

TECHNICAL SPECIFICATION

A. TECHNICAL SPECIFICATION FOR 30 V, 35A AUTO AND MANUAL FLOAT-CUM-BOOST BATTERY CHARGER

1. Scope: The specification covers the design, manufacture, testing at the Manufacturer's works, delivery by road transport to different sites of West Bengal State Electricity Distribution Company Limited for Auto and Manual Float cum Boost Battery Charger. 30 V DC output in Float Mode: Continuous 21 Amp load and trickle charging current for Battery. Boost Charge Mode: Continuous load of 21 Amp and Battery Boost Charge current of 14 Amp. In addition to above, the Charger is capable of delivering short time current of 40 Amp for 1 second for tripping of breaker and lighting purpose.

Supervision and erection of devices shall have to be undertaken by manual acceptance of terms and conditions for the same, if required.

APPLICATION:

The system requires a reliable and uninterrupted D.C. supply for supplying D.C. Power to emergency lights, closing and tripping coils of circuit breakers, relays etc.

2. Service conditions:

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Maximum ambient temperature (Degree C)	50
Maximum temperature in shade (Degree C)	45
Minimum Temperature (Degree C)	3
Relative Humidity (percent)	95
Maximum Annual rain fall (mm)	1450
Maximum wind pressure (kg/sq.m)	150
Maximum altitude above mean sea level(Meter)	1500
Isoceraunic level (days per year)	50
Seismic Level	The sites fall within seismic zone-III and IV as classified in the IS:1983
Moderately hot and humid tropical climate conducive to rust and fungus growth	

3.0 Standards:

Unless otherwise specified, the equipment shall conform to latest applicable Indian standard of equivalent IEC, British or USA standard and in particular to the following standard (or equivalent IEC British, USA standard):

IS:3895/1966	Specification for the rectifier equipment
IS:9224	Specification for HRC fuses.
IS: 1248	Indicating instrument.
IS:375 /1963	Specification for wiring
IS: 4540/1968	Mono crystalline semiconductor rectifier assemblies
IS:2026	Transformers
IS:13947/ 1993	Air Break Switch/Contactor
IS: 5/1978	Colour for ready mix paint
IS: 5421/1981	Printed circuit board
IS: 8828/1993	Miniature circuit breaker
IS:2147	Degree of protection for cubicle
IS:6619	Safety code for semiconductor rectifier equipment

The tenderer shall clearly state the standard to which the equipment offered by him conforms.

4.1 SUPPLY: AC input: 240 volts +20 % & - 25%, 50 HZ +/- 5%, Single phase supply. Input power factor 0.7 minimum at rated load.

4.2 CHARGER SYSTEM OPERATION:

4.2.1. The Battery Charging Equipment shall be float-cum-Boost type with facility to supply the DC continuous load of 20 Amp also. During normal operation, the Battery is floated across the Battery charger at 34.5 V (2.3 V per cell) and should be compatible for battery as per specification) and also supplies the load current 21 Amps. Whenever the battery has run down, it needs to be boost charged passing higher current of 14 Amps, into batteries for higher voltage up to 42 V (2.75V maximum per cell). The charger shall provide this extra voltage for Boost charging.

4.2.2 During boost charging, voltage across the battery terminal will go higher at the order of about 42 volts for which suitable Automatic solid state transistorized dropping device shall be provided (maintain 30 Volts +2/- 0V volts across the load terminal).

4.2.3 Battery Charging Equipment shall be fully automatic for Float and Boost charging facility with suitable indication on front of the panel by means of LED

indication. For this, automatic solid state changeover relay shall be provided. During AC mains fail, Battery supplies the load and gets discharged. The extent of discharge depends on the duration of power failure and the current drawn by load. When the mains are restored after power failure, Battery shall put on automatically on boost mode. During this time, load voltage shall be maintained by load regulator $30\text{ V} \pm 2\text{ Volt}$. After the Battery gets fully charged i.e. its voltage reaches 42 Volts, it should automatically switch over to trickle mode & when Battery voltage falls below 27 volts, the charger should automatically switch over to Boost mode. Soft start feature shall be provided in the system.

4.2.4. The manual mode should be fully independent so that no element of electronic controller comes into its operation. This shall also include an independent full wave bridge rectifier of suitable rating, output of which will be connected to load and battery by means of a contactor controlled switch on the front panel. Output of the charger in manual mode shall be maintained below 35 volts by means of selector switch connecting the suitable tap on the secondary side of power transformer by the operator. Facility should be provided to prevent the excessive in-rush current into the battery, when the discharged battery suddenly comes across the float charger after an emergency period.

