SECTION-1	
2.	Schedule of Technical Deviation format duly signed.	
3.	Supporting documents as asked in the Technical PQR. (As per cl. No. 1.5, 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

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch and supervision of installation & commissioning of 48V Battery Charger complete in all respects for efficient and trouble free operation at site.

This section covers the scope, specific technical requirements and quantities of 48V Battery Chargers. This constitutes minimum technical parameters for the above item as specified by the customer (TANTRANSCO). The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

In case of any discrepancies between the requirements mentioned under Section-1, Section-2 and those specified in Section-3, the order of preference shall be Section-1, then Section-2 followed by Section-3 and shall be treated as binding requirement.

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

The equipment is required for the following project:

Name of the Customer : TAMIL NADU TRANSMISSION CORPORATION LIMITED
(TANTRANSCO)
Name of the Project : 400/230-110 kV Substation at Vellalaviduthi

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

1.2 SPECIFIC TECHNICAL REQUIREMENTS

Equipments and system shall be designed to meet the following major technical parameters as brought out hereunder. For detailed technical requirements, please refer Annexure-1 enclosed with this Section.

1	Nominal Voltage Rating (V)	48 V
2	Rated Current Capacity	120 A
3	Voltage regulation in	
a	- float charging	±1%
b	- boost charging	±1%
4	Short Circuit Level	
a	A.C. (for 1 Sec.)	50 kA
b	D.C. (for 1 Sec.)	25 kA
	Battery Data	
1	Rating	600 (AH)
2	Type of Battery	Lead-Acid (Tubular) type
3	Proposed method of working (Volts per Cell)	
a	Float Charging (normal)	As per Customer Spec
b	Equalising charge (occasional)	As per Customer Spec

c	Boost Charging/cell (after complete discharge)	As per Customer Spec
	Note: 220 V DC system is unearthed & 48 V DC system is +ve earthed	
	System Condition	
1	3 phase A.C. supply	415 V - 50 Hz
2	1 phase A.C. supply	240 V - 50 Hz
3	Voltage Variation	-15% to +10 %
4	Frequency Variation	±5 %
	Combined Voltage + Frequency Variation	10% (absolute sum)

It will be battery charger supplier's responsibility to ensure proper co-ordination and satisfactory operation of the offered chargers with stationary batteries procured separately by BHEL.

1.3 BILL OF QUANTITIES

Sl. No.	Description	Unit	Total Qty.
1.	48V, 120A SMPS Float cum Boost Charger complete in all respects for efficient and trouble free operation as per technical specification	Nos	3
2.	Manual changeover selector switch panel for 48V DCDB, Battery & Charger (120A) System (comprising of DC Change over switch, DC Panel etc)	Set	1
3.	Battery Discharge Resistor Unit/ Load bank of suitable rating with taps for testing (for 48V, 600AH Battery)	Nos	1
4.	Services: Supervision of Installation, Testing & Commissioning of 48V, 120A SMPS Float cum Boost Charger (1 Lot = Supervision required for 1 Nos 48V, 120A Float cum Boost Charger)	Lot	3
5.	Services: Supervision of Installation, Testing & Commissioning of manual changeover selector switch panel for 48V DCDB, Battery & Charger System	Lot	1

NOTE:

- 1) 1 Set of manual changeover selector switch panel shall be suitable for changeover selection among 3 nos Battery Chargers (1 no. Main -1 Charger, 1 no. Main -2 Charger and 1 no. Standby Charger), 2 nos Battery sets (1 no. Battery bank -1, 1 no. Battery bank -2) and DCDB with Bus Coupler section.
- 2) Refer attached Annexure-A for arrangements of Battery bank, Battery 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) Main -1 charger in float mode or boost mode shall be connected with DCDB section -1 and battery bank-1.
 - (ii) Stand by charger in float mode or boost mode shall be connected with battery bank -2 and DCDB section-2.
 - (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 feed Individual DCDB section.
- 3) Battery bank has Tap cell arrangement for boost charging of battery and DCDB load.
- 4) In float mode - Continuous DCDB loads + Trickle charging of battery.
- 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.
- 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
- 7) TB inside charger and manual 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

However, final size of cable shall be intimated during detailed engineering stage. Bidder to provide TB's of appropriate size as per the input.

