



ODISHA POWER TRANSMISSION CORPORATION

TECHNICAL SPECIFICATION

FOR

220 & 48 V VOLTS LEAD ACID PLANTE & 48 V

VRLA TYPE STORAGE BATTERY ALONGWITH

BATTERY CHARGER

I- a) 350AH/ 220 & 48 V BATTERY (FOR 132 and 220KV S/S)
 b) 645 AH for 220 & 48 V BATTERY(FOR 220 KV & 400 KV S/S).
 c) 48 V, 300 AH,Maintenance Free VRLA Type Battery.

II- BATTERY CHARGER SUITABLE FOR 350 AH & 645 AH for
 220V & 48 V
 LEAD PLANTE ACID & 48 V, 300AH VRLA Type STORAGE BATTERY

CONTENTS

Clause No.	Part A	TITLE
		[Lead Acid Plante & VRLA (48 V) Storage Battery)
A1.		SCOPE.
A2.0.		Standards
A3.0.		Installations
A4.0.		Particulars of the System
A5.0.		General Requirement of the equipments.
A6.0.		Details of specifications of plante Batteries.
A7.0.		Design & construction details.
A8.0.		Installation of battery.
A9.0.		Connectors.
A10.0.		Accessories.
A11.0.		Maximum Short circuit current.
A12.0.		Ventilation.
A13.0.		Capacity.
A14.0.		Charging.
A15.0.		Life.
A16.0.		Instruction Manuals.
A17.0.		Transport.
A18.0.		Tests.
A19.0.		Drawings/documents.
A20.0.		Guaranteed Tech. Particulars.

Part – B [CHARGER]

Clause No.	TITLES
B.1	Brief description
B.2	Arrangements
B.3	Cubicle
B.4	Design and constructional details
B.4.8	Charger panel
B.5	Transport
B.6	Tests
B.7	Drawings / documents
B.8	Special tools, plants, and spares
B.9	Guaranteed Technical particulars
B.10	Deviation from specification
B.11	General Technical requirements for Battery Charger

ANNEXURES

I	GTP for 220V Lead Acid Plante storage battery.
II	GTP for Battery Charger
III	Quantity and delivery schedule
IV-A	Calibration status of meters & equipments for testing of battery.
IV-B	Calibration status of meters & equipments for testing of battery charger.
V-A	Check list towards Type Test reports for battery.
V-B	Check list towards Type Test reports for battery charger.
VI	Check list for delivery schedule

PART – A
TECHNICAL SPECIFICATION FOR 220 VOLTS LEAD ACID PLANTE STORAGE BATTERY

A.1. SCOPE :

- A.1.1. These specifications cover the design, manufacturer, assembly, shop testing at manufacturer's works before despatch, supply and delivery at SITE and erection testing and commissioning of 220 volt lead Acid Plante Storage battery.
- A.1.2. The scope of supply shall include all parts and accessories etc. which are usual and necessary for erection, operation and maintenance of the battery banks and the chargers, as specified, above though not individually and specifically stated or enumerated.

A.2.0. STANDARDS :

2.1. The equipments shall comply in all respects with the latest edition of relevant Indian Standard Specifications except for the modifications specified herein. The equipments manufactured according to any other authoritative national / international standard which ensure an equal or better quality than the provisions of these specifications shall also be acceptable. Where the equipment offered conform to any other standard, salient points of differences between the proposed standard and the provisions of these specifications shall be clearly brought out in the tender. A Xerox copy of such standards [in English shall be enclosed with the offer].

2.2. A LIST OF RELEVANT STANDARDS IS GIVEN BELOW :

- | | | |
|--------|---------------------|---|
| [i] | IS-1652-1991 - | Specification for stationery cells and batteries, lead Acid type with Plante Positive Plates |
| [ii] | IS : 266-1993 - | Specification for Suphuric Acid. |
| [iii] | IS-6071-1986 - | Specification for synthetic separators for lead acid batteries. |
| [iv] | IS:1069-1993 - | Specification for quality tolerances water for storage batteries. |
| [v] | IS:1146-1981 - | Specification for rubber and plastic containers for lead acid storage batteries. |
| [vi] | IS:8320-2000 - | General requirements and methods of tests for lead-acid storage batteries. |
| [vii] | IS:1885-Part-8/1996 | Electro technical vocabulary-stationary cells & batteries. |
| [viii] | IEEE-485/1983 - | IEEE recommended practice for sizing large lead storage batteries for generating stations and sub-stations. |

A3.0 INSTALLATIONS :

- A3.1. Equipments covered under these specifications shall be suitable for indoor installation.

A4.0 PARTICULARS OF THE SYSTEM:

A4.1. One set of 220 Volts, 350AH and 645 AH capacity battery alongwith equipments such as boost charger, trickle charger shall be sufficient to cater to the DC power requirements in the Sub-stations as proposed. The system offered should be suitable to OPTCL system.

A.5.0 GENERAL REQUIREMENTS OF THE EQUIPMENTS :

General requirement of the different components of the Battery system are given below.

A5.1 One set of 220V,350 & 645 AH lead acid type plante storage battery set is required for meeting the D.C. load requirements of indicating lamps, emergency lighting, relays, alarms, circuits breakers etc. The battery shall be kept in healthy conditions with the help of the existing float charging unit. The existing boost charger unit shall supply quick charging current to bring back the battery to fully charged conditions after it has discharged to a considerable extent while meeting the emergency load. The battery shall meet practically all the heavy current demands, as required for operation [closing and / or operating of circuit breakers, emergency lighting load and field flashing load etc). It should be noted that, the 220V batteries are to be accommodated in the Battery Room and should operate satisfactorily over the entire range of ambient temperature of 0° C to 50° C and relative humidity of 95%.

A.6.0. DETAILS OF SPECIFICATIONS OF PLANTE BATTERIES Type Battery:

6.1. The batteries shall be made of closed type lead acid cells with 'plante' type plates manufactured to conform to IS: 1652-1991.

6.2. CAPACITY :

6.3. The capacity of the batteries shall be as follows :

- | | | | |
|------|-----------------|---|--|
| [i] | Voltage. | - | 220V/48 V |
| [ii] | Output at 27° C | - | 350AH/550AH at 10 hrs. discharge rate. |

The batteries shall normally remain under 'floating' condition with the 'trickle' charger supplying the continuous load. However, the batteries shall be capable of supplying the following loads under emergency conditions without any assistance from the chargers and without their terminal voltage falling below 200 V [90% of rated voltage]

350AH/645AH

[I] I stage [continuous]- 35A for 10 hours. ,65 A for 10 hours

[ii] Stage emergency - 15A for 3 hours for lighting.

6.4. The number of cells for the 220 V/48V batteries shall be so chosen that for the nominal floating voltage of the cells, the battery voltage shall be 237.5V/51.85V and for the minimum [discharged condition] voltage of the cells, the voltage of the battery shall not be less than 198V/43.2V, while the assigned rating of the battery bank can not lowered below its rated voltage of 220/48V volts.

A7.0 DESIGN AND CONSTRUCTION DETAILS : (For Plante Type)

7.1 **Containers** : The containers for the cells shall be of impervious, moulded transparent, plastic/glass material having heat-resisting, high strength, non-reacting and low inflammable properties conforming to IS-1146-1981. The containers shall be mounted on insulators blocks. The containers shall be of robust construction and free from flaws, bubbles or foreign matter. The surface of the containers shall have a finish substantially free from blisters, rough spots, scales, blow holes and other imperfections or deformations. The handle bars, if provided, shall be of such that sufficient sediment space shall be available and the batteries will not have to be cleared out during their normal life. Battery containers shall be subjected to type, Routine and Acceptance Tests as per the requirements of IS-1146-1981. The containers of the label attached firmly to the containers shall be marked with the information as per requirements of cl No. 2.2 of the above standard. The supplier's manufacturer's test certificates shall be submitted by the tenderer for the scrutiny of the purchaser.

7.2 **Plates** : The positive plates shall be of pure lead lamelle type with plante formation. The negative plates shall be pasted antimonial-lead Grid type so designed as to hold the active material securely in place and in firm contact with the grid during service. The plates shall be designed for maximum durability and shall not buckle during all service conditions including high rate of discharge and the fluctuation of load.

7.3 **Separators** : The separators shall be of synthetic material conforming to the latest edition of IS-6071-1986. These shall permit free flow of electrolyte and would not be affected by the chemical reaction inside the cell and shall last for indefinite time. The internal resistance factor of the separators shall assure high discharge characteristics under all operating conditions. Proper arrangement to keep end plates in position shall be furnished by the bidder alongwith his offer.

