



ODISHA POWER TRANSMISSION CORPORATION LIMITED
JANPATH, BHUBANESWAR – 751022

TECHNICAL SPECIFICATION

FOR

MF-VRLA BATTERY SET

I- BATTERY SETS-	48 Volt, 200 AH:-
	48 Volt, 300 AH:-
	48 Volt, 400 AH:-
	48 Volt, 500 AH:-
	48 Volt, 680 AH:-
	384 Volt, 200AH:-

PART – A
TECHNICAL SPECIFICATION
FOR
48 VOLT & 384 VOLT 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 dispatch, supply and delivery at site, erection, testing and commissioning of 48 volt 200, 300, 400, 500 & 680 AH and 384Volt 200AH MF- VRLA storage batteries along with the required accessories and fittings etc.

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 MF- VRLA batteries as specified, 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 Orissa where the equipment will be installed. Nothing shall be construed to relieve the supplier of his responsibility.

A.2.6. **GOVERNING SPECIFICATION:-**

The MF-VRLA batteries 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:-**

BATTERY: Easy installation and handling and easy cell replacement. Batteries should be compact and can be used in any orientation without any leakage or spillage of electrolyte

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. There should be no emission of corrosive fumes or gases under normal operating condition in case of Battery.

A3.3.3. 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.

A3.3.4. 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:-

A.3.4.4. The equipment with their accessories shall be designed for smooth, efficient and trouble free operation in 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.

A.4.0. CONSTRUCTIONAL DETAILS OF MF- VRLA BATTERY.

A.4.1. PLATES

Positive plates shall be made of flat pasted type using Lead-calcium-tin alloy for durability, low corrosion, maintenance free, low self-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-tin alloy 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 plate to ensure consistency in plate 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 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. 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 H₂SO₄ 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 and 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:-

- a) TIG welding shall be done for post sealing.
- b) 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 information shall be legibly laid durably marked on each cell battery:-

- (a) Nominal Voltage.

- (b) Name of the manufacturer and type reference.
- (c) 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.
- (d) Voltage for float operation 27^o C with tolerance of 1%.
- (e) Cell number.
- (f) Type of positive plate.
- (g) Type of container.
- (h) 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, 300,400, 500 and 680 AH to end cell voltage of 1.75 volts /cells as per IS 15549/2005.

A.7.1. SELF DISCHARGE RATE OF BATTERY:-

Self discharge rate shall be less than 0.5 % of C 10 Capacity per week at 27 degree 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. Two sets of operation & maintenance manuals along with each set of battery shall have to be furnished.

A.11.2. 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.

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 °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 ion leak tester for leak free performance. Vendor shall attach a copy of the Helium ion 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. OPTCL at its discretion may ask the supplier to conduct the above type test (s) at the supplier's cost in the presence of OPTCL's representative without any financial liability to OPTCL.

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. IEC 89-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 along with 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.
7. Pressure of vent plug connected with battery (measuring shall be provided during testing).
8. 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, OPTCL 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 duplicate 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, characteristic curves etc.

A.16.0. TRANSPORT:-

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

A.17. 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 bidder.

**SPECIFICATION FOR 48 Volt 200, 300, 400, 500 & 680 AH and 384 Volt, 200AH
MF-VRLA BATTERY**

SL. NO.	SPECIFICATION	CONFIRM / NOT CONFIRM
1	Maintenance free valve regulated sealed type Lead acid battery 48Volt/ 200,300,400, 500 and 680AH. 2V per cell [Total 24 Nos. battery cells/set] and 384Volt,200AH, 2V per cell [Total 192 Nos. battery cells/set]	
2	The cells should be assembled in stack over insulated steel rack to make 48 Volt / 200,300,400,500 & 680AH and 384Volt, 200AH battery set for communication system.	
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: 15549/2005	
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 1.75 volt per cell to conform to the requirement of IS : 15549/2005 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 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 200,300,400,500 & 680 AH or higher capacity to the communication Systems under any GRID Sub-stations/communication equipments and the same is in successful operation for a minimum period of last 2 years as on date of opening of the tender.	
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 set will be inspected & tested at works before dispatch to store/site.	

