

***MAHARASHTRA STATE POWER GENERATION CO.
LTD.***

1X660MW BHUSAWAL TPS

VOLUME – II

TECHNICAL SPECIFICATION

FOR

220V DC LEAD ACID BATTERY

SPECIFICATION NO: *PE-TS-415-508-E001*



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



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

SPECIFICATION NO. PE-TS-415-508-E001

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REVISION 0 | **DATE : 08.07.2020**

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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 Annexure-A [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 LEAD ACID BATTERY**.
- 1.2 Standard technical requirements of the **220V DC LEAD ACID 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 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.	5.3 The positive and negative terminal posts shall be clearly marked	The positive and negative terminal posts shall be clearly and indelibly marked for easy identification.
2.	5.9. b)	Racks shall be painted with at least three (3) coats of acid resistant/ anti-corrosive paint of approved.

- 3.2 (i) 220V DC system shall be an ungrounded system comprising of:
- a) 2x100% batteries each with float cum boost charger & float charger for main plant and 1x100% sectionalised DCDB.
- b) 1x100% batteries each with float cum boost charger & float charger for Raw water & Cooling water system and 1x100% DCDB.
- The 220V DC system is designed to cater the control, protection, interlocking & emergency DC drives for Main Plant & associated station area and Raw water & cooling water system.
- (ii) For flooded cell, suitable mechanism and/ or Ceramic Vent plug shall be provided to eliminate emission of acid mist during the float operation. The Bidder shall also indicate Gas emission rate of the battery in their offer for necessary design of the ventilation of the Battery room.
- (iii) Battery interbank connection should be adequate size copper bus bar with coating suitable for battery room environment.
- 3.3 Test certificates:
- a) Certified reports of all the test carried out at the works shall be furnished in six copies for approval.

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b) Bidder shall submit type test reports for the type tests as per relevant standards on identical equipment in type & rating. Reports older than five years shall not be acceptable

However, if the contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to BHEL either at third party lab or in presence of client/owners representative and submit the reports for approval.

3.4 PROVENNESS CRITERIA (Project specific requirement)

- a) Bidder should have manufactured & supplied battery similar to as being supplied in this project, which shall be in successful operation for similar duty condition and similar application for minimum one (1) year as on 06.08.18.
- b) In support of above criteria, along with bid, bidder to submit credentials for scrutiny & approval.

4.0 SINGE LINE DIAGRAM FOR 220V DC SYSTEM (Refer Annexure-I enclosed with Section-I)

5.0 LOAD DUTY CYCLE (Refer Annexure-II enclosed with Section-I)

6.0 DRAWING/ DOCUMENT SCHEDULE (Refer Annexure-III enclosed with Section-I)

7.0 Successful bidder has to furnish technical details as per Data sheet – C enclosed with Section-I after the award of Contract.

8.0 The Quality Plan no. PE-QP-999-508-E002, R1 for Lead Acid Battery should be read in conjunction with Annexure-A to QAP and Annexure-A [BOQ-Cum-Price schedule] enclosed with NIT.

**TECHNICAL SPECIFICATION FOR
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1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead Acid Plante high discharge
3.	Conforming to	:	IEEE/ IEC/ IS standards
4.	DC system Fault level & duration	:	50kA for 1 sec
5.	Material of Battery Rack	:	Wooden (seasoned teakwood), acid resistance, anti-corrosive, fully insulated
6.	Design Ambient Temperature	:	50 Deg. C
7.	Minimum Electrolyte Temperature to be considered for Battery Sizing	:	3°C
8.	No. of cells	:	110
9.	End cell voltage	:	1.85V
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) (minimum 3000AH for main plant & minimum 250AH for Raw water & cooling system)
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	:	3-1CX400sqmm (Cu)/ pole (Fire survival cable EPR insulated) for MAIN PLANT BATTERY & 2CX50 sqmm (Cu)/ pole (Fire survival cable EPR insulated) for Raw water & cooling water system (Annexure-III)- Tentative size
15.	Tapping to be provided in battery	:	No
16.	Tapping to be provided at which cell (if Tapping is applicable)	:	No
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 to be informed by BHEL during detailed engineering. Tentative size of cable is mentioned above at sl. no. 14.

