



GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.

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RACE COURSE, BARODA – 390 007.

TECHNICAL SPECIFICATIONS

FOR

110/220 V, PLANTE' TYPE
LEAD ACID BATTERY SETS

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**TECHNICAL SPECIFICATIONS OF 110/220V,
PLANTE' TYPE LEAD ACID BATTERY SET FOR SUB STATION**

1.0 SCOPE:

- 1.1 This specification covers the design, manufacture & testing of 110/220V, 250/350/535/1180 Ah, Plante' type lead acid battery set at the manufacturer's works and supply at site. It also includes supply of FRP stand and all accessories mentioned in this specification.

2.0 APPLICABLE STANDARDS:

- 2.1 Unless otherwise specified in this specification, the lead acid batteries shall comply with the following standards and latest amendments revision thereof.
- a) IEC 60896-11 General requirements & methods of tests for stationary lead acid batteries.
 - b) IS: 1885 Electrical vocabulary – Stationary cells and batteries.
 - c) IS: 1652 Specification for stationery cells and batteries lead acid type with Plante' positive plates.
 - d) IS: 1146 Specification for hard rubber and plastic containers for lead acid storage batteries.
 - e) IS: 6071 Specification for synthetic separators for lead acid batteries
 - f) IS: 652 Specification for wooden separators for lead acid batteries.
 - g) IS: 266 Specification for sulphuric acid
 - h) IS: 1069 Specification for water for storage batteries
 - i) IS: 3116 Specification for sealing compound for lead acid batteries.
 - j) IS:8320 General requirements for methods of tests for lead-acid storage batteries.

- k BS:6290 High Performance Plante' cells
(Part 2)
- l) IEEE - 485 IEE recommended practice for sizing of large lead acid storage batteries for generating stations and sub stations.
- m) IEEE-484 Recommended practice for design and installation of storage batteries.

3.0. GENERAL REQUIREMENT:

The batteries shall be suitable for a long life under continuous float operations at 2.15 to 2.25 volts per cell and occasional discharges and shall be stationary lead acid type with high discharge performance (HDP) confirming to IS: 1652 (latest edition) suitable for Indoor operation.

- 3.1. The batteries shall be of the capacity 110/220V, 250/350/**535/1180**Ah as per requirement of tender.
- 3.2. Battery of 110/220V, 250/350/**535/1180** Ah rating shall consist of 55/110 numbers of series connected HDP lead acid cells of 2.0 Volts, having 250/350/**535/1180** Ampere Hour capacity at 10 Hours discharge rate.
- 3.3 Charge rate.
 - 3.3.1 Fully discharged batteries get recharged at 25/35/**53.5/118** Amps rate for 10 hours at room temperature. The trickle charge rate shall be 50-**200** mA.
- 3.4. The containers should be moulded from transparent Styrene Acrylonitrile (SAN) giving excellent clarity, outstanding chemical resistance, rigidity and toughness with very high insulating qualities which eliminate the need for separate cell insulators. It should have adequate Mechanical strength to prevent bulging, cracking etc. during the life span of battery when operating under expected temperature range and due to action of static and dynamic loads and the action of electrolyte.
- 3.5 The positive plates shall be of Plante' lamellare Type. Plates shall be made of 99.99% pure lead and shall be free from any kind of manufacturing defects. It shall be electro-chemically formed and shall be capable of operating under

normal working conditions without buckling or cracking. The positive plates should be cast in a single piece. Welding together of smaller size lead castings / plates to form larger sizes will not be acceptable. It should be genuine 'Plante' type of plate only and not so called equivalent type. The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load.