4.2.5 The battery charger shall have one top and one bottom for Manual & Auto Bridge circuit. The bottom module (Auto mode) shall be so connected to the top/other modules that if necessary, it can be taken out for repair by simply disconnecting few links. Each arm of the bridge shall be provided with filter circuit as well as fuse protection in order to rectify the fault if any, at the earliest opportunity.

4.2.6 There shall be 4(four) nos. Feeder specific outgoing MCBs to cater DC load as and when needed. Out of 4(four) nos., 3 nos. shall be provided with 32 Amp. MCB for protection circuit and one number with 6 Amp MCB for emergency light without changeover. The above MCBs considered excluding Battery circuit.

4.2.7 Automatic changeover of DC load requirement of substation to Battery in the event of Mains power failure should be without any break. i.e should be made without incorporating any relay in the output DC supply.

4.2.8 Automatic changeover of output to charger supply with restoration of incoming power supply and after meeting short time current requirement from battery.

4.3 **RATING:** 30V DC output, 35 Amp Auto & Manual dual automatic float cum boost Battery Charger.

a) Type : Thyristor controlled

b) At Load Terminal:

During Float charging or Boost charging, the load voltage shall be maintained $30\text{ V} \pm 2\text{ Volt}$ for AC input voltage variation of +20% & -25 % and load variation of 0 to 100 %. Also system shall provide 35 Amps continuous current and also momentary current of 40 Amps for one second.

c) At Battery Terminal:

Trickle charge voltage 34.50 volts (2.3V per cell) at 400 mA maximum. Boost charge voltage 42 volts (2.75 V per cell) at 14 amps.

d) RIPPLE:

The ripple content in the DC output of Battery Charger shall be limited to 2 % RMS.

e) Regulation: +/- 2%

f) Efficiency: More than 70%

g) Method of cooling :Natural air with proper ventilating arrangement

5.1 COMPONENTS:

5.1.1 The Battery charger shall comprise of following components but not limited to the same:

- a) Double pole AC circuit breaker for AC incoming of the battery charger (MCB) with auxiliary potential free contact for indication to SCADA. MCB ratings shall be suitable for 3kA rupturing capacity at 30V DC.
- b) Single phase, double wound, Air Natural Cooled, Vacuum impregnated transformer of CRGO lamination and copper winding.
- c) Single phase, full wave half controlled SCR bridge of 40A rating (Silicon controlled rectifier) together with suitable heat sinks and RC suppression network to take care of momentary high load of 40 Amp. All the electronic components shall be of high MTBF or heavy duty type and liberally rated.
- d) Automatic solid state voltage / current controller for automatic control of voltage and current during float/ boost charging the batteries complete with manual control facility.

- e) Auto /manual mode selector switch (25 A AC rating) with Indication lamp/ LED for respective position.
- f) Float/ Boost indicator lamps/LED.
- g) Potentiometers to adjust DC output voltage and current in respective modes.
- h) Battery charging current and voltage requirements are to be regulated by using voltage current feedback loops.
- i) Smoothing (filter) circuit comprising of smoothing choke, and filter condenser to reduce ripple content in the DC output of the Battery charger to 2% RMS.
- j) DC moving coil Ammeter of 0-25A rating and 72 sq. mm. for load and 0 to 50 A battery current.
- k) DC moving coil Voltmeter of 0-50 V rating and 72 sq. mm. with selector switch and HRC fuse to measure voltage of Charger/ Battery and Load.
- l) Solid state automatic load voltage regulator to maintain the load voltage of $30\text{ V} \pm 2\text{ V}$ (rating of the regulator shall be 20 A continuous and 40 A for one second) during Float charging or Boost charging of the Batteries.
- m) Double pole DC circuit breaker for Battery protection (MCB) with auxiliary potential free contact for indication to SCADA.
- n) DC contactor to by-pass automatic load voltage regulator in the event of AC mains fails to allow the full battery across the load. There should not be any discontinuity of DC supply to the bus bar during any transition period and battery power should be available for tripping circuit, if necessary, even during boost charging.
- o) AC analog Voltmeter 96X 96 sq.mm of rating 0 to 300 V.
- p) Fuse fail indication lamp/ LED for load and Battery fuses.
- q) The indicating instruments shall be of class 1.0 accuracy.
- r) The following provisions conforming to relevant IS shall be made on the front panel:-
 - (i) Voltmeter to indicate battery/ charger DC voltage.
 - (ii) Voltmeter for Input AC supply voltage.
 - (iii) Ammeter to indicate Charge/Discharge current of Battery.
 - (iv) Ammeter to indicate load DC current.