7.4 **Electrolyte** : The electrolyte shall be prepared from the battery grade sulphuric acid conforming to IS-266-1993 and shall have a specific gravity of 1.2 at 27°C. The sulphuric acid of battery grade shall be colourless liquid. The concentrated sulphuric acid on dilution with an equal volume of distilled water shall be free from suspended matter and other visible impurities. The sulphuric acid shall meet the requirements of columns – 4 and 5 Table –1 of IS-266-1993. The requisite quantity shall be despatched in non-returnable containers suitably packed and marked as per the requirements of the above Indian Standards. The container materials and packing shall be subject to approval of the purchaser.

Sufficient quantity of distilled water conforming to IS-1069-1993 shall be supplied in non-returnable containers to correct the level of electrolyte during initial testing and commissioning. The material of containers and packing shall be subject to the approval of the purchaser.

7.5. **Plate group bar with terminals** : The plate group bar with terminals shall conform to IS-1652-1991. The positive and negative terminals shall be clearly marked for easy identification. The legs of the plates of like polarity shall be connected to the load, turned to a horizontal group

bar having an upstanding terminal post adopted for connection to the external circuit. The group bars shall be sufficiently strong to hold the plates in position.

7.6. **Buffers/spring:** Suitable buffers / springs shall be provided in the cells to keep the end plates in position. These shall have adequate length and strength.

7.7. **Cell lids :** Lids used with sealed or closed type cells shall be of glass, plastic or ebonite and shall be provided with vent plugs. Terminal post shall be suitably sealed at the lid to prevent escape of acid spray, by means of rubber grommets, sealing compound or other suitable device. The positive and negative terminal posts shall be clearly and indelibly marked for easy identification.

7.8. **Water :-** Water used for preparation of electrolyte and also to bring the level of electrolyte to approximately correct height during operation / testing shall conform to relevant standards.

7.9. **Venting device :** The venting device shall be anti splash type and shall allow gases to escape freely but shall effectively prevent acid particles or spray from coming out. There shall be two vent holes, one serving as a guide for acid level indicator for checking the electrolyte level and other to permit drawing of electrolyte samples, servicing, checking of specific gravity etc.

7.10. **Marking :** Acid level line shall be permanently and indelibly marked around on all the containers.

The following information shall be indelibly marked on the outside surface of each cell :

- [i] Manufacturer's name, type and trade mark.
- [ii] Nominal voltage.
- [iii] AH capacity at 10 hours rate with specified end cell voltage.
- [iv] Cell number.
- [v] Upper and lower electrolyte level in case of transparent containers.
- [vi] Type of positive plate.
- [vii] Type of container.
- [viii] Date of manufacture [month and year] or [week and year].

A8.0. INSTALLATION OF BATTERY :

8.1. The battery set shall be installed on wooden racks in a separate battery room non air – conditioned but ventilated. The tenderer shall offer racks and mounting insulators etc.

8.2. The cell shall be arranged on the racks in a two-tier arrangement with two rows of cells on each tier or with some other suitable arrangement depending upon the availability of space inside the battery room. The lay out shall be subject to the approval of the purchaser. The racks shall be constructed of best quality seasoned **teak wood** / with metallic stand with at least three [3] coats of anti-acid paint of approved shade and also flame proof coating. These racks shall be such that cells are located at convenient height to facilitate maintenance and they may be so constructed so as to promote free access to the floor directly beneath the rack to facilitate easy cleaning of the floor. These shall be designed and arranged in such a way that easy handling of the cells is possible while in operation. Numbering tags for each cell shall be attached on to the racks.

8.3. The tenderer shall indicate and include the proposed arrangement of the batteries and include arrangement for fixing and mounting of inter-bank, inter-row, inter-cell and tap-off connectors etc.

A9.0. CONNECTORS:

Bars tinned copper lead connectors shall be employed for Inter-cell and inter-row, inter-tier connections. However, the tee-off connection from the battery unit shall be made with acid resisting cables of suitable size. A suitable terminal box alongwith acid-resisting cable shall be provided by the tenderer for this purpose. The connectors shall preferably be of bolted type and the bolts and nuts shall be of similar material as that of connectors and shall be provided with corrosion resisting lead coating.

The connectors shall be of sufficient cross-section to withstand all the working conditions including one minute discharge rate as well as short circuit conditions.

A.10. ACCESSORIES :-

The equipments and accessories, listed below shall be furnished as part of each battery set and the price of the battery quoted shall be inclusive of these items.

- [a] Teak wood racks with three coats of anti-acid paint and flame-proof coating.
- [b] Stand insulators +5% extra.
- [c] Cell insulators +5% extra.
- [d] All Cell interconnectors and end take-offs.
- [e] Lead coated connection hardware such as bolts, nuts etc.5% extra. Or any other connector suitable for VRLA type Battery.
- [f] Cell numbering tags with fixing arrangement.
- [g] Teakwood, cable clamps with hardware.
- [h] Diluted sulphuric acid of sufficient quantity and of specific gravity according to the relevant ISS and 10% extra shall be supplied in non-returnable acid proof containers, suitable packed.
- [i] Two numbers cell testing centre-zero voltmeters 3-0-3 volts range, Accuracy class shall be 0.5 or better and resistance not less than 1000 ohms.
- [j] One number syringe type hydrometer complete with accessories and suitable for measuring SP gravity between 1.1 to 1.320 with graduation of 0.005 Sp. Gravity together with temperature correction charts.
- [k] One number floating hydrometer.
- [l] Two numbers thermo-meters having range 0-100 deg. C whose one division of the graduated scale shall represent at the most 1 degree centigrade with separate gravity correction chart.
[Accuracy of calibration shall not be less than 0.5°C]
- [m] One number wall mounting teak-wood for hydrometers and thermo-meters.
- [n] Two numbers acid-resisting plastic jugs [2 litre capacity]

- [o] Two numbers plastic funnels.
- [p] Two numbers rubber syphons.
- [q] Two numbers rubber aprons.
- [r] Two pairs of rubber gloves.
- [s] Two pairs of rubber boots-knee height.
- [t] Two sets special tools or tools required for connecting the terminals of the batteries.
- [u] The battery terminals shall be brought out in a junction box to be mounted on the battery stands.
- [v] Ampere-hour meter[10 hour discharge rate] of 600 –1250 AH range-1 no.
- [w] Any other accessories, not specified but required for installation, satisfactory operation and maintenance of batteries for a period of 5 [five] years.

A.11.0 MAXIMUM SHORT CIRCUIT CURRENT :

The Bidder shall state the maximum short circuit current of each battery alongwith the safe duration in seconds which it can withstand. Methods, proposed to be adopted for protecting batteries from the short circuit conditions should also be stated to avoid damage to the battery and loss to the associated equipment.

A.12. VENTILATION :

The bidder shall indicate in his bid the requirements of ventilation in the battery room. The battery shall operate satisfactorily over the entire range of the temperature and humidity indicated in this specification without affecting its normal life. Bidder shall indicate the percentage reduction in battery capacity at the lowest temperature of 27 deg C. If any special ventilation requirements are necessary, the same shall be indicated.

A.13. CAPACITY :

The standard Ampere-hour capacity at ten hour rate shall be 350/550 AH with an end cell voltage of 1.85 volts/cell.

A.14. CHARGING :

The bidders shall state whether an equalising charge is recommended for the battery. If so, the equalising charge voltage, current, duration and the interval between the equalising charging shall be specified in the Data sheet. Bidder shall also indicate the requirements for boost charging.

A.15. LIFE :

The bidder shall quote in his offer the Guaranteed life of the battery when operating under the conditions specified.

A.16. INSTRUCTION MANUALS :

Eight sets of instruction manuals for installation, commissioning, charging and maintenance instruction shall have to be furnished.

A.17. TRANSPORT :

The batteries, accessories and racks etc. shall be suitably packed and transported to site.

A.18. TESTS:

A.18.1 TYPE TESTS : The bidder shall submit the test reports alongwith his offer for the following type tests, conducted on the offered samples as per relevant National Standard[s] within five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking, failing which the offer is liable for rejection.

- [a] Verification of constructional requirements.
- [b] Verification of dimensions.
- [c] Test for capacity.
- [d] Test for retention of charge.
- [e] Endurance Test.
- [f] Ampere-hour and watt-hour efficiency test.
- [g] Test for voltage during discharge.

