

**TELENGANA STATE POWER GENERATION
CORPORATION LIMITED**

5X800MW YADADRI TPS

**TECHNICAL SPECIFICATION
FOR
*220V DC BATTERY***

SPECIFICATION NO: PE-TS-417-508-E001, R0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301**



TECHNICAL SPECIFICATION FOR 220V DC BATTREY

SPECIFICATION NO. PE-TS-417-508-E001

REVISION 00

DATE: 29.03.19

SHEET 1 OF 1

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>	<u>NO. OF SHEETS</u>
1.0	SECTION – I	
	COMPLIANCE SHEET	01
	SPECIFIC TECHNICAL REQUIREMENT	03
	DATA SHEET - A	01
	DATA SHEET - C	02
	ANNEXURE-I LOAD DUTY CYCLE FOR 220V DC SYSTEM	01
	ANNEXURE-II ONE LINE DIAGRAM FOR 220V DC SYSTEM	01
2.0	SECTION- 'II'	
	STANDARD TECHNICAL REQUIREMENTS	09
	ANNEXURE-A LIST OF APPLICABLE STANDARDS	01
	ANNEXURE-B ACCESSORIES	02
	QUALITY PLAN	05

TOTAL SHEETS INCLUDING COVER SHEET/CONTENT SHEET = 28

	TECHNICAL SPECIFICATION FOR 220V DC BATTERY	SPECIFICATION NO. PE-TS-417-508-E001	
		VOLUME II	
		SECTION I	
		REVISION 00	DATE: 29.03.19
		SHEET 1 OF 1	

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

1.0 SCOPE

1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing, despatch to site and supervision of E&C of 220V DC batteries as described in the various sections of this specification. The batteries shall generally conform to IS/ IEC/ IEEE. Erection and commissioning is not included in vendor's scope. However Vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.

1.2 Technical requirements of 220V DC BATTERY are indicated in Data Sheet-A & Section-II.

1.3 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A & Section-II.

2.0 BILL OF QUANTITIES

Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

S. No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	4.01 : Main Plant: 220V DC system shall be an ungrounded system comprising of two sets of batteries (2X100%) with 1x100% float cum-boost charger for each set of battery and one sectionalised 1X100% DCDB & 1 no. common standby float cum boost charger for each unit	220V DC system shall be an ungrounded system comprising of 2x100% batteries each with individual float cum boost charger & float charger and 1x100% sectionalised DCDB. A Standby Float cum boost charger shall also be provided common for 2x100% batteries. One such system will be provided for each unit.
2	4.02 : The battery shall be designed to restrict maximum fault level on DCDB limited to 50kA for 1 Sec.	The battery shall be designed to restrict maximum fault level on DCDB limited to 25kA for 1 Sec.
3	4.04 : The 220V batteries shall be sized considering emergency load cycle requirement of 120 minutes and various factors as per Annexure-II.	The 220V batteries shall be sized considering emergency load cycle requirement of 600 minutes and various factors as per Annexure-I of Section-I.
4	5.1 (E): Vent plugs shall be provided in each cell. They shall be anti splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.	For flooded cell, Ceramic Vent plugs shall be provided in each cell. They shall be anti-splash type to prevent explosion and contamination, having more than one exit hole shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed from topping up the cells and shall be of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

		The bidder shall also indicate the Gas emission rate of the battery for necessary design of the ventilation of the Battery Room.
5	5.1 (I) : Necessary 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 minutes 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.	The bidder shall supply bent copper plate, tubular copper lugs, teakwood clamps/ L Type copper connector, bolts, nuts, washers, etc. for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering. Calculation for sizing of connectors and fasteners shall be furnished during detail engineering. All connectors and lugs shall be capable of continuously carrying the 10 hour discharge current of respective batteries and through fault short circuit current, which the battery can produce and withstand for the period of one second. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage.
6	5.1(j) : Wooden racks for all the batteries shall be provided. These racks shall be made of good quality first class seasoned teak wood in line with CPWD specification. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators	Battery racks for supporting battery cells shall be constructed of best quality FRP forming a rigid structure. Battery Racks and wooden supports for cable termination shall be painted with at least three (3) coats of electrolyte-resistant paint of approved shade. Racks shall be free standing type, mounted on porcelain / electrolyte-resistant high impact plastic insulators. The cells shall be supported on insulators fixed on to the rack with adequate clearance between adjacent cells. The nameplates, resistant to acid, for each cell shall be attached on the necessary racks.
7	5.1 : (m) Battery health management system	BHMS is not applicable
8	7.3 :	Following type tests as per IS-1652 / IEC60896-11 to be conducted on two cells of the battery. - Ampere hour & watt hour efficiency test. - Endurance Test - Capacity test and test for voltage on battery during discharge / Discharge Performance test at low temperature - Test for retention of charge - Container shall be type tested as per IS



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

		1146 f. Sealing compound shall be type tested as per IS 3116. The Capacity test and test for voltage on battery during discharge shall also be carried out at site on completion of E&C and immediately prior to putting battery in service. Necessary testing equipment (except discharge resistor and battery charger) required for testing at site (including site visit) shall be arranged by bidder. The charges for this test shall be given separately in price schedule as indicated in BOQ Annexure-I at Sr. No. 4.3.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

4.1 Documents required along with Technical offer

Signed and Stamped copies of following documents:-

- Battery sizing calculation with respect to load duty cycle as per Annexure-I of Section-I to be provided along with supporting documents (capability / discharge curve, temperature correction factor, float charging factor & published technical catalogue) for considered factors.
- Schedule of BOQ cum Price Schedule (Unpriced)
- Compliance certificate
- Schedule of deviations.

