

1 X 660 MW PANKI THERMAL POWER EXTENSION PROJECT

VOLUME – II

**TECHNICAL SPECIFICATION FOR
*220V DC Lead Acid / Ni-Cd BATTERY***

SPECIFICATION NO: *PE-TS-426-508-E001*



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



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

SPECIFICATION NO. PE-TS-426-508-E001

VOLUME II

REVISION 0 DATE :05.11.19

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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, & supervision of E&C 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
	Section-II part-I (Ni CD Battery)	
1	Clause no 5.2: CONTAINER :Containers shall be made of transparent glass/hard rubber, robust, heat resistant, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc.	Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistance, leak proof, non absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc.
2	Clause no 5.5 : CONNECTIONS :Inter-cell, inter-tier, inter-rack connectors, terminals, bolts and nuts shall be lead - coated copper connector/Rubber Moulded Copper connector. The cross section of the connectors shall be designed to withstand the one minute discharge rating and also short circuit rating of the battery.	Nickel coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively Nickel coated to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. 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 AL conductors and XLPE insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the contractor. 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. Contractor shall furnish necessary sizing calculations to prove compliance to the same. Suitable number of Inter-rack connectors shall be supplied by the contractor to suit the battery room layout during detailed engineering.



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3	Clause no 5.6 Vent plugs :	Add: Vent plugs shall be provided in each cells. 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.
4	Clause no 5.9 : Electrolyte	Add: The electrolyte shall be prepared from battery grade potassium hydroxide conforming to BS:1069. The cells can be shipped either in charged condition or in dry condition
5	Clause no 5.11 : Battery racks : Wooden/FRP/Steel battery racks to be supplied as specified in datasheet-A. Wooden rack shall be made of best quality seasoned teak wood b. Two (2) coats of wood primer shall be applied on wadded battery racks prior to application of two (2) coats of anti-acid paint. c. The battery racks shall be free standing type mounted on porcelain/hard rubber insulators. 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.	Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic 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-alkali paint of approved shade. Name plates, resistant to alkali, 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 conditions, match markings shall be provided to facilitate easy assembly.
6	Clause no 5.8 :	The information indicated in clause no 5.8 shall be indelibly marked on outside of each cell. Add following point also in marking a) Manufacturer type designation.
7		THE FOLLOWING INFORMATION SHALL BE GIVEN ON THE INSTRUCTION CARDS SUPPLIED WITH THE BATTERY: (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 IS:10918. (d.) Storing conditions of electrolyte.
8		The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.
9		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. (a.) Physical Examination. (b.) Dimensions, Mass & layout. (c.) MARKING. (d.) Polarity and absence of short circuit. (e) Air pressure test. (f.) Ampere -



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		hour capacity. (g.) Retention of charge. (h.) Insulation resistance. The Contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.
	Section-II part-II (Lead acid battery)	
1	Clause no 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.	Containers shall be made of transparent glass, hard rubber, 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
2	Clause no 5.2 : Container	Add: The material of level indicator shall be acid proof and oxidation proof. All type tests shall be carried out for sealing compound as per IS:3116. 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.
3	Clause no 5.7 :	The information indicated in clause no 5.7 shall be indelibly marked on outside of each cell. Add following point also in marking Manufacturer type designation.
4	Clause no 5.4 : Connections	Add: 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).
5	Clause no 5.4: Connections: 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.	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. Contractor shall furnish necessary sizing calculations to prove compliance to the same.
6	Clause no 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	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 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 rack and wooden support for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade.



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	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.	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.
7		Cell insulator : Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on the racks with adequate clearance between adjacent cells. Minimum distance between adjacent cells shall be more than the bulge allowed for two cells in accordance with IS:1146.
8		The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/IS 1652 (for lead-acid plate batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.
9		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. 1) Verification of markings. 2) Verification of dimensions. 3) Test for capacities for 10 hrs discharge rate alongwith the test for voltage during discharge. The Contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments. BHEL shall provide battery charger and discharge resistor at site.
GENERAL		
1		DC health monitoring system shall be provided as per details given below: DC Health Monitoring System: DC Health Monitoring System shall include microprocessor based hardware and software to monitor the condition of each battery cell of 220V DC systems battery banks on-line on 24x7 basis. With DC 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. A typical Architecture is shown in Drg. No. 0000-000-POE- A-002. Each Battery set shall have its own independent DC Health Monitoring System. DC Health Monitoring System shall measure and store the following parameters at pre- determined time interval as



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		decided by the owner during detail engineering: a) Each Cell Voltage. b) Battery DC Current. c) Ambient and Cell temperature. Further, DC 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). DC Health Monitoring System shall also be able to store these inputs status for future reference.
2		Communication: DC Health Monitoring System shall communicate with the DDCMIS System and provide alarms for abnormal condition of Cell/Battery as finalized by owner during detailed engineering. DC Health Monitoring System modules shall have one port suitable for connecting laptop locally and 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).
3		Software: Necessary software for communication between DC Health Monitoring System and DDCMIS System as well as for analysis of stored data shall be provided by the contractor. The software for analysis shall be capable of showing graphical representation of various stored parameters and shall give some corrective suggestion based on the abnormal parameters. The software shall calculate and show battery Ah during charge/discharge cycles. Logging of cell/battery parameters (voltage, current and temperature) and 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.
4	Part-I Clause 8.3: Type, Routine and Acceptance Tests Part-II Clause 9.2 : Type, Routine and Acceptance Tests	All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in Annexure-B & C and carried out within last five years from the date of bid opening (02.11.15) . These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. 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 (02.11.15) , 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



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additional cost to BHEL either at third party lab or in presence of client/owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of UPRVUNL, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design change". Minor changes if any shall be highlighted on the endorsement sheet.