If the type test report [s] does/do not meet the requirements as per this specification, OPTCL at its discretion may ask the supplier to conduct the above type tests [s] at the supplier's cost in the presence of OPTCL's representative without any financial liability to OPTCL

A.18.2 ACCEPTANCE TESTS : Following shall constitute the acceptance tests which shall be test witnessed by the purchaser's representative at the works of the manufacturer at the cost of supplier.

- [i] Verification of marking.
- [ii] Verification of dimensions.
- [iii] Test for capacity for 10 hours discharge rate along with the Test for voltage during discharge.
- [iv] Ampere-hour and watt-hour efficiency test.

A18.3.1 The Purchaser may at his discretion undertake test for capacity and voltage during discharge after installation of the battery at site without any extra cost.

A.18.3.2. The supplier shall arrange for all necessary equipments including the variable resistor, tools, tackles and instruments. If a battery fails to meet the guaranteed requirement, OPTCL shall have the option of asking the supplier to replace the same within 15 [fifteen] days from the date of declaring the same to be insufficient/failed / not as per the specification [s].

A.19. DRAWINGS / DOCUMENTS :

The tenderer shall submit the following drawings / documents along with his offer failing which the offer is liable for rejection.

- [a] General battery arrangement, proposed size of individual and over all dimensions along with sectional views showing all connections etc.
- [b] Pamphlets and technical literature giving detailed information of

the batteries offered.

The manufacturer shall submit the following drawings / documents in 7 [seven] copies within 15[fifteen] days from the date of issue of the purchase order for purchaser's approval. :-

- [a] Lay out details of the batteries.
- [b] OGA and cross-sectional details for battery cells.
- [c] Instruction manuals for initial charging and subsequent charging.
- [d] Technical data, curves etc.

A.20. GUARANTEED TECHNICAL PARTICULARS :

The Guaranteed technical particulars, as called for in the 'Annexure – I & II shall be furnished alongwith the tender. Any tender lacking complete information in this respect is likely to be rejected.

A.21. All deviations from the specification shall be separately listed, in the absence of which it will be presumed that the provisions of these specifications are complied with by the tenderer

**TECHNICAL SPECIFICATION
FOR
220VOLT,350Ah MF-VRLA STORAGE BATTERY**

A.1.0. SCOPE:-

- A.1.1. This specification covers the design, manufacture, assembly, shop testing at manufacturer's works before despatch, supply and delivery at site and erection, testing and commissioning of 220 volt 350Ah MF- VRLA storage batteries.
- A.1.2. It is the intention of the purchaser to install the most up to date type of equipment conforming to modern practices.

A.1.3. The scope of supply shall include all parts and accessories etc, which are usual and necessary for erection, operation and maintenance of VRLA batteries as specified above, though not individually and specifically stated or enumerated.

A.2.0. STANDARDS:-

A.2.1. All equipment and their accessories, covered by this specification shall be designed, manufactured and tested in compliance with the latest relevant standards, published by the Bureau of Indian Standards including those, listed at Clause 2.6 in order that specific aspects under Indian climatic conditions are taken care of .

A.2.2. The equipment and accessories for which Indian Standards are not available shall be designed, manufactured and tested in accordance with the latest standards, published by any other recognized National Standards Institution and latest publication of International Electro Technical commission [IEC].

A2.3. The equipment manufactured according to any other authoritative national / international standard, which ensures an equal or better quality than the provisions of these specifications shall also be acceptable. Where the equipment, offered conform to any other standard, salient points of differences between the proposed standard and the provisions of these specification shall be clearly brought out in the tender. A copy of such standards [in English] shall be enclosed with the offer.

A.2.4. The equipment shall conform to the Indian Electricity Rules, 1956 with latest amendments as regards safety earthing and other essential provisions specified therein for installation and operation of electrical plants.

A.2.5. All equipment shall also comply with the statutory requirements of the Government of Odisha where the equipment will be installed. Nothing shall be construed to relieve the supplier of his responsibility.

A.2.6. GOVERNING SPECIFICATION:-

The VRLA batteries and the associated chargers shall unless otherwise specified, conform to the following standards. The firms are requested to furnish the following specifications for our further reference.

i	IS-1651/1991	Specification for stationary cells batteries, leads acid type.
ii	IS-1885 [Part-8] / 1986	Electro technical vocabulary: Part- 8-Secondary cells & batteries.
iii	IS-266/1977	Sulphuric acid
iv	BS-46290 (Part-4) 1997	British standard specification for lead acid type valve regulated sealed type batteries.
v	ANSI, IEEE STD 450/1987	IEEE recommended practice for maintenance, testing and replacement of large lead storage batteries for generating stations and sub-stations.
vi	IEC 896-2/1995	Stationary lead-acid batteries, general requirements and methods of test (part-2, valve regulated types)
vii	IS-(1146 / UI-94) / ASTM - d -29863	Plastic container for lead acid storage batteries.
viii	IS-3136-1965	Specification for polycrystalline semiconductor rectifier equipment
ix	IS-1248-1968	Specification for direct acting indicating analogue electrical measuring instruments and tier accessories. (Part - I)-1983-General Requirements. (Part - II)- 1983 - Ammeters & voltmeters. (Part-III)-1984-Accessories.
x	IS-2208-1962	Specification of HRC Cartridge fuse link up to 650V

xi	IS-2959-1966	Specification of contractors for voltages not exceeding 1000V AC or 1200V DC
xii	IS-3395-1966	Specification for monocrystalline semiconductor rectified cells and stacks.
xiii	IS-4540-1968	Monocrystalline semiconductor rectifier assemblies & equipment
xiv	IS-2147/1962	Degree of protection provided by enclosure for low voltage switchgear and control gear
xv	IS-5578/1984	Guide for marking of insulated conductors.
xvi	IS-8623/1993 [Part 1 to 3]	Low voltage switchgear and control gear assemblies.
xvii	IS-11171/1985	Dry type power transformers.
xviii	IS-11353-1985	Guide for uniform system of marking and identification of conductors and apparatus
xix	IS-13947-1993 (Part 1 to 5)	Low voltage switchgear and control gear

A.3.0. OTHER REQUIREMENTS:-

A.3.1. ACCESSIBILITY AND INTER CHANGEABILITY:-

All working parts, in so far as possible, shall be arranged for convenience of operation, inspection, lubrication and ease of replacement with minimum down time. All like parts of the equipment, furnished shall be inter changeable.

A.3.2. QUALITY AND WORKMANSHIP:-

Workmanship and materials shall be of good commercial quality, suitable for the purpose, intended and in accordance with the highest standards and practices for equipment of the class, covered by this specification.

A.3.3. SAFETY

A3.3.1. All equipment shall be complete with approved safety devices wherever a potential hazard to personnel exists and with provision for safe access of personnel to and around the equipment for operational and maintenance functions. The design shall include all necessary precautions and provisions for the safety of operating and maintenance personnel.

A3.3.2. Special care shall be taken to make enclosed equipment proof against entry of rat, lizards and other creeping reptiles, which may create electrical short circuits inside, live equipment.

A3.3.3. Continuity of power supply is the first consideration and the design shall be such as to provide facilities to simplify inspection, testing maintenance, clearing and repair at site.

A.3.4. SPECIAL SITE CONDITIONS:-

A3.4.4. The equipment with their accessories shall be designed for smooth, efficient and trouble free operation tropical humid climate for maximum temperature of 50 degree C and maximum humidity of 98 percent. Maximum temperature and maximum humidity are however not likely to occur simultaneously. De-rating of equipment shall be done for an ambient temperature of 50 degree C.

A.3.5. PAINTING:-

All items of equipment and materials shall be thoroughly cleaned and painted in accordance with IS Specification. The clean surface shall be given two coats of epoxy polyamide resin based red-oxide zinc-phosphate primer, deposited either by immersion or powder spray. They phosphate coated surface shall have one coat of high build epoxy resin based intermediate paint coating and two coats of air drying epoxy polyamide

enamel suitably pigmented finish paint. The colour shade for exterior parts of equipment located inside the sub-station control room building shall be as per shade No. 631. Clean and touch-up paint shall be applied at site as required.

A.4.0. **CONSTRUCTIONAL DETAILS OF VRLA BATTERY.**

A.4.1. **PLATES:**

Positive plates shall be made of flat pasted type using lead-Cadmium-antimony alloys for durability, high corrosion resistant, maintenance free, low discharge rates and long life both in cyclic as well as in the float applications.

