

# TRANSMISSION CORPORATION OF ANDHRA PRADESH LIMITED

O/o The Chief Engineer/ Telecom & IT,  
Vidyut Soudha, Vijayawada.

## U.O to Chief Engineer/ Construction,

Sub:- APTransco – Telecom – Supply, erection and commissioning of i) 220/132 kV Substation at Penukonda with connected 220 kV DC single Moose line from 400 kV Hindupur SS ii) 220 kV DC line of twin moose from 400/220 kV Hindupur SS to existing 220 kV SS Gollapuram, iii) 220 kV DC/SC line of twin moose from 400/220 kV Hindupur SS to existing 220 kV SS Hindupur iv) 220 kv Single moose DC line from 400 KV Hindupur to 220 kV Pampanurtanda SS – Gauranteed Technical Particulars and Drawings of 48V/50A Charger and 48V/300AH Battery sets Submitted by M/s Amararaja Power Systems Ltd., - Scrutinized and communicated – Reg.

Ref: - 1. Lr.No.CE/Const/EE/Designs/D.No.250/2019, Dt.11.07.2019.

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With reference to the letter cited, the Gauranteed Technical Particulars and Drawings of 48V/50A Battery Chargers and 48V/300AH Battery set Submitted by M/s Amararaja Power Systems Ltd., are scrutinized and the remarks are herewith communicated.

Guaranteed Technical particulars (DRS)			
Sl.No.	Description	Document No.	Remarks
1.	Amara raja make 48V/50A Dual Float Cum Boost Charger (FCBC-1 and FCBC-2) with Dropper Diode circuit, AC Distribution & DC Distribution boards	-----	i)Colour Should be Light Grey – 631 of 1S5 instead of Silver Ash colour  ii) Protection should be IP-42 instead of IP-30
2.	Bill of Material Report		
a.	48V/50A FCBC-1 PH-2W-FCBC-1		Scrutinized
b.	48V/50A FCBC-1 PH-2W-FCBC-2		
c.	48V Switching Cubicle +DD Ckt+ACDB+DCDB-48V/50A		
3.	GTP of 48V/300 Ah Battery Set	IAE/GTP-PS/2019-20	Battery Set (1+1) Shall be Supplied



**Amara Raja Power Systems Limited, Tirupati**

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**DRAWINGS**  
**FOR**  
**APPROVAL**

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**Rating : 48VDC/50A DUAL FLOAT CUM BOOST  
CHARGER WITH IN-BUILT DCDB & ACDB  
(Suitable for 48V/300AH VRLA Battery of 24cells)**

**CUTOMER : APTRANSCO**

**PROJECT : SUPPLY OF 220/132KV SUBSTATION AT PENUKONDA**

**S.O. NO : PHYDS/000326/18-19**

**PO No : LOA No:CPT-150/SE PM/ICB 7/F.Penukonda/D.No.262/19  
Dated:06/02/2019**

**S.O. No. : PHYDS/000326/18-19**

**JOB No : 18-2001P**

**Manufacturer : AMARA RAJA POWER SYSTEMS LIMITED  
Renigunta - Kadapa Road, Karakambadi – 517 520  
Tirupati, Andhra Pradesh, India, Ph: 0877-2265000  
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## **TABLE OF CONTENTS**

<b>SL. NO.</b>	<b>DESCRIPTION</b>
1.	GENERAL DESCRIPTION
2.	TECHNICAL SPECIFICATION
3.	CHARGER THEORY
4.	AMARARAJA SUB-VENDOR LIST
5.	SCHEMATIC DRAWINGS
6.	BILL OF MATERIALS
7.	DIMENSIONAL DRAWINGS
8.	BATTERY DRAWINGS
9.	BATTERY CHARGER QAP
10.	BATTERY QAP



## GENERAL DESCRIPTION

The Battery Charger is for charging the Battery in various modes and at the same time, to supply the load requirement. The system basically consists of Two Float cum Boost Chargers, One DC Distribution Board and One AC Distribution Board. Each Charger consists of Double Wound Input Transformer, Rectifier Bridge Circuit, Filter Circuit, AC Input Circuit Breaker and DC Output Fuse.

The Battery Chargers works from 160-270V AC, Single Phase, 50Hz Supply. The Chargers are capable of delivering the full rated load at the specified voltage at output terminals. This voltage is maintained for AC Input variation of 160 to 270V AC and Load variation from 10 to 100% of rated full load.

## PRINCIPLE OF OPERATION

During normal operation, one of the Chargers will be in ON condition, supplying to Load and Battery charging requirements and other charger is made OFF. If main charger fails to supply DC power, then standby will automatically come into picture and take over the functions of failed charger without interruption to the load.

## BATTERY CHARGING

Provision is there to select the type of Battery being charged and according to selection, charging voltages and current limit values can be adjusted using potentiometers.

Suppose if the Battery Selector Switch is at VRLA position, provision is there to change the Battery either in Auto Mode or in Manual Float or in Manual Boost depending upon AUTO/FLOAT/BOOST Selector Switch position. In auto mode, battery can be charged automatically either in float or boost depending upon the current drawn by the battery. Provision is also there to select float or boost manually through the same AUTO/FLOAT/BOOST Selector Switch.