[To be filled in by the bidder]

ANNEXURE II

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 48 VOLT 200,300,400, 500 & 680 AH AND 384 VOLT, 200AH MF-VRLA LEAD ACID STORAGE BATTERY

(TO BE FILLED IN BY THE BIDDER)

Values / Others.

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:-
	<ul style="list-style-type: none"> a. 15⁰C. b. 27⁰C c. 50⁰C
18	Cell Particulars:-
	<ul style="list-style-type: none"> a. Material of container. b. Overall dimensions of each cell. c. Weight of cell complete with acid.
19	Voltage:-
	<ul style="list-style-type: none"> 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 rate
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	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.
	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.
	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.
	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).
	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:
	(i) Finishing rate. (ii) High starting rate. (iii) Two step charging by starting and finishing rate.

ANNEXURE – IV
(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	In spite 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

(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 along with drawings etc. furnished or not ?	Whether the type tested Plante lead acid battery fulfills the technical requirements as per TS	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 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

Signature of the tenderer with seal & date



ODISHA POWER TRANSMISSION CORPORATION LIMITED
JANPATH, BHUBANESWAR – 751022

SECTION – IV

TECHNICAL SPECIFICATION

FOR

SMPS BASED BATTERY CHARGERS

50 VOLT BATTERY CHARGER	:
(SUITABLE FOR 48V MF-VRLA	50 Amp-
BATTERY)	75 Amp-
	100 Amp-
	125 Amp-

PART – A
TECHNICAL SPECIFICATION

FOR
50 VOLT SMPS BASED BATTERY CHARGER

A.1.0. **SCOPE:-**

- A.1.1. This specification covers the design, manufacture, assembly, shop testing at manufacturer's works before dispatch, supply and delivery at site, erection, testing and commissioning of 50 volt 50A,75A,100A & 125A SMPS based float cum boost chargers.
- A.1.2. Comprehensive AMC of the said commissioned Chargers for a period of 5 years beyond successful completion of guarantee period.
- 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 SMPS based chargers 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 Orissa where the equipment will be installed. Nothing shall be construed to relieve the supplier of his responsibility.**

A.2.6. **GOVERNING SPECIFICATION:-**

The MF-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
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:-**

CHARGER: 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.

A.3.3.3. 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:-

A.3.4.4. The equipment with their accessories shall be designed for smooth, efficient and trouble free operation in 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. The 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.

PART-B

TECHNICAL SPECIFICATION FOR 50V- 50,75,100 &125 Amp **SMPS BASED AUTOMATIC FLOAT-CUM-BOOST CHARGERS** **SUITABLE FOR 48V MF-VRLA BATTERIES.**

1. SCOPE:

This specification covers the design, manufacture testing before dispatch, delivery at site and erection, testing & commissioning at site of 50V Automatic Float-cum- Boost Charger of different capacities and comprehensive AMC thereof for 5(Five) years beyond successful completion of guarantee period..

2. BASIC REQUIREMENT:

- 2.1. The charger shall preferably be modular type based on high frequency switching mode power supply(SMPS) technique using IGBT devices and the front mounted SMPS modules should be hot swappable.
- 2.2. The float -cum- boost charger shall be suitable for charging 48V battery in addition to trickle charging and feeding power to communication equipment whenever AC mains supply is available to the charger.
- 2.3. In spite of the fluctuations in the voltage and the frequency variation of mains supply to the charger, there must be line regulated DC output voltage for feeding the communication equipment load. The DC output voltage shall also be load regulated.
- 2.4. In the event of mains supply failure, the batteries shall supply total load current as long as the battery is not discharged below 40V . A Low Voltage Disconnect (LVD) should protect the battery from deep discharge. On restoration of main supply the float-cum-boost charger shall resume its normal function of charging the battery as well as feeding communication equipment load automatically.
- 2.5. Depending on the status of battery i.e voltage per cell and previous discharge history, there shall be need for automatic switching between float and boost charging. Separate outputs for battery and equipment should be available, otherwise dropping diode technique may be used to prevent boost voltage appearing across the load.
- 2.6. Digital Control: charger should employ digital control with DSP controller for providing predictive control of rectification & monitoring capability. The charger should have a multi line dot matrix display of suitable size , on front panel to indicate control status and event log.
- 2.7. The side and top panels of the equipments should be designed in such a way to allow sufficient ventilation for the components. The ON – OFF switch, input and output fuses, indication lamps, voltmeters, ammeters, filters, condensers fuses, output voltage