Negative plates shall be heavy duty, durable flat plate using lead calcium alloy pasted box grid. Negative plates shall be designed to match the life of positive plates and combination of positive and negative plates shall ensure long life, durability and trouble free operation of the battery. PLC Operated equipment should be deployed for preparation of paste to ensure consistency in paste quality. Conventional / manual type of plate preparation is not allowed.

A.4.2. **SEPARATORS:-**

The separator shall be absorptive glass mat type or spun glass micro porous matrix type and shall be resistant to sulphuric acid. It shall be capable of keeping all the electrolyte and shall be electrically insulated. Sufficient separator overlap and PVC shield protection to top and bottom edges of the plates is to be provided to prevent short circuit formation between the edges of adjacent plates. The uncompressed water absorption of the separator shall be at least 5 gm. of water / gm of separator material.

A.4.2.1. **REQUIREMENT OF WICKING TEST ON SEPARATORS:-**

The total wicking height shall not be less than 635 mm in 24 hours. The minimum water content at 125 mm. Height shall be at least 5 gm. of water per gm. of separator. The weight of water per gm. shall be at least 90% of the value at 125 mm when checked at a height of 450 mm.

A.4.3. **VALVE:-**

Safety valve vent plugs shall be provided in each cell. They shall be explosion resistant, self-resealing and pressure regulating type. They shall not allow gas (air) to enter into the cell but shall allow gas to escape from the cell above a certain internal pressure, which does not lead to deformation or other damage to the cell.

A.4.3.1. The vent plug used shall be explosion resistant and self re-sealing pressure regulating type. Vent plug shall be such that it cannot be opened without proper tool.

A.4.3.2. The valve shall be so designed that it operates at a pressure between 0.14 Kg / Sq. mm to 0.63 Kg / Sq. mm to release the excess gas and reseal automatically as soon as the gas pressure within the cell drops to atmospheric value.

A.4.3.3. All the cells shall be subjected to pressure test upto 0.7 Kg / Sq. mm.

A.4.3.4. The self-discharge rate at room temperature shall not be more than 5 % of the capacity of each battery per month.

A.4.3.5. Each valve opening shall be covered with flame barrier capable in preventing the ingress of flame into the cell interior when the valve opens and hydrogen / oxygen gas mixture is released.

A.4.4. **CONTAINERS AND LID:-**

A.4.4.1. The container shall be made up of a special grade polypropylene copolymer plastic material, which should be of flame-retardant.

A.4.4.2. The container shall be sufficiently robust and not liable to deformation under internal operating pressures and within the temperature range, naturally encountered, leak proof, non-absorbent and resistant to the acid with low water vapor permeability.

A.4.4.3. The container shall be enclosed in epoxy coated steel trays. The steel trays shall be so designed as to make both vertical and horizontal stacking of cells / batteries possible.

A.4.5. **LIDS / COVERS:-**

Sealed maintenance free batteries shall have polypropylene copolymer covers. The complete container along-with lid / cover shall be able to withstand without fracture for 5 hours at 25 degree Celsius at an internal pressure of 5 times the normal operating pressure as declared by the manufacturer. The complete design includes the pillar to lid

seal, which shall be designed to remain gas-tight and electrolyte-tight during the designated life of the battery.

A.4.6. **PILLAR SEAL ASSEMBLY:-**

A.4.6.1. The pillar to lid seal shall be designed to remain gas-tight and electrolyte-tight during the designated life of the unit. The terminal shall conform to Class 3.2 of BS: 6290, Part - 4 - 1987.

A.4.7. **ELECTROLYTE:-**

The electrolyte shall be prepared from the battery grade H₂ SO₄ conforming to ISS:266. The batteries shall be supplied in factory filled charged condition. All the acid will be in immobilized condition the AGM separator.

A.4.8. **WATER:-**

Water required for preparation of electrolyte shall conform to IS:1069.

A.4.9. **CONNECTORS AND FASTENERS:-**

Lead or lead coated copper connectors shall be used for connecting up adjacent cells and rows. The thickness of lead coating of connectors should be not less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX-F of IS : 6848 : 1979. All the terminals and cells inter connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cable having stranded aluminum / copper conductors and PVC / XPE insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the supplier. All connectors and lugs shall be capable of continuously carrying the 30 minute discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Bidder shall furnish necessary sizing calculations to prove compliance to the same.

A.4.10. **PLATE CONNECTIONS:-**

Lugs of plates of like polarity shall be connected by lead burning to a horizontal strap having an upstanding terminal post adopted for connection to external circuit. Strap and post shall be casted with lead alloy. The positive and negative terminal posts shall be clearly marked for unmistakable identification.

A.4.11. **NUT & BOLTS:-**

Nuts and bolts for connecting the cells shall be made of copper, brass or superior grade passivated stainless steel which should be resistant to sulphuric acid. Copper & brass shall be coated / plated with suitable materials such as Nickel / Chromium to prevent sulphation or corrosion.

A.4.12. **TERMINALS:-**

Terminals shall be of integral lead terminal with solid copper core with M6 threading for fastening. The junction between terminals posts and cover and between the cover and container shall be hermetically sealed.

A.4.13. **SEAL:-**

- (i) TIG welding shall be done for post sealing.
- (ii) Additional Epoxy resin sealing shall be provided for double assurance against leakage.

A.4.14. **SUPPORTING RACKS:-**

Batteries shall be installed on MS racks to be supplied by the supplier to fit in the battery /battery charger room. Racks / trays shall be powder coated with anticorrosive paint and supplied in unassembled state. Rack / tray shall be subjected to 7 tank process before painting for protection against fungus growth and other harmful effect due to tropical environment.

The steel trays / containers shall be stackable one over the other horizontally in multi-tier arrangement. The bottom most tray shall be mounted on I-channels with 150 mm height. The positive and negative terminals shall be terminated onto the terminal plate assembly, which is fitted to one of the steel tray depending on the convenience at site.

A.4.15. **MARKING:-**

The following informations shall be legibly laid durably marked on each cell battery:-

- 6. Nominal Voltage.
- 7. Name of the manufacturer and type reference.

8. Rated or nominal capacity expressed in ampere hour (AH) with an indication of the rating expressed either as a current or as time together with the relevant final voltage of each cell.
 9. Voltage for float operation 27° C with tolerance of 1%.
 10. Cell number.
 11. Type of positive plate.
 12. Type of container.
 13. Date of manufacture (month and year) or (week and year).
- A.5.0. **MAXIMUM SHORT CIRCUIT CURRENT:-**
The bidder shall state the maximum short circuit current of each battery along-with the safe duration in seconds, which it can withstand. Complying with clause 5.5 of IEC – 896 – 2/1995. Method proposed to be adopted for protecting batteries from the short circuit conditions should also be stated to avoid damage to the battery and loss to the associated equipment.
- A.6.0. **VENTILATION:-**
The Bidder shall indicate in his bid the requirements of ventilation in the battery room. The battery shall operate satisfactory over the entire range of temperature indicated in this specification without affecting its normal life. Bidder shall indicate the percentage reduction in battery capacity at the lowest temperature of 27 Degree C. If any special ventilation requirements are necessary, the same shall be indicated.
- A.7.0. **CAPACITY:-**
The standard Ampere-hour capacity at ten hour rate shall be 200, 300 and 500 AH and end cell voltage of 1.80 volts /cells.
- A.7.1. **SELF DISCHARGE RATE OF BATTERY:-**
Self discharge rate shall be less than 0.5% of C 10 Capacity per week at 27degree C.
- A.8.0. **CHARGING:-**
The bidder shall state whether an equalizing charge is recommended for the battery. If so, the equalizing charge voltage, current, duration and the interval between the equalizing charging shall be specified in the Data Sheet. Bidder shall also indicate the requirements for boost charging.
- A.9.0. **LIFE:-**
The bidder shall quote in his offer the guaranteed life of the battery, when operating under the conditions, specified. The bidder shall also quote the change in life of the battery due to change in temperature form 27 degree centigrade in the event the batteries are required to be operated under higher temperature environment.
- A.10.0. **DESIGN VALIDATION:-**
Over the range of manufacturer's capacity, at least one capacity should have been tested and should meet the requirement of Service Life as per ANSI TI : 330 Specification. Necessary evidences maybe enclosed along-with the offer.
- A.11.0. **MAINTENANCE TOOLS & INSTRUCTION:-**
- A.11.1. One cell – testing –center-zero volt meter 3-0-3 volt range of accuracy class not less than 0.5 shall have to be supplied alongwith each of the battery sets. The resistance of the voltmeter shall not less than be 100 ohms.
- A.11.2. Eight sets of instruction manuals for installation, commissioning and initial charging, the calculations of charging / discharge under float and boost charging and maintenance instructions shall have to be furnished.
- A.11.3. It is mandatory for the bidder to provide with the spare relating to the batteries including cells for replacement for a minimum period of 8 years and above.
- A.12.0. **ELECTRICAL CHARACTERISTICS:-**
DESIGN SHOULD ENSURE THAT:-
- (a) Battery shall be suitable for constant current constant voltage charging.
 - (b) Nominal float voltage shall not exceed 2.25 V per cell @ 27 degree C.
 - (c) Recharging shall be done at normal float voltage.
 - (d) Charging current shall not exceed 0.15 C. Where C is the capacity in AH @ 10 hours of discharge to end cell voltage 1.80 V @ 27 deg C.

