

**2 X 660MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS,
CHENNAI
TAMIL NADU GENERATION & DISTRIBUTION CORPORATION
LTD.**

VOLUME – II

**TECHNICAL SPECIFICATION FOR
220V DC Lead Acid Battery**

**BHEL DOCUMENT NO. : PE-TS-412-508-E001
REV-0**



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301, UTTAR PRADESH, INDIA**



**TECHNICAL SPECIFICATION FOR
220V DC Lead Acid Battery**

SPECIFICATION NO. PE-TS-412-508-E001

VOLUME II

REVISION 0 DATE : 26.12.17

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TOTAL NO. OF SHEETS = 31 (INCLUDING COVER/ SEPARATOR SHEETS)



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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 enclosed with NIT shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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SECTION –I
SPECIFIC TECHNICAL REQUIREMENTS

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1.0 SCOPE OF ENQUIRY

- 1.1 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of 220V DC BATTERY.
- 1.2 Standard technical requirements of the 220V DC BATTERY are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I & Data Sheet-A.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A, followed by Section-II shall prevail in case of any conflict between the stipulations of Section-I, Section-II & Datasheet-A.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per BOQ cum Unpriced Price Schedule enclosed with NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS:

3.1 Technical /Quality/ Inspection:

S. No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	Section-II, Clause no. 3, D): Power & Control Cables	Shall be read as: "Power & Control Cables excluding Interfacing Cables of BHMS with EDMS. These cables are in Bidder's scope of supply"

4.0 220V DC SYSTEM

Battery and charger will be connected to DCDB. Under normal conditions, each charger will cater continuous loads and trickle charging current of batteries. If load is high and exceeds the charger capacity, then excess load will be supplied by the battery. All the terminals and inter-cell and inter-bank connectors will be fully insulated. In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the float charger will continue to supply the loads as well as trickle charge the battery.

- 5.0 SINGE LINE DIAGRAM FOR 220V DC SYSTEM (Refer Annexure-I enclosed with Section-I).
- 6.0 LOAD DUTY CYCLE (Refer Annexure-II enclosed with Section-I).
- 7.0 DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER (Refer Annexure-III enclosed with Section-I).
- 8.0 DOCUMENTS REQUIRED AFTER AWARD OF LOI (Refer Annexure-IV enclosed with Section-I).
- 9.0 The Quality Plan no. PE-QP-999-508-E002 for Lead Acid Battery should be read in conjunction with Annexure-A.



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DATA SHEET-A

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1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead-Acid Plante High Discharge Type
3.	Conforming to	:	IEEE/ IS standards
4.	DC system Fault level & duration	:	25KA for 1 Sec
5.	Material of Battery Rack	:	Mild Steel rack coated with three coats of anti-acid paint of approved shade
6.	Design Ambient Temperature	:	50 Deg. C
7.	Minimum Electrolyte Temperature to be considered for Battery Sizing	:	25 Deg. C
8.	No. of cells	:	108
9.	End cell voltage	:	1.85V/cell
10.	Nominal Float voltage (V)	:	2.25 V/cell
11.	Boost voltage (Maximum) (V)	:	Bidder to furnish the detail along with offer
12.	AH Capacity of Battery	:	Bidder to furnish quoted AH capacity and battery sizing as per LOAD DUTY CYCLE (Annexure-II)
13.	Arrangement of batteries on racks	:	Single tier for batteries having cell weight 50kg or more
14.	Cable size to be terminated at Battery end	:	4 RUNS 1C x 400 sq.mm (Cu) FS CABLE/ pole
15.	Tapping to be provided in battery	:	No
16.	Tapping to be provided at which cell (if Tapping is applicable)	:	NA
17.	Recommended boost charging rate	:	Bidder to furnish the detail along with offer
18.	Recommended trickle charging rate	:	Bidder to furnish the detail along with offer

Notes:

1. Suitable number of copper lugs for cable termination at battery terminals shall be provided by bidder as per cable size informed by BHEL above.
2. Bidders stand guarantee that the rating offered at S. No. 12 shall meet 'Load Duty Cycle' as per Annexure-II of specification.
3. Refer Annexure-I (Single Line Diagram of 220V DC system) for connection arrangement of Battery, charger and DCDB.
4. Suitable number of inert-cell, inter-row and inter-bank connectors to be provided by bidder.



