



ODISHA POWER TRANSMISSION CORPORATION LIMITED

**TECHNICAL SPECIFICATION
FOR**

**TECHNICAL SPECIFICATION FOR 220
VOLTS VENTED LEAD ACID STORAGE
BATTERY (PLANTE TYPE).**

1. IMPORTANT INSTRUCTION:

Please read the following instructions carefully before submitting your bid:

- 1.1. All the drawings, i.e. dimension, elevation, side view, front view, plan, cross sectional view, isometric view, important component drawing etc., in PDF along with AutoCAD format and manuals (Technical/Installation/Operation) in PDF format, for offered item shall be submitted. The hard copies as per specification also shall be submitted.
- 1.2. The acceptability of Type Test reports submitted by any bidder/EPC shall be strictly in adherence to the broad guidelines mentioned in clause no. 2 of “CEA guidelines for the validity period of Type Tests conducted on major electrical equipment of power transmission system” published in May 2020.
- 1.3. The Bidder/EPC shall have to submit all the required type test reports for the offered item along with the accessories. In case of submission of soft copy of type test report, high resolution colour scan of the original test report must be submitted. Scanned copy of Xerox of type test reports shall not be entertained. If required, the firm has to show the original type test report for the purpose of verification. In absence of this, the evaluation shall be carried out accordingly as non-submission of type test reports. The type test report of 220 volt DC Battery submitted by the manufacturer shall be considered valid if the date of type test does not exceed 07 years as on the last date of submission of bid; provided:-
There is no major changes introduced in the basic design / technology /material /mechanical /construction /functionalities /performance characteristics/ manufacturing process of the equipment.
OR
Until the relevant IS/IEC / statutory guidelines is revised which warrants fresh type tests because of introduction of new type tests even though there is no change in material/basic design of the equipment.
- 1.4. The Bidder/EPC must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.
- 1.5. The Bidder/EPC is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by OPTCL, in the event of an order, free of cost. The cost of logistics will be borne as per the clauses of respective purchase orders/work orders.
- 1.6. The discrepancies between the specification and the catalogues or literature, submitted as part of the offer OR with prevalent standards/Govt. guidelines shall not be considered as valid deviations unless otherwise the same deviations related to TS is brought out separately by the Bidder/EPC in the pre-bid queries or in form of clarification. If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be submitted along with Pre-Bid Queries with reasons duly supported by documentary evidences and such modifications, not mentioned in Pre-bid queries, will not be considered.
- 1.7. For purpose of Agreement, the firm shall provide warranty as specified in the purchase order / tender document. Notwithstanding the foregoing, Supplier agrees to waive the expiration of the Warranty Period in the event where in a pattern of defect/trend of failure is observed after the Warranty Period in a significant portion of the supplied quantity, or any critical defect discovered which, in Purchaser's opinion, constitutes a threat of damage to property or to the health and safety of any person.
- 1.8. Warranty certificate for purchase of any material, whether directly procured by OPTCL or EPC agency, shall be issued directly in favour of OPTCL.

2. SCOPE:

- 2.1. These specifications cover the design, manufacturer, assembly, shop testing at manufacturer's works before dispatch, supply and delivery at SITE and erection, testing and commissioning of 220 volt vented lead Acid storage Battery.
- 2.2. 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.
- 2.3. This scope shall also include the lifting of old batteries on buy back system basis if mentioned in the purchase order/work order.

3. STANDARDS:

- 3.1. The equipment shall comply in all respects with the latest edition of relevant Indian Standard & IEC Specifications except for the modifications specified herein. The equipment 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].

3.2. LIST OF RELEVANT STANDARDS IS BS/IEC GIVEN BELOW :

A			Indian Standards
1	IS:1885-15		Electro technical Vocabulary, Part 15: Primary Cells and Batteries
2	IS1652		Stationary cells and lead-acid type with batteries, Planté positive plates
3	IS 266		Sulphuric acid
4	IS 1069		Quality Tolerances for Water for Storage Batteries
5	IS 6071		Synthetic separators for lead-acid batteries
6	IS 3116		Sealing Compound for Lead-acid Batteries (Bitumen Based)
7	IS 1146		Rubber and plastic containers for lead-acid storage batteries
8	IS 8320		General Requirements and Methods of Tests for Lead-acid Storage Batteries
B			IEC Standards
1	IEC 60896-11		Stationary lead-acid batteries – Vented types – General requirements and methods of tests
2	IEC 62485-1		Safety Requirements for Secondary batteries and Battery Installations – General Safety Information
3	IEC 62485-2		Safety Requirements for Secondary batteries and Battery Installations – Stationary Batteries