- 3.6 The negative plates shall be of flat pasted type. It should have adequate mechanical strength and should be so designed that active material is maintained in intimate contact with the grid under normal working conditions throughout the life of the battery.
- 3.7 The separators should be of sintered PVC providing complete diaphragm between the plates. It should be acid resistant, chemically inert and should have excellent oxidation resistance and high degree of porosity to ensure minimum internal resistance. It should not exhibit any tendency to swell or shrink at temperature encountered during operation.
- 3.8. Connectors should be adequately designed to offer minimum impedance. The current carrying area of the connectors shall conform to the requirement of BS 6290 Part II 1999. While considering the terminal voltage of the cell at the time of testing for discharge, the voltage drop due to inter-row and inter-cell connectors shall be considered. Connectors shall be of lead plated copper. The lead coating shall be adequate and tenacious. Minimum thickness of lead coating shall be 25 microns. Connectors shall be adequately designed to withstand various stress due to temperature changes, attack of acid and dynamic forces that could occur during the operation of the battery.
- 3.9 The vent plugs should be specially designed incorporating a micro porous ceramic filter which effectively returns all acid spray to the cell, but allow free exit of oxygen and hydrogen which is generated at the end of boost charging. On removal, the plugs shall permit draining of the electrolyte sample for servicing and of checking of the electrolyte level.
- 3.10. The electrolyte shall be battery grade sulphuric acid conforming to latest edition of IS 266. Required quantity of electrolyte for the initial filling with 10% extra quantity shall be supplied in non-returnable, non-degradable acid resistant strong plastic containers.

- 3.11 Water used in preparation of electrolyte and also for periodic topping up during the course of operation or testing shall conform to the latest edition of IS-1069.
- 3.12 Positive and negative terminal posts of the cells shall be clearly and unmistakably identifiable. Terminal posts shall be designed to accommodate external bolted connections conveniently and positively. The terminal post size should be capable of carrying current so as to conform to BS 6290 Part II 1999. All metal parts of the terminals shall be of lead or lead coated type. Bolts, heads and nuts, except seal nuts, shall be hexagonal and shall be lead covered. Terminal posts shall be adequately fixed to prevent its turning or twisting when the connectors are being fixed or removed. The junction between terminal posts and cover shall be adequately sealed to prevent any seepage of the electrolyte. All terminals shall be provided with insulated covers (Shrouds).
- 3.13. Accessories.

The bidder shall supply the battery with accessories and devices as stated here under:

- i) One battery stand constructed out of FRP as per detailed specifications mentioned at cl.no.3.14.
- ii) One set of inter-cell, inter raw, inter-tier, inter rack, end take off connectors and lugs for termination of cables as required for the complete installation.
- iii) One set of stand insulators of hard rubber material.
- iv) Syringe Hydrometer capable of indicating specific gravity reading in steps of 0.005. The hydrometer shall be complete with wall mounting teak wood holder.
- v) One DC voltmeter having range -3V – 0 - +3V, conforming to IS: 1248 (latest edition) with suitable leads for measuring cell voltage.
- vi) One filler hole thermometer (Gravity correcting scale).
- vii) Electrolyte shall be prepared from battery grade sulphuric acid confirming to IS: 226 and distilled water confirming to IS: 1069

Electrolyte for first filling with 10% extra shall be supplied in non-returnable containers. (Type of electrolyte, qty per cell, total first filling qty and total qty, no. of containers (Carboys) may please be specified in GTP).

- viii) 110 Nos. of cell number plates (No stickers) and fixing pins / screws
- ix) Two Nos of rubber syringe.
- x) Two nos of acid resisting plastic jug each of 2-litre capacity.
- xi) Two nos of acid resisting plastic funnels.
- xii) Lead plated MS or acid proof stainless steel Bolt & nuts. (Size and quantity may please be mentioned in GTP).
- xiii) Each cell shall be provided with ceramic type vent plug. It shall be anti-splash type, having more than one exit hole and shall allow the gases to escape freely but shall prevent acid from coming out.
- xiv) Rubber Apron
- xv) Rubber Boot and Gloves
- xvi) Petroleum jelly 250 gms.
- xvii) Insulated Spanner set (Indicate size and Nos.in GTP)
- xviii) Log book for maintenance.
- xix) Any item not specified above but which is needed for maintenance & efficient working of batteries may be indicated separately without extra cost.