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DATA SHEET-C

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DATASHEET-C

16.00.00 BATTERY**S. NO. DESCRIPTION****1.00.00 BATTERY****1.01.00 General**

a. Make

b. Type

1.02.00

a. Rated Voltage Volt

b. 10-hour rating at 27 Deg.C to end cell voltage AH

c. 2-hour discharge rate to end cell voltage Amp

d. 1 –hour discharge rate to end cell voltage Amp

e. 1 -minute discharge rate to end cell voltage Amp

1.03.00**Performance**

a. Battery duty cycle curve furnished Yes/No

b. Cell voltage characteristics during duty cycle furnished Yes/No

c. Minimum cell voltage during duty cycle Volt

d. AH efficiency at 10-hour discharge rate %

e. Expected life of Battery Yr

1.04.00**Battery Characteristics**

a. Recommended charging rate for

i) Float charging Amp



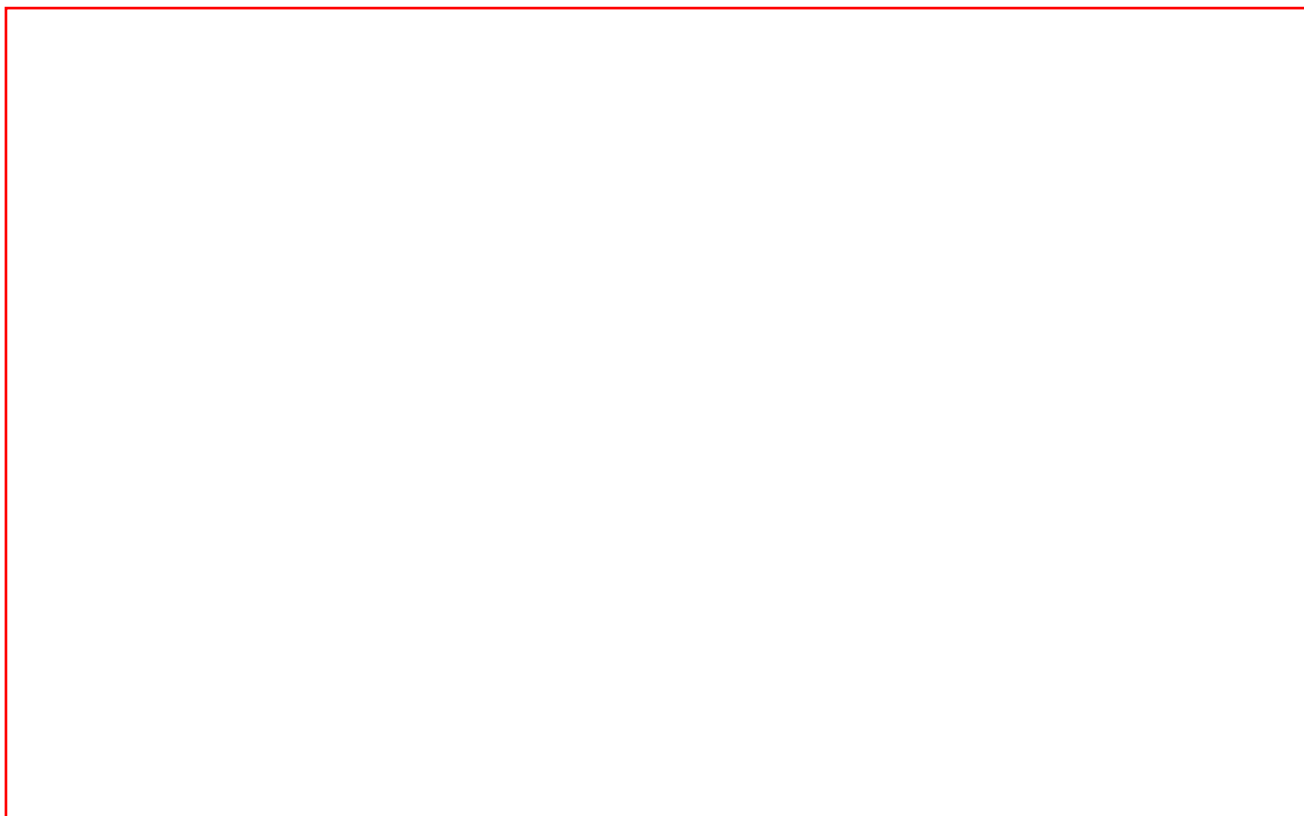
ii) Equalising Charge	Amp
iii) Boost charging in 10 hrs.	Amp
Start	Amp
Finish	Amp