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.



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DATA SHEET-C

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Sr. 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	
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	



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DATA SHEET-C

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15.2	Charging in 10 hours	Amp	
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		



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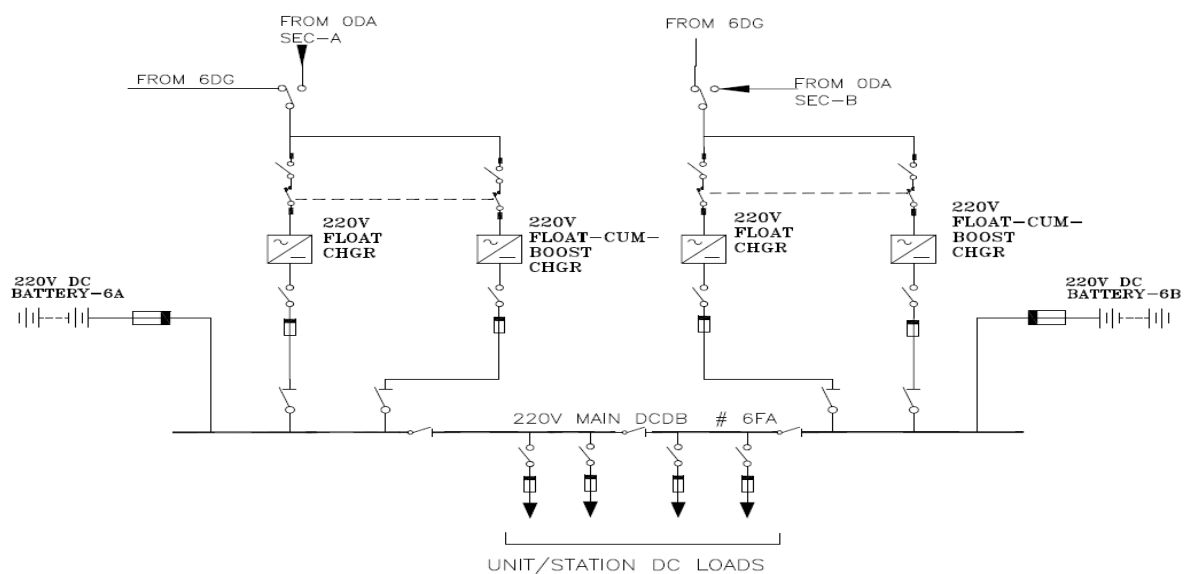
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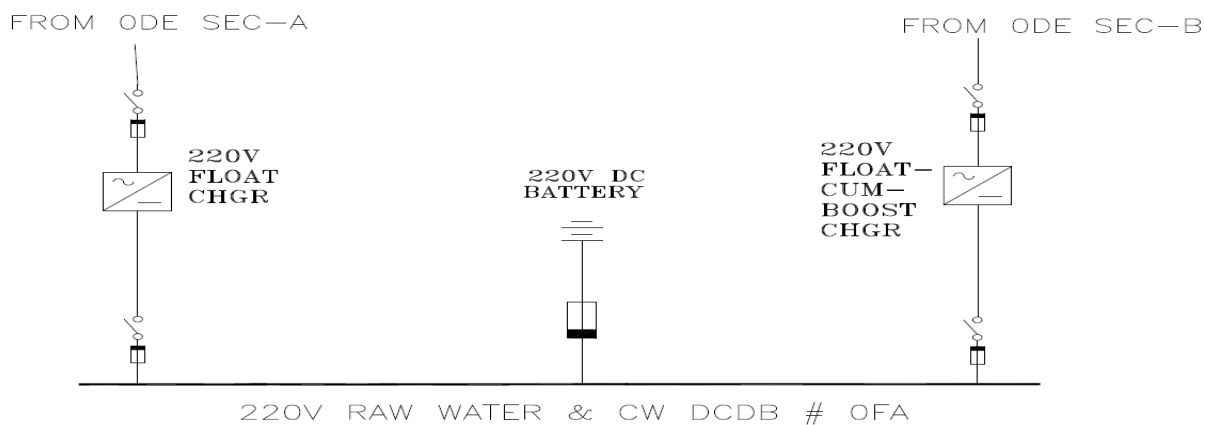
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ANNEXURE-I