- 8) Necessary provisions like Transducers etc shall be included in the charger for display of AC, DC voltage, current and mode selection in the SAS.

1.4 TYPE TESTING

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

1.5 TECHNICAL QUALIFYING REQUIREMENT

Refer Annexure: PQR_48V: Applicable for 48V Battery Charger

1.6 SUPERVISION OF INSTALLATION, TESTING & COMMISSIONING

Manufacturer of Battery Charger shall supervise the installation, testing and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for installation, testing at site and commissioning are to be arranged by Battery Charger manufacturer.

1.7 QUALITY PLAN

Bidder to follow valid TANTRANSCO/BHEL approved Quality Plan. In case the bidder don't have TANTRANSCO approved QP, it will be the bidder's responsibility to get its QP approved directly from the ultimate customer.

1.8 PROJECT TITLE BLOCK

CUSTOMER	TAMIL NADU TRANSMISSION CORPORATION LIMITED (TANTRANSCO)			
PROJECT	400/230-110 kV Substation at Vellalaviduthi			
CONTRACT NO	LOA No. CE/TR/SE/TR IV/EE3/AEE1/F.T-2004/LOA2966/D080/2018, dt. 28.06.2018			
BHEL P.O. No.		PROJ. DOC. No.		REV. No.
CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED			
VENDOR'S STANDARD TITLE BLOCK				

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Annexure: PQR_48V

TECHNICAL QUALIFYING REQUIREMENT FOR 48V BATTERY CHARGER

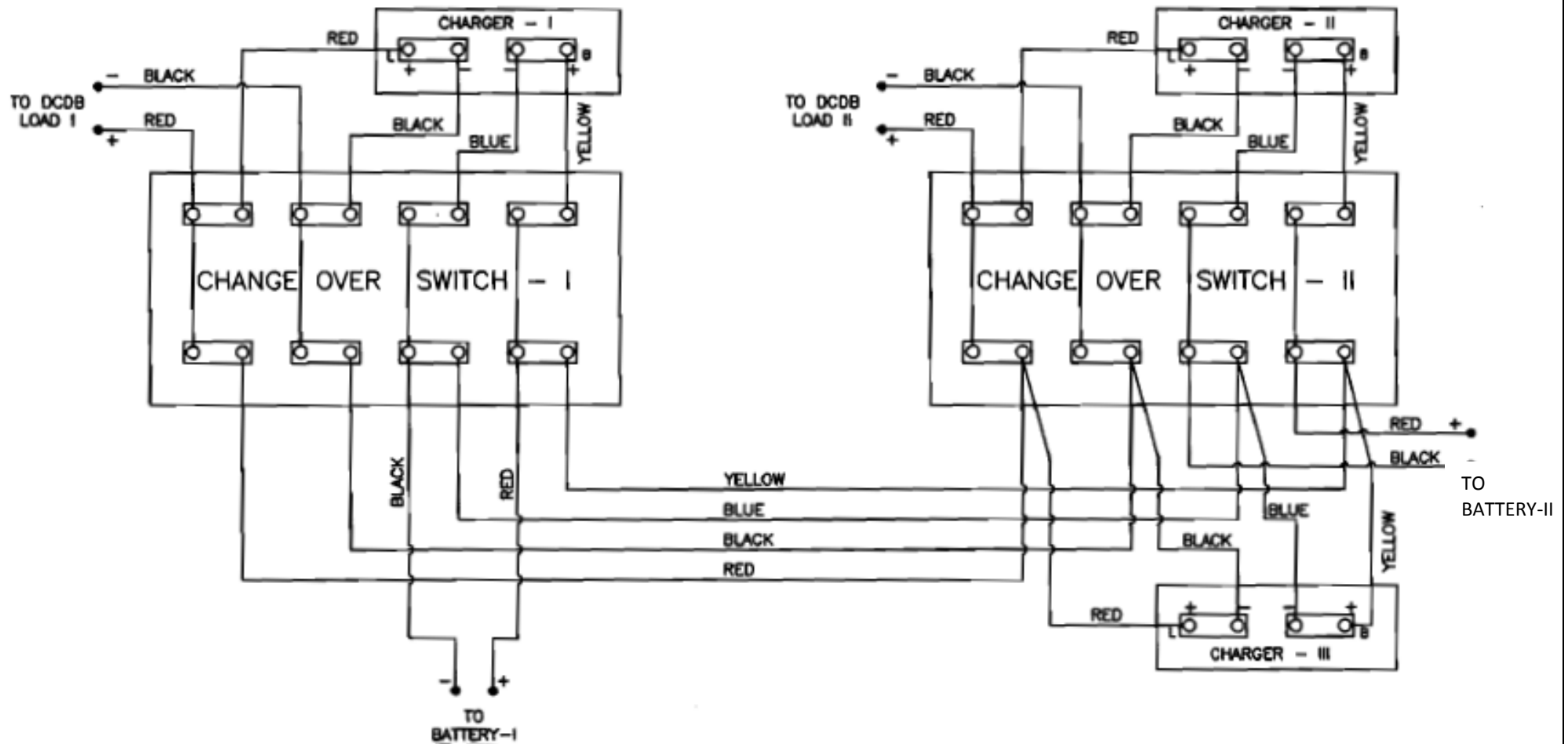
1. Bidder should have designed, manufactured and supplied 48V, 125A or higher SMPS based battery charger.
2. Bidder to submit test certificates for the test conducted at independent laboratory or witnessed by third party as per IS / International standards for SMPS based battery charger/SMPS module of 48V rating.
3. Bidder to submit at least 1 performance certificate for SMPS based battery charger of 48V or higher rating which are in satisfactory operation# for at least 2 (two) years as on the date of techno-commercial bid opening of this tender.