b. Recommend specific gravity at 27 Deg.C

- i) For first filling
- ii) At full charge
- iii) At end of 10-hour discharge

c. Short-circuit current for a dead-short
across battery terminals, when

- i) Float charge at 2.15 V/Cell kA
- ii) Boost charge at 2.75 V/Cell kA
- d. Battery internal resistance Ohm
- e. Cell voltage characteristics during charging furnished Yes/No





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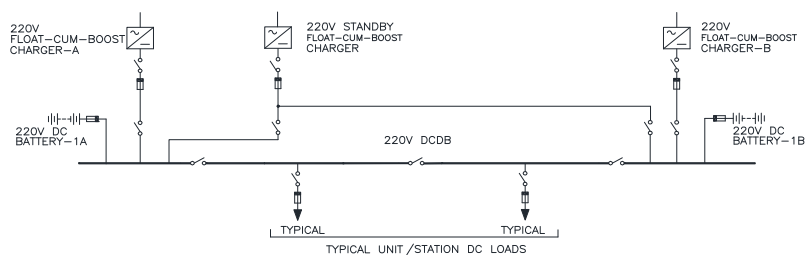
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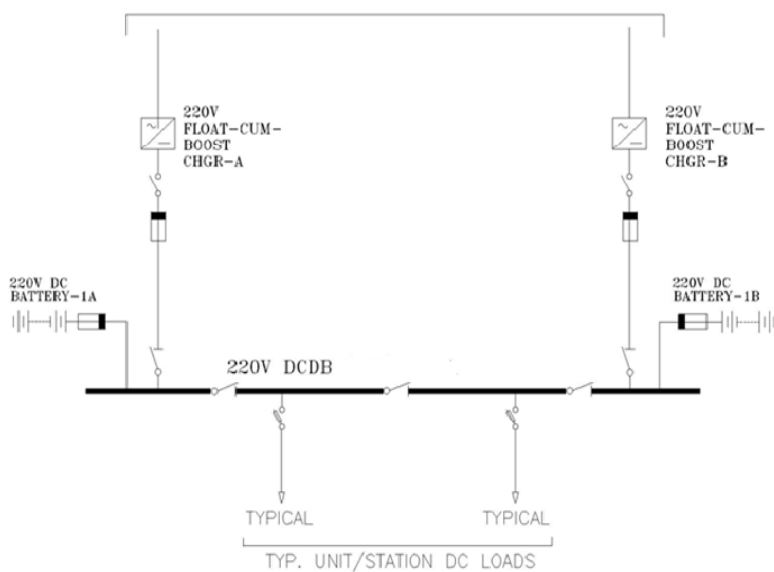
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ANNEXURE-I

SINGE LINE DIAGRAM FOR 220 V DC SYSTEM OF AREA-1 (FOR MAIN PLANT & ASSOCIATED STATION LOADS)



SINGE LINE DIAGRAM FOR 220 V DC SYSTEM OF AREA 2 (FOR WATER TREATMENT & RO PLANT LOADS)