5.1.2 The Charger shall be provided with following LED of reputed make
Indication:

- (i) Supply of power -- Green
- (ii) Charger on -- Green
- (iii) Battery reverse polarity
- (iv) Input power supply fail – Red
- (v) Output over/under voltage
- (vi) Earth fault

5.1.3 Audio/ Visual alarm to indicate:-

- (i) Power failure.
- (ii) Charger failure.
- (iii) Battery disconnection/failure.
- (iv) DC under/Over voltage.
- (v) Condenser Fuse failure.
- (vi) In case of failure of charger on fault, it should give buzzer as well as LED indication. However, the buzzer alarm should be provided for battery fuse fail, load fuse fail and charger trip due to overload indication with an accept and reset switch. The charger shall have provision for an alarm relay contact for remote Indication. Suitable terminals with identification label shall have to be provided.

5.1.4 Controlling arrangement for following functions shall be provided:-

- a) Auto/Manual Selector Switch
- b) Manual operation controlling device
- c) Accept/Reset push button
- d) Voltmeter selector switch

5.2 a. Wiring: Charger cubicle shall be supplied completely wired upto terminal block for purchaser's external connection using solder less crimping type copper lugs. All wiring shall be carried out with 750 V grades PVC insulated multi-strand copper conductor of 2.5 Sq mm and shall be flame/ vermin proof. All wiring shall be neatly bunched without affecting access to equipment/ components mounted within the cabinet. The Charger DC output circuit for Battery and load connection separately shall be wired with 6.00 sq.mm PVC insulated cable.

Suitable two earthing terminal and outgoing terminal shall be supplied to connect the external supply cables.

Control/Indication/Annunciation circuit shall be wired with suitable size of PVC insulated cable as per scheme requirement. Colour coded wires should be used to facilitate easy tracing, as under:-

- i. Single Phase A.C. Circuit:-
 - (a) Yellow for Phase
 - (b) Green for Earthing
 - (c) Blue for Neutral
 - ii. D.C. Circuit:-
 - (a) Red for Positive
 - (b) Black for Negative
 - iii. Control Wiring:-
 - (a) Gray for annunciation and other control circuits.
- b. Ferrules: Embossed/Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted at both ends of each wire.
- c. Termination:
- The input, battery and load terminals shall be located in easy accessible positions. The terminals shall be properly labelled for easy identification of Input (Ph & Neutral), Battery (positive & negative), Load (Positive & negative) and Emergency Lamp (Positive & negative).
 - The terminals shall be rated at 25 Amps or more depending on scheme requirement.
 - The Input terminals shall be connected to a 3 core PVC insulated multi-stranded copper conductor cable (minimum 2 mtr. length) with a 16 Amp 3 pin plug socket at the other end. The earth conductor of the cable shall be provided on the charger body.
 - The charger shall incorporate terminals and fuse of 4 Amp rating for connecting wires from outside to bring emergency light into battery circuit in the event of mains failure.
 - All control cables should run through the bottom side of the Charger cubicle with proper gland arrangement.

5.3 Special Feature:

- a) All printed circuits boards used in the Battery charger shall be solder marked, glass, epoxy, FR 4 grade copper clad material having edge type gold plugging connectors conforming to latest IS-IEC specifications. All assembled PCB conforming coating on component side & epoxy varnish on the other side with suitable protective coating for protection against humidity and corrosion.
- b) Transformer shall be with class-B insulation having a continuous rating at least 125% of the rating of the charger. Reactance of the transformer shall be suitable to take care of regulation and surges. The power transformer rectifier unit of the battery charger shall be designed

for adequate VA rating but in any case it should not be less than 4000 VA and should be rated for 300 V at factor of safety of 3.