3.2 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 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.

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 DOCUMENTS REQUIRED ALONG WITH TECHNICAL OFFER (Refer Annexure-III enclosed with Section-I)

7.0 DOCUMENTS REQUIRED AFTER AWARD OF LOI (Refer Annexure-IV enclosed with Section-I)

8.0 The Quality Plan no. PE-QP-999-508-E002 for Lead Acid Battery and Ni-Cd Battery should be read in conjunction with Annexure-A and Annexure-B.

9.0 **PROVENNESS CRITERIA** (Project specific prequalification criteria):

The Bidder / Sub 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 (in case bidder offers Lead Acid Plante type battery) or High Discharge type Nickel Cadmium battery (in case bidder offers Nickel Cadmium battery), at least one (1) each at two (2) different industrial installations, which should have been in successful operation for at least two (2) years prior to the date of Techno-Commercial bid opening (02.11.15).

NOTE: Two different installations mean two different project sites or two different contracts

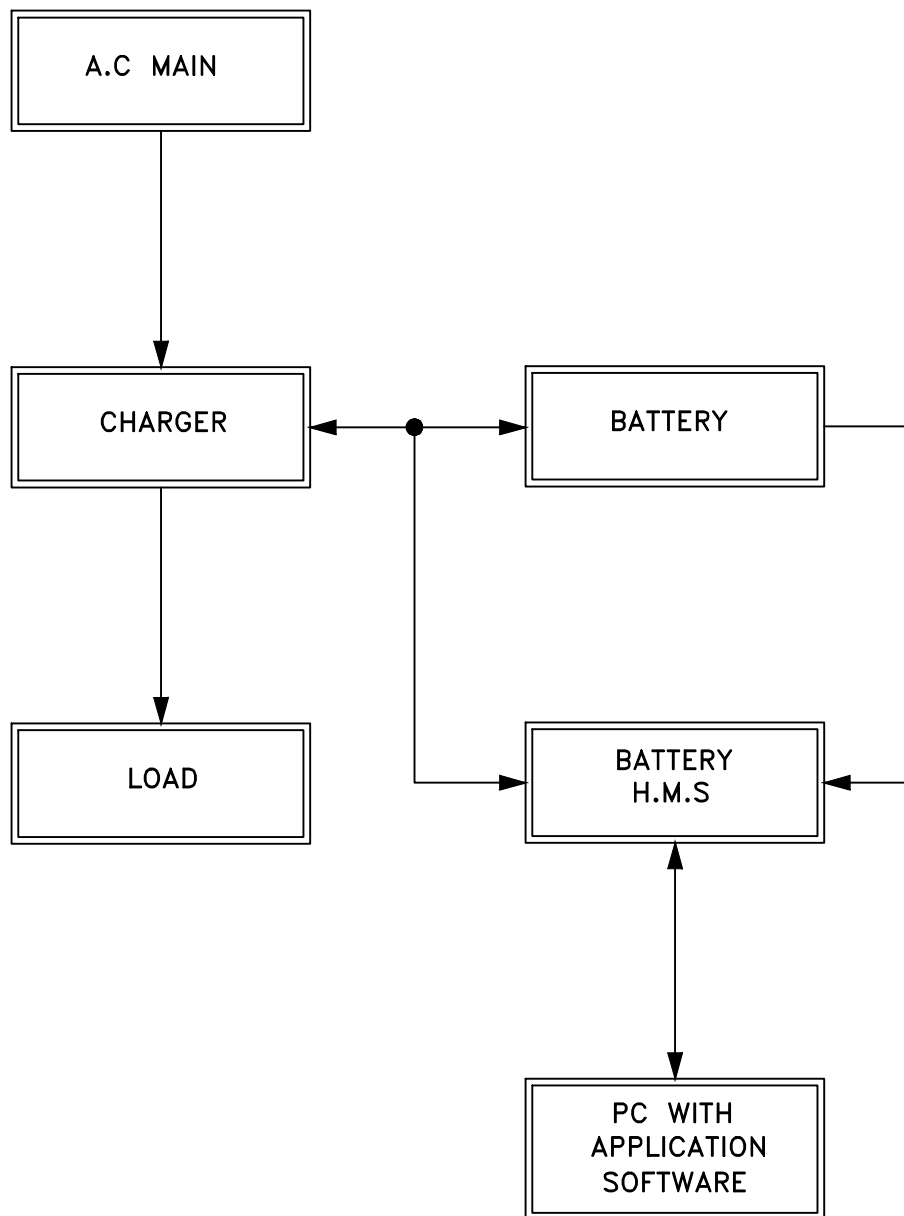


FIG : SYSTEM ARCHITECTURE OF BATTERY HEALTH MONITORING SYSTEM

NOTES :

1. THIS DRAWING SHOWS TYPICAL SYSTEM ARCHITECTURE FOR BATTERY HEALTH MONITORING SYSTEM ONLY. ACTUAL MAY VARY AS PER OEM STANDARD PRACTICE.
2. APPLICATION SOFTWARE SHALL BE BASED ON LATEST OPERATING SYSTEM OF WINDOWS.