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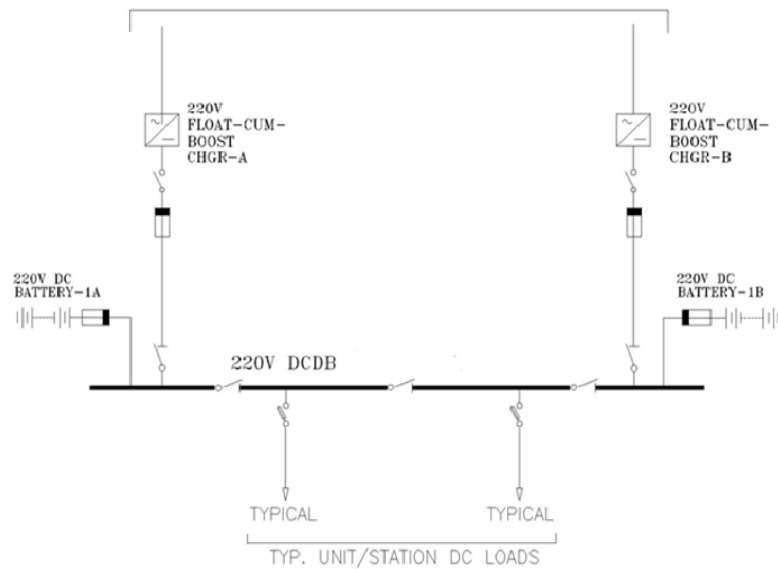
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SINGE LINE DIAGRAM FOR 220 V DC SYSTEM OF AREA 3 (FOR ECHS & SW SYSTEM LOADS)





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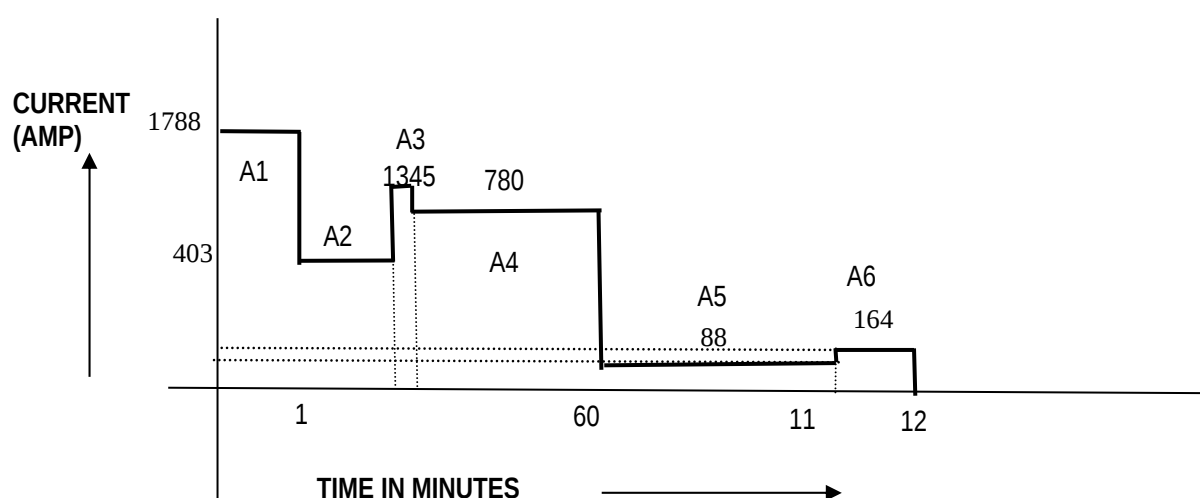
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ANNEXURE-II

**LOAD DUTY CYCLE
LOAD DUTY CYCLE OF AREA 1 (MAIN PLANT & ASSOCIATED STATION
LOADS)**



Duration	0-1 min	1-06 min	06-07 min	07-60 min	60-119 min	119-120 min
Current	1788	403	1345	780	88	164

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|---|
| 1. AGEING FACTOR | : 1.0 for Lead-Acid |
| 2. MIN.ELECTROLYTIC TEMP. | : 25 °C |
| 3. END CELL VOLTAGE | : 1.85V/cell |
| 4. DESIGN MARGIN | : 1.2 |
| 5. TEMPERATURE CORRECTION FACTOR | : IEEE 485 for Lead Acid shall be the principle for sizing the battery including temperature correction factor. |

Note:

- Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 27 °C.
- Due to maximum AH capacity limitation, bidder can offer battery with parallel banks. However, because of layout constraint, bidder can offer maximum of 2 banks in parallel.