control are to be provided on the front panel. Cable entry holes shall be provided at the bottom with suitable clamping arrangements.

COMPONENTS:

- 2.8. Components used shall be of professional grade of reputed manufacturer. Iron and ferrite core transformer and chokes if used shall be wound with copper with adequate insulation provided.
- 2.9. **The positive output of SMPS units must be connected to common ground.** Circuit breakers, output fuse, ammeter shunt etc should be provided on the negative path of the output. Sensing circuit , fuses or circuit breakers shall be provided wherever appropriate to protect the charger
- 2.10. Suitable mechanical front loading rack arrangement for holding modules in position shall be provided so that the modules are held firmly by sliding through it.
- 2.11 **Efficient earthing of the Charger shall be provided, taking care that in communication system 48V DC positive is always connected to earth.**

PROTECTION:

- 2.12. Protection circuit should be provided for the following cases:
- i) Under voltage / Over voltage for both input and output.
 - ii) Over load / short circuit.
 - iii) Battery earth Fault
 - iv) SMPS Unit failure.
 - v) Wrong battery connection/reverse polarity
 - vi) Power ON self test
 - vii) Supply wrong phase, phase failure.

VISUAL INDICATION:

- 2.13. Visual indication such as LED, Dot matrix LCD etc. shall be provided to indicate:
- (a) Mains available
 - (b) Phase failure / wrong phase
 - (c) Charge/ Discharge
 - (d) Charger over load

- (e) Float mode/ Boost mode
- (f) Output fail
- (g) Battery Low.

ALARM FACILITIES:

- 2.14. The equipment shall be provided with audio alarm facility for all the conditions as mentioned in 2.12 with suitable resetting facilities. The audio alarm in respect of the above conditions should automatically reset itself after a lapse of 30 seconds. The visual indication should persist till the fault is cleared. Potential free contact shall be provided for extension of alarm for centralised display.

COMPONENT MARKING:

- 2.15. Each electrical component should be located on the PCB by the layout / circuit diagram. The wiring shall be clearly and permanently identified with a designation or a colour code which must correspond to the equipment circuit diagram.

2.16.

CABINET

- Free standing steel cabinet 1.6/2.0
Or above gauge sheet steel. Degree of protection not less than IP42

NAME PLATE:

- 2.17. A name plate etched, engraved, anodized or any other better arrangement ensuring better life expectancy shall be suitably fixed on the cabinet of the charger and should contain following information.

- a) Specification No.
- b) Type of the unit
- c) Manufacturers name
- d) Model No.
- e) Serial No.
- f) Input voltage and phase
- g) Output voltage and current
- h) Year of manufacture

HEAT – RUN:

- 2.18. All units shall be subjected to heat run test of 12hours at full load and temperature of component shall not be more than as mentioned below:

- a) Transformers and chokes - 70°C
- b) Transistors / diodes /FETs - 60°C or as per component spec.

INSULATION RESISTANCE:

- 2.19. The insulation resistance of the charger when tested with a 500V DC megger shall be as given below.
- a) AC input and earth - Greater than 2 Meg. Ohms.
 - b) DC output and earth - Greater than 1 Meg Ohms.