FOR TENDER PURPOSE ONLY

					TYPICAL ARCHITECTURE FOR DC HEALTH MONITORING SYSTEM		 DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS			
					UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM LIMITED					
DS	RD	AK	NIL	20.11.19	1X660MW PANKI THERMAL POWER PROJECT		JOB NO. 14A14		SCALE : NTS	
APPVD.	REVWD.	CHKD.	REV.	DATE			DWG. NO. 14A14-DWG-POE-A-002 SHT. 01		REV. NIL	



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DATA SHEET-A

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1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead-Acid Plante OR Ni-Cd high discharge Pocket Plate type
3.	Conforming to	:	IEEE/ IEC/ IS standards
4.	DC system Fault level & duration	:	25KA for 1 Sec
5.	Material of Battery Rack	:	Seasoned Teak Wooden for Lead Acid Battery/ Mild Steel Racks for Ni-CD battery
6.	Design Ambient Temperature	:	50 Deg. C
7.	Minimum Electrolyte Temperature to be considered for Battery Sizing	:	5 Deg. C
8.	No. of cells	:	107 for Lead Acid Battery/ 169 for Ni-Cd Battery
9.	End cell voltage	:	1.85V/cell (Lead Acid) / 1.14V/ cell (Ni- Cd)
10.	Nominal Float voltage (V)	:	2.25 V/cell (Lead-Acid)/1.42V/cell (Ni-Cd)
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.	Minimum AH rating of Battery	:	Refer attached Annexure-II for battery sizing.
14.	Arrangement of batteries on racks	:	Single tier for batteries having cell weight 50kg or more.
15.	Cable size to be terminated at Battery end	:	2 Run-1Cx630 sq.mm
16.	Tapping to be provided in battery	:	Yes
17.	Tapping to be provided at which cell (if Tapping is applicable)	:	Bidder to furnish the detail along with offer
18.	Recommended boost charging rate	:	Bidder to furnish the detail along with offer
19.	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. 15.
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 or equivalent IEC		
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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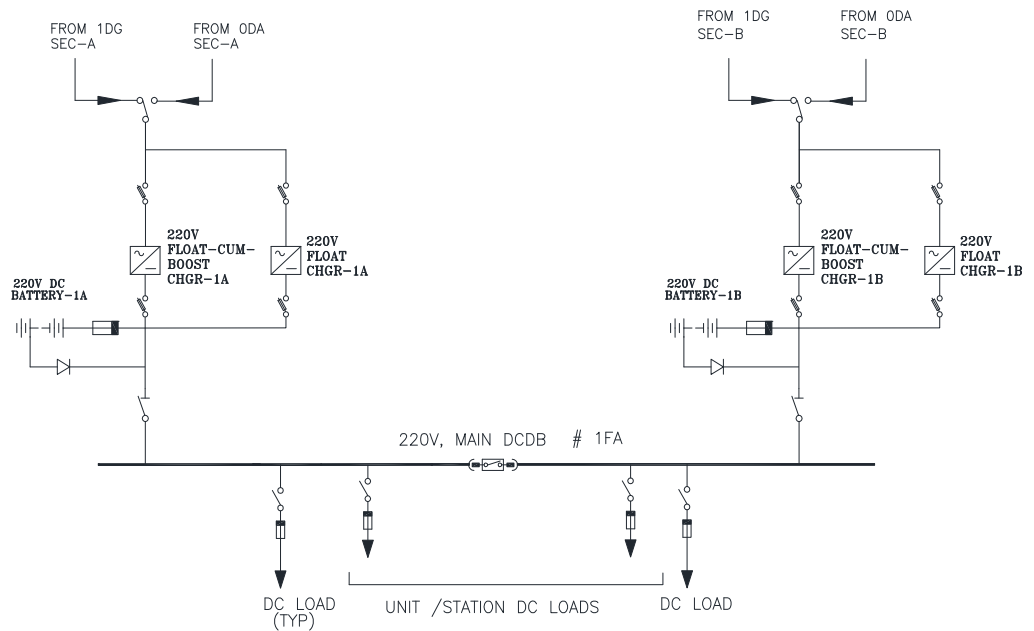
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ANNEXURE-I

SINGE LINE DIAGRAM FOR MAIN PLANT 220V DC SYSTEM





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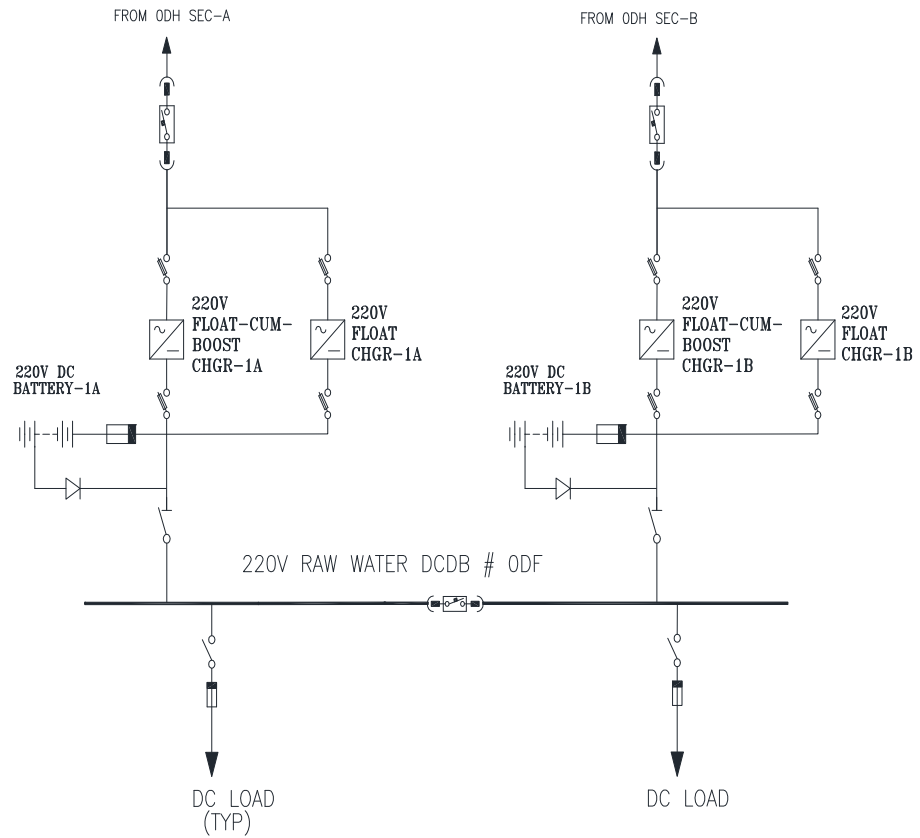
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SINGE LINE DIAGRAM FOR RWPH 220V DC SYSTEM