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



SINGLE LINE DIAGRAM FOR 220 V DC SYSTEM OF RAW WATER





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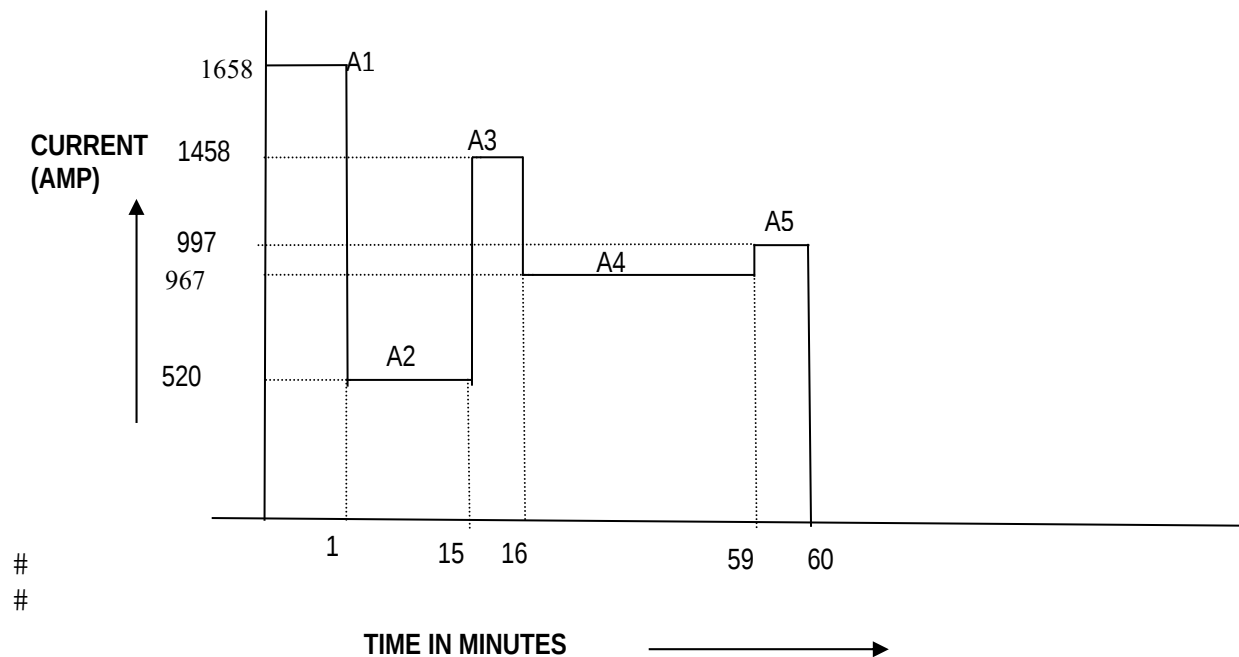
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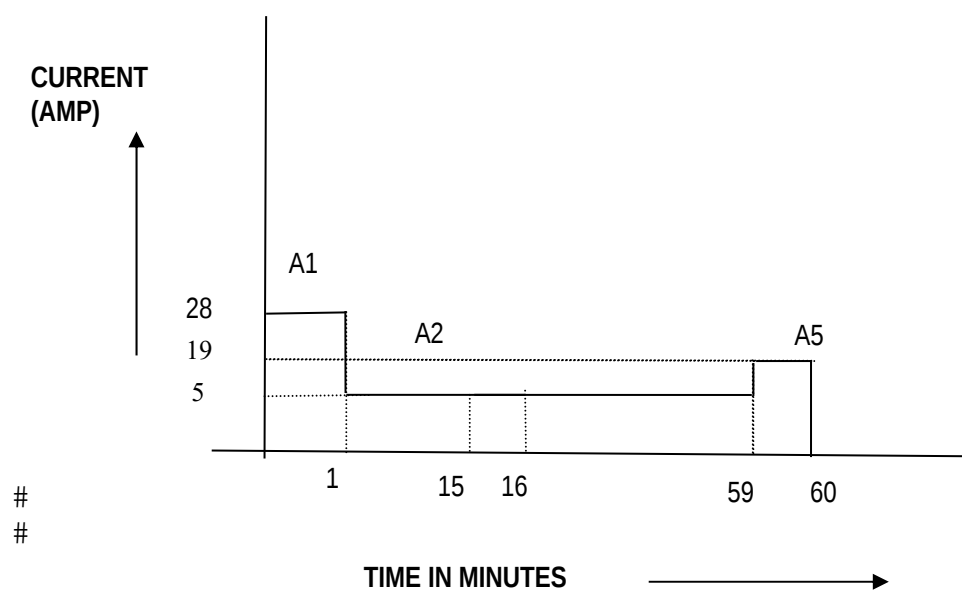
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ANNEXURE-II