4.2 Documents required after award of LOI

Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:-

S. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.
1	Quality Plan for battery	PE-V0-417-508-E902
2	Data Sheet for battery	PE-V0-425-508-E101
3	General Arrangement drawing for Battery	PE-V0-417-508-E102
4	Battery sizing calculation (Including battery catalogues, curves etc)	PE-V0-417-508-E103
5	Bill of Material for the battery	PE-V0-417-508-E104
6	Field Quality Plan for battery	PE-V0-417-508-E105
7	List of Mandatory Spares for battery	PE-V0-417-508-E108
8	O & M manual for battery	PE-V0-417-508-E109



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

9	Fault calculation & Connector sizing calculation	PE-V0-417-508-E106
10	Type test reports for the battery	PE-V0-417-508-E111
11	Cable Termination arrangement for battery terminal	PE-V0-417-508-E112
12	Battery room lay out	PE-V0-417-508-E113
13	List of E&C spares for battery	PE-V0-417-508-E114

Note:-

1. Document indicated at clause no. 4.2 above, shall be submitted through document management system (DMS).

5.0 PROVENNESS CRITERIA (PROJECT SPECIFIC PRE QUALIFICATION CRITERIA)

- 1) Vendor should have manufactured and supplied at least two (2) numbers of highest offered rating or above of high discharge type Plante positive plate type battery at least one (1) each at two (2) different industrial installations, which should be in successful operation for at least two (2) years as on 17.10.2017.
- 2) Vendor to submit relevant documents in support of above.

	TECHNICAL SPECIFICATION FOR 220V DC BATTERY	SPECIFICATION NO. PE-TS-417-508-E001	
		VOLUME II	
		SECTION I	
		REVISION 00	DATE: 29.03.19
		SHEET OF 5	

DATA SHEET -A
LEAD ACID PLANTE BATTERY

1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead Acid Plante high discharge
3.	Design Ambient temp.	:	50°C
4.	Min Electrolyte temp.	:	7°C
5.	Cell Container	:	Transparent glass
6.	DC System Earthing	:	Unearthed
7.	Conforming to	:	IEEE/ IEC / IS standards
8.	No. of cells & End cell voltage	:	108 Nos.; 1.8V
9.	Nominal Float voltage (V)	:	2.25 V/cell
10.	Boost voltage (Maximum) (V)	:	Bidder to furnish the detail along with offer
11.	AH Capacity of battery at temp 'T' (27°C) for a) MAIN PLANT BATTERY as per Annexure-I	:	Bidder to furnish quoted AH capacity and battery sizing calculation along with offer
12.	Arrangement of batteries on racks	:	Single tier for batteries having cell weight 50kg or more.
13.	Connection from battery to DCDB	:	4-1CX400sqmm (Cu)/ pole (Fire survival cable) for MAIN PLANT BATTERY (Annexure-III)- Tentative size
14.	Fault current (DC)	:	The battery shall be designed to restrict maximum fault level on DCDB limited to 25kA for 1 Sec.
15.	Battery to be suitable for duty	:	As per Annexure-II for MAIN PLANT Battery
16.	Recommended charging rate for boost charging (battery to be charged in 10 hours) a) For Main Plant Battery (as per Annexure-I)	:	Bidder to furnish the detail along with offer
17.	Tapping to be provided in battery	:	NO
18.	Tapping to be provided at which cell	:	NO

Note 1: Bidder shall furnish following along with offer:

- Battery capability / discharge curve.
- Battery sizing calculation as per IEEE-485.
- Indicate value at sl. No. 10, 11 and 16 above.
- Supporting calculation for temp correction factor as per IEEE 485 shall be furnished for batteries which are not designed at 25°C.
- Bidders stand guarantee that the rating offered at S. No. 11 shall meet 'Load Duty Cycle' taking into factors account for battery sizing as per Annexure-I of specification.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

DATA SHEET -C

S. No.	PARAMETER	UNIT	VALUE
1.0	Make and Type		
2.0	AH capacity at 27° C and end voltage		
2.1	At 10 Hr discharge rate	AH	
2.2	At 1 Hr discharge rate	AH	
3.0	Battery Discharge current		
3.1	At one minute rate	Amp	
3.2	At 30 minutes rate	Amp	
3.3	At 30 minutes rate at end voltage	Amp	
3.4	At 60 minutes rate	Amp	
3.5	At 60 minutes rate at end voltage	Amp	
3.6	At 120 minutes rate at end voltage	Amp	
4.0	Types of plates		
4.1	Negative plates		
4.2	Positive plates		
5.0	Method of connection between cells		
6.0	Voltage per cell at the end of charge at the finishing rate	V	
7.0	Recommended Trickle charge current	Amp	
8.0	Type and material of separators		
9.0	Material of container		
10.0	Type of container		
11.0	Internal resistance of cells	Ohms	
12.0	Total resistance of connectors	Ohms	
13.0	Insulator Material for		
13.1	Cells		
13.2	Racks		
14.0	Average life	Years	
15.0	Recommended boost charger rating for		
15.1	Charging in 8 hours	Amp	
15.2	Charging in 10 hours	Amp	