C	ANSI/IEEE Standards	
1	IEEE Std 484	IEEE Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Sub-stations
2	IEEE Std 485	IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
D	Other Standards	
1	DIN 40738	Lead storage batteries; stationary cells with positive Planté plates, narrow plate distance; rated capacities, main dimensions
2	BS 6290-2	Lead acid stationary cells and batteries – Specification for the high-performance Plante positive type

4. PARTICULARS OF THE SYSTEM:

- 4.1** One set of 220 Volts, 350AH Vented capacity battery along with equipment such as boost charger, trickle charger shall be sufficient to cater to the DC power requirements in different EHT Sub-stations in the State under OPTCL. DC System shall have rated nominal voltage of 220 V designed for maximum durability during all service condition including high rate of discharge and rapid fluctuation of load.
- 4.2** The battery set(s) are meant to cater the following DC load requirements under emergency conditions without any assistance from chargers:

Continuous Loads	Emergency DC Lighting, Protection Panels (Relays, IEDs, Indicating lamps, Annunciators etc.), SAS System, Station HMIs, Inverters, LT DC System, Miscellaneous permanently connected loads etc.
Non-continuous Loads	CB Spring Charging Motor, Isolator/Earth Switch Operation Motor in GIS etc.
Momentary loads	Simultaneous CB Tripping etc.
Random Loads	Loads that occur at random should be shown at the most critical time of the duty cycle in order to simulate the worst-case load on the battery.

5. GENERAL REQUIREMENTS OF THE EQUIPMENT:

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

- 5.1** One set of 220V, 350AH vented lead acid type having high cyclability, Low maintenance storage battery set is for required for meeting the D.C. load requirements of E.H.V sub-station for indicating lamps, emergency lighting, relays, alarms, circuits breakers etc. of normal load current of 10 Amp.(max) and maximum intermittent load of 45 Amps.
- 5.2** 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 opening of circuit breakers, emergency lighting load etc. It should be noted that, the 220V batteries are to be accommodated within the floor space area and area to be provided by the manufacturer in the following format.

SL.NO	PARTICULARS	ROOM SIZE
1	350 AH 220 VOLT SINGLE SET	
2	350 AH 220 VOLT DOUBLE SET	

- 5.3 It should operate satisfactorily over the entire range of ambient temperature of 0° C to 50° C and relative humidity of 95%.

6. DETAILS OF SPECIFICATIONS OF VENTED LEAD ACID BATTERIES:

- 6.1 The batteries shall be made of closed type lead acid cells of very low internal resistance having high cycling capability ,moderate size, high service life minimum 25 years, excellent performance for both low & high rates of discharge, rigid cell plates design type manufactured to conform to relevant latest IS/IEC.

6.2 **CAPACITY:**

The capacity of the batteries shall be as follows:

- i. Voltage. - 220V
- ii. Output at 27° C- 350AH 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 198 V [90% of rated voltage]

- i. I stage [continuous] - 35A for 10 hours.
- ii. II Stage [emergency] - continuous current of 35 Amps. Plus light load of 10 Amps

- 6.3 **The Battery Bank shall consist of 110 Nos. battery cells with 2 Volt nominal voltage per cell and for the minimum [discharged condition] voltage of the cells, the voltage of the battery set not be less than 85% of the rated voltage (220 Volt), while the assigned rating of the battery bank cannot be less than its rated voltage of 220 volts.**

7. DESIGN AND CONSTRUCTION DETAILS:

7.1. Containers : The containers for the cells shall be of high grade, impervious molded transparent, with excellent thermal, chemical & impact resistance having heat-resisting, high strength, non-reacting, halogen free Styrene-Acrylonitrile (SAN) and low inflammable properties conforming to latest IS/IEC. 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/IEC latest edition. 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 Bidder for the scrutiny of the purchaser.

7.2. PLATES :

- (a) POSITIVE PLATES :** The positive plates shall be of pure lead. Structure made by pasting of active materials is not acceptable. It shall offer high resistance to corrosion. The plates shall be arranged in hanging/any other position inside the container, which will allow the growth extending superior ageing of the battery.
- (b) NEGATIVE PLATES :** The negative plates shall be pasted antimonial-lead/lead alloy Grid plate 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 micro porous combined with pocket for positive plates separators shall be of synthetic material conforming to the latest edition of IS/IEC. 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 along with his offer.