The heat dissipation and power control system should be designed with a factor of safety of 8. Rating of silicon diode should not be less than 40 A. Please note that necessary documentary evidence, showing transformer rating of 4000 VA along with test certificate from manufacturer, if bought-out, shall be enclosed, for approval of the purchaser.

c) Tenderer shall furnish full description and illustration of all components complete with quantity, make, rating, type, tolerance etc. including, but not limited to the list of components given below.

d) Following make of components shall be used in the Battery charging equipment or equivalent approved by C.E. (P&E) WBSEDCL.

i)	Switches	Kaycee/ Recom
ii)	Meters	AE/IMP/USHA/RISHAV
iii)	Contacts /Relay	L&T/Siemens/ABB/C&S
iv)	MCB	MOS/ABB/Siemens/L&T
v)	HRC fuses	S&S/Bussman/Siemens/L&T
vi)	SCR	USHA/HIRECT/IR/Semicon
vii)	Diode	USHA/KELTRON/IR/Semicon
viii)	Lamps/LED	Essen/vaishna/Siemens/L&T/Emco
ix)	Filter condenser	Rescon/Elcon/Kendil
x)	Potentiometer	Pankaj
xi)	Voltmeter A.C.	IMP/AE/Rishav/ Mecco

e) All other bought out items shall conform to the relevant IS and of reputed make subject to approval of C.E. (P&E) WBSEDCL.

f) a) The charger cubicle will be indoor type with all associated and auxiliary equipments mounted therein.

b) The charger cabinet shall be 2 mm. thick sheet steel for Non – Load bearing members & 3 mm for Load bearing members enclosed and shall be dust and vermin proof. The maximum overall dimension of the charger shall be height-1500 mm. Width – 700 mm. and depth - 600 mm.

c) The cabinet shall be free standing floor mounting type with a provision for proper ventilation. Backside Cover will be double door type. Necessary arrangement on front, back & top side shall be provided for easy access to different components for repair/maintenance etc. The enclosures of the cabinet shall provide at least degree of protection IP-42 as specified in IS: 13947.

d) All doors, removable covers and plates shall be provided with neoprene gasket all around. Louvers, when provided shall have screens and filters. The screen shall be of fine wire mesh made of G.I. wire.

- e) All sheet steel work shall be degreased, pickled phosphate and then applied with two coats of Zinc primer and two coats of finishing epoxy powder coating or polyethylene protective coating of light gray as per IS : 631, both inside and outside. The cabinet legs shall be of adequate height and strength and should provide minimum clearance of 500 mm from ground.
- f) All fuses shall be of HRC cartridge types conforming to IS: 2208 mounted on plug type fuse bases.
- g) Electrical indicating instruments shall be flush mounted on panel with only flanges projecting. Dial shall be white with black number and lettering.
- h) Control and instrument switches shall be of rotary type.
- i) Indicating lamps shall be LED type with low watt consumption. The LEDs shall be provided with series resistors.
- j) Strip type space heaters of adequate capacity shall be provided inside cabinet to prevent moisture condensation.
- k) All door mounted equipments as well as equipment mounted inside the cabinet shall be provided with individual labels with equipment designation engraved on aluminium/plastic plate (stickers are not acceptable).
- l) POLARITY MARKING:-

The polarity marking of the terminals shall be marked for identification. The positive terminal may be identified by “**P**” or **(+)** sign or **Red** colour mark and the negative terminal may be identified by “**N**” or **(-)** or **Blue** colour. Terminal marking shall be permanent and non-deteriorating.

m) TERMINALS

Battery charger cabinet shall be provided with two separate suitable earthing terminals. Separate terminals shall be provided for connecting load and battery leads to the charger. All terminals shall be of M12 size. Suitable copper lugs shall be provided by the supplier for use of the purchaser for connecting the load wiring. It would be the bidder's responsibility to prove the adequacy of its design by submitting all technical particulars and relevant graphs to show suitability of charger for supplying load on continuous basis.

The following documents shall be necessarily enclosed along with Tender Submission:

- i) General Arrangement and cross sectional drawing showing

device positions, dimensional details and erection arrangement of Charger.

- ii) Schematic diagram of charger showing different components
- iii) Wiring diagram of the charger including ferrule numbering
- iv) operation & maintenance manuals
- v) Type test report.

n) All Deviations from this specification shall be set out by the bidder and should be brought out clearly in the Deviation sheet.

5.4 Method of cooling of charger equipment shall be specified by the bidder.

6.0 Technical Particulars of Matching Lead Acid Cell Battery for 30 V, 100 AH

6.1 Standard rating

15 nos. 2 volts, 100AH at 27 Deg C when discharged at 10 hours with final cell voltage not less than 1.85 Volts.