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

REVISION 00

DATE: 29.03.19

SHEET OF 5

S. No.	PARAMETER	UNIT	VALUE
16.0	Allowable ripple content acceptable to battery (r.m.s)	%	
17.0	Hydrogen evaluation		
18.0	Cell designation in accordance with IS: 1651/1652		
19.0	Applicable standard		
20.0	Whether battery performance curve and calculation for capacities enclosed		
21.0	Recommended Maximum period of storage of Electrolyte before first charge		
22.0	Amount and specific gravity of electrolyte per cell required for first filling at 27° C		
23.0	Recommended specific gravity of electrolyte at 27° C		
23.1	When fully charged		
23.2	When fully discharged		
24.0	Container dimensions	(L X B X H)mm	
25.0	Distance between centres of cells when erected	Mm	
26.0	Terminal connectors		
26.1	Type		
26.2	Material		
27.0	Battery Racks		
27.1	Type & Material		
27.2	Outline dimensions	(L X B X H) mm	
27.3	Net weight	Kg	
28.0	Weight per cell	Kg	
28.1	Net dry weight	Kg	
28.2	Net weight with electrolyte	Kg	
29.0	Total shipping weight of one battery unit (without electrolyte)	Kg	
30.0	Taps provided at cell no.		
31.0	Connection from battery to charger (busbar/ cable)		
32.0	Recommended size of (busbar/ cable)		
33.0	Whether backup calculation furnished		
34.0	Cable lugs at battery terminals of suitable size		

Note: Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

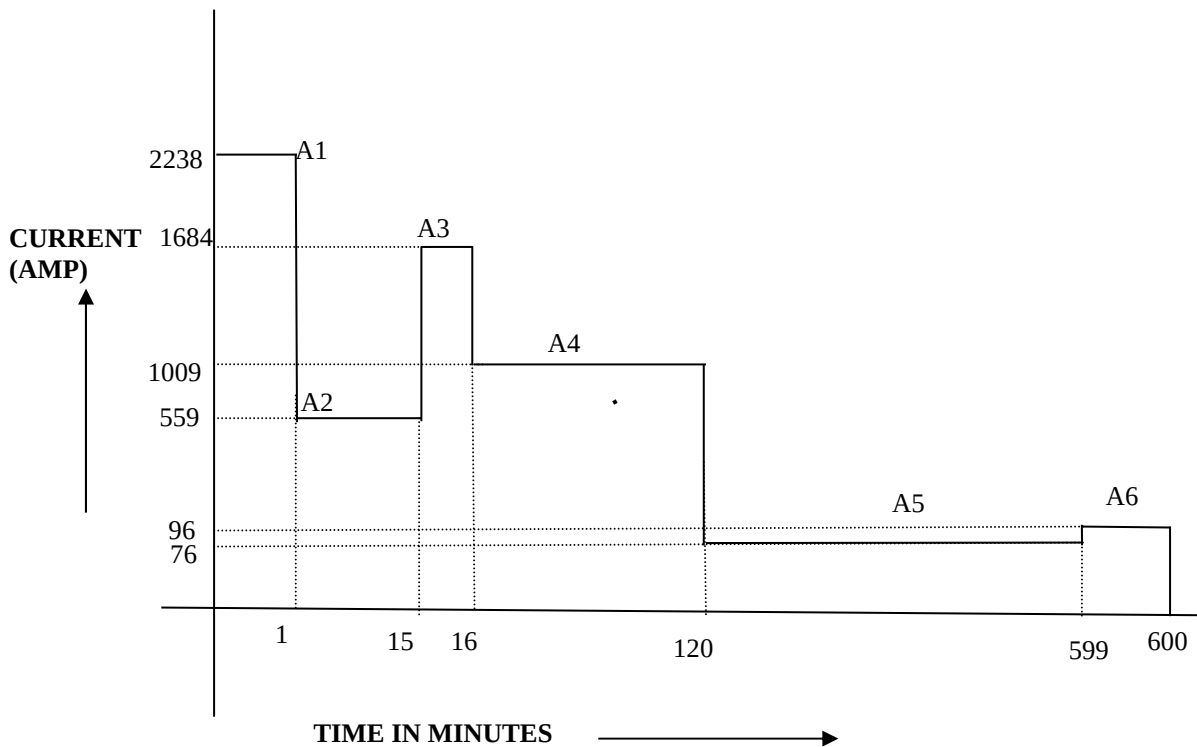
REVISION 00

DATE: 29.03.19

SHEET OF 5

ANNEXURE-I

LOAD DUTY CYCLE OF MAIN PLANT & ASSOCIATED STATION



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|------------------------------|
| 1. AGEING FACTOR | : 1.25 |
| 2. MIN.ELECTROLYTIC TEMP. | : 7 °C |
| 3. END CELL VOLTAGE | : 1.80V PER CELL |
| 4. DESIGN MARGIN | : 20% |
| 5. TEMPERATURE CORRECTION FACTOR | : As per manufacturer's data |
| 6. NO. OF CELLS | : 108 |