LOAD DUTY CYCLE FOR MAIN PLANT



LOAD DUTY CYCLE OF RAW WATER





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FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|------------------|
| 1. AGEING FACTOR | : 1 |
| 2. MIN.ELECTROLYTIC TEMP. | : 3 °C |
| 3. END CELL VOLTAGE | : 1.85V PER CELL |
| 4. DESIGN MARGIN | : 20% |
| 5. TEMPERATURE CORRECTION FACTOR | : As per IEEE |
| 6. NO. OF CELLS | : 110 |

Minimum AH for Main plant battery: 3000 AH

Minimum AH for Raw water & cooling water battery: 250AH



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ANNEXURE-III

DRAWING/ DOCUMENT SCHEDULE

DWG. / DOCUMENT No.	DOCUMENT TITLE	DOCUMENT TYPE
PE-V0-XXX-508-E101	TDS FOR BATTERY	Primary
PE-V0-XXX-508-E102	GA AND BATTERY ROOM LAYOUT OF BATTERY BANK	Primary
PE-V0-XXX-508-E103	BATTERY SIZING CALCULATION, FAULT CALCULATION AND CONNECTOR SIZING CALCULATION	Primary
PE-V0-XXX-508-E104	BILL OF MATERIAL FOR BATTERY	Primary
PE-V0-XXX-508-E108	LIST OF MANDATORY SPARES FOR BATTERY	Primary (for MS)
PE-V0-XXX-508-E902	QUALITY PLAN FOR BATTERY	Primary
PE-V0-XXX-508-E105	FIELD QUALITY PLAN FOR BATTERY	Secondary
PE-V0-XXX-508-E106	LIST OF E & C SPARES FOR BATTERY	Secondary
PE-V0-XXX-508-E107	LIST OF O&M SPARES FOR BATTERY	Secondary
PE-V0-XXX-508-E110	TYPE TEST REPORT FOR BATTERY	Secondary
PE-V0-XXX-508-E111	CABLE TERMINATION ARRANGEMENT FOR BATTERY TERMINAL	Secondary
PE-V0-XXX-508-E109	O & M MANUAL FOR BATTERY	Secondary



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SECTION - II
STANDARD TECHNICAL REQUIREMENTS



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1.0 TECHNICAL REQUIREMENTS

This specification covers the design, materials, constructional features, manufacture assembly, testing, packing and dispatch of 220V DC Lead-Acid Battery complete with all accessories.

In this specification, as erection and commissioning is not included in vendor's scope, Vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.

It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee. This enquiry covers the supply of 220V DC LEAD ACID BATTERY conforming to this specification.

2.0 CODES AND STANDARDS

Unless otherwise specified, the latest revisions of codes/standards as specified under Table-1 enclosed are applicable and shall referred to.