(e) Except during commissioning. Battery shall not demand boost charging at any point of time during its operation.

(f) Battery shall not demand equalizing charge at any point of time during its operation.

A.13.0. PROCESS REQUIREMENT:-

- (a) 100% cells shall be tested by Helium. I on leak tester for leak free performance. Vendor shall attach a copy of the Helium. I on tester report along with the dispatch documents.
- (b) Vendor is expected to monitor the voltage and current data of the cells during initial charge and test discharge by means of automatic data logging for traceability. Vendor shall maintain the database of the same and provide the document to the company as and when called for.

A.14.0. TESTS

A.14.1. TYPE TESTS:-

The bidder shall submit the test reports along with his offer for the following type tests, conducted on the offered samples as per relevant National Standard (s) within five years from the date of opening of the bid and test witnessed by any Government Department / Government undertaking failing which the offer is liable for rejection.

- (a) Verification of constructional requirements.
- (b) Verification of dimensions /weight.
- (c) Test for capacity.
- (d) Test for charge retention.
- (e) Endurance test.
- (f) Ampere-hour and watt-hour efficiency test.
- (g) Test for voltage during discharge.
- (h) Test for endurance under short circuit conditions.
- (i) Test for gas recombination efficiency.
- (j) Wicking test Separators.
- (k) Service Life test as per ANSITI : 330 Specification.

If the type test report (s) does / do not meet the requirements as per this specification. GRIDCO at its discretion may ask the supplier to conduct the above type test (s) at the supplier's cost in the presence of GRIDCO's representative without any financial liability to GRIDCO.

A.14.2. ROUTINE TESTS:-

All the routine tests, listed below shall be carried out on all the cells, containers. Hardware being supplied as per latest issue of BS : 6290, Part – 4. IE C89-I or IEEE – 1188 (whichever is applicable) at the cost of the supplier.

(a) Container

- (i) Verification of constructional requirements.
- (ii) Verification of marking and packing.
- (iii) High voltage tests (CI : 7.6 of IS : 1146).

(b) Cells and batteries:-

- (i) Verification of constructional requirements.
- (ii) Verification of markings.
- (iii) Verification of dimensions.

A.14.3.0. ACCEPTANCE TESTS:-

Followings shall constitute the acceptance tests which shall be test-witnessed by Purchaser's representative at the works of the manufacturer at the cost of the supplier.

- 1. Verification of dimensions.
- 2. Verification of marking.
- 3. Tests for capacities for 10 hours discharge rate alongwith the test for voltage during discharge.
- 4. Ampere-hour and watt-hour efficiency test.
- 5. Short circuit current test of batteries (arrangement for this shall be provided during testing).
- 6. Resistance of cell / batteries.

8. Pressure of vent plug connected with battery (measuring shall be provided during testing).

9. Measurement of weight / material type and dimension of cell / racks / batteries and all other accessories as per approval of drawings / technical data submitted during tender process. All these shall be submitted in detail with the submission of tender paper.

A.14.3.1. The purchaser may at his discretion undertake test for capacity and voltage during discharge after installation of the battery at site without any extra cost.

A.14.3.2. The supplier shall arrange for all necessary equipments, including the variable resistor, tools, tackles and instruments. If a battery / battery charger fails to meet the guaranteed requirements, GRIDCO shall have the option of asking the supplier to replace the same.

A.15.0. DRAWINGS / DOCUMENTS:-

The tenderer shall submit the following drawings documents along with his offer failing which the offer is liable for rejection.

(a) General battery arrangement including proposed size of individual and over all dimensions along with sectional views showing all connections etc.

(b) Pamphlets and technical literature giving detailed information of the batteries offered.

The manufacturer shall submit the following drawings / documents in 7 (seven) copies within (fifteen) days from the date of issue of the purchase order for purchaser's approval.

(a) Layout details of the batteries with all accessories.

(b) OGA Cross-sectional details for battery cells.

(c) Instruction manuals for initial charging and subsequent charging.

(d) Technical data, curves etc.

A.17.0. TRAINING:-

The bidder shall arrange for training of at least five Telecom. engineering personnel of OPTCL on operation and maintenance of the VRLA type of batteries at free of cost. Every detail regarding the intricacies of these special type batteries need be imparted to the trainee engineers at works of the manufacturer. The bidder in their offer need intimate the duration of training. However the training must be imparted prior to the delivery of the battery sets.

A.18.0. TRANSPORT:-

The charged batteries, accessories and racks shall be suitably packed and transported to site in ready to use condition.

ANNEXURE -1A

SPECIFICATION FOR 350AH 220 VOLT MF-VRLA BATTERY SYSTEM

[To be filled in by the bidder]

SL. NO.	SPECIFICATION	CONFIRM / NOT CONFIRM
1	Maintenance free valve regulated sealed type acid battery 200,300 and 500 AH. 2V per cell [Total 24 Nos. battery cells]	
2	The cells should be assembled in stack over insulated steel rack to make 48 Volt / 200,300,400, 510 & 800AH battery system for Power Line Carrier Communication application.	
3	The steel rack will be placed over porcelain. Hard rubber insulator of 100 mm Height [approx.] to minimize leakage current to ground	
4	All the battery cells are to be assigned with number	
5	The final positive and negative terminals are to be brought to the terminal plate assembly (TPA). Suitable arrangement should be made for terminating the cables at the TPA	
6	Test for capacity of batteries should conform to IS: 1652 (Clause 11.6)	
7	The battery should be supplied with all accessories like connectors, links, S.S. nuts. Bolts and insulator etc.	
8	All the portion of connectors and adjacent steel plates are to be sleeved and insulated.	
9	Discharge test of batteries at 10 hr. rate of discharge to end cell voltage of 1.85 volt per cell to conform to the requirement of IS : 1652. Clause - 11.7 (Test for capacity) should be carried out by the supplier at the works of manufacturer and at the site. The ambient temperature at the place of installations will be considered for the calculation period of discharge.	
10	The battery should have a life expectancy of minimum 8 years at battery room ambient temperature that varies from a minimum of 20 degree centigrade during winter season and a maximum of 50 degree centigrade during peak summer. The tenderer should submit the relevant technical literature preferably in p form with details design calculation graph documents etc. in support of indicated life of the battery taking care of the above seasonal ambient temperature variation.	
11	The supplier should submit the documentary evidence) P.O. copy) for supply, installation and commissioning of battery capacity of 200,300,400,510 & 800 AH or higher capacity to the PLCC. Systems under any GRID Sub-stations and the same is in successful operation for a minimum period of 5.	
12	The watt-hour and ampere-hour efficiency and internal resistance value of the battery should be furnished.	
13	The supplier should show the values of internal resistance of all the cells at the time of commissioning at site and the same should confirm to the value indicated by them in their technical bid.	
14	The procedure of charging the battery before the capacity test should be furnished. The battery et will be inspected tested at works before despatch to store site.	