Satisfactory operation means certificate issued by the customer certifying the operation without any adverse remark.

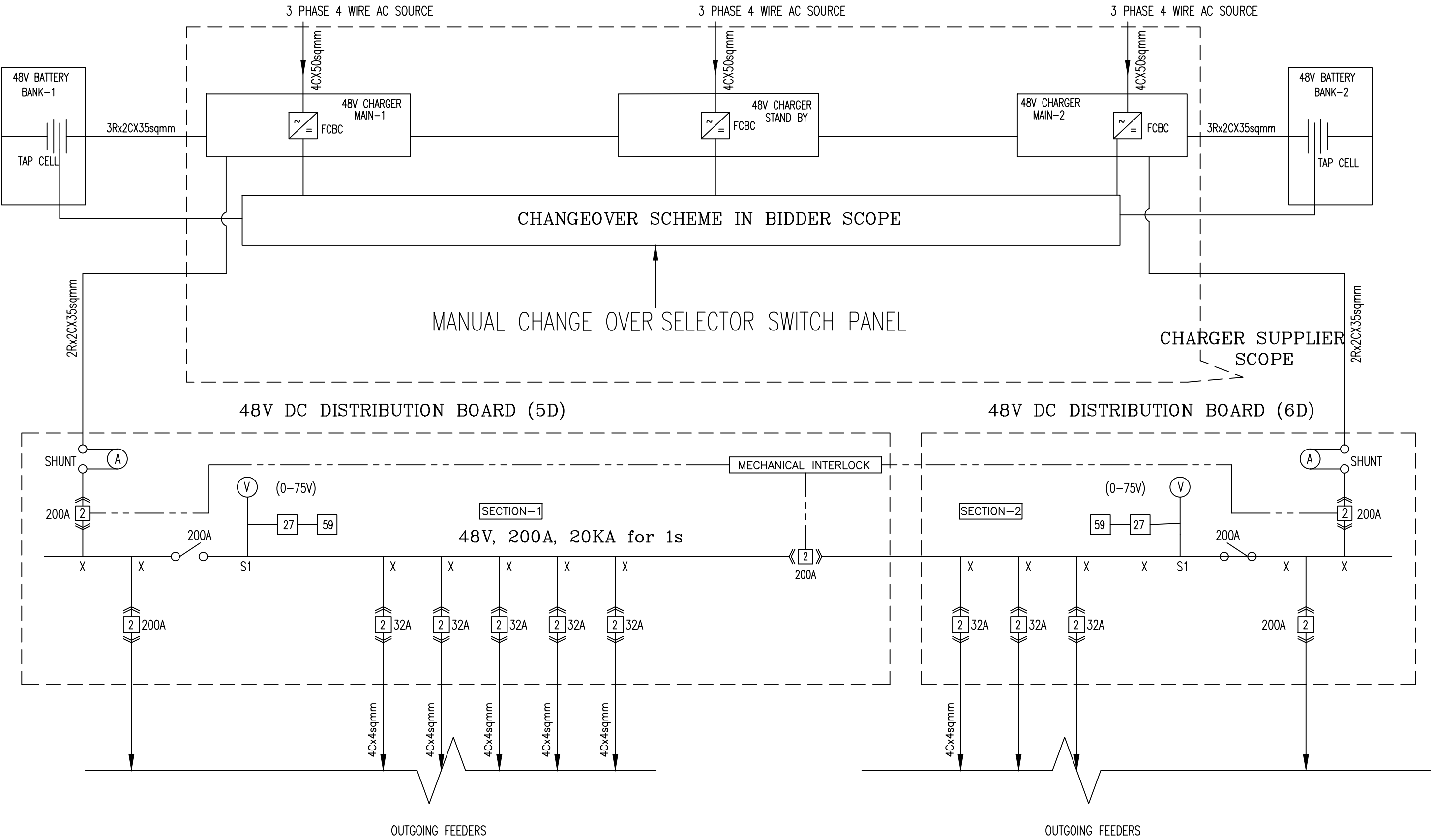
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DC DISTRIBUTION SYSTEM WITH THREEE CHARGERS, TWO BATTERY SETS AND TWO CHANGE OVER SWITCHES
(48V DC SYSTEM)



- NOTE:
1. 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. 1.3, SECTION-1 OF TECHNICAL SPECIFICATION.
 2. 48V CHARGER SHALL BE FCBC (FLOAT CUM BOOST CHARGER)

BATTERY CHARGERS TECHNICAL SCHEME

Battery data is provided for information

- A. The charger 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 shootup 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 alongwith 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/bypass 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.

&&&&&

TECHNICAL SPECIFICATION **FOR SMPS BATTERY CHARGER**

1. Input AC :i) 20A :170 to 270 V AC, 1ph, 50Hz
ii) 40A, 60,80A & 120A: 370 to 490 V AC, 3 ph, 50Hz
2. DC Output : 46V - 70V DC Continuously variable
3. Ripple : 300mv peak to peak
4. Noise voltage : 2mV phopho
5. Regulation : ± 0.3 V
6. Efficiency : 70%
7. Power Factor : 0.8 @ 230V/440V, 70V DC & full load
8. Alarm Indication :
 - a) A.C. fail
 - b) DC over voltage
 - c) DC under voltage
 - d) Output fail
 - e) Audible alarm to be cancelled
AC fail on acknowledgement
9. Rating in Amps :

	<u>20A</u>	<u>40A</u>	<u>60A</u>	<u>80A</u>	<u>120A</u>
Load Current -	10	20	30	40	60
Battery current-	10	20	30	40	60
Total current -	20	40	60	80	120
10. Initial Charging :
For initial charging of the battery
The constant current mode is to be used and the current shall be set at any value within the range

TECHNICAL SPECIFICATION FOR BATTERY

GENERAL :

This Specification covers the manufacture, testing before despatch and delivery FOR(D) of Lead-Acid Stationary Battery sets conforming to ISS 1651/1991.