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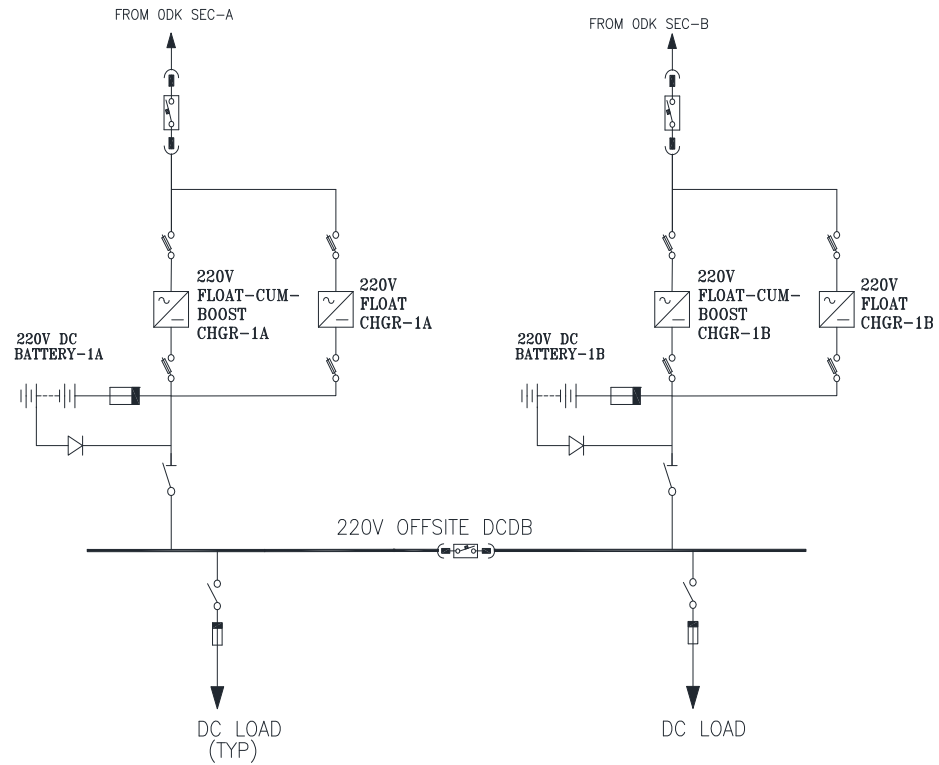
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SINGE LINE DIAGRAM FOR RW INTAKE PH & FOPH 220V DC SYSTEM





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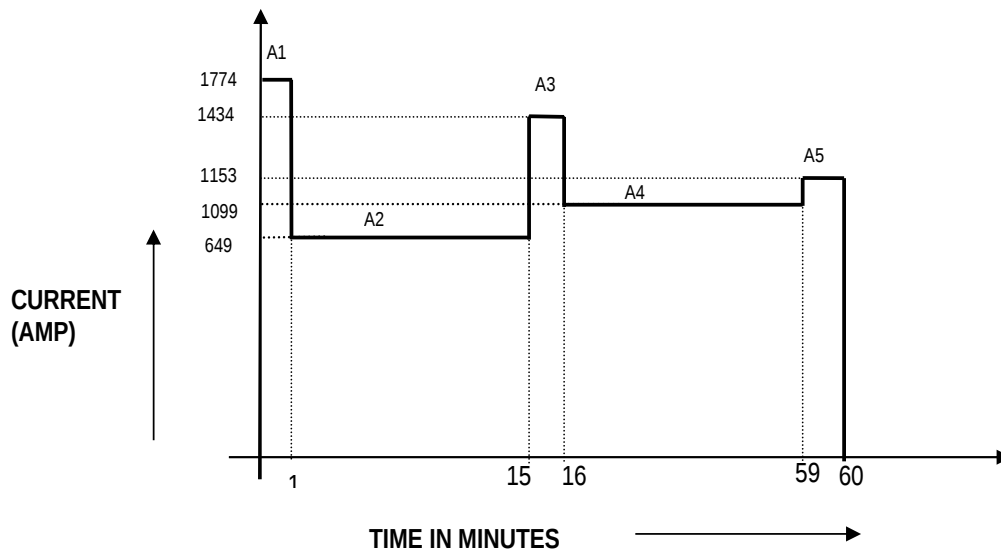
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ANNEXURE-II

LOAD DUTY CYCLE LOAD DUTY CYCLE OF MAIN PLANT



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|---|
| 1. AGEING FACTOR | : 1.25 (Not applicable for lead acid battery). |
| 2. MIN.ELECTROLYTIC TEMP. | : 5 °C |
| 3. END CELL VOLTAGE | : 1.85V (for Lead-Acid Plante) & 1.14V (for Ni-Cd) PER CELL |
| 4. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485 (Refer note-2) |
| 5. CONTINGENCY MARGIN | : 10%. |
| 6. DESIGN MARGIN | : 20%. |

Note :

- Bidder has to take ageing factor (margin) in their battery sizing calculation for Ni-CD battery. No deviation is acceptable on ageing factor.
- Supporting calculation for temp correction factor as per IEEE 485 shall be furnished for batteries which are not designed at 25° C.