ANNEXURE IIA

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220 VOLT 350 AH MF-VRLA LEAD ACID STORAGE BATTERY
(TO BE FILLED IN BY THE BIDDER)

1	Manufacturer's name and address :
2	Conforming to standards.
3	Type and designation as per IS.
4	Manufacturer's type and designation
5	Capacity of battery bank at the following discharge rates at 27°C
	Cap. AH Rate of Disch. Current End Cell voltage
	a. 15 minutes. b. 30 minutes. c. 45 minutes. d. 1 hour e. 2 hours f. 3 hours. g. 4 hours. h. 5 hours. i. 6 hours. j. 7 hours. k. 8 hours. l. 9 hours. m. 10 hours.
6	Number of cells in the battery.
7	Method of interconnection between cells.
8	Maximum short circuit current of battery when short circuit is at the end of terminals
9	Recommended float-charging voltage across the battery terminals (volts).
10	Recommended boost charging voltage across battery terminals (volts).
11	Time required for boost charging from discharged conditions (in hours).
12	Recommended trickle / float charging rate
13	Recommended boost charging rate.
14	Trickle charging current range / cell.
15	Shelf life of charged battery bank.
16	Open circuit voltage of battery bank when fully charged.
17	AH capacity at 10 hours rate at room temperatures of:-
	a. 15°C. b. 27°C c. 50°C
18	Cell Particulars:-
	Material of container. Overall dimensions of each cell. Weight of cell complete with acid.
19	Voltage:-
	a. Open circuit voltage of cells. b. Float charging voltage. c. Boost charging voltage.
20	Type of material / thickness / dimension of positive plates.
21	Type of material / thickness / dimension of negative plates.
22	Separators:-

	<ul style="list-style-type: none"> a. Type. b. Materials. c. Thickness of separator.
23	Type of valve provided.
24	Internal resistance of each cell at
25.	Clearance in mm between.
	<ul style="list-style-type: none"> a. Top of plates and top of container. b. Bottom of plates and bottom of container. c. Edges of plates and inner surface of container.
26	Maximum ambient temperature that the cells can withstand. Without injurious effect.
	<ul style="list-style-type: none"> a. Continuously. b. Short periods (duration to be stated along with temperature).
27	Maximum number of charge / discharge cycles that the cell can withstand.
28	Ampere-hour efficiency at ten-hour discharge rate.
29	Watt-hour efficiency at ten hour discharge rage
30	Estimated life of cell under normal operating conditions (in years) % change in life of battery for change in ambient temperature 27 degree centigrade.
31	<ul style="list-style-type: none"> a. Maximum short circuit current per battery. b. Allowable duration of short circuit.
32	Short circuit current for a dead short across the Battery terminals when.
	<ul style="list-style-type: none"> a. Float at 2.1V per cell b. Boost charge to 2.75 V per cell.
33	Recommended floating voltage per cell and the Minimum variation.
34	Recommended interval at which battery should be Discharged at 10 hour rate and quick charged.
35	Recommended storage period of a fully charged battery.
36	Inter cell connector.
	<ul style="list-style-type: none"> a. Inter-cell connector furnished ? (Yes/No). b. Type of inter-cell connector (bolted or others)? c. Materials of inter cell connector.
37	Inter-row, inter tier connectors and end take- off furnished? Description. Size current rating type and material
38	Battery stack / rack.
	<ul style="list-style-type: none"> a. Outline dimensions. b. Type and material. c. Anti-acid coating type. d. Number of trays. e. Height of bottom tier from ground level. f. No. of cells which can be stacked in tray. g. Dimensions of each tray.
39	Total shipping weight of battery units.
40	A dimensional layout drawing of the battery stock / rack along with battery attached with the tender (yes /No)
41	The following characteristic curves to be furnished along with the tender (yes/No).
	<ul style="list-style-type: none"> a. Battery discharge curves at various rates between 1 minute and 10 hour rate. b. Curves showing the relation between the cell voltage and charging current, when charged at:
	14. Finishing rate. (ii) High starting rate. (iii) Two step charging by starting and finishing rate.

PART – B

CHARGER FOR PLANTE BATTERIES

B.1 BRIEF DESCRIPTION

Charging equipment comprising of a float charger and a Float cum boost & Float Cum Boost Charder suitable for 48 V Battery Type VRLA for Telecommunication Purpose) charger, is required to meet the D.C. power requirements of the sub-station under normal conditions, i.e., when AC auxiliary power supply is available and also to keep all the cells in the state of full charge. The float charger shall supply the continuous DC load at the bus bars in addition to keeping, the plante batteries floated in a healthy condition. In case of failure of A.C. mains or sudden requirement of additional DC power, the battery shall meet the demand as the battery shall be connected in parallel with the charger. After the battery has discharged to a considerable extent, it shall be fully recharged by the 'boost' charger unit in a short period so as to prepare it for the next emergency. Even during the 'boost' charging of the battery, the continuous DC load at the bus shall be met by the trickle-charging unit. The 'boost' charging unit shall however be provided with suitable control arrangement to function as a stand-by for float charging unit in case of necessity.

B.2 ARRANGEMENTS :

B.2.1 Trickle (Float) Charger :

The trickle charger shall have arrangement for regulation of D.C. output voltage by:-

- (i) automatic voltage regulation system.
- (ii) Shall be of thyristor control type with both 'auto/manual' control arrangement.

B.2.2. Quick (Boost) Charger :

The quick charger shall be similar type as trickle charging equipment, but shall have the following features.

- (i) Shall be of higher capacity to deliver D.C. output, as stipulated in this specification for quick charging of the plante batteries.

(ii) Shall be provided with control arrangement for 'auto/manual' current regulation features, necessary for quick charging

(iii) Shall also have 'auto/manual' voltage control arrangement for use when the charger will be utilised as a trickle charger.

B.3. The 'Trickle' and 'Quick' charger shall be self supporting cubicle type with front panels hinged and suitable for mounting instruments, incoming A.C., circuit breaker with thermal and instantaneous releases relays, contactors and control switches etc. The panels shall have access from the backside also. These cubicles shall also house transformers, rectifiers and other equipment's, accessories, as stipulated in this specification.

B.4 DESIGN AND CONSTRUCTION DETAILS:

B.4.1 The 'trickle' charger and 'quick' charger shall be complete with silicon controlled rectifier units, dry type air-cooled transformers, control electronics, smoothing filters etc. suitable for operation from $415V \pm 10\%$, $50 \text{ HZ} \pm 5\%$, 3 phase A.C. supply. The charger output shall be stabilized to $\pm 1\%$ of set value for $\pm 10\%$ input voltage variations and 0-100% load variation.

B.4.2 The battery charger shall have full-wave, Half-controlled thyristor controlled bridge rectifier circuit. The charger output voltage shall suit the battery offered. The float voltage shall be adjustable from 80% to 115% of nominal voltage. The boost voltage shall be adjustable from 80% to 135% of nominal voltage. Ripple voltage shall be less than 3% RMS voltage.

B.4.3 Each float charger shall be capable of floating each cell of the battery bank at the specified voltage and supplying specified float current continuously under normal system operation.

B.4.4 Under normal operation, the float charger shall be supplying the DC load current and at the same time trickle charge the station battery. When the battery voltage goes down considerably, automatic transfer arrangement shall be provided such that the battery is disconnected from the float charger and gets connected to the boost charger. However, when battery is on boost charge, DC load shall be fed from the float charger. In addition, means shall be provided to ensure interruption free availability of control power from the battery whenever there is a power failure irrespective of whether the battery is on boost charge or float charge.

B.4.5 The selection of electronic components shall be used on ambient temperature of 50 degree C. and shall be of worst-case design to ensure continuous and trouble

free service. The control electronics shall be built on plug in type glass epoxy printed circuit boards of modular design.

B.4.6 The maximum temperature, attained by any part of trickle charger and quick charger, when in service at site under continuous full load conditions shall not exceed the permissible limits as fixed by relevant standards and as corrected to site condition.

B.4.7 Charger Panel :

B.4.7.1 Charger panels shall be rigid, self supporting structures, completely assembled and totally enclosed cubicle type construction, made out of structural steel members with sheet steel-coverings.

B.4.7.2 The enclosure of the charger shall be made of CRCA sheet steel of thickness not less than 2 mm for load bearing members, 1.6mm for door and non-load bearing members and 3 mm for gland plates. Panels shall be offered with base frame of 3.0 mm thick CRCA sheet, painted black all around, suitable for bolting/ welding/ grouting on to the foundation. Gaskets on doors and inter panel gaskets shall be of neoprene rubber.

B.4.7.3 The panel shall have hinged front and back doors with concealed type hinged locks and latches.

B.4.7.4 The panel shall have adequate cross -ventilation arrangement to avoid any undue rise in temperature.

B.4.7.5 All equipment' s and wiring used in the panel shall be tropicalised dust proof and vermin-proof.

B.4.7.6 Power wiring for the chargers shall be done with 1.1KV grade, heavy duty, single core, stranded copper conductor PVC insulated cables or suitable sized PVC sleeved copper bus bars. Control wiring for the charger shall be done with 1.1 KV grade PVC insulated copper wires of cross section 2.5 sq. mm for all control connection. Wire of 2.5 sq. mm cross section shall be used for control bus. All control wiring shall be ferruled.