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION I

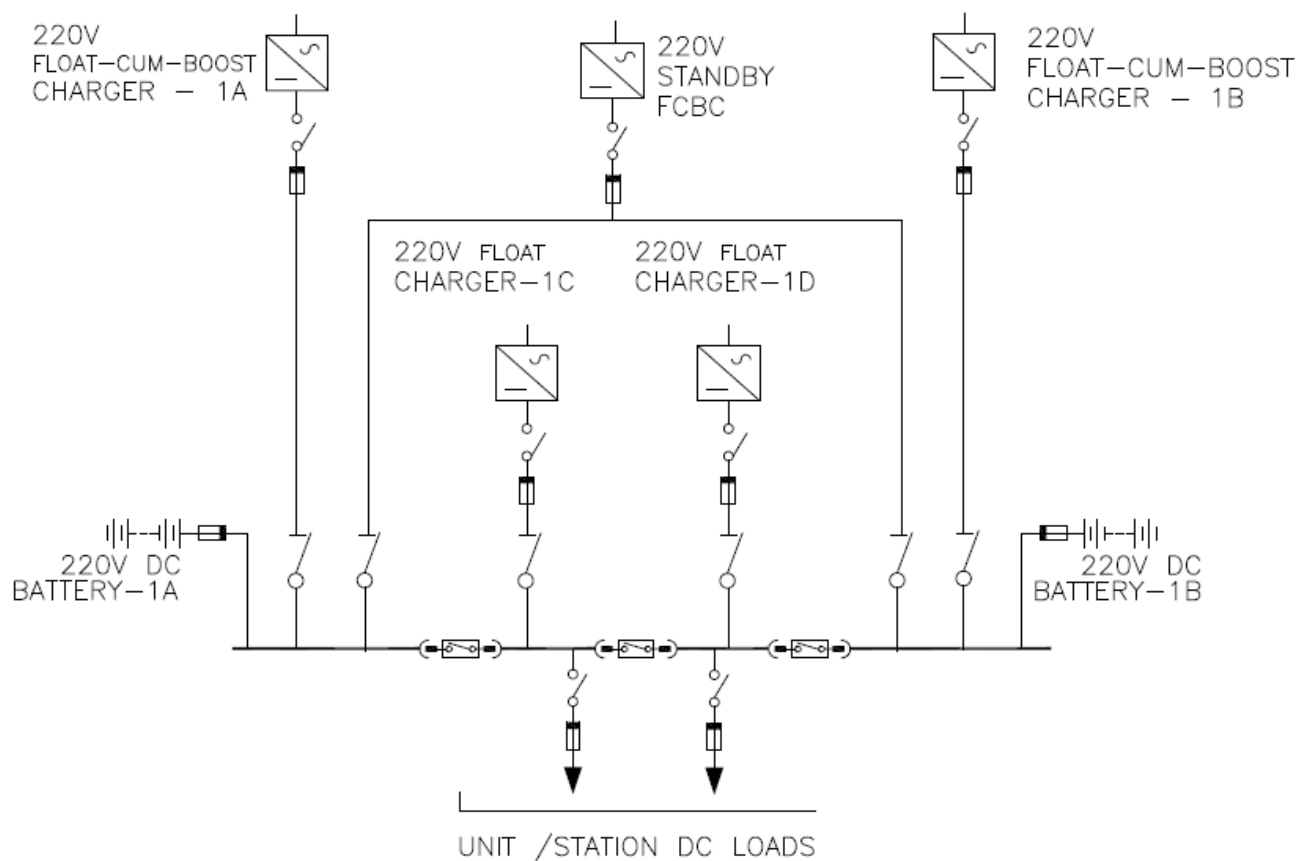
REVISION 00

DATE: 29.03.19

SHEET OF 5

ANNEXURE-II

ONE LINE DIAGRAM FOR 220 V DC SYSTEM OF MAIN PLANT & ASSOCIATED STATION





**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00 29.03.19

SHEET 1 OF 1

SECTION-II

STANDARD TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

1.0 INTENT OF SPECIFICATION

The intent of specification is not to specify all details of design & construction of material. The material shall, however, conform in all aspects to high standard of design, engineering and workmanship and be capable of performing in continuous operation up to & after bidder's guarantee period in manner acceptable to purchaser who will interpret the drawings & specification and shall have power to reject any work or material which in his judgement is not in full accordance with this specification.

2.0 CODES & STANDARDS

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The design, material, construction, manufacture, inspection, testing and performance of 220V DC Battery shall conform to the latest revision of relevant standards and codes of practices as per Annexure-I.
- 2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

- A) Civil works like foundation and cable cellar, flooring of the battery room etc.
- B) Ventilation of battery and charger room.
- C) DCDB
- D) Power and control cables
- E) Erection of the equipment
- F) Battery charger, battery fuse box and discharge resistor panel

4.0 SYSTEM CONCEPT

- 4.01 **Main Plant:** 220V DC system shall be an ungrounded system comprising of two sets of batteries (2X100%) with 1x100% float cum-boost charger for each set of battery and one sectionalised 1X100% DCDB & 1 no. common standby float cum boost charger for each unit. The 220V DC system is designed to cater the control, protection, interlocking, emergency lighting and emergency dc drives for main plant and associated station (excluding CHP & Switchyard). The load duty cycle and typical single line diagram for 220V battery and charger connections for Main Plant is enclosed as Annexure-I & Annexure-II in section-I respectively.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

- 4.02 The battery shall be designed to restrict maximum fault level on DCDB limited to 50kA for 1 Sec.
- 4.03 In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the float/float cum boost charger will continue to supply the loads as well as trickle charge the battery.
- 4.04 The 220V batteries shall be sized considering emergency load cycle requirement of 120 minutes and various factors as per Annexure-II.
- 4.05 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for 220V DC system.
- 4.06 Batteries shall be connected to DC distribution board through single cores copper cables. Battery terminals shall be made suitable for cable size to be informed during contract stage. Long barrel heavy duty copper lugs for cable termination at battery terminals shall be in the scope of bidder. Size of the cable shall be informed during detailed engineering.
- 4.07 The equipment will be located indoor but in a hot, humid and tropical atmosphere.
- 4.08 Necessary accessories required for maintenance and testing of batteries shall be supplied with each battery bank as per enclosed Annexure-IV.