3.0 EQUIPMENT AND SERVICES TO BE PROVIDED BY THE BIDDER

The bidder shall supply the equipment and provide the services in accordance with the various sections of this specification and as per BOQ cum unpriced Price Schedule (Annexure-A) enclosed with NIT.

4.0 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. 220V DCDB
- d. Power and control cables
- e. Erection of the equipment
- f. Battery charger, battery fuse box and discharge resistor

5.0 DESCRIPTION OF EQUIPMENT

5.1 BATTERY

All batteries shall be stationary storage Lead-Acid *high discharge* type conforming to IS-1652/IEC60896-11. The batteries shall meet the duty cycle requirements under all site and operating conditions as specified in data sheet 'A'. IEEE 485 shall be the principle for sizing the battery including temperature correction factor.

5.2 CONTAINER

Containers shall be made of transparent polymeric material, robust, heat resistant, leak proof, non-absorbent, acid/alkali resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc. The marking for the electrolyte level shall be for upper & lower limits. Container shall be closed/sealed lid type. Open type cells are not



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acceptable. Lid and sealing compound shall be non-cracking type.

5.3 PLATES

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load.

The separators shall maintain the electrical insulation between the plates and shall permit free flow of electrolyte. Proper arrangement to keep end plates in position shall be provided. Separators shall be suitable for continuous immersion in the electrolyte without distortion.

The positive and negative terminal posts shall be clearly marked

5.4 CONNECTIONS

Lead coated copper connectors (or a better product) shall be used for connecting up adjacent cells and rows. Bolts, nuts, clamps, washers etc as applicable in shall be provided. All the terminals and inter-cell connectors shall be fully insulated or shrouded. End take of connections from positive and negative poles of batteries shall be done through single core cables. Necessary support equipments and copper lugs for termination of these cables on batteries shall also be supplied by the contractor. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering.

All connectors and lugs shall be capable of continuously carrying the discharge current of the respective Batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Successful bidder shall furnish necessary sizing calculations to prove compliance to the same.

5.5 VENT PLUG

Vent plug shall be provided in each cell. It shall be anti-splash type and having more than one exit hole to allow the gases to escape freely but prevent the acid spray from the battery. 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 of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

5.6 SEDIMENT SPACE

Sufficient sediment space shall be provided beneath the plates to accommodate any plate deposit, which accumulates at the bottom of the cell over a reasonable life of battery without short-circuiting the plates.

5.7 The following information shall be marked on out side of each cell.

- Name, type and trade mark of manufacturer
- Country and year of manufacture
- Capacity at 10 hr discharge rate .
- Upper and lower electrolyte level
- Serial Number



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5.8 ELECTROLYTE

The electrolyte comprise of battery grade sulphuric acid conforming to IS: 266 and water conforming to IS: 1069. The cells shall be shipped dry, uncharged with electrolyte supplied in non-returnable good quality polyethylene or other suitable containers. Ten percent extra electrolyte shall be supplied to account for any spillage during transit.

5.9 BATTERY RACKS

- a. Wooden/FRP/Steel battery racks to be supplied as specified in datasheet-A. Wooden rack shall be made of best quality treated wood
- b. Racks shall be painted with at least two (2) coats of acid resistant/ anti corrosive paint.
- c. Racks shall be free standing type mounted on porcelain/hard rubber/ PVC Pad insulators as applicable.
- d. Numbering tags for each cell shall be attached on to the battery racks.
- e. Battery racks and other supporting/interconnecting accessories shall be as per layout arrangement to be approved by purchaser during contract engineering stage.
- f. The bottom tier of the stand shall not be less than 150 mm above the floor.
- g. Wherever racks are transported in dismantled conditions, match markings shall be provided to facilitate easy assembly.

6.0 Following minimum information shall be given on the instruction cards:

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

7.0 LIFE

The guaranteed life of battery when operating under the specified conditions shall be furnished.