B. 4.7.7 Necessary terminals for grounding the panel with two separate earthings shall be arranged for bottom entry and suitable cable glands shall be provided for the cables.

- B. 4. 7. 8 Each charger panel shall incorporate all the necessary controls, Indications, interlocks, protective devices and timing features to ensure any operation.

Provision shall be made with necessary contact / relays for annunciation in the event of alternating current power failures to the charger and automatic shut down of the charger by over-voltage / current devices. Annunciation shall however be prevented when the charger is manually shutdown or when A.C. power supply is momentarily interrupted for adjustable period of 1 to 5 seconds.

- B. 4. 7. 9. The float and equaliser charging rates shall both be adjustable from the front of the charger control panel. Each charger shall be protected against any damage from over voltage/ load currents and shall be so designed that it can continuously deliver at least rated current output without operation of the protective over-load device for abnormal conditions of low battery voltage down to 175V (80%) of the rated voltage). But the chargers shall be disconnected from A.C. input supply through an over-voltage relay, if the input voltage exceeds 10% of the rated voltage of the equipment. Necessary selector switches for 'Trickle Charging' and 'Quick charging' shall be provided. There shall be 'make before break' type blocking Diodes and other equipments to be shown in the drawing or otherwise found necessary for charging or otherwise found necessary for charging the battery without increasing the voltage beyond safe value across the load shall also be supplied by the tenderer.

- B. 4. 8 The rectifier units of the chargers shall be capable of supplying an impulse load of 6/7 times its rated capacity. The trickle charger in conjunction with automatic voltage regulators shall have drooping characteristics, So as to transfer the load beyond its capacity to the battery.

- B. 4. 9 The incoming and outgoing circuits shall be provided with MCCBs with static releases for overload, short circuit and earth fault protections. The incoming power supply to the chargers will be from two sources with a facility of changeover switch. The change over facility shall be provided in the charger itself.

- B. 4. 10 The battery circuit shall be provided with HRC fuse protection over a suitably rated load break isolator switch and reverse protection circuits.

- B. 4. 11 Input volt meter and ammeter shall be of moving iron type and shall be 96 x 96 mm. Square. These meters shall be of accuracy class not less than 1.0 and shall be of flush mounting type with required PTs and CTs and selector switches. Output voltmeter and ammeter shall be moving iron type and shall be 96 x 96 mm square. The meter shall be of accuracy class not less than

1.0 and shall be flush mounting type. The ammeter shall be centre zero type for measurement of charging and discharging current from the battery.

B.4.12 Cluster LED lamps for indicating 'Input on' condition and 'Output on' condition, float status on / off, boost status on / off etc. shall be provided. Annunciation with audiovisual alarms shall be provided for the following.

- Input mains failure.
- Input phase failure.
- Input fuse failure.
- Rectifier fuse failure.
- Filter fuse failure
- DC over voltage
- DC under voltage
- Output fuse failure
- Charger over-load
- Earth leakage
- Alarm supply fuse failure
- Charger trip
- Output MCCB tripped
- AC under voltage
- Battery low condition

ACCEPT, TEST AND RESET push buttons shall be provided. 20% spare annunciation windows shall be provided.

B.4.13 : Any other item(s), not stipulated in this specification, but required for installation, operation and maintenance of the battery charger is / are included in the scope of supply without any extra charge on OPTCL.

B.5 **TRANSPORT** : The chargers alongwith its accessories shall be suitably packed and transported to site in ready to use condition.

B.6 **TESTS**

B.6.1 **Type Tests** : The bidder shall submit the test reports alongwith his offer for the following type tests conducted on the offered samples (both float charger and boost charger) as per relevant National Standard (s) within five years from the date

of opening of the bid and test-witnessed by any Government Department /Government undertaking, failing which the offer is liable for rejection.

- (a) Measurement of voltage regulation / AVR regulation
- (b) Efficiency and power factor measurement test
- (c) Temperature rises test so as to determine the temperature rise of SCR, Transformer primary, Secondary and core, Diode, capacitor, choke and cabinet etc.
- (d) Measurement of insulation resistance.
 - i) AC input to earth.
 - ii) AC input to DC output.
 - iii) DC output to earth
- (e) Test for rectifier transformer.
- (f) DC voltage current characteristic
- (g) High Voltage Tests.
- (h) Determination of regulation
- (i) Measurement of ripple
- (j) Reverse leakage test.

B.6.2 Acceptance Tests : Followings shall constitute the acceptance tests which shall be tested by the purchaser's representative at the works of the manufacturer at the cost of the supplier (both for FC & FCBC) for each charger. No sampling is allowed.

- (a) Measurement of voltage regulation / AVR Regulation
- (b) Efficiency and power factor measurement
- (c) Temperature rise test so as to determine the temperature rise of SCR, Transformer primary, secondary and core, diode, capacitor, choke and cabinet etc.
- (d) Measurement of insulation resistance.
 - (1) AC input to earth
 - (2) AC input to DC output
 - (3) DC output to earth
- (e) Test for rectifier transformer (all relevant tests as per corresponding ISS)
- (f) DC voltage current characteristic
- (g) High voltage tests.
- (h) Determination of regulation.
- (i) Measurement of ripple
- (j) Tests for indications and alarms as per this specification

- (k) Tests for indicating instruments.
- (l) Determination of system set points.
- (m) Soft start test

N.B. : The supplier shall provide arrangements for monitoring the temperature across the elements, as stipulated above, continuously during the temperature rise test without disconnection of any of the temperature measuring devices across the hottest spot of each of the above elements.

All other tests, as may be necessary to ensure that all equipment' s are satisfactory shall also be carried out. In addition to the above tests, manufacturer' s test certificates, vendor' s test certificates for different equipment' s, accessories, instruments etc. shall be submitted, whenever required by the purchaser.

B.7. DRAWINGS / DOCUMENTS

The tenderer shall submit the following drawings / documents alongwith his offer failing which the offer is liable for rejection.

- (a) OGA of the battery chargers
- (b) General layout with overall dimensions
- (c) Electrical schematic diagram showing connections and controls.
- (d) Leaflets and technical literature giving detailed information of the panels offered.

The manufacturer shall submit the following drawings / documents in 7 (seven) copies within 15 (fifteen) days from the date of issue of the purchase order for purchaser' s approval.

- (a) OGA of the battery chargers
- (b) General layout with overall dimensions marked alongwith sectional views showing cable entry position etc.
- (c) Rating calculations for transformer, rectifiers, diode, capacitor, inductor etc.
- (d) Detailed schematic and connection and control wiring diagram for all the equipments.
- (e) Complete bill of materials
- (f) Technical excerpts on operation.
- (g) The circuit diagram of charger including circuit diagrams of all cards to facilitate the maintenance of chargers

B. 8 SPECIAL TOOLS, PLANTS AND SPARES

The tender shall quote for recommended special tools, plants and spares, considered necessary for installation and maintenance of batteries and charges for a minimum period of 5 (five years.)

The following mandatory spares are to be quoted by the bidder in the price bid:-

- a) Voltage regulator cards- 1 No/Charger.
- b) protection card (if any)- 1 No/ Charger.
- c) Thyristor (SCR)- 2 Nos. for F.C. + 2 Nos. for B.C. / Charger.
- d) Rectifier Diode- 2 Nos. for F.C, + 2 Nos. for B,.C./Charger.
- e) Blocking Diode- 1 No. for F.C. + 1 No. for B.C. / Charger.
- f) Filter Capacitor- 1 Set/Charger.
- g) Auto-manual switch- 1 No. for F. C. + 1 No. for B.C. / Charger.
- h) Indicating LED- 10 Nos./Charger
- i) Indicating fuse (if any)- 10 Nos./Charger
- j) Input A.C. contactor- 1 No. for F.C,. + 1 No. for B.C. / Charger
- k) Rectifier H.R.C. fuses- 4 Nos. for F.C. + 4 Nos. for B.C./Charger.

B. 9 GUARANTEED TECHNICAL PARTICULARS

The guaranteed technical particulars of this specification shall be furnished alongwith the tender. Any tender, lacking complete information in this respect is likely to be rejected.

B. 10 DEVIATION FROM SPECIFICATION

All deviations from the specification shall be separately listed in the technical deviation sheet, in the absence of which it will be presumed that the provisions of these specifications are complied with by the tenderer.