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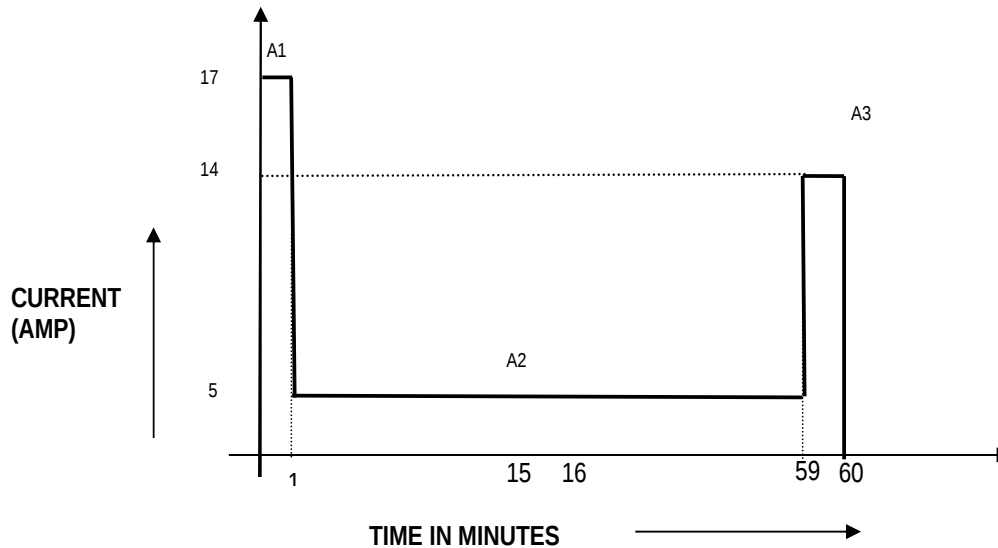
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LOAD DUTY CYCLE LOAD DUTY CYCLE OF RWPH



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|---|
| 1. AGEING FACTOR | : 1.25 (Not applicable for lead acid battery). |
| 2. MIN.ELECTROLYTIC TEMP. | : 5 °C |
| 3. END CELL VOLTAGE | : 1.85V (for Lead-Acid Plante) & 1.14V (for Ni-Cd) PER CELL |
| 4. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485 (Refer note-2) |
| 5. CONTINGENCY MARGIN | : 10%. |
| 6. DESIGN MARGIN | : 20%. |

Note :

- Bidder has to take ageing factor (margin) in their battery sizing calculation for Ni-CD battery. No deviation is acceptable on ageing factor.
- Supporting calculation for temp correction factor as per IEEE 485 shall be furnished for batteries which are not designed at 25° C.



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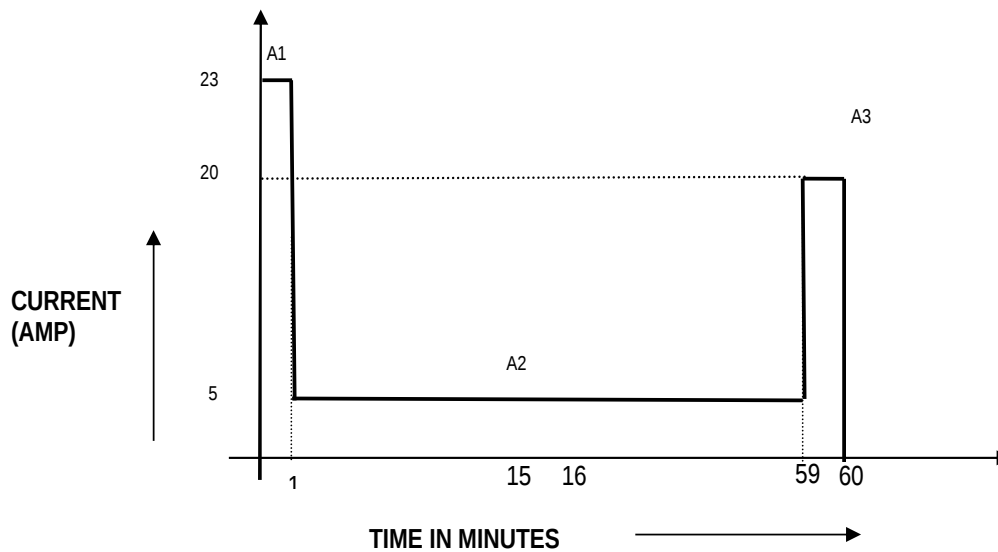
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LOAD DUTY CYCLE LOAD DUTY CYCLE OF RW INTAKE PH & FOPH



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|---|
| 1. AGEING FACTOR | : 1.25 (Not applicable for lead acid battery). |
| 2. MIN.ELECTROLYTIC TEMP. | : 5 °C |
| 3. END CELL VOLTAGE | : 1.85V (for Lead-Acid Plante) & 1.14V (for Ni-Cd) PER CELL |
| 4. TEMPERATURE CORRECTION FACTOR | : As per IEEE 485 (Refer note-2) |
| 5. CONTINGENCY MARGIN | : 10%. |
| 6. DESIGN MARGIN | : 20%. |

Note :

- Bidder has to take ageing factor (margin) in their battery sizing calculation for Ni-CD battery. No deviation is acceptable on ageing factor.
- Supporting calculation for temp correction factor as per IEEE 485 shall be furnished for batteries which are not designed at 25° C.