- 3.14 The construction of the stand shall be suitable for mounting on a flat concrete floor. The stand shall be rigid, free standing type and free from warp and twist. The stand should be made up of MS channels/angles with FRP coating of min.5.0 mm or of pure FRP material. The FRP STAND shall also be non reactant to acid. The stand should be designed considering all aspect of loading and safety, so as to withstand the loading of battery set throughout its life, which shall be supported by load bearing calculation. The lower tier of the stand will be at the height of 300

mm from the ground level. Support angle should be provided for each rack so as to safeguard each battery cell from falling or declining. There shall be sufficient space between two tiers of stand so that maint. of battery cells of lower tier can be done easily. Necessary supports for power cable connected to end takeoff terminals shall be mounted on the stand.

3.15 **QAP**

The bidder shall submit Quality Assurance Plan adopted for manufacturing of battery cell specifying detailed manufacturing process covering incoming material inspection to final product testing, packing and dispatch.

Quality Assurance Plan shall cover following aspects.

1. Incoming material / Brought out items verification:

The details containing list of important incoming materials, list of standard according to which the incoming materials shall be tested, list of tests to be performed on incoming materials along with respective OEM test certificates etc.

Precaution taken for ensuring usage of quality raw materials and sub-components shall be a part quality assurance plan.

2. In process inspection steps:

Details of manufacturing facilities available, manufacturing process steps, verification points, list of standards to be followed to ensure correctness of process to have desired product as per specification etc.

3. Routine tests:

Details of verification check points for all routine tests as per specification to be performed on finished product along with list of relevant applicable standards.

4. Acceptance tests:

Details of verification check points for all acceptance tests as per specification to be performed on finished product along with list of relevant applicable standards.

5. Type tests

Details of all type the tests as per specification along with list of relevant applicable standards.

6. Packing and Dispatch

Process of packing along with its verification check points to ensure safe transport, transit, unloading, unpacking and completeness of consignment.

4.0 DRAWINGS AND DATA:

4.1. The bidder shall submit alongwith their offer the following drawings in soft copy.

- i) Set of GA Drawing for complete battery sets, battery stand and individual battery cell drawing with sectional view.
- ii) Technical literature/Manuals
- iii) Performance curves/write-up on working of battery. The Data submitted shall be adequate to evaluate the performance/quality of item offered.
- iv) The detailed drawing showing the size & qty of steel sections for FRP stands.
- v) All the drawings submitted in soft form shall be in pdf format. However, requirement in AutoCAD for shall be at the discretion of GETCO.

4.2. The successful bidder shall submit following drawings for approval in soft copy.

- i) Set of GA Drawing for complete battery sets, battery stand and individual battery cell.
- ii) Compete bill of material accessories indicating make, material, quantity, size & type wherever applicable.
- iii) Sectional view showing interior construction of the battery cell. It shall also include the information of C/S area of positive and negative plates, container dimensions, type/grade and quantity of electrolyte.
- iv) The detailed drawing showing the size & quantity of steel sections for FRP stand.
- v) Technical literature/Manuals covering manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate, maintenance instructions and storage conditions of electrolyte and battery cells.

- 4.3. The successful bidder shall have to supply the 3 sets of the approved drawings/literature and manuals alongwith each battery set to be supplied.

5.0 PACKING:

- 5.1 Battery shall be supplied in dry and uncharged condition suitably packed, securely in wooden crates. Packing shall be suitable for handling during transit by Rail / Road and secured to avoid any loss or damage during transit.