- c) AC input and DC output - Greater than 5 Meg ohm

LIGHTNING PROTECTION:

- 2.20. The system shall be adequately protected against lightning at the input.

RADIO FREQUENCY INTERFERENCE SUPPRESSION:

- 2.21. The equipment should be designed to minimize the level of electromagnetic interference both conductor and radiator, detected in the vicinity of the equipment and generated by switch mode power conversion equipment inside the charger.

TOTAL VOLTAGE HARMONIC DISTORTION:

- 2.22. The total line harmonic voltage distortion shall not be more than 10%.

TOTAL CURRENT HARMONIC DISTORTION:

- 2.23. The total current harmonic distortion contributed by the unit shall not exceed 20% for all input condition and load 50% to 100% of the rated capacity.

MANDATORY SET OF SPARES:

- 2.24 The suppliers shall provide the following mandatory spares for each of Charger supplied.

- | | | | |
|-----|--|----|-----------------|
| (a) | AC Contactor (if used in the charger) | :- | 1 no./ charger |
| (b) | DC Contactor (if used in the charger) | :- | 1 no./ charger. |
| (c) | Required HRC Fuses of appropriate rating:- | | 4 nos./ charger |

INSTRUCTION AND MAINTENANCE MANUAL:

- 2.25 Two copies of the instruction manual shall be supplied along with each unit. The manual has to include dimensioned layout drawings, detailed circuit and schematic diagrams, PCB layout and detailed inter connecting drawings of modules and switching arrangements. Details on testing and adjustment procedure, initial check on receipt at site, detailed installation and commissioning procedure, maintenance procedure, proposed routine maintenance tests, actual test results obtained for the particular unit at the factory.

- 2.26 detailed trouble shooting chart shall be outlined in the manual.

Instruction manual is to be prepared using good quality paper. All drawings in Clear printing shall be attached to the manual along with the flow chart drawing necessary for trouble shooting.

2.27. The bidder shall arrange for training of at least five Telecom. Engineering personnel of OPTCL on operation & maintenance of 50 V Float-Cum-Boost chargers free of cost. Every details regarding repair of all probable defects 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 conducted prior to delivery of the Battery chargers.

TYPE TEST

2.28 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) Measurement of Power loss/ consumption in rectifier auxiliaries
- (b) Equipment reactance test
- (c) Measurement of voltage regulation / AVR regulation
- (d) Efficiency and power factor measurement test
- (e) Temperature rise test so as to determine the temperature rise of Semiconductor, Ferrite cores and cabinet etc.
- (f) Measurement of insulation resistance.
 - (i) AC input to earth.
 - (ii) AC input to DC output.
 - (iii) DC output to earth
- (g) DC voltage current characteristic
- (h) High Voltage Tests.
- (I) Determination of regulation
- (J) Measurement of ripple
- (k) Reverse leakage test
- (l). Test for confirmation of reduction in float voltage with increase of battery temperature and vice-versa.

The bid offers in confirmation to the above tests as well as the tests certified by Telecom RDSO center and followed by REL-TEL shall be given due weight age.

ACCEPTANCE TESTS:

2.29 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 for each charger. No sampling is allowed.

- (a) Measurement of voltage regulation
- (b) Efficiency and power factor measurement
- (c) Temperature rise test so as to determine the temperature rise of Semiconductor capacitor, choke, Ferrite cores 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) DC voltage current characteristic
- (f) High voltage tests.
- (g) Determination of regulation.
- (h) Measurement of ripple
- (I) Tests for indications and alarms as per this specification
- (j) Tests for indicating instruments.
- (k) Determination of system set points.
- (l) 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.

DRAWINGS / DOCUMENTS

2.30 The bidders shall submit the following drawings / documents along with their 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 bidder shall submit the following drawings / documents in 3 (three) 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 along with sectional views showing cable entry position etc.
- (c) Rating calculations for power semiconductors, torridly transformers, capacitors inductors etc.
- (d) Detailed schematic and connection and control wiring diagram for all the equipments.
- (e) Complete bill of materials
- (f) Technical excerpts on operation.