The materials used for the manufacture of the Lead Acid Battery sets shall be of best class and capable of satisfactory operation on tropics with humid atmospheric condition without distortion (or) deterioration. The workmanship shall be of highest grade and the entire works in accordance with the best modern practice.

I. TECHNICAL SPECIFICATIONS:-

- i) Type : Lead-Acid
- ii) Positive Plates : Tubular plates
- iii) Negative Plates : Pasted plates
- iv) Connector : Lead plated copper connector and
Lead plated Brass nuts, bolts and washers.
- v) Initial charging : Conforming to IS:1651/1991
- vi) Accessories : Teak wood stand, cell stand insulators, cell
number plates.

2 Nos. Syringe Hydrometers, Battery Thermometer and 3V-0-3V cell testing voltmeter shall be supplied in the accessories with battery set. It may be noted that the voltmeter shall be of accuracy class not inferior to 0.5 and the resistance shall be atleast 1000 Ohms per Volt. The Thermometer shall be for measuring appropriate temperature and one division of the graduated scale shall represent at the most 1 Degree "C". The accuracy of calibration shall be not less than 0.5 Degree "C".

The Hydrometer shall be provided with graduated scale one division of which shall represent at the most 0.005 unit of Specific Gravity. The accuracy and calibration shall not be less than 0.005 unit of Sp. Gravity.

- vii) Capacity : The capacity of the Batteries are at 10Hrs discharge rate to an end voltage of 1.85V per Cell. The batteries are assembled with tubular positive, pasted negative plates and microporous PVC separators in wrapped ~~SAN hard rubber~~ containers complete with acid level indicating floats, connectors, Bolts, nuts and washers as per IS 1651/1991. The battery sets shall be supplied with battery stands made out of seasoned Teakwood, stand insulators, cell insulators and Inter-row cell connectors, in dry uncharged condition and acid for filling in separate containers (with 10% excess) as per IS 1651/1991.

- viii) Insulation : The internal insulation of the cell shall be such as to stand the heavy wear & tear. The separators shall not split (or) crush under heavy strain (or) discharge.
- ix) Terminals and : Batteries with individual cells connectors in series. Connectors by welding, soldering will not be accepted. The connectors should be such as to facilitate easy isolation of any cell, when necessary, for purpose of maintenance and shall be made of lead. Copper connectors suitably coated with lead to withstand corrosion due to sulphuric acid shall be used where the cells are called upon to discharge at very high rates. Bolts, nuts and washers for connecting the cells with intercell connectors shall be robust, made of brass material and effectively coated with lead to prevent corrosion.
- x) steel Stand : The stand shall be for single tier two row cell arrangement for all the battery sets. The stand shall be made of Stainless steel and shall be supplied well finished but without painting. However, in order to apply three coats of anti-corrosive black paint subsequently sufficient quantity of anti-corrosive black paint in separate containers shall be supplied with each stand. TNEB will arrange to paint the stands made of steel stand. The drawing of the ~~wooden~~ stand may be ~~steel~~ furnished. If any change in the dimensions of the Stainless steel stand is required, the same has to be incorporated to meet the requirements.
- xi) Electrolyte: 10% excess electrolyte in carboys for initial charging. The specific gravity of electrolyte supplied for the initial charging of the batteries shall be uniform and such as to obtain the required value i.e. 1.200 (or) as per specification of the manufacturer, equally in all the cells after the completion of the first charge itself. It shall not necessitate adding concentrated acid for obtaining required specific gravity later.
- xii) Cell containers: The containers shall be of **Sans transparent (seethrough)** (or) and shall conform to IS 1146/1981. The Type Tests for containers conforming to the requirements as per IS 1146/1981 may be furnished. The containers shall be designed such that they do not crack (or) become leaky and shall withstand normal conditions of service and will resist any acid action on them.
- The Technical particulars are specified in Annexure.