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ANNEXURE-III

DOCUMENTS REQUIRED ALONG WITH THE TECHNICAL OFFER

- i. 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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ANNEXURE-IV

DOCUMENTS REQUIRED AFTER AWARD OF LOI

S.NO	DOCUMENT TITLE	DWG. / DOCUMENT No.
1.	220V Battery Datasheets	PE-V0-426-508-101
2.	Battery- GA drawing and Bill of material	PE-V0-426-508-102
3.	Battery sizing calculation for 220V DC battery bank (including battery catalogue & curves)	PE-V0-426-508-103
4.	220V Battery Type test reports	PE-V0-426-508-105
5.	220V battery O & M manual	PE-V0-426-508-106
6.	220V battery bank FQP	PE-V0-426-508-901
7.	220V Battery bank MQP	PE-V0-426-508-902
8.	List of mandatory spares for battery	PE-V0-426-508-903
9.	Fault calculation & Connector sizing calculation	PE-V0-426-508-E104
10.	Cable Termination arrangement for battery terminal	PE-V0-426-508-E904
11.	Battery room layout	PE-V0-426-508-E905
12.	List of E&C spares for battery	PE-V0-426-508-E906
13	GA schematic, circuit diagram and BOM for BHMS	PE-V0-426-508-113
14	Quality plan for BHMS	PE-V0-426-508-114

NOTE:

Drawing/Documents indicated above shall be submitted through document management system (DMS).



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SECTION –II
STANDARD TECHNICAL REQUIREMENTS



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DC NI-CD BATTERY

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1.0 SCOPE OF ENQUIRY

- 1.1 This specification covers the design, materials, constructional features, manufacture assembly, testing, packing and dispatch of 220V DC Ni-CD 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.*

2.0 CODES AND STANDARDS

- 2.1 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 Unpriced Price Schedule enclosed as Annexure-A.

4.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

- Civil works like foundation and cable cellar, flooring of the battery room etc.*
- Ventilation of battery and charger room.*
- 220V DCDB*
- Power and control cables*
- Erection of the equipment*
- Battery charger, battery fuse box and discharge resistor*

5.0 DESCRIPTION OF EQUIPMENT

5.1 BATTERY

Batteries shall be stationary storage Nickel-Cadmium *high discharge* type suitable for float charged operation conforming to IS-10918/IEC60623. The batteries shall meet the duty cycle requirements under all site and operating conditions as specified in data sheet 'A'. *IEEE 1115 shall be the principle for sizing the battery.*

5.2 CONTAINER

Containers shall be made of transparent glass/hard rubber, robust, heat resistant, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc. Electrolyte level lines shall be marked on containers in case of translucent containers. The marking for the electrolyte level shall be for upper & lower limits on the translucent container. Container shall be closed/sealed lid type. Open type cells are not acceptable. Lid and sealing compound shall be non-cracking type. sealing arrangement shall be such that no alkali particle gets entrapped due to alkali

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

5.3 PLATES

The plates shall have Pocketed Plates designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load. Separator between plates shall permit free flow of electrolyte. Springs to keep end plates in position shall be provided.

5.4 TERMINAL POST

Positive and negative terminal posts provided of cells shall be clearly and unmistakably identifiable. The positive terminal shall be marked with red colour in addition to '+' marking.

5.5 CONNECTIONS

Inter-cell, inter-tier, inter-rack connectors, terminals, bolts and nuts shall be lead - coated copper connector/*Rubber Moulded Copper connector*. The cross section of the connectors shall be designed to withstand the one minute discharge rating and also short circuit rating of the battery.

5.6 VENT PLUG

Vent plug and filler cap 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.
Provision shall be made for drawing electrolyte samples checking and topping up of the electrolyte. The design shall be such that the water loss due to evaporation is kept to minimum.

5.7 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.

5.8 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 5 hr discharge rate.
- Upper and lower electrolyte level in case of transparent containers.
- **Serial No. of each Cell as per Layout**

5.9 ELECTROLYTE



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The electrolyte used shall be a solution of potassium hydroxide in distilled water made up to the specific gravity at 27 Deg. C. The cells shall be shipped dry, uncharged with electrolyte supplied in non-returnable good quality polyethylene or other suitable containers *which do not get punctured/damaged during transportation/handling at site.* Ten percent extra electrolyte shall be supplied to account for any spillage during transit.

5.10 SEPARATORS

Separator between plates shall permit free flow of electrolyte. Separator between plates of the cells shall be porous alkali resistant and have insulating capacity to avoid shorting or leakage of current between the plates of opposite polarity. The separator shall also be dimensionally stable without deformation or determination at the temperatures of use.

5.11 BATTERY RACKS

- a. *Wooden/FRP/Steel battery racks to be supplied as specified in datasheet-A. Wooden rack shall be made of best quality seasoned teak wood*
- b. *Two (2) coats of wood primer shall be applied on wodded battery racks prior to application of two (2) coats of anti-acid paint.*
- c. *The battery racks shall be free standing type mounted on **porcelain/hard rubber insulators.***
- 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.*

6.0 LIFE

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

7.0 ACCESSORIES

Battery accessories shall be provided as specified in BOQ-Cum-Price Schedule.

8.0 INSPECTION AND TESTING

- 8.1 *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-E003).*

8.2 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-E003 enclosed with this specification and which shall be complied with.

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All acceptance and routine tests as per IS-10918 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.

8.3 Type, Routine and Acceptance Tests

Type, Routine and Acceptance tests to be performed as per Quality Plan(QP no. PE-QP-999-508-E003) enclosed with this specification.

9.0 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.

10.0 By all Bidders as technical offer:

- i. Battery sizing calculation with respect to load duty cycle enclosed with Section-C 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 the specification) with "Quoted word against items with bidder's signature and company stamp.
- iii. A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
- iv. A copy of sheet "List Of Contents" with bidder's signature and company stamp.
- v. A copy of sheet "Deviation schedule" with NO DEVIATION and bidder's signature and company stamp.
- vi. A copy of sheet "Data Sheet-A" with required information and bidder's signature and company stamp.

11.0 Final documents to be submitted after award of contract shall be as given in Annexure- C enclosed with section-C.

12.0 No. of prints to be submitted by vendor after award of contract shall be as specified under Annexure-B enclosed with section-C.

13.0 INSTRUCTION MANUALS

- 13.1 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.



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- 13.2 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.
 - (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.
- 13.3 *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.*

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TABLE-1

LIST OF CODES AND STANDARDS FOR NI-CD BATTERY

1.	VENTED TYPE NI-CD BATTERY	IS 10918
2.	RECOMMENDED PRACTICE FOR SIZING OF NI-CD BATTERIES	IEEE 1115
3.	SPECIFICATION FOR WATER FOR STORAGE BATTERIES	IS 1069
4.	SPECIFICATION FOR POTASSIUM HYDROXIDE FOR NI-CD BATTERIES	IS 6831
5.	RUBBER & PLASTIC CONTAINERS FOR NI-CD BATTERIES	IS 1146
6.	SYNTHETIC SEPARATORS FOR NI-CD BATTERIES	IS 6071
7.	SEALING COMPOUND FOR NI-CD BATTERIES	IS 3116
8.	METHODS OF TESTS FOR NI-CD BATTERIES	IS 8320
9.	ELECTRICAL VOCABULARY, PRIMARY CELLS AND BATTERIES.	IS: 1885
10.	VENTED NICKEL-CADMIUM PRISMATIC RECHARGEABLE SINGLE CELLS	IEC60623
11.	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.



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DC LEAD ACID BATTERY

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1. 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. 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 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 SERVICES AND EQUIPMENT TO BE EXCLUDED

- b. Civil works like foundation and cable cellar, flooring of the battery room etc.
- c. Ventilation of battery and charger room.
- d. 220V DCDB
- e. Power and control cables
- f. Erection of the equipment
- g. Battery charger, battery fuse box and discharge resistor

5 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.

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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 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

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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 outside 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

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 Following minimum information shall be given on the instruction cards:

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

7 LIFE

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

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8 ACCESSORIES

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

9 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).

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. 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.

- General description giving type and rating of various batteries.
- Technical data

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- 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.

11. 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.

12. 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.

		QUALITY PLAN		CUSTOMER : NTPC		PROJECT: 1 X 660 MW PANKI TPEP TITLE		SPECIFICATION NO. PE-TS-426-508-E001					
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0		SPECIFICATION : TITLE 220 V DC Battery					
		SHEET 1 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	
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 : NTPC			PROJECT: 1 X 660 MW PANKI TPEP		SPECIFICATION NO. PE-TS-426-508-E001			
				BIDDER/ : VENDOR			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0		SPECIFICATION : TITLE 220 V DC Battery			
		SHEET 2 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
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	<i># 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.</i>
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 enduarmce 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	-	<i># Conduction of Type Tests from S.No. (d) to (g) shall be as per Annexure-B enclosed.</i>
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 : NTPC		PROJECT: 1 X 660 MW PANKI TPEP		SPECIFICATION NO. PE-TS-426-508-E001					
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0		SPECIFICATION : TITLE : 220 V 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	
1	2	3	4	5	6	7	8	9	10	P	W	V	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

ANNEXURE-B

QUALITY PLAN

STANDARD QP NO. : PE-QP-999-508-E002, REV. 0

LIST 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	IS:1652	NO	* YES
		• AH & WH efficiency Test	IS:1652	NO	* YES
		• Retention of Charge	IS:1652	NO	* YES
		• Endurance Test	IS:1652	NO	* YES

		STANDARD QUALITY PLAN		CUSTOMER : NTPC			PROJECT: 1 X 660 MW PANKI TPEP		SPECIFICATION NO. PE-TS-426-508-E001			
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01		SPECIFICATION TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY			
		SHEET 1 OF 4		SYSTEM			ITEM : NI CD BATTERY		SECTION		VOLUME III	
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	CELL CONTAINER											
a)	Dimensional & constructional conformance	Visual	MA	IS:10918	Random Sample	IS:10918	IS:10918	Test Cert.	3/2	-	1	
b)	Ball drop test	Mechanical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Hydraulic thrust endurance test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Resistance to alkali	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
e)	HV test	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
f)	Shade difference, straightness of side walls, free from burrs, flash lines etc.	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
1.2	TERMINAL POST											
a)	Dimensional Conformance	Visual	MA	IS:10918	Random Sample	IS:10918	IS:10918	Test Cert.	3/2	-	1	
b)	Material Conformance	Chemical	CR	As per IS-2062	-do-	As per IS-2062	As per IS-2062	-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%	MFR's Std.	MFR's Std.	Test Cert.	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			