Range of charging Current and Final Cell voltage

- a) Range of Float Charging : 80mA to 240mA
- b) Range of Boost charging
 - i) Starting Current : 14 Amp
 - ii) Finished rate : 7 Amp.
- c) Cell voltage at the end of charge
 - i) Float charge condition : 2.3 V per cell
 - ii) Boost Charge condition : 2.75V per cell
- d) Permissible cell voltage at : 1.75V
the end of discharge

6.2 Ampere Hour capability of each cell of Battery

Amp-Hour Capacity	100AH
Discharge duration	10H
Final Voltage	1.85V

7.0 Nameplate Information

Battery Charger nameplate information shall be determined in agreement with the Employer. This information may include for example:

- Name of manufacturer and country
- Type, design, and serial number

- Rated frequency
- Rated Output Voltage and Current
- Purchase Order number and date
- Month and year of supply
- Property label: 'Property of WBSEDCL'
- Guarantee : Five years

8.0 Type Tests:-

The following tests shall constitute the type tests as per IS: 3136-1965 and IS:4540-1968 (latest amended):

- a) DC voltage current test.
- b) Automatic voltage regulator operation.
- c) Efficiency test.
- d) Ripple Voltage test.
- e) High Voltage test.
- f) Temperature rise test.

9.0 List of Routine Tests as follows:-

- Physical checking of charger as per approved drawing.
- Insulation resistance test.
- High voltage test (2.0 KV).
- Line regulation test at No Load and full load in test at load in Float/ boost mode.
- Full load ripple content measurement test at load terminals in float and boost mode.
- Voltage regulation test at load terminal and Battery terminals in float and boost mode.
- DC short circuit test without blowing HRC fuses and without tripping MCBs at load terminal and also at Battery charger output terminals with observation of total current limit.
- Efficiency measurement test at full load and 20% load.
- Checking of automatic operation Float to Boost, Boost to float mode as per Battery condition.
- Checking of Battery voltage, load voltage and Load current Boost Mode at different charging current.
- Temperature rise test of complete charger at full load current (21+14) Amp @ ambient temperature.
- Checking of battery & Load Terminal voltage in manual Mode operation at different position of Manual Mode Selector Switch.
- Checking of automatic connection of Battery to load in case of 'Mains Failure' or Charger Trip' conditions.

- Checking of Float voltage setting range and Boost current setting Range in Automatic Mode.
- Any other routine test shall be carried as per IS: 4540 on the complete battery Charging equipment.

9.1 For acceptance of lot all above routine tests shall be carried out on selected 2 samples.

10.0 Testing Facilities:

The Bidder must clearly indicate what testing facilities are available in the works of manufacture and whether the facilities are adequate to carry out all Routine, Acceptance Tests. These facilities should be available to WBSEDCL's Engineers, if deputed to carry out or witness the tests in the manufacturer's works. If any of the tests can not be carried out in the manufacturer works, Bidder shall have to arrange for such testing at any NABL Accredited/ Govt. Test House or Laboratory at Bidder's cost.

11.0 Inspection :

All tests and inspection shall be made at the place of manufacturer unless otherwise specially agreed upon by the manufacturer and WBSEDCL. The manufacturer shall provide the WBSEDCL all reasonable facilities, without charge to satisfy him that the material is being supplied in accordance with this specification.

12.0 Tests:-

General: The equipment including all components and accessories shall be subjected to all type of tests including Routine and acceptance tests in accordance with provision contained in relevant standard.

12.1 Type Test: The Bidder shall have to submit along with their Tender documents, as pre-requisites, the complete Type test Reports as stipulated as per Clause No.8.0 of the specification, carried out within 5 years from the due date of Tender, from CPRI/NABL accredited/Govt. recognised Test House or Laboratory on the offered Item, failing which their offer may not be technically acceptable. However, in case of failure to submit the same, submission of type test report on 20.5 Amp Auto & Manual Float-cum-Boost Charger during submission of Tender is essential.

If the Tenderer fails to produce the said type test report on the offered item during submission of tender, he will have to submit the said type test report before opening of price bid at his own cost.

12.2 Routine and acceptance Tests: Routine & acceptance tests shall have to be carried out in compliance with provision contained in the relevant standard and / or to ascertain satisfactory performance of the offered

device at the works of the Manufacturer.

The acceptance tests shall have to be conducted in the presence of authorised representative of the WBSEDCL before effecting delivery.