- 7.4. **Electrolyte:** The electrolyte (dilute sulphuric acid) 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 colorless 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 latest IS/IEC.
- (a) **Terminal:** Leak proof safety pole with solid brass/lead insert & M10 stainless steel bolt. The nuts & Bolts should be of same materials.
 - (b) **Connectors:** Insulated solid copper/lead connectors shall be used.
- 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(vent pug) shall be anti-splash, flame arrestor type and shall allow gases to escape freely but shall effectively prevent acid particles or spray from coming out. The length of insertion of vent pug shall be so arranged that will give high conductivity. Vent plug shall be maintenance free over entire service life. The safety vent plug shall have excellent gas drying properties, prevents emission of electrolyte or aerosols. It should be easily remove for cell inspection. 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 with maximum & minimum.
The following information shall be indelibly marked on the outside surface of each cell:

- a. Manufacturer's name, type and trade mark.
- b. Nominal voltage.
- c. AH capacity at 10 hours rate with specified end cell voltage.
- d. Cell number.
- e. Upper and lower electrolyte level in case of transparent containers.
- f. Type of positive plate.
- g. Type of container.
- h. Date of manufacture [month and year] or [week and year].

8. INSTALLATION OF BATTERY:

- 8.1. Battery shall be installed on FRP coated steel/seasoned wood racks in a non-air-conditioned ventilated battery room. The Bidder shall offer racks and mounting insulators etc.
- 8.2. 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 wooden racks shall be constructed of best quality seasoned wood with at least three [3] coats of anti-acid paint of approved shade and also flame proof coating. Stand should have at least 5.0 mm FRP coating and the FRP coated shall be non-reactant to acid. The stand should be suitable for mounting on flat concrete floor & should be designed to withstand loading of the Battery set throughout its life. 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. Bidder 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.

9. CONNECTORS-

Solid copper/ lead connectors with transparent cap for ease of inspection shall be employed for Inter-cell and inter-row, inter-tier connections. Possibility of voltage check through an opening of small size for allowing the pin of the lead of the millimeter can be inserted in the cap. However, the tee-off connection from the battery unit shall be made with acid resisting cables of suitable size. A suitable terminal box along with acid-resisting cable shall be provided by the Bidder 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.

10. ACCESSORIES

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

- I. FRP racks / Teak Wood racks with three coats of anti-acid paint and flame-proof coating.
- II. Stand insulators (+20% extra.)
- III. Cell insulators (+5% extra.)
- IV. All Cell inter-connectors and end take-offs.
- V. Lead coated connection hardware such as bolts, nuts etc.5% extra.
- VI. Cell numbering tags with fixing arrangement.
- VII. Cable clamps with hardware.
- VIII. Diluted sulphuric acid of required quantity and of specific gravity according to the relevant ISS and 10% extra shall be supplied in non-returnable acid proof containers, suitable packed.
- IX. Two 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.
- X. Two number floating hydrometer.
- XI. 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 0.50C]
- XII. One number wall mounting teak-wood for hydrometers and thermo-meters.
- XIII. Two numbers acid-resisting plastic jugs [2 liter capacity]
- XIV. Two numbers plastic funnels.
- XV. Two numbers rubber syphon.
- XVI. Two numbers rubber aprons.
- XVII. Two pairs of rubber gloves.
- XVIII. Two pairs of rubber boots-knee height.
- XIX. Two sets special tools or tools required for connecting the terminals of the batteries.
- XX. The battery terminals shall be brought out in a junction box to be mounted on the battery stands.
- XXI. Ampere-hour meter [10 hour discharge rate] of 600 –1250 AH range-1 no.
- XXII. Any other accessories, not specified but required for installation, satisfactory operation and maintenance of batteries for a period of 5 [five] years.

11. 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. 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.

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.

13. CAPACITY:

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

14. CHARGING:

The bidders 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. The trickle charge current should also be specified.

15. LIFE:

The bidder shall quote in his offer the guaranteed life of the battery when operating under the conditions specified. As per clause A 5.1 the bidder shall also furnish the life cycle of the battery indicating the capacity of the battery each year upto 20 years in a tabular form & also in a graphical form in standard operating condition.

16. INSTRUCTION MANUALS:

Eight sets of instruction manuals for installation, commissioning, charging and maintenance instruction along with its soft copies in CD/DVDs shall have to be furnished

17. TRANSPORT:

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

18. TESTS:

18.1. Type Test:

Along with their offer, the bidder/during submission of drawings, EPC shall submit type test reports of **all type tests as per IS 1652:1991 (or its latest revised edition) and other relevant/applicable National Standard[s]** conducted on the offered design, within seven years from the date of opening of the bid. The type tests should be conducted in a NABL accredited laboratory and the tests should have been witnessed by representatives of any Government Department / Government Undertaking, failing which the offer is liable for rejection/ failing which the drawings shall not be considered for approval.