5.0 OTHER TECHNICAL REQUIREMENTS

5.1 Lead-Acid Batteries

- a) Batteries shall be stationery storage Lead Acid Plante high discharge type conforming to IS-1652/IEC60896-11/ IEEE 485-1995. The batteries shall meet the 'Load Duty Cycle' requirements under all site-operating conditions as specified.
- b) Each set of battery shall consist of number of cells assembled together on mounting racks.
- c) The battery shall be flooded cell with Plante Lead acid. In the event of failure of any cell, there shall be no interruption in power supply to load.
- d) Containers:
Container shall be made of clear view SAN type, suitable robust, heat resistance, leak proof, non-absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container. The marking for the electrolyte level should be for the upper and lower limits. Container shall be closed / sealed lid type. The pole sealing arrangement should be such that no acid particle gets entrapped due to acid creep



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.

e) Vent Plugs:

Vent plugs shall be provided in each cell. They shall be anti splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

f) Plates:

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS : 1652 as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked. The positive plates shall be supported from the ledges of the SAN container. They should not be supported at the bottom of container. Sufficient space shall allowed to allow the creepage of the plates.

g) Sediment Space:

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

h) Electrolyte:

The electrolyte shall be prepared from battery grade Sulphuric Acid conforming to IS-266 and distilled water conforming to IS-1069. The cells shall be shipped in dry uncharged condition and electrolyte shall be supplied separately in non-returnable containers. 10% extra electrolyte shall be furnished as extra fitting to cover spillage in transit or during erection.

i) Connectors and Fasteners:

Lead coated copper connectors/ Rubber moulded and fully insulated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. The thickness of lead-coating of connectors should not be less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX F of IS:6848 (latest edition). All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded copper conductors and PVC insulation. Necessary 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 minutes 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.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

j) Battery Racks:

Wooden racks for all the batteries shall be provided. These racks shall be made of good quality first class seasoned teak wood in line with CPWD specification. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries having cell weight of 50 Kg or more will be arranged in single tier. The batteries rack and wooden support for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags, resistant to acid, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor. Wherever racks are transported in dismantled condition, suitable match markings shall be provided to facilitate easy assembly.

Following information shall be indelibly marked on outside of each cell:

- Manufacturer's name and trademarks
- Manufacturer type designation
- Country and year of manufacture
- AH capacity at 10 hour discharge rate
- Serial number

k) Positive and negative terminal posts shall be clearly and indelibly marked for easy identification. Numbering tags for each cell shall also be attached on to the racks.

l) Following minimum information shall be given on the instruction cards:

- Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate
- Maintenance instructions
- Designation of cell in accordance with relevant standard
- Storing conditions of electrolyte

m) **BATTERY HEALTH MONITORING SYSTEM (BHMS)**

- Battery Health Monitoring System shall include microprocessor based hardware and software to monitor the condition of each battery cell of 220V DC system battery banks on-line on 24x7 basis with Battery Health Monitoring System, it shall be possible to measure & analyse the individual cell and battery parameters so that any damage to battery shall be prevented by pro-active maintenance. Each Battery set shall have its own independent Battery Health Monitoring System.
- Battery Health Monitoring System shall measure and store the following parameters.
 - i) Each Cell Voltage
 - ii) Battery DC Current
 - iii) Ambient and Cell temperature



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

iv) Cell Electrolyte level 3 cells per battery set

- Further, Battery Health Monitoring System module shall have additional provision of accepting at least 6 Nos. of Digital inputs and 2 Nos. of Analog inputs (4-20mA). Battery Health Monitoring System shall also be able to store these inputs status for future reference.
- Each battery shall be supplied with micro-processor based battery health monitoring system (BHMS) for individual cell healthiness monitoring which shall be located in 220V DC charger/ DCDB room. The voltage of each cell shall be monitored to ascertain any probable failure in the cell. In case of any failure, particular cell number will be indicated locally and alarm will be generated. Provision shall be kept to transmit the group alarm signal in remote also.
- Battery Health Monitoring System shall communicate with the DDCMIS & provide alarms for abnormal condition of Cell/ Battery as finalized by owner during detailed engineering. Battery Health Monitoring System modules shall have one port suitable for connecting laptop locally & one port suitable for TCP/ IP protocol for communication to DDCMIS system. DC FAIL alarm shall be generated and given in Central Control Room buzzer (Audio Visual Fascia). The cable required for connecting the cells to Battery Health Monitoring System & Battery Health Monitoring System to DDCMIS shall also be in bidder's scope.
- Technical Parameters:
 - a) Input Power Supply 230V AC (UPS) / 220V DC
 - b) Voltage Measurement Accuracy 0.5% or better
 - c) Current Measurement Accuracy 0.5% or better
 - d) Operating Temperature Range 0-50 deg C
 - e) Mounting Panel Mounting
 - f) IP Protection IP-42
- Necessary software for communication between Battery Health Monitoring System & DDCMIS as well as for analysis of stored data shall be provided by the bidder. The software for analysis shall be capable of showing graphical representation of various stored parameters & shall give some corrective suggestion based on the abnormal parameters. The software shall calculate & show battery Ah during charge/discharge cycles. Logging of cell/ battery parameters (voltage, current & temperature) & alarm conditions as well as event log of all activities affecting the battery bank shall be possible with date/ time stamp. Logged data can be exported in MS Excel format.
- Cable Requirement for BHMS:
In addition to all the accessories required for meeting the above requirement of BHMS system, Suitable length & type of Cables required to establish connection between the cells and BHMS should be considered by bidder in their scope of supply. Distance of 100 m is to be considered between Battery Health monitoring system and DDCMIS for cables and these cables should also be considered by bidder in their scope of supply.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