13.0 Drawings:

The successful bidder shall have to submit the 6(six) copies of drawings, manuals, literatures for approval to the office of the Chief Engineer (P & E) for approval before starting manufacture of the equipment. It is desired that the complete schematic of the charger is provided on a permanently laminated/engraved plate of suitable thickness which has to be bolted/riveted at the four corners on the inside face of rear door. In addition, one more plate of similar type and dimension shall be provided on the outside of the rear door providing guidelines and instructions for operation of the charger. The guidelines and schematic to be provided on the plates shall be as per approved drawings.

Before despatch of the equipment, 6(six) copies of drawings, manual and literature shall be submitted to WBSEDCL for distribution to different offices of the Company.

In addition to above, every crate of complete set of equipment shall also contain in waterproof folder, 2(two) sets of drawing, manuals and literature for commissioning, operation and maintenance at site.

14.0 PERFORMANCE GUARANTEE:

Battery Chargers shall be delivered to the various consignees of WBSEDCL and shall be suitably packed to avoid damages during transit. The Battery Charger with all its integral part will be guaranteed for the period of 5 years from the date of last dispatch.

In the event of any defect in any integral part of the equipment arising out of faulty design, materials, and workmanship within the above period, the supplier shall guarantee to replace or repair the same to the satisfaction of the WBSEDCL. However, any engineering error, omission, wrong provision, etc. which do not have any effect on the time period, shall be attended to as and when observed/pointed out without any price implication.

15.0 GUARANTEED TECHNICAL PARTICULARS:

The bidder should fill up the details in schedule A – ‘Guaranteed Technical Particulars’ and the statement such as “as per drawing enclosed”, “as per WBSEDCL requirement”, “as per IS”, “as per specification” etc. shall be considered as details not furnished and such offers will be rejected.

16.0 Schedules:

The Bidder shall fill in the following schedules, which is part and parcel of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.
Schedule A ----- Guaranteed Technical Particulars.

17.0 QUALITY ASSURANCE PLAN:

17.1. Immediately on receipt of this order you shall have to submit a “Quality Assurance Plan” indicating the specific quality control procedure and practices adopted in the major activities of production to ensure its standard.

17.2 The successful Bidder shall within 30 days of placement of order, submit following information to the purchasers.

(i) List of raw material as well as bought out accessories and the names of sub suppliers selected from those furnished alongwith offer.

(ii) Type test certificates of the raw material and bought out accessories.

(iii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection. The quality assurance plan and purchaser's hold points shall be discussed between the purchaser and supplier, before the QAP is finalized.

17.3 The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing of the fully assembled equipment.

Schedule 'A'

GUARANTEED TECHNICAL PARTICULARS OF 30V, 35 A (14A+21A) BATTERY CHARGER SUITABLE FOR 30 VOLT 100 AH LEAD ACID PLANTE TYPE BATTERY

Sl. No.	Description	Particulars
1	Name of manufacturer	
2	Type of charger	
3	Indicate specification to which the offered charger conforms	
4	Rated Input supply voltage	
5	Rated Input current	
	Input Power Factor	
6	Output voltage with range of variation	
7	Output current range	
8	Output current a) Max. Battery charging current b) Max. continuous DC external load current c) Max. continuous output current	
9	Output voltage Regulation a) No load b) Full load	
10	Ripple factor	
11	Efficiency	
12	Method of Cooling	
13	Painting details	
14.	Whether separate terminals of M-12 size for connecting load and charger leads to the battery terminals has been provided.	
15	Provision of LEDs for indication purpose	
16	Provision of Audio/ Visual alarm	
17	Provision of labels for individual components	
18	Provision of ferrules	
19	Provision of separate terminals for connecting battery and load	
20	Provision of two separate Earthing terminals	
21	Weight of the complete charger	
22	Overall dimensions of battery charger	
23	Thickness of the sheet enclosure	

24	Make and rating of Miniature Circuit Breaker for AC Input supply	
25	Make & rating of main transformer	
26	Make and type of rectifier SCR	
27	Rating of rectifier SCR in Amps	
28	PIV value of rectifier diode	
29	Output in Amps of complete rectifier stack	
30	Make, Type & range of Voltmeter	
31	Expected service life of Charger	
32	Commitment for availability of spares during service life	
33	Applicable Standards	
34	List of accessories to be provided with the Charger	
35	Recommended particulars of matching Battery	
36	Technical particulars of different components including make, type and rating	
37	Description of operating principle of Auto/Manual float cum boost charger with functions of different components supported by drawing and block diagram	

Place:
Name of the Company:

Signature with Date:
Name & Designation:

Seal of the Company: