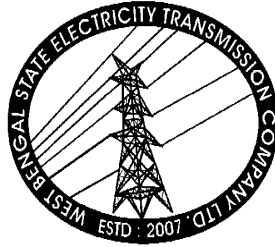


# LEAD ACID STORAGE BATTERY

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**March 2015**

*Engineering Department*

**WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED**

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড  
( পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ )

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## **TECHNICAL SPECIFICATION OF LEAD ACID STORAGE BATTERY**

### **1. SCOPE :**

- 1.1. This specification covers the design, manufacture, assembly, testing at manufacturer's works, supply, delivery of –
  - a) Three sets 220 V D.C. Lead Acid Storage Battery, two set having minimum capacity of 300 AH and another set having minimum capacity of 400AH Battery for each 400/220/132/33 KV substation.
  - b) Two set Battery having minimum capacity of 300AH shall be required for each 220/132/33KV substation.
  - c) One set of batteries having minimum capacity of 200 AH rating shall be required for 132/33KV Substation.
- 1.2. The battery charger will be procured separately as per specification of Battery charger.
- 1.3. Each battery shall have sufficient capacity considering continuous emergency and intermittent loads for the periods specified below and for all bays (i.e. present and future bays as mentioned in technical specification of cabling system) with the charger out of service :
  - a) Continuous DC load for protection, control, indications, alarms and interlock for 10 hours.
  - b) Emergency lighting loads for 10 hours.
  - c) Intermittent DC load for closing and tripping operation of Circuit Breakers, Isolators and Earth Switches. This load shall be determined considering simultaneous tripping of breakers on bus-bar protection for 400 KV S/Stns & 220KV S/stn.. Duration of intermittent load shall be considered as one minute. Battery shall have 20% spare capacity. Supplier shall furnish characteristic curve for satisfactory operation and maintenance of battery under service condition.

### **2. STANDARDS :**

The equipment covered by this specification shall unless otherwise stated, be designed, constructed and tested in accordance with the applicable sections of the latest Indian Standard specification and Indian Electricity Rules. Some relevant IS specifications are mentioned below :

Sl.No.	Indian Standards	Title
1)	IS 266	Sulphuric Acid.
2)	IS 1652	Lead Acid Batteries with plante positive plate.
3)	IS 1069	Water for storage battery.
4)	IS 6304	Lead Acid Batteries with pasted –ve plate.
5)	IS:6071	Synthetic separators for Lead acid batteries.
6)	IS:3116	Specification for sealing compounds for lead acid batteries
7)	IS:1146	Rubber and Plastic Containers for lead acid batteries.

3. **I) DEVIATIONS :**

Normally the offer should be as per Technical Specification without any deviation.

**II) MODIFICATION:**

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. **RATING OF BATTERY AND FUNCTION OF CHARGER :**

D.C. Power Supply shall comprise of Battery and a Battery Charger in parallel operation. In this mode the charger shall be required not only to continuously feed a variable load but also deliver trickle/boost charging current for the battery. Battery will be capable of feeding the DC load requirement of the Sub-station in case of failure of the charger.

5. **TRICKLE / BOOST CHARGE VOLTAGE :**

The trickle and Boost charge voltage per cell shall be as follows :

- i) TRICKLE CHARGE :  
Voltage shall correspond to 2.15 V/cell to 2.25±0.02V/cell.
- ii) BOOST CHARGE :  
Continuous variation shall remain between 2.00 V/cell and 2.75 V/cell. The voltage at any time during duty cycle shall not be less than 1.85 V / cell.

6. **VOLTAGE REGULATION OF CHARGER FOR FLOAT CHARGING :**

Output voltage for float charging from battery charger shall be auto controlled by adjusting the firing angle of thyristor for float charger to keep the voltage variation within ± 1% from no load to full load and AC supply voltage variation of ±10% and frequency variation of ± 3% of 50 Hz. Manual control of output voltage shall also be possible through Auto/Manual selector switch.

7. **CURRENT REGULATION OF CHARGER FOR BOOST CHARGING :**

An automatic current controller for boost charging shall control the output current of the boost charging by adjusting the firing angle of the thyristor. Manual control of the output current shall also be possible through Auto/Manual selector switch.

## **8. DESCRIPTION OF BATTERY :**

### 8.1. Lead Acid (LA) stationary battery :

Bidder shall provide for 107 nos. cells in the lead acid battery for 220 V D.C.

### 8.2. Plates :

The cells shall be provided with plate type positive plates and pasted type negative plates. The plate shall be designed for maximum durability and shall not buckle during all service conditions including high rate of discharge and rapid fluctuation of load.

### 8.3. Separators :

They shall be made of microporous PVC materials as per IS:6071, shall maintain the electrical insulation between the plates, shall permit free flow of electrolyte, would not be affected by chemical reaction inside the cell and shall last during its service time. Their internal resistance shall assure high discharge performance. End plates should be kept in position by proper arrangement.

### 8.4. Container and provisions :

Containers shall be made of transparent SAN material (Styrene Acrylonitrile) or glass or suitable plastic material or glass fibre reinforced plastics. Containers shall be robust, heat resistant, leak proof, non-absorbent, acid resistant and free from flaws. Containers shall be transparent. Electrolyte level lines shall be marked on the container. The marking for electrolyte level should be for upper, middle and lower limits. The material of level indicator shall be acid-proof and oxidation proof. It must be spacious enough to accommodate any deposition particularly at the bottom level of the container so that cells will not have to be cleaned out during normal life, and to prevent short circuit between the plates through deposited materials.

8.5. Vent plugs shall be provided in sealed type cells. They shall be of anti-splash type, having more than one exit hole to allow the gas to escape freely but to prevent acid from coming out. Open type cells shall be provided with suitable arrestors to prevent spilling of electrolyte.

8.6. The positive and negative terminals shall be clearly marked. A small hole with lid shall be provided on the cover for topping of diluted sulphuric acid/distilled water when required as well as for measuring density by Density Meter.

8.7. Connectors for connecting cells in series shall be provided. Lead or lead coated connectors shall be used for connecting adjacent cells, rows and end take off. Bolts, nuts and washers shall be effectively lead-coated to prevent corrosion. End take-off connectors shall be provided from positive and negative poles of the batteries for end connections to the power cables. The cable will be single core having stranded copper conductor and PVC insulation which will be provided by the bidder. More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on the battery terminals.

8.8. Necessary insulating supports and lugs for termination of these cables on batteries shall also be supplied by the bidder. All connectors and lugs shall be capable of continuously carrying the 30 min. discharge current of the respective batteries and shall be capable to carry 4 KA for 1 sec.

8.9. The racks for supporting battery cells shall be of best quality teak wood structure with at least three coats of anti-acid paint of approved shade. They shall be free-standing type mounted on porcelain/hard rubber insulators.

- 8.10. Numbering tags for each cell shall be attached to the racks. Provision for clamping outgoing cables shall be kept. Racks shall have two tiers. Two nos. cells shall be placed side by side in each rack.
- 8.11. The battery to be supplied shall be dry and uncharged.

**9. ELECTROLYTE :**

Electrolyte shall be prepared from battery grade sulphuric acid of specific gravity 1.200 at 27°C conforming to IS:226 and distilled water conforming to IS:1069. A minimum of 10% extra electrolyte shall be supplied after completion of initial charging to cover spillage in transit or during commissioning. It shall be supplied in separate corrosion proof jar.

**10. ASSOCIATED EQUIPMENTS & ACCESSORIES (For each set of battery) :**

- |   |   |                      |
|---|---|----------------------|
| a) Double row and Double Tier suitable best quality teak wood or steel rack stand properly treated against corrosion and white ants.  | } | Appropriate quantity |
| b) Stand insulators +5% extra   |   |                      |
| c) Inter row connectors   |   |                      |
| d) Inter tier connectors  |   |                      |
| e) Non-returnable containers for electrolyte  |   |                      |
| f) Centre-zero (3-0-3) volts DC Voltmeter   |   | : 1 No               |
| g) Hydrometer for indicating Specific Gravity (1.100 to 1.300) readings with Sp.Gr. correction Scale  |   | : 1 No               |
| h) Thermometer(Mercury type)  |   | : 1 No               |
| i) Wall-mounting type holder made of Plastic For hydrometer and thermometer   |   | : 2 Nos.             |
| j) Rubber tube for syphoning  |   | : 2 Nos.             |
| k) Rubber Gloves  |   | : 2 Pair             |
| l) Funnel (10 cm size)  |   | : 2 Nos              |
| m) Spanners   |   | : 1 No               |
| n) Rubber Apron   |   | : 1 No               |
| o) Lead coated connection hardware, such as strips, bolts, nuts(with 5% extra)  |   |                      |
| p) Cable clamps with hardware   |   |                      |
| q) Cell numbering tags with fixing arrangement  |   |                      |
| r) Two sets of special tools and tackles for connecting terminals of the battery  |   |                      |
| s) Dilute Sulphuric acid of sufficient quantity and of Specific Gravity according to the relevant ISS and 10% extra shall be supplied in non-returnable acid proof containers suitably packed |   |                      |
| t) Any other accessories not specified but required for satisfactory operation.   |   |                      |

## **11. PACKING :**

All equipments shall have to be despatched suitably and securely, packed in wooden crates, suitable for handling during transit by road indicating Name of the Consignee Officer, Name of the Purchaser, LOA No., Destination Station, Crate Sl.No. etc.

## **12. GUARANTEE :**

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

## **13. CONTRACT DRAWINGS, CATALOGUE AND MANUAL :**

- 13.1. In the event of placement of Letter of Award, drawings of general arrangement showing placement of battery in racks as well as layout of racks in plan and in section, details of battery cells, take off terminal connections arrangement, sectional drawings of cell and catalogue of battery cells are to be submitted in six (6) copies to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhavan (9<sup>th</sup> floor), Kolkata - 700 091 as per schedule of submission of drawings for WBSETCL's approval.
- 13.2. After approval, ten (10) sets of approved drawings, approved G.T.P., catalogue as stated above including instruction manuals for installation, commissioning, operation and maintenance in respect of each set of battery are to be submitted. Manuals shall clearly indicate the installation methods, check up and number of charges and discharges including first charging of the battery to be made before commissioning of the equipments. Cell voltage for float and boost charge, different characteristic curves and calculation for battery capacity shall also be furnished.

## **14. TEST AT FACTORY AND TEST CERTIFICATES :**

- 14.1. Routine tests at manufacturer's works shall be carried out on battery as per stipulation of relevant Indian Standard in presence of representatives from WBSTCL.
- 14.2. All Acceptance tests shall be carried out at the manufacturer's works on every lot offered for inspection as per relevant IS. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of Battery. Three (3) copies of routine and acceptance test reports shall be submitted to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhavan (9<sup>th</sup> floor), Kolkata - 700 091 for approval and adequate extra copies for distribution to site.
- 14.3. The contractor shall give at least 15 (fifteen) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

## 15. TEST REPORTS & TYPE TESTS :

Only type tested Battery are to be offered conforming to our technical specification, and relevant IS and IEC. Battery offered should be identical with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively alongwith submission of drawings during detailed Engineering. Successful bidder may require to produce original copies of type test reports at the time of detail Engineering if asked by WBSETCL.

Each type test report shall comply the following information with test result

- a) Complete identification, date and serial no .
- b) Method of application, Where applied, duration and interpretation of each test.

### SPECIFIC TECHNICAL PARAMETERS FOR LEAD ACID STORAGE BATTERY

SNO	DESCRIPTION	220 V, 200AH BATTERY SET	220 V 300 AH BATTERY	220 V, 400AH BATTERY SET
1.	Min.AH capacity and voltage of battery at the 10 hour discharge rate at 27 °C (minimum)	200AH 1.85 V/Cell (min.)	300 AH 1.85 V/Cell	400AH 1.85 V/Cell
2.	Types of positive plate negative plate	Plante Pasted	Plante Pasted	Plante Pasted
3.	Specific Gravity of Sulphuric Acid (Electrolyte)	1.200 at 27 °C	1.200 at 27 °C	1.200 at 27 °C
4.	Recommended a) Trickle charge voltage across battery terminal b) Boost charge voltage	2.15 V to 2.30 V/Cell 1.85 V to 2.75 V/Cell	2.15 V to 2.30 V/Cell 1.85 V to 2.75 V/Cell	2.15 V to 2.30 V/Cell 1.85 V to 2.75 V/Cell
5.	Minimum Steady demand load on battery signal lamps etc. in case of failure of charger	16 Amps.	24 Amps	40 Amps.
6.	Boost charging current	28A to 14 A	42 A to 21 A	48 A to 24 A
7.	Trickle charging current	480 to 160 mA	720 to 240 mA	960 to 320 mA
8.	Set value of cell voltage of the battery during service.	2.15 V	2.15 V	2.15 V
9.	Duty cycle for discharge upto cell voltage of 1.85 V	10 hour	10 hour	10 hour
10.	Battery Voltage	220 V	220 V	220 V
11.	Number of Cell	107 nos	107 nos	107 nos

GUARANTEED TECHNICAL PARTICULARS FOR LEAD ACID STORAGE BATTERY

*(To be filled in and signed by the Bidder)*

<b>SL</b>	<b>DESCRIPTION</b>	<b>400 AH</b>	<b>300 AH</b>	<b>200 AH</b>
1	<b>Battery General</b>			
1.01	Name and address of the Manufacturer			
1.02	Location of factory			
1.03	Conforming Standards			
1.04	Type Model of the Battery			
1.05	Date of Last Type Test			
1.06	Ampere-hour capacity at 10 hour rate of discharge (AH)			
1.07	No. of positive plates per Battery			
1.08	Total no. of plates per Battery			
1.09	Battery voltage before Charging			
1.10	Battery voltage After Full Charging			
1.11	No. of Battery in each bank			
2	Capacity in ampere-hours of the battery for (Amp.hrs/End Voltage)			
2.1	1 hour load			
2.2	5 hour load			
2.3	10 hour load			
2.4	Ampere hour efficiency			
2.5	Watt hour efficiency			
3	Electrical Parameters			
3.01	Short circuit Current (Amps)			
3.02	Current: Trickle Charging			
3.03	Voltage: Trickle Charging			
3.04	Current: Quick Charging			
3.05	Voltage: Quick Charging			



3.06	Recommended value of float charging voltage.			
3.07	Internal resistance of charged Battery ( milli ohms)			
3.08	Total Resistance of the Bank including Interconnection between the cells.(ohms )			
4	Battery Container			
4.01	Materials of containers			
4.02	Thickness, type and material of separators			
4.03	Volume of Electrolytes required for first filling (including 10% extra) liters.			
4.04	Weight of electrolyte per Battery			
4.05	Specific Gravity of electrolyte at 27°C with all cells fully charged			
4.06	Specific Gravity of electrolyte at the end of discharge at 10 hour discharge rate			
4.07	Construction Details of Positive plate			
4.08	Construction Details of Negative plate			
4.09	Surface area of plates sq.mm.			
4.1	Clearance between edges of plates and inner surface of container (mm)			
4.11	Clearance between bottom of negative plates and bottom of container (mm)			
4.12	Clearance between top of plates and top of container (mm)			
4.13	Sediment space (depth) (mm)			
4.14	Distance between centres of cells when erected (mm)			
4.15	Dimensions of each Battery (mm) : L X B X H			
4.16	Thickness of container (mm)			
4.17	Net weight of the Battery, complete with Electrolyte (Kg)			