TECHNICAL PARTICULARS.
LEAD-ACID STATIONARY BATTERIES IS1651/1991

Sl. No.	Description	48V/120 AH	48V/250 AH	48V/600AH
1.	Make & Type :			
2.	Capacity	:120AH AT 10 HRS.	250AH AT 10 HRS.	400AH AT 10 HRS.
3.	Number of cells in Battery set }	24 NOS.	24 NOS.	24 NOS.
4.	Discharge capacity at 3 Hrs. Rate for end volt 1.8 volt.	: 86AH	179.25AH	287AH
5.	Discharge capacity at 10 Hours Rate for end voltage 1.85 volt }	120AH	250AH	400AH
6.	Normal charging rate	: 6 A	15 A	24 A
7.	Maximum charging rate	: 12 A	30 A	48A
8.	Normal charging time after complete discharge }	12-14 HRS.	12-14 HRS.	12-14 HRS.
9.	Recommended current for initial charging }	6 Amps.	15 Amps.	24 Amps.
10.	Time required for initial charging at the above current }	100 Hrs.	100 Hrs.	100 Hrs.
11.	Watt-Hour efficiency when discharged at 10 Hours rate	75%	75%	75%
12.	Number of rows used for the stand :	Double row	Double row	Double row

To suit 600AH

		600		
Sl. No.	Description	48V/120 AH	48V/250 AH	48V/ 400 600AH
13.	Approximate weight of Lead required per cell (kg)	: 5.5 Kg.	11.00 Kg.	17.4 Kg.
14.	Approximate weight of 0.525Kg. Antimony per cell	: 0.175Kg.	0.325Kg.	
15.	Type & Material of	: PVC Envelope	PVC Envelope	PVC Envelope separators
16.	Material of containers	:SANS transparent (seethrough)	SANS transparent (seethrough)	SANS transparent (seethrough)
17.	Amount and specific gravity of electrolyte required per cell for first filling	: 3.7 Lit. 1.190 SG at 27 Deg.C	6.9 1.190 SG at 27 Deg.C	8.5 Lit. 1.190 SG at 27 Deg.C
18.	Recommended specific gravity: at the end of a full charge	1.200	1.200	1.200
19.	Expected specific gravity at the end of the discharge at the specified rate ($\pm 0.015\%$)	: 1.095	1.095	1.095
20.	Recommended trickle charging rate for different type of working	120-480 mA	250-1000mA	400-1600 mA
21.	Overall dimensions of each: cell and complete battery set.	As per IS 1651		
22.	Distance between centres of cells when erected.	:	As per IS 1651	
23.	Weight of cell complete with Acid.	:	As per IS 1651	
24.	Recommended Maximum period of storage (dry uncharged)	: 2 Year	2 Year	2 Year
25.	Internal resistance of cell	: 1.60 m Ω	0.795 m Ω	0.535 m Ω

Sl No.	Description	48V/120 AH	48V/250 AH	48V/600AH
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Testing Equipments: (As per BOQ)

1. Voltmeter:
 - a) accuracy class 0.5
 - b) resistance per volt 1000 Ohms per volt
2. Hydrometer:
 - a) graduations reading possible. Min. 0.005
3. Thermometer:
 - a) Range: 0 to 100 Deg.C
 - b) Graduation: 1 Deg.C Min. temperature possible

SECTION – 3

PROEJCT DETAILS & GENERAL TECHNICAL REQUIREMENT

3.0 FOREWORD

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

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

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

Physical and other parameters:

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

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

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

3.1.4 AUXILIARY POWER SUPPLY :

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

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

3.2 GENERAL REQUIREMENT

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

3.0.1 The bidder shall also furnish drawings for the following:

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

3.2.2 GENERAL:

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

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

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

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

3.3 SPECIFIC REQUIREMENT

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

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

3.4 STANDARD:

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

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

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

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

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

3.5 TEST CERTIFICATE:

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

3.6 TESTS :

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

3.7 MATERIALS AND WORKMANSHIP:

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

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

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

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

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

of noise.