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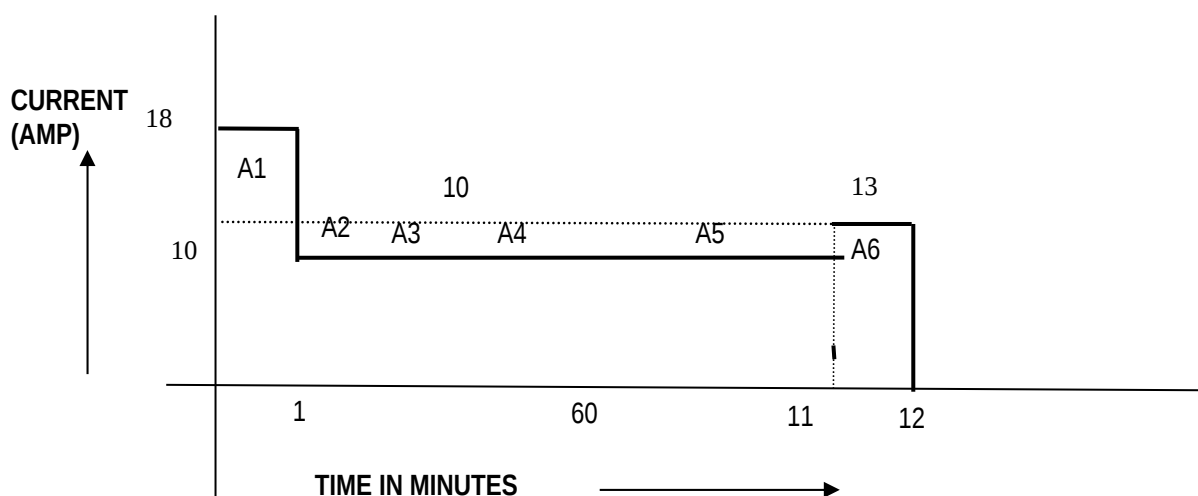
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LOAD DUTY CYCLE OF AREA 2 (FOR WATER TREATMENT & RO PLANT LOADS)



Duration	0-1 min	1-06 min	06-07 min	07-60 min	60-119 min	119-120 min
Current	18	10	10	10	10	13

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.0 for Lead-Acid
2. MIN.ELECTROLYTIC TEMP. : 25 °C
3. END CELL VOLTAGE : 1.85V/cell
4. DESIGN MARGIN : 1.2
5. TEMPERATURE CORRECTION FACTOR : IEEE 485 for Lead Acid shall be the principle for sizing the battery including temperature correction factor.

Note:

Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 27 °C.