6.0 PERFORMANCE GUARANTEE

- 6.1 Bidders shall guarantee that battery offered shall meet the 'Load Duty Cycle' and information given in Annexure –II as stipulated in this specification and as confirmed by them in technical data sheets. In case the performance of battery at site is not as per the performance guarantee, the bidder will have to replace the battery at site free of cost.

7.0 INSPECTIONS & TESTING

- 7.1 Offered equipment shall be of type test design. The bidder shall confirm compliance to quality plan enclosed with the specification, which is subject to BHEL & End customer approval and the inspection shall be carried out based on this approved Quality Plan (QP No. PE-QP-999-508-E002, Rev. 00).

- 7.2 All acceptance and routine tests as per relevant standards and as per QP (attached) shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

- 7.3 The type, routine and acceptance test on battery will be conducted on two cells of battery as per relevant standard.

(A) Following type tests shall be conducted for the battery.

- Capacity test for voltage on battery during discharge at 27°C.
- Ampere hour & watt hour efficiency test
- Verification of constructional requirement
- Verification of marking
- Verification of dimension

(B) For following tests only type test reports will be submitted.

- Endurance test.
- Test for retention of charge

(C) Commissioning Checks:

All tests as listed below shall be carried out on sample cell selected at random by the owner at site after completion of installation.

- Verification of markings.
- Verification of dimensions.
- Test for capacities for 10 hrs discharge rate along with the test for voltage during discharge.
- The Bidder shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.

- 7.4 For all components / materials, for which type test reports have been asked as per relevant standard, such Type tests should have been carried out on identical components / materials. In absence of such type tests reports or in



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

case such reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval. (Type test charges as per clause 7.5 shall not be applicable in such cases).

7.5 The bidder shall indicate cost of carrying out all the Type tests as specified in clause 7.3 of the specification. The charges for each of the Type tests shall be given separately in price schedule as indicated in BOQ cum Price schedule at Sr. No. 6.0.

7.6 All material used for the construction of the equipment / items shall be new and shall be in accordance with the requirements of this specification. Materials utilised shall be those, which have established themselves for use in such applications.

8.0 Instruction Manuals

Instruction manuals for the installation, operation and maintenance of battery to be supplied shall be furnished at least two months before the date of despatch of equipment.

The installation and maintenance manual of battery shall contain the following:

- A) General description giving type and rating of various batteries.
- B) Technical data.
- C) Salient constructional details.
- D) Instruction to be followed on receipt at site.
- E) Instructions for foundations, if any.
- F) Erection procedures and checks (handling at site, erection, pre-commissioning).
- G) Procedure for filling of electrolyte.
- H) Commissioning procedures and site tests.
- I) Routine, periodic and preventive inspection and maintenance procedures.
- J) Safety rules.
- K) Possible faults, their causes and remedies.
- L) Copies of the type, acceptance and routine test certificates in bound volume.
- M) Catalogues, literature and drawings.
- N) Outline dimension drawings showing constructional features, relevant cross sectional views and earthing details, operator oriented description of equipment and accessories.
- O) Operating procedures, maintenance procedures & precautions to be taken during operation and maintenance work.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

- 8.1 Bidder shall furnish field quality plan detailing out the specific quality control procedure covering receipt of material/equipment and handling at site, storage, erection, commissioning, post commissioning etc.

9.0 TOOLS AND TACKLE

Tools & tackle which are essential to facilitate assembly, adjustments, maintenance & dismantling of equipment shall be provided as part of equipment supplied. The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection.

10.0 BASIC DESIGN DOCUMENTS

'Basic Design Documents' cover: Battery sizing calculations, battery data sheet, connector sizing calculation, Quality Plan, OGA for 220V battery, BOM, List of approved makes, type test reports & type test procedure (if applicable) for battery.

Successful bidder shall also prepare battery room lay out during detailed engineering based on BHEL input drawing. Same shall be subject to BHEL/end customer review and approval. There shall be no commercial implication towards the same.

11.0 AS-BUILT DRAWINGS

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.