8.0 ACCESSORIES

Battery accessories shall be provided as specified in BOQ cum unpriced Price Schedule (Annexure-A) enclosed with NIT.

9.0 INSPECTION AND TESTING

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



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9.1 Quality Assurance

All materials components and equipment's covered under this specification shall be procured, manufactured, inspected and tested as per the BHEL standards, quality plan number PE-QP-999-S08-E002 enclosed with this specification and which shall be complied with.

All acceptance and routine tests as per IS-1652 shall be carried out by the manufacturer. Charges for all routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

9.2 Type, Routine and Acceptance Tests

Type, Routine and Acceptance tests to be performed as per Quality Plan(QP no. PE-QP-999-508-E002) enclosed with this specification.

10.0 PERFORMANCE GUARANTEE

Bidders shall guarantee that battery offered shall meet the duty cycle requirements 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.

11.0 INSTRUCTION MANUALS

11.1 Instruction manuals for the installation, operation and maintenance of battery to be supplied shall be furnished. The installation and maintenance manual 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.
- 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) Type and routine test certificates.
- m) Catalogues, literatures and drawings.



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12.0 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.

13.0 By all Bidders as technical offer:

- i. Battery sizing calculation with respect to load duty cycle 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 (Annexure-A) 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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Table-1

LIST OF CODES AND STANDARDS FOR LEAD ACID BATTERY

- | | |
|---|-------------|
| 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. STATIONARY LEAD-ACID BATTERIES – VENTED TYPES – GENERAL REQUIREMENTS & METHODS OF TESTS | IEC60896-11 |
| 12. 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.

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		QUALITY PLAN				SPEC NO.: -PE-TS-415-508-E001			DATE:- 08/07/2020				
				CUSTOMER	MAHARASHTRA STATE POWER GENERATION CO. LTD.				QP NO.: -PE-QP-999-508-E002, REV.01			DATE:- 30/06/2020			
				PROJECT	1x660 MW BHUSAWAL				P.O NO.:-			DATE:-			
				ITEM:- DC LEAD ACID BATTERY		SYSTEM:- DC SYSTEM		SECTION:-			SHEET 1 OF 3				
SL. NO.	COMPONENT & OPERATIONS		CHARACTERISTIC CHECK	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2		3	4	5	6		7	8	9	D *	10			11
						M	C/N					**			
												M	C	N	
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.	√	P	V	V	
1.2	SEPARATOR														
a)	Visual		Visual	MA	Visual	Random Sample	-	IS:1652 & MFR's Std.	IS:1652 & MFR's Std.	Test Cert.	√	P	V	-	
b)	Physical		Physical	MA	Physical	Random Sample	-	-do-	-do-	-do-	√	P	V	-	
c)	Chemical		Chemical	MA	Chemical	Random Sample	-	(For Synthetic IS : 6071)	(For Synthetic IS : 6071)	-do-	√	P	V	-	
d)	Electrical Resistance Test		Electrical	MA	Electrical	Random Sample	-	-do-	-do-	-do-	√	P/V	V	-	
e)	Acceptance test Dimension, Volume Porosity, Wettability of separator		Test	MA	Test	Random Sample	-	-do-	-do-	-do-	√	P	V	-	
1.3	TERMINAL POST														
a)	Dimensional Conformance		Dimension	MA	Measurement	Random Sample	-	IS:1652, IS:8320 & MFR's Std.	IS:1652, IS:8320 & MFR's Std.	Test Cert.	√	P	V	-	
b)	Material Conformance		Chemical	CR	Chemical	Random Sample	-	-do-	-do-	-do-	√	P	V	-	
c)	Thread size depth & chamfer		Physical	MA	Measurement	Random Sample	-	-do-	-do-	-do-	√	P	V	-	
d)	Surface finish & defects		Visual	MA	Visual	100%	-	-do-	-do-	-do-	√	P	V	-	
e)	Plating Quality		Thickness	CR	Measurement	Random Sample	-	-do-	-do-	-do-	√	P	V	-	
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.	√	P/V	V	V	
b)	Thickness of lead coating		Thickness	CR	Measurement	Random Sample	-	-do-	-do-	-do-	√	P/V	V	V	
1.5	VENT CAP														
a)	Dimensional Conformance		Dimension	MA	Measurement	Random Sample	-	IS:1652 & Appd. Drg./Doc. Also Refer Remarks#	IS:1652 & Appd. Drg./Doc. Also Refer Remarks#	Test Cert.	√	P	V	V	# 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.