**B11. GENERAL TECHNICAL REQUIREMENTS FOR BATTERY CHARGER SUITABLE FOR 220 V/48 V
LEAD ACID PLANTE BATTERY**

1	Type	Float & Float cum boost charger for 220 V & Float Cum Boost Charger for 48 V DC full wave, full controlled type.	
2.	RATINGS	>220V : 350 AH Plante Battery: 35A/60A Float & Float cum Boost Charger. >48V : 350 AH & 550 AH Plante Battery: 35A/70A & 50A/100 : Float cum Boost Charger. >220 V : 645 AH Plante Battery:70/100 A Float & Float cum Boost Charger.	
3.	AC INPUT (a) Voltage (b) Frequency (c) Phase	415VAC \pm 10% 50Hz \pm 5% 3-phase-4 wire	
4.	D. C. OUTPUT VOLTAGE SETTINGS Nominal Float	FC 220V/48V 253V/54.5V (adj. By + 20%, - 5%	BC 220V/48V 302V/66.5V (adj. By + 2%, - 5%)
5.	OUTPUT CURRENT LIMIT	35A 70 A 70 A for 48 V, 350 AH 60A (for 350AH) 100A(for 645AH)	
6.	POWER CONVERSION	AC to DC by means of three phase full wave, Half controlled bridge rectifier consisting of thyristors and diodes.	
7.	VOLTAGE REGULATION AT BRIDGE OUTPUT.	\pm 1% of set value for \pm 10% Input Voltage Variations, 0-100% Load variation.	
8.	RIPPLE VOLTAGE	Less than 3% RMS without battery connected.	
9.	EFFICIENCY	More than 75% at full load	
10.	PROTECTIONS		
	(a) Input side	AC input MCCB with input ON/OFF switch and fuses, contactor (for source-1&2 with interlocking)	
	(b) Output side	DC output MCCB with output ON/OFF switch and fuses contactor.	
	(c) Protection	Current limit protection, soft start feature, surge suppressor. Fast semiconductor fuses for rectifier bridge.	
	(d) control circuit	Fuses	
	(e) Capacitor	Rectifier HRC fuses.	

	circuit		
	(f)	Over-voltage cut-back	
	(g)	Charger over load / short circuit	
	(h)	Blocking diode	
11.	CONTROLS AND SWITCHES	Followings controls and switches are provided in the system a) AC input source MCCBs with interlocking b) DC output MCCB c) Auto/Manual float/boost mode selector switch. d) Float and boost voltage variable potentiometers. e) Manual voltage adjustment Potentiometer f) Test push button g) Reset push button h) Battery current adjustment potentiometers i) Heater’ s power supply switch j) Socket power supply switch	
12.	FEATURES	The following features are provided in the systems: a) Soft start on DC side b) Class-F insulation for all magnetic c) Automatic voltage regulation. d) Automatic changeover from float to boost and vice versa based on current, drawn by battery. e) Filter circuit to eliminate ripple. f) Charger current limit g) Separate battery path current limit. h) Built-in auto phase reversal of operation.	
13.	Meters	<u>F. C.</u> (i)Input Voltmeter (ii) Input Ammeter (iii) Output Voltmeter (iv) Output Ammeter	<u>B. C.</u> (i) Common (ii) Input Ammeter (iii) Output Voltmeter (iv) Output Ammeter.
		Battery volt meter Battery ammeter Earth leakage ammeter	
14.	Indications	(i) R, Y, B Phase ‘ON’ lamps (ii) Output ‘ON’ lamp	(i) R. Y. B. phase ‘ON’ lamps (ii) Output ‘ON’ lamp. (iii) Charger ‘ON’ float LED (iv)Charger ‘ON’ boost LED.
15.	Annunciation with audiovisual alarms.	(i) AC input mains failure (ii) Input phase failure (iii) AC under voltage (iv) Input phase failure	

		(iii) Rectifier fuse failure (iv) Output fuse failure (v) Filter fuse failure (vi) DC under voltage (vii) DC over voltage (viii) Charger trip (ix) Capacitor fuse fail (x) Output MCCB tripped (xi) Charger over load (xii) Earth leakage (xiii) DC earth fault (xiv) Alarm supply fuse failure (xv) Battery low condition.	v) Rectifier fuse failure vi) Output fuse failure vii) Filter fuse failure viii) DC under voltage ix) DC over Voltage x) Charger trip xi) Capacitor fuse fail xii) Output MCCB tripped.
Note : All the alarms shall be provided through electronic display cards. Audio alarm through buzzer, visual indication through 10 mm LEDS & alarm ackn. / reset and LED provision is through push buttons.			
16.	Operating ambient temperature surrounding the panel	0° to 50°C	
17.	Surrounding the panel Relative humidity.	0-95% non-condensing	
18.	<u>PANEL</u> (a) Protective grade (b) Cooling (c) Paint	(a) IP - 42 (b) Natural air-cooled (c) Smoke Grey of ISS-692 shade	
19.	<u>MAGNETICS :</u> (a) Average winding temperature rise over ambient temperature (b) Insulation class (c) Insulation breakdown voltage.	As per relevant ISS. 'F' 3 KV for 1 min withstand.	
20.	<u>CABLES</u>	1100 V grade PVC insulated copper. Ferrules shall be provided for identification of connection.	

N.B. : - Besides the above general technical requirements, all other stipulations, as enumerated in this technical specification shall be followed. Any deviation should be clearly brought out with clear explanation.

Any extra feature/ equipment / instrument as necessary for operation and performance of the battery charger for the 220V /48 V battery set as per this specification shall be provided without any extra cost to OPTCL..

ANNEXURE – IV-A
(For Testing of Battery)
(To be filled in by the bidder)

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/ METERS

Name of the Test	Meters & Equipments required for the corresponding test with range, accuracy, make & Sl. No.	Date of Calibration	Due date of Calibration	Name of the Calibrating Agency	Whether Calibrating Agency is Govt. approved	Whether documents relating to Govt. approval of the calibrating Agency furnished	Whether the meters/ equipments fulfil the accuracy class as per calibration report.	Whether the calibrating agency has put any limitation towards the use of the particular meter/ equipment. If yes, state the limitations	Whether the calibrating agency has put any limitation towards the use of the particular meter/equipment/ meter. State the colour of the affixed sticker	Inspite of imposed limitations. Whether the particular meter / equipment can still be used ? Justify its use for corresponding test(s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with seal & date

ANNEXURE – IV-B
(For Testing of Battery Charger)
(To be filled in by the bidder)

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/ METERS

Name of the Test	Meters & Equipments required for the corresponding test with range, accuracy, make & Sl. No.	Date of Calibration	Due date of Calibration	Name of the Calibrating Agency	Whether Calibrating Agency is Govt. approved	Whether documents relating to Govt. approval of the calibrating Agency furnished	Whether the meters/ equipments fulfil the accuracy class as per calibration report.	Whether the calibrating agency has put any limitation towards the use of the particular meter/ equipment. If yes state the limitations	Whether the calibrating agency has put any limitation towards the use of the particular meter/equipment/ meter. State the colour of the affixed sticker	Inspite of imposed limitations. Whether the particular meter / equipment can still be used ? Justify its use for corresponding test(s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with seal & date

ANNEXURE V – A (To be filled in by the bidder) CHECK LIST TOWARDS TYPE TEST REPORTS FOR BATTERY

Name of the Type Test	Date of Test	Name of the Laboratory where the Test has been conducted	Whether the Laboratory is Government approved	Whether the Test report is valid as per Spn.	Whether the Test report in complete shape alongwith	Whether the type tested Plante lead acid battery fulfills the	If the type tested battery does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct he particular type test again at their	Remarks
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					drawings etc. furnished or not ?	technical requirements as per TS	own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period	
1	2	3	4	5	6	7	8	9

Signature of the tenderer with seal & date

ANNEXURE V – B

(To be filled in by the bidder)

CHECK LIST TOWARDS TYPE TEST REPORTS FOR BATTERY CHARGER

Name of the Type Test	Date of Test	Name of the Laboratory where the Test has been conducted	Whether the Laboratory is Government approved	Whether the Test report is valid as per Spn.	Whether the Test report in complete shape alongwith drawings etc. furnished or not ?	Whether the type tested battery charger fulfills the technical requirements as per TS	If the type tested battery charger does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct he particular type test again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative within the specified delivery period	Remarks
1	2	3	4	5	6	7	8	9

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Signature of the tenderer with seal