- 12.0 Statutory and regulatory requirements as per IE rule 1956 with amendment - 3 rule 1986, rules Nos. 35, 42, 50 & 51 shall be adhered to.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

ANNEXURE-A

LIST OF APPLICABLE STANDARDS

- | | | |
|-----|---|-------------|
| 1. | STATIONERY LEAD ACID PLANTE BATTERY | IS 1652 |
| 2. | RECOMMENDED PRACTICE FOR SIZING LEAD ACID BATTERIES | IEEE 485 |
| 3. | SPECIFICATION FOR WATER FOR STORAGE BATTERIES | IS 1069 |
| 4. | SPECIFICATION FOR SULPHURIC ACID FOR LEAD ACID BATTERIES | IS 266 |
| 5. | RUBBER & PLASTIC CONTAINERS FOR LEAD ACID BATTERIES | IS 1146 |
| 6. | SYNTHETIC SEPARATORS FOR LEAD ACID BATTERIES | IS 6071 |
| 7. | SEALING COMPOUND FOR LEAD ACID BATTERIES | IS 3116 |
| 8. | METHODS OF TESTS FOR LEAD ACID BATTERIES | IS 8320 |
| 9. | SPECIFICATION FOR HIGH PERFORMANCE PLANTE'S CELLS | BS-6290 |
| 10. | ELECTRICAL VOCABULAR, PRIMARY CELLS AND BATTERIES. | IS: 1885 |
| 11. | LEAD-ACID BATTERIES FOR TRAIN LIGHTING & AIRCONDITIONING SERVICES | IS: 6848 |
| 12. | STATIONARY LEAD-ACID BATTERIES – VENTED TYPES – GENERAL REQUIREMENTS & METHODS OF TESTS | IEC60896-11 |
| 13. | INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS | |

Note:

Vendor to note that wherever IS is mentioned equivalent IEC is also acceptable. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

ANNEXURE-B

ACCESSORIES

Following accessories shall be provided for each battery set (Already part of BOQ cum price schedule)

1.1 Each battery is furnished with following items

Sl. No.	Fittings
1	Electrolyte (sulphuric acid for first filling plus 10% extra in non-returnable container)
2	FRP rack properly treated with three coats of anti-acid paints for acid resistance for 220V battery bank
3	Insulators with 5% extra, rubber pad etc. for rack
4	One set of inter cell, inter tie and inter bank connectors required for complete installation.
5	Teakwood Cable clamps with hardware/ cable supporting arrangement having L Type copper connectors

1.2 Additionally, following set of accessories shall be provided with each battery:

no	Name of accessory	QTY (in Nos.)
1	Hydrometer (in step of 0.005)	1
2	Thermometer with plug & cap, specific gravity correction scale	2
3	Digital Cell testing voltmeter (3-0-3V)	2
4	Pair of rubber hand gloves	2
5	Pair of spanners	1
6	Cell lifting straps	2 set
7	Bridging clamps	2 Set
8	Goggles (industrial)	1
9	Instruction card	2
10	Battery log book	1
11	Electrolyte resistant plastic funnels	2
12	Electrolyte resistant plastic Jugs	2
13	Plastic filling bottles	2
14	Self-adhesive PVC stickers for cell numbering	1 SET



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET OF 13

15	Pocket Thermometer (digital Type)	3
16	Set of hydrometer syringes (suitable for the vent holes in different cells for specific gravity reading)	1 Set.
17	Rubber Apron	2 No
18	No smoking notice	2 No
7.2	Following set of additional accessories shall be provided for entire 5 unit	
1.	Battery trolley	3 no
2.	Hot air gun	2 no
3.	Siphon	2 no