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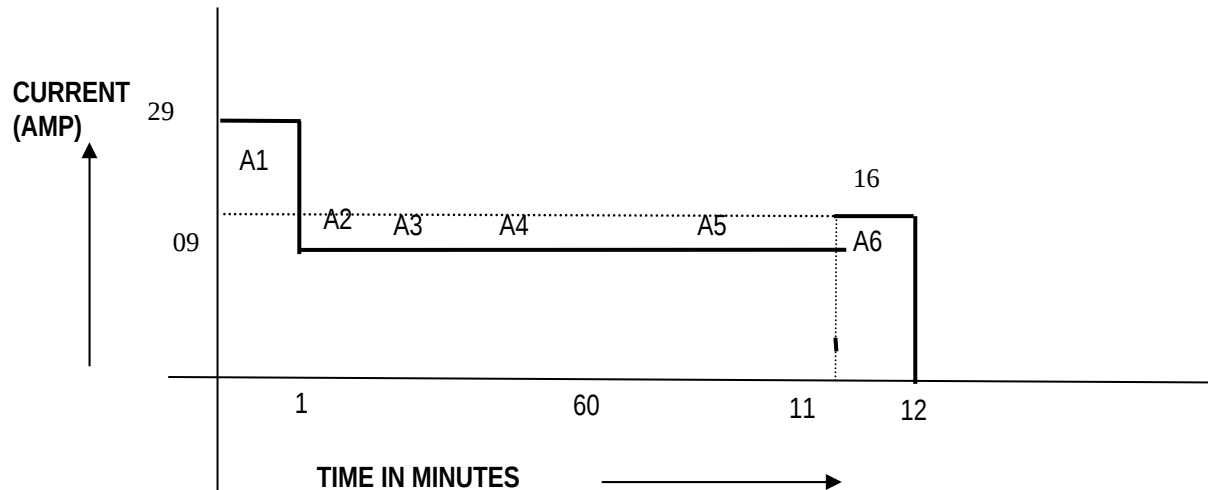
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LOAD DUTY CYCLE OF AREA 3 (FOR ECHS & SW INTAKE LOADS)



Duration	0-1 min	1-06 min	06-07 min	07-60 min	60-119 min	119-120 min
Current	29	09	09	09	09	16

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.0 for Lead-Acid
2. MIN.ELECTROLYTIC TEMP. : 25 °C
3. END CELL VOLTAGE : 1.85V/cell
4. DESIGN MARGIN : 1.2
5. TEMPERATURE CORRECTION FACTOR : IEEE 485 for Lead Acid shall be the principle for sizing the battery including temperature correction factor.

Note:

Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 27 °C.

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ANNEXURE-III

DOCUMENTS REQUIRED ALONG WITH THE TECHNICAL OFFER

- i. Battery sizing calculation with respect to load duty cycle (Annexure-II) enclosed with Section-I to be provided along with supporting documents (capability / discharge curve, temperature correction factor, float charging factor & published technical catalogue) for considered factors.
- ii. Unpriced Price Schedule as enclosed with NIT with "Quoted" word against items with bidder's signature and company stamp.
- iii. A copy of the sheet "Compliance certificate" with bidder's signature and company stamp.
- iv. A copy of sheet "Data Sheet-A" with required information and bidder's signature and company stamp.



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ANNEXURE-IV

DOCUMENTS REQUIRED AFTER AWARD OF LOI

S. NO	DOCUMENT TITLE	DWG. / DOCUMENT No.
1	Data Sheet for battery	PE-V0-412-508-E201
2	General Arrangement Drawing for battery	PE-V0-412-508-E202
3	Battery sizing calculation (Including battery catalogues, curves etc.)	PE-V0-412-508-E203
4	Bill of Material for battery	PE-V0-412-508-E204
5	Field Quality Plan for battery	PE-V0-412-508-E903
6	List of E&C Spares for battery	PE-V0-412-508-E206
7	List of O&M Spares for battery	PE-V0-412-508-E207
8	List of Mandatory Spares for battery	PE-V0-412-508-E208
9	O&M Manual for battery	PE-V0-412-508-E209
10	Fault calculation & Connector sizing calculation	PE-V0-412-508-E210
11	Type test reports for the battery	PE-V0-412-508-E211
12	Cable Termination arrangement for battery terminal	PE-V0-412-508-E212
13	Loose items to be shipped with battery	PE-V0-412-508-E213
14	Battery room layout	PE-V0-412-508-E214
15	Power Circuit Diagram of BHMS	PE-V0-412-508-E215
16	GA of BHMS	PE-V0-412-508-E216
17	QAP of BHMS	PE-V0-412-508-E217