6.0 TESTS:

- 6.1 The following tests from NABL accredited laboratory shall be carried out in accordance with IS 1652 & IEC 60896 – 11 or the latest / amended / up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL approved laboratory shall not be older than seven years. Type test reports shall be valid as on the last date of submission of bid.

i) TYPE TESTS: -

- a. Verification of constructional requirements (As per IS 1652).
- b. Verification of marking and packing (As per IS 1652).
- c. Verifications of dimensions (As per IS 1652).
- d. Capacity test (As per IEC 60896 – 11)
- e. Charge Retention Test (As per IEC 60896 – 11)
- f. Endurance in discharge – charge cycles (As per IEC 60896 – 11)
- g. Endurance in overcharge (As per IEC 60896 – 11)
- h. Test of suitability for floating battery operation (As per IEC 60896 – 11)
- i. Short circuit current and internal resistance Test (As per IEC 60896 – 11)
- j. Ampere- hour and watt-hour efficiency tests (As per IS 1652).
- k. Test for voltages during discharge (As per IS 1652).

Note:

In case of non-submission /partial submission or type test reports of which validity is over, bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.

ii) ACCEPTANCE TESTS: -

Tests shall be carried out as under at Manufacturer's works:

- a) Visual inspection including marking and packing.
- b) Dimensional check.
- c) Capacity test.
- d) Test for voltage during discharge.
- e) Battery Impedance Measurement Test.

Note: - Battery Impedance Measurement Test shall also be the routine test and Signature Value (Battery Impedance) of all the cells shall invariably be submitted with routine test reports.

The acceptance test certificates shall be submitted for approval, before dispatch of the battery sets in bound volume. Also one set shall be submitted and sent with battery set.

7.0 COMMISSIONING:

The first commissioning of each battery set at site shall be in the scope of the Bid. The successful Bidder/s shall have to carry out first commissioning of each battery set at site. The successful bidder shall arrange for all the necessary equipment, including the variable resistor, tools, tackles, and instruments.

SCHEDULE OF GURANTEED TECHNICAL PARTICULAR **FOR 220 VOLTS PLANTE' TYPE LEAD ACID BATTERY**

The bidder 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.

CHECK LIST FOR Plante' LEAD ACID BATTERY SET				
	Supplier :-			
	Manufacturer :-			
	Battery Set Rating :-			
	Quantity :- Sets			
Sr. No.	Data / Item of Verification	Acceptable / Design data	Particulars to be filled in by bidders	Remarks
A	Drawings			
	Battery Cell			
1	Rating	2V, 250Ah / 350Ah / <u>535AH / 1180 Ah</u>		
2	Type	High Discharge Performance - HDP type		
3	Designation			
4	No. of Cells	55/110		
5	Sectional View	shall be shown		
6	Dimensions			
	- Height (mm)			
	- width (mm)			
	- Depth (mm)			
7	Container			
	- Material	Transparent SAN		
	- Thickness (mm)			
8	Positive plates			
	- Type	Plante' lamellar		
	- Material	99.99 % pure Lead		
	- Size			
	-- Height (mm)			
	-- Thickness (mm)			
	-- Area (sq.mm)			
	- Nos. of Plates			
	- Total area (sq.m)			
9	Negative plates			
	- Type	Flat pasted		
	- Material	Lead alloy		
	- Size			
	-- Height (mm)			

	-- Thickness (mm)			
	-- Area (sq.mm)			
	- Nos. of Plates			
	- Total area (sq.m)			
10	Separator			
	- Material	Sintered PVC		
	- Thickness (mm)			
11	Vent plug			
	- Type	Ant splash type Micro-porous		
	- Material	Ceramic		
12	Electrolyte			
	- Type/Grade	Battery grade Sulphuric Acid		
	- Quantity per cell (Ltr)			
	- 10% extra Quantity (Ltr)			
	- Total Quantity per cell (Ltr)			
13	Weight of Cell (Kg.)			
	- Without electrolyte			
	- With electrolyte			
14	Drawing showing cell connections (Battery set layout Drawing)	shall be shown		
15	Connectors			
	- Material	Lead plated copper		
	- Lead coating (Min.)	25 microns		
	- Dimensions	Min. 4 mm thick		
	-- Inter-cell connectors			
	-- Inter-row connectors			
	-- Inter-tier connectors			
	-- End take-off connectors			
	-- Lugs for cable			
16	Nut-Bolts, washers			
	- Material	Lead plated SS		
	- Size			
17	Total weight of Battery set (Kg.)			
18	Charging rate			
	Normal charging rate			
	Starting charging rate			
	Finishing charging rate			
	Trickle charging rate			
	Discharge rate on 3 Minutes : basis in Amp. At end voltage 1.85 V/Cell for lead acid Battery cell.			
19	Performance curve State design values			