		STANDARD QUALITY PLAN		CUSTOMER : NTPC			PROJECT: 1 X 660 MW PANKI TPEP			SPECIFICATION NO. PE-TS-426-508-E001			
				BIDDER/ :			QUALITY PLAN			SPECIFICATION TECHNICAL SPECIFICATION			
				VENDOR			NUMBER: PE-QP-999-508-E002 REV.01			TITLE FOR 220V DC BATTERY			
SHEET 2 OF 4		SYSTEM			ITEM : NI CD BATTERY			SECTION			VOLUME III		
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	
1.3	CONNECTOR												
a)	Material Conformance	Chemical	CR	As per IS-1897	Random Sample	As per IS-1897	As per IS-1897	-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.	
b)	Dimensional Conformance	Visual	MA	Measurement	-do-	Approved drg/ doc & MFR's Std.	Approved drg/ doc & MFR's Std.	-do-	3/2	-	1		
c)	Visual defects	Visual	MA	-do-	100%	-do-	-do-	-do-	3/2	-	1		
d)	Plating Quality (Duplex)	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2	-	1		
1.4	SEPARATOR												
a)	Dimensional Conformance	Visual	MA	Measurement	-do-	As per BHEL Spec. / IS:10918	As per BHEL Spec. / IS:10918	-do-	3/2	-	1		
b)	Colour shade difference, burrs, flash at the edge	Visual	MA	-do-	-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		
BHEL			PARTICULARS			BIDDER/ VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/ VENDORS COMPANY SEAL				

		STANDARD QUALITY PLAN		CUSTOMER : NTPC			PROJECT: 1 X 660 MW PANKI TPEP			SPECIFICATION NO. PE-TS-426-508-E001		
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01			SPECIFICATION TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY		
		SHEET 3 OF 4		SYSTEM			ITEM : NI CD BATTERY			SECTION VOLUME III		
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	10	11	12	13
1.6	Rubber Components (Gaskets & Sealing ring etc)											
a)	Material quality	Shore hardness	CR	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
b)	Resistance to alkali & oil	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Dimensional Conformance	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Flash or burrs	Visual	MA	Visual	-do-	-do-	-do-	-do-	3/2	-	1	
1.7	Strip											
a)	Plating Quality including thickness	Dimension	CR	Measurement	1 sample/ coil	MFR's Std.	MFR's Std.	Test Cert.	3/2	-	1	Nickel plating thickness of steel strip shall be minimum 3 microns.
2.0	FINISHED BATTERY	Routine Test	CR	Elec. & Meas.	100%	IS:10918 & IS:8320	IS:10918 & IS:8320	Test Cert.	3/2	-	1	
3.0	FINAL INSPECTION											
3.1	Type Test #											
a)	Physical Examination	Visual	MA	Visual	Random Sample	Approved drg/ doc & IS:10918	Approved drg/ doc & IS:10918	Test Cert.	3/2	1	-	
b)	Dimensions, Mass & Layout	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Cell marking	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Polarity & absence of short circuit	Electrical	MA	-do-	Sample Plan as per IS: 8320	-do-	-do-	-do-	3/2	1	-	By voltage measuremnet according to polarity
BHEL			PARTICULARS			BIDDER/ VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/ VENDORS COMPANY SEAL			

		STANDARD QUALITY PLAN		CUSTOMER : NTPC			PROJECT: 1 X 660 MW PANKI TPEP		SPECIFICATION NO. PE-TS-426-508-E001				
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01		SPECIFICATION TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY				
		SHEET 4 OF 4		SYSTEM			ITEM : NI CD BATTERY		SECTION		VOLUME III		
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	10	11	12	13	
e)	Air pressure test	Visual	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	# Conduction of Type Tests from S.No. (g) to (j) shall be as per Annexure-C enclosed.	
f)	Insulation Resistance	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
g)	Ampere-hour capacity	Test	CR	As per IS: 10918	Sample Plan as per IS: 8320	-do-	-do-	Inspection Report	3/2	1	-		
h)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
i)	Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
j)	Test for discharge performance at low temp.	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
3.2 Acceptance Test													
a)	Physical Examination	Visual	MA	Visual	Random Sample	Approved drg/ doc & IS:10918	Approved drg/ doc & IS:10918	Test Cert.	3/2	1	-		
b)	Dimensions, Mass & Layout	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-		
c)	Cell marking	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
d)	Polarity and absence of short circuit	Electrical	MA	-do-	Sample Plan as per IS: 8320	-do-	-do-	Inspection Report	3/2	1	-		
e)	Air pressure test	Visual	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-		
f)	Insulation Resistance	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
g)	Ampere-hour capacity	Test	CR	As per IS: 10918	Sample Plan as per IS: 8320	-do-	-do-	-do-	3/2	1	-		
4.0	ACCESSORIES	Visual & Dimension	MA	-	100%	Approved drg/ doc	Approved drg/ doc	-do-	2	1	-		
5.0	CABLE LUGS	Visual	MA	-	100%	Approved drg/ doc	Approved drg/ doc	-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.													
LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER CHP: CUSTOMER HOLD POINT SHALL BE DECIDED AT CONTRACT STAGE													
1. End Customer/ End Customer's Consulatnt & BHEL 2. Vendor 3. Sub-Vendor of Vendor													
BHEL			PARTICULARS			BIDDER/ VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/ VENDORS COMPANY SEAL				

ANNEXURE-C

QUALITY PLAN

STANDARD QP NO. : PE-QP-999-508-E002, REV. 0

LIST OF TYPE TEST FOR Ni-Cd 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	• Ampere-hour capacity	IS:10918	NO	* YES
		• Test for discharge performance at low temp.	IS:10918	NO	* YES
		• Retention of Charge	IS:10918	NO	* YES
		• Endurance Test	IS:10918	NO	* YES