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ANNEXURE-V

ACCESSORIES

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

1.1 Each battery bank of 108 cells is furnished with following items

Sl. No.	Fittings
1	First charge of electrolyte plus 10% extra
2	Mild Steel racks with 3 coats of anti-acid paint
3	Stand insulators plus 5% extra
4	Cell inter-connectors with 5% extra and one extra end take-off
5	Inter-bank, Inter-row connectors with 5% extra
6	Cell numbering tags with fixing arrangement
7	PVC Spill Tray under each cell

8.2 Following accessories shall be provided for each AREA 220V DC System

Sl. No.	Accessories	QTY
1	Inter-connector bolt wrench	1 No.
2	Hydrometer to measure specific gravity (in steps of 0.005)	1 No.
3	Specific gravity correction chart	1 No.
4	Set of Hydrometer syringes	1 No.
5	Thermometer with plug & cap, specific gravity correction scale	1 No.
6	Cell testing voltmeter (digital) with leads (3-0-3V)	1 No.
7	Pocket thermometer	1 No.
8	Electrolyte resisting funnels	2 Nos.
9	Electrolyte resisting jug of adequate capacity	1 No.
10	Rubber apron	1 No.
11	Pair of Rubber hand gloves	1 Set
12	Cell lifting straps	1 Set
13	PVC spill trays	1 No.
14	Spanner for cells	1 No.
15	First aid box	1 No.
16	Goggles (Industrial)	2 Nos.
17	No smoking Notice	2 Nos.
18	Wall mounting holders for hydrometer and thermometer	2 Nos.



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SECTION-II

STANDARD TECHNICAL REQUIREMENTS



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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 IS / IEEE standards and codes of practices.
- 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 220V DC system for each of the above mentioned areas shall comprise of the following:

- 2x100% battery bank
- 1x100% SMPS based Modular Float cum Boost Charger (FCBC) for each battery bank.
- 1 Nos. common standby SMPS based Modular Float cum Boost Charger (FCBC) for each unit of main plant.
- 1x100% sectionalised DCDB



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220V DC system will be an ungrounded system. Separate independent 220V DC system is designed to cater 220V DC supply for the control, protection, interlocking, annunciation, emergency DC drives and DC lighting (as applicable) for the following areas

1. AREA1: For Main plant and station loads,
2. AREA2: For Water treatment and RO plant loads,
3. AREA3: For ECHS and sea water intake system.

The typical single line diagram and load duty cycle for 220V battery and charger connections is enclosed as Annexure-I & Annexure-II respectively.

- 4.02 The battery shall be designed to restrict maximum fault level on DCDB limited to 25kA.
- 4.03 In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the SMPS based Modular Float cum Boost Charger (FCBC) 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. An ageing factor of 1.0, design margin 1.20 and temperature correction factor considering minimum electrolyte temperature of 25° C shall be considered for sizing the battery as per IEEE 485 and IS-1652. Based on the above calculations, next higher available battery rating will be provided.
- 4.05 The voltage at load terminal will not exceed the limits of minimum 187V and maximum 242V (+10% to -15% of 220V).
- 4.06 The 220V DC power cable between battery & DCDB, charger and DCDB shall be single core copper conductor Fire Survival cable. HRC fuse shall be located near battery. Main HRC fuse on battery and charger output shall have alarm contact. Battery terminals shall be made suitable for cable size mentioned in Datasheet-A. Long barrel heavy duty copper lugs for cable termination at battery terminals shall be in the scope of bidder.
- 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-V.
- 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/ IEEE 485-1995. The batteries shall meet the 'Load Duty Cycle' requirements under all site-operating conditions as specified.



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- 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 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 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 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 plante 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 be provided 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 shall be used for connecting up adjacent cells, rows and banks. The cell terminal post shall be provided with connector bolts, nuts,



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clamps, connectors and washers made of copper/ brass effectively coated with lead to prevent corrosion.