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.

18.2. Acceptance tests:

All factory acceptance tests (FAT) as per IS 1652:1991 (or its latest revised edition/amendments) shall be witnessed by the OPTCL's representative at the works of the manufacturer at the cost of supplier.

For sampling of cells during FAT for 350 AH batteries, Annexure D of IS 8320:2000 (or its latest revised edition/amendments) shall be followed.

The manufacturer shall provide the test certificates (Type, Routine and Acceptance test) pertaining to **Battery Cell Containers** to OPTCL inspector at the time of acceptance test in accordance to IS 1146 (1986 or its latest revision / amendment.)

19. DRAWINGS / DOCUMENTS:

19.1. The Bidder 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.

19.2. 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. :-

- i. Lay out details of the batteries.
- ii. OGA and cross-sectional details for battery cells.
- iii. Instruction manuals for initial charging and subsequent charging.
- iv. Technical data, curves etc.
- v. **Manufacturing Quality Plan of 220 Volt DC Battery.**

20. **BUY- BACK OF OLD BATTERY CELLS:**

The Bidder will quote buy-back rates of old battery cells (different AH capacities), available at the following Sub-Stations of OPTCL in the State of Odisha. The scope of 'BUY-BACK' system includes the loading, transportation, taxes, duties, and any other statutory levies, rules and regulations, notified by Govt. of India/ Govt. of Orissa, or their Undertakings.

OLD BATTERY SET FOR DISPOSAL ON BUY BACK:

DETAILS OF READILY AVAILABLE SCRAP (PHASE-I)/ WILL BE AVAILABLE AFTER BATTERY REPLACEMENT (PHASE-II)

PHASE	Sl. No.	Name of the Grid S/s	Make	Type	Rating	No. of cells in each set

The bidders are advised to inspect the old batteries, available in different Grid Sub stations prior to submission of their bids and the rate of the battery cell should be quoted in the prescribed price bid of this tender specification on AH basis. The bidder may also visit other Sub-stations of OPTCL and may quote for available Nos. of old battery cells on AH basis, stating the name of Sub-station, AH capacity of the cell, Nos. of cells etc. The old battery cells will be lifted by the bidder "AS IS WHERE IS BASIS" and the loading, transportation, taxes, duties and all other charges shall be borne by the Bidder. It should be noted that the bidder is to abide by all the rules, regulations, as prescribed by Govt. of India/Govt. of Odisha in this respect.

The purchaser may at its discretion may postpone/terminate the 'BUY BACK OF OLD BATTERY CELLS, as the situation warrants or direct the bidder to lift old battery cells of similar type from other Grid Sub-stations or reduce the quantity of battery cells, to be sold on buy back system or free to the take any other decision, conducive to both the purchaser and the bidder.

A.22. 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.

ANNEXURE – I
SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS
FOR 220V VENTED LEAD ACID STORAGE BATTERY(PLANTE TYPE)
[To be filled in by the bidder]

		Values/Others
1.	Manufacturer's Name and address along with Fax No. & Tele phone No.	
2.	Conforming to standards	
3.	Type and designation as per ISS	
4.	Manufacturer's type and designation	
5.	AH capacity and voltage of the battery at 27 deg.C.	
[a]	At 10 hour rate of discharge.	
[b]	At 5 hours rate of discharge.	
[c]	At 1 hour rate of discharge	
[d]	At 1 minute rate of discharge.	
[e]	At ½ hour rate of discharge.	
6.	Open circuit voltage of each battery cell.	
[a]	Fully charged	
[b]	Floating condition.	
[c]	When completely discharged at.	
[i].	10hr. rate.	
[ii].	5 hour rate	
[iii]	1 hour rate	
[iv]	½ hr. rate	
[v].	1 minute rate	
[vi]	1-second rate.	
7.	Recommended float charging voltage [volts] across the battery terminals.	
8.	Recommended boost charging voltage [volts].	
9.	Time required for boost charging from discharged conditions [in hours]	
10.	Trickle charging Current range/cell	
11.	AH capacity at 10 hour rate at 10 hour rate at room temperatures of :	
[a]	15 deg C.	
[b]	27 deg C.	
[c]	50 deg C.	
12.	CELL DETAILS	
[i].	No. of cells per Battery Bank	
[ii].	Total nos. of plates per cell.	
[iii]	No. of positive plates per cell.	

(iv)	Type of positive plate	
(v)	No. of negative plates per cell	
(vi)	Type of negative plate	
(vii)	Surface area of plates in sq. mm.	
(viii)	CONSTRUCTIONAL DETAILS AND DIMENSIONS OF	
(a)	Positive plate	
(b)	Negative plate	
(c)	Material of the container	
(d)	Thickness of the container	
(e)	Overall dimensions of each cell (LxBxH)	
ix.	Weight per Cell (Kg)	
(a)	Active elements-positive	
(b)	Active elements-Negative	
(c)	Container	
(d)	Net dry weight	
(e)	Weight with electrolyte	
x.	Distance between center of cells where erected.	
xi.	Nominal cell voltage.	
xii.	Internal resistance of each cell at	
(a)	Fully charged condition	
(b)	Fully discharged condition	
(c)	Floating condition	
13.	Type, Thickness and materials of the separators	
14.	Containers	
(a)	Type	
(b)	Material	
(c)	Outside dimensions (LxBxH)	
15.	Cover and its type and material	
16.	Clearance in mm between	
(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.	
17.	Sediment space (depth) in mm	
18.	ELECTROLYTE	
(a)	Amount of electrolyte and specific gravity at 27 deg. C for first filling.	
(b)	First filling per set with 10% of extra furnished.	
(c)	Electrolyte conforms to standard	
(d)	Rated specific gravity of electrolyte when fully charged at room's temperature of	
(i)	15 deg. C	
(ii)	27 deg. C	
(iii)	50 deg C.	
(e)	Specific gravity of electrolyte at the end of discharge at 10 hour discharge rate.	
(f)	Maximum electrolyte temp. that the cells can withstand without injurious effect.	
(i)	Continuously	
(ii)	For short period	
19.	INTER CELL CONNECTOR	
(a)	Whether Inter-cell connector to be furnished ? (Yes / No)	
(b)	Type of inter-cell connector (bolted or others)	
(c)	Materials of inter cell connector	
20. (a)	Inter row, inter-tier connectors and end take-off furnished ? (Yes / No)	
(b)	Description, size, current rating, type and material.	
21.	RACKS	
(a)	No. of racks per battery	
(b)	No. of cells per rack	
(c)	Type of racks (rows and tiers)	
(d)	Material of the rack	

(e)	Racks provided with		
(i)	Numbering tags for cell		
(ii)	Teak wood clamps for cables		
(f)	Whether anti-acid coating provided ?		
(g)	Description of rack insulators		
(h)	Outline dimensions of racks		
(i)	Net weight of racks		
(j)	Shipping weight		
22.	Recommended rate for charging the battery in 8 hours.	Start	Finish
(a)	Current		
(b)	Voltage		
23.	Recommended float charge rate		
24.	Resistance of the battery including inter-connector between the cells in ohms.		
25. (a)	Maximum short circuit current per battery		
(b)	Allowable duration of short circuit		
26.	Short circuit current for a dead short across the battery terminals when		
(a)	Float at 2.1 volts per cell.		
(b)	Boost charge to 2.75 volts per cell.		
27.(a)	Time to full charge at finishing rate only		
(b)	Time to full charge at higher starting rate		
(c)	Time for full charge to charge by two step charging at starting up and finishing rates		
28.	Guaranteed AH efficiency at 10 hour rate of discharge in percent.		
29.	Guaranteed WH efficiency at 10 hour rate of discharge in percent.		
30.	Instructions for filling and initial charging of the battery with finishing and two step charging rates.		
31.	Recommended interval at which battery should be discharged at 10 hour rate and quick charged.		

32.	Recommended floating voltage per cell and the minimum variation.	
33.	Recommended maximum period of storage before the first charge.	
34.	Average life in years	
35.	Guaranteed life of battery in years.	
36.	Estimated life of battery in years.	
37.	Total shipping weight of battery units	
38.	Battery sizing calculation provided(Yes/NO)	
39.	Dimensioned lay-out drawings of the rack and battery to be attached with the tender. (Whether furnished ? Yes / No)	
40.	The following characteristic curves, to be furnished alongwith the tender (whether furnished)	
(a)	Battery discharge curves at various rates between one minute and 10 hour rate. (Yes / No.)	
(b)	Curves showing the relation between the specific gravity and amount of charge in the battery for both charging and discharging conditions. (Yes / No)	
(c)	Curves showing the relation between cell voltage and charging current when charged at	
(i)	Finishing rate (Yes/ No)	
(ii)	High starting rate (Yes/ No)	
(iii)	Two step charging by starting and finishing rate (Yes / No)	
(d)	Curve of internal resistance at the end of various discharge rates (Whether furnished (Yes / No)	