BHEL						BIDDER/SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No.			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared By		Kanhaiya Kumar	Prepared By		Kunal Gandhi			Reviewed By			
Checked By		Manish Shukla	Checked By		Ritesh K Jaiswal			Checked By			

०१००५ एम 				MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				QUALITY PLAN				SPEC NO.: -PE-TS-415-508-E001			DATE:- 08/07/2020				
								CUSTOMER		MAHARASHTRA STATE POWER GENERATION CO. LTD.				QP NO.: -PE-QP-999-508-E002, REV.01			DATE:- 30/06/2020		
								PROJECT		1x660 MW BHUSAWAL				P.O NO.:-			DATE:-		
								ITEM:- LEAD ACID BATTERY				SYSTEM:- DC SYSTEM			SECTION:-			SHEET 2 OF 3	
SL. NO.	COMPONENT & OPERATIONS			CHARACTERISTIC CHECK	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS			
1	2			3	4	5	6		7	8	9	D *	10			11			
							M	C/N					**						
													M	C	N				
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.	✓	P	V	-				
b)	Verification of Markings			Visual	MA	Visual	-do-	-	-do-	-do-	-do-	✓	P	V	-				
c)	High Voltage Test			Electrical	MA	Electrical	-do-	-	-do-	-do-	-do-	✓	P	V	-				
d)	Drops Ball Test			Mechanical	MA	Mechanical	-do-	-	-do-	-do-	-do-	✓	P	V	-				
e)	Plastic Yield Test			Mechanical	MA	Mechanical	-do-	-	-do-	-do-	-do-	✓	P	V	-				
f)	Acid Resistance Test			Chemical	MA	Chemical	-do-	-	-do-	-do-	-do-	✓	P	V	-				
g)	Hydraulic thrust enduarnece test			Physical	MA	Physical	-do-	-	-do-	-do-	-do-	✓	P	V	-				
2.0	FINISHED BATTERY			Routine Test	CR	Electrical & Measurement	100%	100%	IS:1652 & IS:8320	IS:1652 & IS:8320	Inspection Report	✓	P	V	V				
	Note: Before Start of Inspection, Manufacturer Internal Inspection Record(QC) of the offered Batteries to be Verified																		
3.0	FINAL INSPECTION																		
3.1	Type Test ##																		
a)	Verification Constructional requirement			Visual	MA	Visual	Sample as per IS: 8320/IS:1652	Sample as per IS: 8320/IS:1652	IS:1652	IS:1652	Inspection Report	✓	P	W	W				
b)	Verification of Markings			Visual	MA	Visual	-do-	-do-	-do-	-do-	-do-	✓	P	W	W				
c)	Verification of Dimensions			Dimension	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	W	W				
d)	Test for Capacity & Voltage during discharge			Test	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	Type Test report	✓	P	W	W	# # Conduction of Type Tests from S.No. (d) to (j) shall be as per Annexure-A enclosed.			
e)	AH & WH efficiency Test			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	W	W				
f)	Test for loss of capacity on storage			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	V				
g)	Endurance Test			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	W	W				
h)	Loss of water test			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	V				
i)	Test for suitability for Floating Battery Operation			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	V				
j)	Internal Resistance and Short Circuit Test			-do-	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	V				

Conduction of Type Tests from S.No. (d) to (j) shall be as per Annexure-A enclosed.