GUARANTEED TECHNICAL PARTICULARS

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

DEVIATION FROM SPECIFICATION

2.32 All deviations from the specification shall be separately listed in the technical deviation sheet(As per Annexure-XIIB), in the absence of which it will be presumed that the provisions of these specifications are complied with by the tenderer. Any extra feature/equipment/ instrument as necessary for operation and performance of the

battery charger for the 48V MF-VRLA batter set as per this specification shall be provided without any extra cost to OPTCL. **The extent of up gradation facility shall be mentioned.**

TRANSPORT :

2.33 The chargers along with its accessories shall be suitably packed and transported to site in ready to use condition.

3. BRIEF TECHNICAL SPECIFICATION:

The required capacity of chargers may be 50V-150A/125A/100A/75A/50A/50A Chargers of 75 Amp. Rating and above shall be of 3 phase type.

Charging Curve: Completely programmable .Can support batteries of any type, voltage, capacity.

- a) Input Voltage: - 230 \pm 20% VAC single phase in case of 25A, 40A and 50A charger. 30%
400 \pm 20% VAC three phase in case of 60A, 75A, 125A and 160A charger 30%

Frequency – 50Hz \pm 5%

Power factor – Single phase model- > 0.90 at full load

Three phase models >0.97 at full load .

Voltage withstand test – 1500V AC input to chassis for 1 minute.

- b) Float mode – Adjustable 48V – 52 V Trickle charging of battery and simultaneously supplying the load.

Boost mode – Adjustable 48V – 65V

Boost charging of battery and simultaneously supplying the load after suitable voltage dropping arrangement.

Static Regulation – Line : \pm 0.5%

Load : \pm 0.5%

Dynamic Regulation : \pm 0.5% for 10% - 90% - 10% stop load change.

\pm 1 % within 1 m sec. Of stop change.

\pm 1 % for \pm 25% stop change in AC input voltage.

Phosphometric noise (emf weighted at 800 Hz)

< 2mV rms while delivering full rated load at normal input.

Out Ripple:- Less than 1% RMS at full load.

EFFICIENCY:

a) Single Phase AC

i) At normal input, output and full rated load : - Better than 85%.

ii) For other specified input output condition and load between 25% to 100% : - Better than 80%.

b) Three Phase AC

i) At normal input, output and full rated load : - Better than 90%

ii) For other specified input, output conditions
and load between 25% to 100% : - Better than 85%.

**GUARANTEED TECHNICAL PARTICULARS FOR
BATTERY CHARGER (48V D.C. SYSTEM) SUITABLE
FOR SPECIFIED MF-VRLA TYPE STORAGE BATTERY**

(To be filled in by the Bidder)

Values/ Others

1. MANUFACTURER'S NAME
2. RATED OUTPUT OF THE CHARGER
 - 2.1 Voltage (volts)
 - 2.2 Current (amps)
 - 2.3 Power factor
3. SHORT TIME RATING
4. TYPE OF COOLING
5. HOTTEST STACK TEMPERATURE ($^{\circ}\text{C}$)
6. CHARGER DIMENSIONS
 - (a) Height (mm) :
 - (b) Depth (mm) :
 - (c) Width (mm) :
 - (d) Sheet thickness (mm) :
7. CHARGER WEIGHT :
8. CHARGER RATED OUTPUT CURRENT
 - (a) Float charging mode :
 - (b) Boost charging mode :
9. LOAD LIMITER CURRENT SETTING RANGE (Trickle mode)
10. AUTOMATIC VOLTAGE REGULATOR MODULE
 - 10.1 manufacturer's name
 - 10.2 Manufacturer's type
 - 10.3 Percentage stabilization of the rectifier with the help of AVR when