The thickness of lead coating shall be measured as per appendix-F of IS-6848. All the terminals and inter-cell connectors shall be fully insulated or have insulated shrouds. End take of connections from positive and negative poles of batteries shall be done through single core copper cable having stranded copper conductor and EPR insulation (Cable size in line with Datasheet-A). The bidder shall supply lead coated bent copper plate, tubular copper lugs, clamps, 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 2 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.

- j) Battery Health Monitoring System shall include microprocessor based hardware & software to monitor the condition of each battery cell of 220V DC system battery banks on-line on 24 X 7 basis. With Battery Health Monitoring System, it shall be possible to measure & analyse the individual cell & battery parameters so that any damage to the battery shall be prevented by proactive maintenance. Each battery set shall have its independent Battery Health Monitoring System.
- k) Each battery bank of **Area-1** 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.
- l) Battery Health Monitoring System shall communicate with the EDMS & 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 SCADA system (future requirement). The cable required for connecting the cells to Battery Health Monitoring System & Battery Health Monitoring System to EDMS shall also be in bidder's scope.
- m) Technical Parameters:
 - a) Input Power Supply 230V AC (UPS) / 220V DC
 - b) Voltage Measurement Accuracy 0.5% or better



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- 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
- n) Necessary software for communication between Battery Health Monitoring System & EDMS 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.
- o) 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. Battery room layout is shown in Annexure-VI-A & B. For Unit # 1: Distance of 220 m & for Unit # 2: Distance of 100 m is to be considered between Battery Health monitoring system and EDMS for cables and these cables should also be considered by bidder in their scope of supply.
- p) Battery Racks:
Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Name plates, 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 trade marks
 - Country and year of manufacturer
 - Manufacturer type designation
 - AH capacity at 10 hour discharge rate
 - Serial number
- q) 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.



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- r) 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
- s) Following protections are provided for batteries:
- Under voltage protection for DC system
 - Over voltage protection for DC system
 - Over current protection on DC side
 - Fuse for short circuit protection of the battery
 - Earth fault protection for DC system
 - Fuse failure indication on DC side

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).
- 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 All type tests as per IS-1652 to be conducted on two cells of the battery.
- 7.4 Capacity Test on all batteries shall be carried out at Site on completion of E & C & immediately prior to putting battery in service & same shall be done during Vendor Visit for supervision of E & C.
- 7.5 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 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.



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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.

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 TACKLES

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



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'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.

		QUALITY PLAN		CUSTOMER :		PROJECT: 2 X 660MW ENNORE STPP		SPECIFICATION NO. PE-TS-412-508-E001				
				BIDDER/ :		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.		SPECIFICATION TECHNICAL SPECIFICATION				
		SHEET 1 OF 3		VENDOR		ITEM : LEAD ACID BATTERY		TITLE FOR 220V 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
1	2	3	4	5	6	7	8	9	P	W	V	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						BIDDER'S/ VENDORS COMPANY SEAL			

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

		QUALITY PLAN		CUSTOMER :		PROJECT: 2 X 660MW ENNORE STPP		SPECIFICATION NO. PE-TS-412-508-E001				
				BIDDER/ :		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.		SPECIFICATION TECHNICAL SPECIFICATION FOR 220V LEAD ACID BATTERY				
		SHEET 2 OF 3		VENDOR		TITLE		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
1.4	CONNECTOR											
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	# Vent cap shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into vent to take electrolyte sample.
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	-	# Conduction of Type Tests from S.No. (d) to (g) shall be as per Annexure-A enclosed.
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	Test	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	
BHEL			PARTICULARS		BIDDER/ VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/ VENDORS COMPANY SEAL			

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

		QUALITY PLAN		CUSTOMER :		PROJECT: 2 X 660MW ENNORE STPP		SPECIFICATION NO. PE-TS-412-508-E001					
				BIDDER/ :		TITLE		SPECIFICATION		TECHNICAL SPECIFICATION			
		SHEET 3 OF 3		VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.		TITLE		FOR 220V 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-	3/2	1	-		
g)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	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.													
BHEL			PARTICULARS		BIDDER/ VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/ VENDORS COMPANY SEAL					

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