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

SPECIFICATION NO. PE-TS-417-508-E001

VOLUME II

SECTION II

REVISION 00

DATE: 29.03.19

SHEET 1 OF 1

STANDARD QUALITY PLAN

		QUALITY PLAN		CUSTOMER : TSGENCO		PROJECT: 5x800 MW YADADRI TPS 220V DC BATTERY		SPECIFICATION NO. PE-TS-417-508-E001	
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO. - PE-QP-999-508-E002, REV.0		SPECIFICATION : TS FOR 220V DC BATTERY	
				SHEET 1 OF 3		ITEM : LEAD ACID BATTERY		DOC. NO.	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10
11									
1.0 RAW MATERIALS & BOUGHT OUT ITEMS									
1.1	(Pure Lead for Pos. plate, Lead Alloy for Neg. plate & Sulphuric acid)	Chemical	MA	Chemical Analysis	Random Sample	IS:1652, IS:266, IS:1069 & MFR's Std.	IS:1652, IS:266, IS:1069 & MFR's Std.	Test Cert.	3/2 - 1
1.2 SEPARATOR									
a)	Visual	Visual	MA	Visual	Random Sample	IS:1652 & MFR's Std.	IS:1652 & MFR's Std.	Test Cert.	3/2 - 1
b)	Physical	Physical		Physical	-do-	-do-	-do-	-do-	3/2 - 1
c)	Chemical	Chemical		Chemical	-do-	(For Synthetic IS : 6071)	(For Synthetic IS : 6071)	-do-	3/2 - 1
d)	Electrical Resistance Test	Electrical		Electrical	-do-	-do-	-do-	-do-	3/2 - 1
e)	Acceptance test Dimension, Volume Porosity, Wettability of separator	Test		As per Standard	-do-	-do-	-do-	-do-	3/2 - 1
1.3 TERMINAL POST									
a)	Dimensional Conformance	Visual	MA	Visual	Random Sample	IS:1652, IS:8320 & MFR's Std.	IS:1652, IS:8320 & MFR's Std.	Test Cert.	3/2 - 1
b)	Material Conformance	Chemical	CR	Chemical	-do-	-do-	-do-	-do-	3/2 - 1
c)	Thread size depth & chamfer	Physical	MA	Measurement	-do-	-do-	-do-	-do-	3/2 - 1
d)	Surface finish & defects	Visual	MA	-do-	100%	-do-	-do-	-do-	3/2 - 1
e)	Plating Quality	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2 - 1
BHEL									
PARTICULARS				BIDDER/ VENDOR					
NAME									
SIGNATURE									
DATE									
2 - VENDOR				3 - SUB- VENDOR		P - PERFORM		W - WITNESS	
1 - BHEL/ CUSTOMER								V - VERIFICATION	
LEGEND :								BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER : TSGENCO		PROJECT: 5x800 MW YADADRI TPS 220V DC BATTERY		SPECIFICATION NO. PE-TS-417-508-E001	
SHEET 2 OF 3									
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY
									P W V
1	2	3	4	5	6	7	8	9	10
1.4	CONNECTOR								11
a)	Dimension	Dimension	MA	Measurement	Random Sample	IS:1652, IS:6848 & Appd. Drg./Doc.	IS:1652, IS:6848 & Appd. Drg./Doc.	Test Cert.	3/2 - 1
b)	Thickness of lead coating	Visual		Visual	-do-	-do-	-do-	-do-	3/2 - 1
1.5	VENT CAP								
a)	Dimensional Conformance	Dimension	MA	Measurement	-do-	Refer Remarks#	Refer Remarks#	-do-	3/2 - 1
1.6	CONTAINER								
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS:1146	IS:1652, IS:1146, IS:8320	IS:1652, IS:1146, IS:8320	Test Cert.	3/2 - 1
b)	Verification of Markings	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
c)	High Voltage Test	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
d)	Drops Ball Test	Mechanical	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
e)	Plastic Yield Test	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
f)	Acid Resistance Test	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
g)	Hydraulic thrust endurance test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2 - 1
2.0	FINISHED BATTERY	Routine Test	CR	Elec. & Meas.	100%	IS:1652 & IS:8320	IS:1652 & IS:8320	Test Cert.	3/2 - 1
3.0	FINAL INSPECTION								
3.1	Type Test #								
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2 1 -
b)	Verification of Markings	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2 1 -
c)	Verification of Dimensions	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2 1 -
d)	Test for Capacity & Voltage during discharge/ Discharge performance test at low temperature	Test	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2 1 -
BHEL		PARTICULARS		BIDDER/ VENDOR					
		NAME							
		SIGNATURE							
		DATE							

 भारतीय बिजली होल्डिंग्स लिमिटेड		QUALITY PLAN		CUSTOMER : TSGENCO		PROJECT: 5x800 MW YADADRI TPS 220V DC BATTERY		SPECIFICATION NO. PE-TS-417-508-E001				
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0		SPECIFICATION : TS FOR 220V DC BATTERY				
		SHEET 3 OF 3		SYSTEM		ITEM : LEAD ACID BATTERY		DOC. NO.				
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
									P	W	V	
1	2	3	4	5	6	7	8	9	10	11		
e)	AH & WH efficiency Test	-do-	CR	As per IS:1652	Sample Plan as per IS:8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
f)	*Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	-	1	-	
g)	*Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	-	1	-	
h)	Tests on container as per SI. No. 1.6 of the quality plan.								3/2	1	-	Tests on container as per SI. No. 1.6 of this document shall also be conducted during final inspection for customer witness. Tests shall be conducted on two(2) containers.
i)	Tests on sealing compound								3/2	1	-	
3.2 Acceptance Test												
a)	Verification of Markings	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
b)	Verification of Dimensions	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Test for Capacity	Capacity	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Voltage during discharge	Voltage during discharge	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
4.0 ACCESSORIES		Visual & Dimension	MA	Visual	100%	Appd. Drg./Doc.	Appd. Drg./Doc.	-do-	2	1	-	
5.0 CABLE LUGS		Visual	MA	Visual	100%	Appd. DataSheet	Appd. DataSheet	-do-	2	1	-	

NOTE:- Wherever IS is mentioned equivalent IEC is also acceptable. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.
*Type test report of identical battery to be submitted.

BHEL		PARTICULARS		BIDDER/ VENDOR	
		NAME			
		SIGNATURE			
		DATE			

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION BIDDER'S/ VENDORS COMPANY SEAL

ANNEXURE TO QP

QUALITY PLAN
STANDARD QP NO. : PE-QP-999-508-E002, REV. 0LIST OF TYPE TEST FOR LEAD ACID BATTERY

S No	Test	Type test description	Referred standard	Test to be specifically conducted (Yes/No)	BHEL/Customer's approval Req. on test certificate (Yes/No)
1	Type Test	Test for Capacity & Voltage during discharge/ Discharge performance test at 27 degree C.(As per Sr. No. 4.5 of BOQ cum Price Schedule)	IS:1652	Yes	Yes
		AH & WH efficiency Test	IS:1652	Yes	Yes
		Retention of Charge	IS:1652	Yes	Yes
		Endurance Test	IS:1652	Yes	Yes
		Verification of constructional requirement	Relevant IS	Yes	Yes
		Verification of marking	Relevant IS	Yes	Yes
		Verification of dimension	Relevant IS	Yes	Yes
		Test on container as per IS: 1146	IS1146	Yes	Yes
		Sealing Compound as per IS : 3116	IS3116	Yes	Yes