	% Ah after 5 yr. and 10yr.			
	Discharge rate (end voltage) at 5 hr & 10 Hr			
	Charging curve cell voltage At 60 hrs and 100 hrs			
	Discharge Amp v/s time curve Amp for 1 Hr.and 10 Hr			
	Battery Stand			
18	Material	FRP coated MS / Pure FRP		
19	Thickness of FRP coating (mm, Min.)	5		
20	Size of Channels / Angles			
21	Size of Supports			
22	Stand insulators			
	- Material	Hard Rubber		
	- Size			
	- Nos.			
23	Height of lower tier from the ground (mm, Min.)	300		
24	Space between lower tier cell & bottom of the upper tier (mm,Min.)	400		
25	Height of Upper tier from the ground (Total height of the stand), (mm, Max.) (mm, Max.)			
26	Total height (mm, Max.)			
27	Length of the stand (mm, Max.)			
28	Width of the stand (mm, Max.)			
29	Weight of the stand (Kg.)			
B	Bill of Quantity			
1	Battery cells			
2	Battery Stands			
3	Stand insulators			
4	Inter-cell connectors			
5	Inter-row connectors			
6	Inter-tier connectors			
7	End take-off connectors			
8	Lugs for cable (50 sq. mm)			
9	Lead plated SS Nut-Bolts, washers			
10	Ceramic Vent plug			
11	Syringe type Hydrometer with stand	1 No.		
12	3 - 0 - 3 Volts Cell tester	1 No.		
13	Thermometer with stand	1 No.		
14	Gravity correcting scale	1 No.		
15	Electrolyte Qty. (first filling + 10% extra) in Ltr			
16	No of carboys (35 ltr)			
17	Acid filler (Rubber Syringe)	2 Nos.		

18	Acid Resistance plastic jug (2 Ltr capacity)	2 Nos.		
19	Acid Resistance Funnels	2 Nos.		
20	Cell Number plates with fixing pins / screws	55 Nos./110 Nos		
21	Spanner set (Size and Nos)	1 set		
22	Petroleum Jelly .	250 gms		
23	Rubber boot & Gloves	1 pair each		
24	Rubber apron	1 No.		
25	Log book	1 No.		
26	Installation, commissioning and O & M manual	1 set		
27	FQP	1 copy		
C	Type Test Reports	Of offered battery set (250 Ah / 350Ah / <u>535Ah</u> / <u>1180Ah</u>) From NABL Approved Lab		
	Verification of constructional requirements (As per IS 1652).			
	Verification of marking and packing (As per IS 1652).			
	Verifications of dimensions (As per IS 1652).			
	Capacity test (As per IEC 60896 – 11)			
	Charge Retention Test (As per IEC 60896 – 11)			
	Endurance in discharge – charge cycles (As per IEC 60896 – 11)			
	Endurance in overcharge (As per IEC 60896 – 11)			
	Test of suitability for floating battery operation (As per IEC 60896 – 11)			
	Short circuit current and internal resistance Test (As per IEC 60896 – 11)			
	Ampere- hour and watt-hour efficiency tests (As per IS 1652).			
	Test for voltages during discharge (As per IS 1652).			