Suppose if the battery selector switch is at Station Battery position, then provision is there to select float or boost or equalize modes manually through FLOAT/BOOST/EQUALIZE Selector Switch. Battery current limit can be adjusted to desired value from 20 to 100% of charging current through battery current limit potentiometer, provided inside the cubicle.

**IT IS RECOMMENDED TO ISOLATE THE LOAD DURING EQUALIZING CHARGING OF THE BATTERY.**

## DROPPER DIODE CIRCUIT

Adequately rated dropper diodes are provided in the load path to limit the output voltage to load acceptable level i.e. 52V DC. Necessary shorting contactors are provided to bypass the dropper diodes during Mains failure and battery float charging. The no. of dropper diodes which are to be connected can be controlled by a master voltage detector card, which is provided before the dropper diode circuit, which senses the load path voltage continuously.

All the above components are housed in three different cubicles of equal height and depth, constructed with sheet steel of CRCA. The cabinets are provided with front and back door for easy accessibility and maintainability. All the meters, meter selector switches, control switches and mimic panel are provided on the front door. Terminations for AC Input, DC Output and Battery Input are provided at the bottom of the cabinet.

*All the three cubicles shall be connected with each other.*

# TECHNICAL SPECIFICATION OF THE BATTERY CHARGER

Type : DUAL FLOAT CUM BOOST CHARGER WITH DROPPER DIODE CIRCUIT, AC DISTRIBUTION & DC DISTRIBUTION BOARDS

Rating : 48V/50A Dual FCBC (FCBC-1 and FCBC-2)  
(Suitable for 48V/300AH VRLA Battery of 24 Cells)

## 1. AC INPUT

- a. Voltage : 160 – 270V AC (230V AC + 18%, -31%)
- b. Frequency : 50Hz  $\pm$  5%
- c. Phase, Wire : Single Phase

## 2. DC OUTPUT

### a. Float cum Boost Charger – 1 & 2 for VRLA Battery

- i. Float Voltage : 48V to 54V DC adjustable
- ii. Boost Voltage : 50V to 56V DC adjustable
- iii. Regulation : Better than  $\pm$  1% of set value for line variation of 230V AC  $\pm$  10%
- iv. Ripple : Less than 5mV Psophometric without Battery
- v. Current : 50A

### b. Float cum Boost Charger – 1 & 2 for NVRLA Battery

- i. Float Voltage : 48V to 57V DC adjustable
- ii. Boost Voltage : 50V to 58V DC adjustable
- iii. Equalize Voltage : 56V to 65V DC adjustable
- iv. Regulation : Better than  $\pm$  1% of set value for line variation of 230V AC  $\pm$  10%
- v. Ripple : Less than 5mV Psophometric without Battery
- vi. Current : 50A

c. *System O/P voltage:* Max. 52V (VRLA)/54V (NVRLA) DC + 2V at load terminals after Dropper Diode Circuit

c. *Efficiency* : Not less than 75% at full load at nominal AC Input

3. METERS : Following analog type meters of 96 x 96 with 90° deflection and  $\pm$ 1.0% accuracy class will be provided in the system for measuring the respective parameters:

DC Voltmeter with Selector Switch  
DC Ammeter with Selector Switch  
Battery Charge / Discharge Ammeter

4. INDICATIONS : Clustered LED Lamps will be provided at AC Input for Mains ON condition. LED Indicators will be provided for the following conditions with audio alarm for abnormal conditions:

### In FCBC – 1 & 2

- a. Rectifier Fuse Blown
- b. DC Over Load
- c. Charger Fail
- d. Filter Capacitor Fuse Blown

### Common

- a. DC Over Voltage
- b. DC Under Voltage / Battery Low
- c. AC Mains Fail



**5. PROTECTIONS :** Following protections will be provided in the system:

- a. AC Input Circuit Breaker (MCB) for both FCBC-1 & 2
- b. Fast acting Semiconductor fuses for the rectifier bridge for both FCBC-1 & 2
- c. DC OV Cutback protection for both FCBC - 1 & 2
- d. Charger DC Output fuses for both FCBC - 1 & 2
- e. Under Voltage Protection (i.e. Isolation of Battery from Load)
- f. Battery Path Current Limit with Potentiometer.
- g. DC Over Load for both FCBC - 1 & 2
- h. Filter Circuit Fuses

**6. CONTROLS & :  
SWITCHES**

- a. AC input MCB for both FCBC - 1 & 2
- b. Float/Boost Selector switch for both FCBC - 1 & 2
- c. Float, Boost & Equalize Voltage variable POTs
- d. Battery Current limit adjustment POT.
- e. Battery Current limiting ON/OFF Selector Switch.
- f. Battery Input ON/OFF Rotary Switch
- g. DC Over Voltage Reset Push Buttons.
- h. Lamp Test Push Button
- i. Door Lamp Push Button for both FCBC - 1 & 2
- j. Alarm Silence Push Button

**7. SPECIAL FEATURES**

- a. Soft start on DC side
- b. Class-F insulation for all Magnetics
- c. Automatic Voltage Regulation using digital controlled logic.
- d. Filter circuit to limit ripple
- e. Separate Battery path current limiting
- f. Automatic changeover from float to boost and vice versa, based on current drawn by the battery for VRLA Battery.