3.8 INSPECTION :

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

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

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

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

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

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

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

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

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

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

3.9 GUARANTEE:

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

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

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

3.10 PRE COMMISSIONING TESTING (if applicable) :

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

3.11 DOCUMENTATION :

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

3.12 PAINTING, GALVANISING :

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

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

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

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

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

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

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

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

3.13 SURFACE FINISH

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

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

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

3.14 PROTECTION

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

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

3.15 FUNGI-STATIC VARNISH

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

3.16 DEGREE OF PROTECTION

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

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

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

3.17 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

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

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

3.18 RATING PLATES, NAME PLATES AND LABELS :-

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

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

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

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

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

3.19 TERMINAL CONNECTORS :

The terminal connectors shall meet the following requirements.

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

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

3.20 EARTHING :

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

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

3.21 TERMINAL BLOCKS AND WIRING

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

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

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

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

its escape from the mounting rails.

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

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

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

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

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

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

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

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

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

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

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

3.23 SPACE HEATERS

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

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

3.24 DELIVERY OF GOODS AND DOCUMENTS RELATED THERETO:

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

3.25 INCIDENTAL SERVICES:

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

3.26 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

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

3.27 LIST OF DRAWINGS AND DOCUMENTS :

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

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

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

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

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

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

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

Following Documentation schedule to be followed

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

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

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD-2004 or Later version or any other CAD package along with conversion files for all major items. Final Documentation shall be submitted in bound volumes with details of Customer & Project etc. written on top.

3.28 QUALITY ASSURANCE PLAN :

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

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

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

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

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

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

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

3.29 TEMPERATURE RISE :

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

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

3.30 FITTINGS AND ACCESSORIES :

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

Operation mechanism housing complete with:

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

3.31 PACKING AND FORWARDING:

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

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

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

3.32 SPECIFICATION FOR NITRYL BUTYL RUBBER

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

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

AFTER AGEING

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

Schedule of guaranteed Technical particulars of 48V Chargers.

Battery

Sl. No.	Particulars	
1.	Manufacturer's type of 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	
	Minimum	:
	Maximum	:
6.	Float Charge Current	
	Minimum	:
	Maximum	:
7.	Trickle Charge Current	
	Minimum	:
	Maximum	:
8.	Rated D.C. output voltage for	
a)	Boost charger (Volts)	
b)	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.
- 14) a) Allowable limits to voltage variation
on A.C. side for satisfactory charging :
of DC side.
b) 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 Charger :
- 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 48V BATTERY CHARGER

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	48 V	YES/NO	Remarks
1.	Type of battery charger	Float cum Boost Charger	YES/NO	
2.	Charger shall be suitable for Lead Acid Tubular Battery of capacity	600AH	YES/NO	
3.	Rating of charger	120A	YES/NO	
4.	Charger type	SMPS	YES/NO	
5.	Manual Changeover Selector Switch Panel feature to be provided	As per Cl. No. 1.3, Section-1 of Technical Specification	YES/NO	
6.	Potential free alarm contact to be provided	As per Note at Sl. No. 6, Cl. No. 1.3, Section-1 of Technical Specification	YES/NO	
7.	Necessary provisions shall be included in the charger for display of AC, DC voltage, current and mode selection in the SAS.	As per Note at Sl. No. 8, Cl. No. 1.3, Section-1 of Technical Specification	YES/NO	
8.	Whether OGA drawing and scheme of charger and Manual changeover selector switch panel enclosed	Enclosed	YES/NO	
9.	Bidder to comply requirements as per Technical Specification	Complied	YES/NO	
10.	Bidder will be responsible for getting approval from customer	Yes	YES/NO	
11.	All valid Type test reports as per Cl. No. 1.4, Section -1 available as on 21.08.17	Yes, available	YES/NO	
12.	Conduction of type test (if any)	Free of cost	YES/NO	

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

SECTION - 6
SCHEDULE OF TECHNICAL DEVIATIONS

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

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Tenderer's Stamp & Signature