BHEL						BIDDER/SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No.			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared By		Kanhaiya Kumar	Prepared By		Kunal Gandhi			Reviewed By			
Checked By		Manish Shukla	Checked By		Ritesh K Jaiswal			Checked By			

बीएसई एल BHEL		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		QUALITY PLAN				SPEC NO.: -PE-TS-415-508-E001			DATE:- 08/07/2020			
				CUSTOMER	MAHARASHTRA STATE POWER GENERATION CO. LTD.				QP NO.: -PE-QP-999-508-E002, REV.01			DATE:- 30/06/2020		
				PROJECT	1x660 MW BHUSAWAL				P.O NO.:-			DATE:-		
				ITEM:- LEAD ACID BATTERY			SYSTEM:- DC SYSTEM			SECTION:-			SHEET 3 OF 3	
SL. NO.	COMPONENT & OPERATIONS		CHARACTERISTIC CHECK	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY		REMARKS
1	2		3	4	5	6		7	8	9	D *	10		11
						M	C/N					**		
												M	C	N
3.2	Acceptance Test													
a)	Verification of Markings		Visual	MA	Visual	Sample Plan as per IS: 8320	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	√	P	W	W
b)	Verification of Dimensions		Dimension	MA	Measurement	-do-	-do-	-do-	-do-	-do-	√	P	W	W
c)	Test for Capacity		Capacity	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	√	P	W	W
d)	Test for Voltage during discharge		Voltage during discharge	CR	Electrical & Measurement	-do-	-do-	-do-	-do-	-do-	√	P	W	W
4.0	Battery Racks		Visual & Dimension	MA	Visual & Dimension	1 Sample	1 Sample	Approved drg/ doc	Approved drg/ doc	-do-	√	P	W	V
5.0	Accessories		Visual & Dimension	MA	Visual & Dimension	100%	100%	Approved drg/ doc	Approved drg/ doc	-do-	√	P	W	-
6.0	Cable Lugs and Terminal Plate		Visual	MA	Visual	100%	100%	Approved drg/ doc	Approved drg/ doc	-do-	√	P	W	-
7.0	Packing		Verification of Packing Methods, Finish & Completeness	MA	Visual	100%	100%	Approved drg/ doc/ As Per Manufacturer Std./ Approved Packing drg/ doc	Approved drg/ doc/ As Per Manufacturer Std./ Approved Packing drg/ doc	-do-	√	P	W	-

NOTES:-

- Wherever IS standard is mentioned, equivalent IEC/International standard is also acceptable as per applicability of test. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.
- BHEL Reserves the right for conducting repeat test, if required.
- Photographs of complete Battery Package items after packaging to be sent to BHEL-Purchase Group for review before issuing MDCC.
- In case, any changes in QAP commented by customer at contract stage shall be carried out by bidder without any implication to BHEL/Customer.
- Packing shall be suitable for storage at site in tropical climate conditions.

LEGEND :-

- * RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
- ** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N:** CUSTOMER
- P:** PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE
- MA:** MAJOR, **MI:** MINOR, **CR:** CRITICAL, **D:** DOCUMENTATION

BHEL						BIDDER/SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No.			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared By		Kanhaiya Kumar	Prepared By		Kunal Gandhi			Reviewed By			
Checked By		Manish Shukla	Checked By		Ritesh K Jaiswal			Checked By			

ANNEXURE-A

QUALITY PLAN

QP NO. : PE-QP-999-508-E002, REV. 01

LIST OF TYPE TEST FOR LEAD ACID BATTERY

S No	Test	Type test description	Referred standard	Type Test to be specifically conducted (Yes/No)	BHEL/Customer's approval/Review Req. on test certificate (Yes/No)
1	Type Test	• Test for Capacity & Voltage during discharge	IS:1652	Yes	Yes
		• AH & WH efficiency Test	IS:1652	Yes	Yes
		• Test for loss of capacity on storage (Retension of Charge)	IS:1652	--	Yes
		• Endurance Test	IS:1652	Yes	Yes
		• Loss of water test	IS:1652	--	Yes
		• Test for suitability for floating batteryoperation	IS:1652	--	Yes
		• Internal resistance and short circuit test	IS:1652	--	Yes