**8. DC DISTRIBUTION BOARD**

**Outgoing Feeders : 6A - 1P - MCB - 18 Nos.**

**9. AC DISTRIBUTION BOARD**

**Outgoing Feeders : 6A - SPN - MCB - 6 Nos.**

**10. GENERAL**

- a. Cabinet : Free Standing, Floor Mounting Type, Sheet Steel Construction, easy access for Installation and Maintenance, Cable Entry at bottom.
- b. Colour : Silver Ash light grey colour - 631 of ISS
- c. Protection : IP-30 42
- d. Temperature : 0 to 50°C  
range of Operation
- e. Relative humidity : 0% to 95% non-condensing.

Checked

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**DES-1  
DESIGNS**

**DES-2  
DESIGNS**

**DES-3  
DESIGNS**

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APTRANSCO, Vidyut Soudha,  
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## CHARGER THEORY

The system basically consists of two similar Float cum Boost Chargers and a Battery Bank. The both chargers are similar in nature and works on the same principle. These chargers are rated to meet the requirement of Load and Battery charging current as specified. For clear understanding of system description, refer schematic drawing enclosed.

The Float cum Boost Charger - 1 & 2 are of full wave half controlled configuration and having constant voltage/current limit characteristic depending upon the mode of operation. Each Float cum Boost chargers consist of double wound input step down transformer, SCR/Diode rectifier bridge, charger control board, Auto/Float/Boost selector switch, LC filter circuit, AC Input Circuit Breakers, Battery input ON/OFF switch, Blocking diode, DC output fuse and Alarm Circuit.

The Float cum Boost chargers - 1 & 2 are connected to the AC input power through (CB 401/501). The Input transformer (T401/501) step down the input AC Voltage to the required level and is connected to the rectifier bridge (SCR/V 401-402/501-502) through Fast acting Semiconductor Fuses (FU 401/501). The charger control board PC 401/501 provides gate signals to these SCR's at appropriate timing depending on the output voltage/current feed back. The Rectifier DC is connected to DC filter (L 401 & 402/ 501 & 502 and C 403 & 405/ 503 & 505/C 1) which in turn filters out all Harmonics and provide DC voltage with low ripple content as specified. The Blocking diode (V404/504) prevents reverse current flow into the charger. The output voltage of Float cum Boost Charger is adjusted using the potentiometer R 401-402/501-502 respectively.

The shunt SH 401/501 provides the current feedback to the charger control board PC 401/501 which causes the unit to go into current limit beyond the set value. This characteristics causes the output voltage to go down when the battery is run down, so as to maintain a constant level of charging current.

The Battery ammeter P2 with shunt SH 1 provided monitor the battery charge and discharge current. The DC voltmeter P1 monitor the output voltages FCBC-1/FCBC-2/Load/Battery through selector switch(S1).The DC ammeter (P 3) monitor output currents of FCBC-1/FCBC-2. Battery current limit adjust potentiometer (R13) is provided with selector switch to limit the Battery current.

The system is having LED indicators for different operating conditions. An audio alarm is provided which can be heard during any fault conditions. All fault conditions and indicators are derived through the alarm control board (PC 6). This PC 6 consists of triggering and reset circuit for alarm. For any indication of fault condition this board supplies power to the corresponding LED and activate the alarm for faulty condition.

Alarm can be disabled by pressing the alarm silence pushbutton (PB 2), however, the LED will be glowing continuously until the fault is rectified. Lamp test push button (PB 1) is provided to test the alarm and LEDs connected through PC 6.



## **PRINCIPLE OF OPERATION**

During normal operation Float cum Boost Charger - 1 is in ON condition and Float cum Boost Charger - 2 is made OFF. During this operation FCBC - 1 supplies the Load current and battery charging current. If FCBC - 1 fails FCBC - 2 will automatically come into operation without interruption to Load. During mains failure condition, load is supplied by the Battery Bank.

During normal operation the FCBC-1 supplies load current as well as trickle (Float) current to the battery. At this stage the output of FCBC-2 is made OFF. The common mode selector switch (SW 4) is kept in Auto Mode (FCBC-1 in Auto position) to select the battery-charging mode (Float or Boost) automatically based on battery condition.

The Master Auto current detector board PC 1 senses the battery charging current, through Relay board and whenever the Float charging current is more than the preset value, it changes the status of its Relay potential FCBC-1ee contacts and the batteries starts getting charged in Boost mode. Whenever the battery is fully charged and charging current comes down the preset value the current detector board PC 1 changes its Relay contacts status and makes the boost charger OFF.

Provision is available to put the batteries in Boost Charge mode manually by using the selector switch SW 4. This manual mode overrides the battery condition and switches ON the boost charger and the batteries will be kept in boost mode. Whenever the FCBC-1 fails the FCBC-2 goes into Float mode automatically and starts supplying the load and battery charging current.