- (a) Input voltage changes with \pm of its nominal value.
 - (b) DC output of the rectifier varies from no-load to full load.
- 11.4 Rated output voltage
 - 11.5 Allowable AC frequency fluctuations
 - 10.6 Voltage setting range
 - 10.7 Response time of automatic voltage regulator
 - 11.0 CONTACTORS / MOULDED CASE CIRCUIT BREAKERS
 - 11.1 Type
 - 11.2 Make
 - 11.3 Rated voltage (V)
 - 11.4 Rated continuous currents (A)
 - 11.5 Contact material
 - 11.6 Operating coil
 - 11.7.1 Voltage (V)
 - 11.7.2 Voltage range and power for closing and holding
 - 11.7.3 Voltage range and power for drop off.
 - 11.8 Details of CT if any
 - 11.9 Auxiliary contacts.
 - 11.9.1 Number
 - 11.9.2 Current rating
 - 11.10 Characteristics of back-up HRC fuse.

12.0 RELAYS :

- 12.1 Make and type of protective and alarm relays
 - (a) Thermal overload relay
 - (b) Input under voltage relay
- (a) Single phasing alarm relay
- (b) Phase reversal relay
- (c) D.C. output over-voltage relay
- (d) D.C. output under voltage relay
- (e) Charger failure relay
- (f) Battery earth fault relay
- (g) A.C. input failure relay (for connecting the D.C. load)
- (h) Fuse failure relay
- (i) Alarm accept relay

12.2 Rated voltage of each of the above

- (a) AC/DC
- (b) Permissible variation
- (c) Frequency

12.3 VA burden of each of the above

12.4 Operating time of each of the above

12.5 Reset time

12.6 Accuracy

12.7 Setting range

12.8 Reset factor

12.9 Number of contacts

- a. Normally open
- b. Normally closed

12.10 Rating of contacts

- (a) Rated Voltage (V)
- (b) Rated making and breaking
- (c) Continuous rating

12.11 Operation indicator

13. INDICATING LAMPS/ LCD DISPLAY

13.1 Manufacturer's name

13.2 Type and designation

13.3 Permissible voltage variation

13.4 Rated power consumption (watts).

13.5 Series resistance, if any

14. SWITCHES:

14.1 Manufacturer's name

14.2 Ratings

- (a) Continuous current
- (b) Short circuit – making capacity
- (c) Breaking capacity
- (d) Voltage

14.3 Operating mechanism details

14.4 Type of visual indication

- (a) OFF and ON position
- (b) Fuse blow out

15.0 FUSES/Circuit breaker

- (a) Make
- (b) Type
- (c) Rating (Amps)
- (d) Interrupting rating (KA)

16. INSTRUMENTS

16.1 Manufacturer's Name

- (a) Ammeter
- (b) Voltmeter

16.2 Type

- (a) Ammeter
- (b) Voltmeter

16.3 Standard

- (a) Ammeter
- (b) Voltmeter

16.4 Scale range

16.4.1 Ammeter

- (a) Float charger
- (b) Boost charger
- (c) Battery float
- (d) Battery boost

16.4.2 Volt meter

- (a) Input supply
- (b) Charger output
- (c) Load

16.5 Size of dial

- (a) Volt meter
- (b) Ammeter

16.6 Accuracy class

- (a) Volt meter
- (b) Ammeter

16.7 Temperature at which calibrated

16.8 Limit of errors

16.9 Out line dimensions

16.10 Type of mounting

16.11 Selector switch for volt meter (AC & DC)

- (j) Make
- (k) Rating

17. Reference float voltage at ambient temperature of 27°C

18. Whether protection is given for float voltage to Avoid low battery voltage due to sensor or circuit Malfunction. (Yes/ No)
19. Whether the positive output of SMPS units is connected to common ground. Circuit breakers, output fuse, ammeter shunt etc are provided on the negative path of the output (Yes/No)

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	In spite 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 along with drawings etc. furnished or not ?	Whether the type tested Plante lead acid battery fulfills the technical requirements as per TS	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 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

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 along with 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 the 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

Signature of the tenderer with seal