

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED

2x660MW (UNIT #1 &2)
MAITREE SUPER-CRITICAL TPP
(AT RAMPAL, DISTRICT-BAGERHAT, BANGLADESH)

VOLUME – II

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

BHEL DOCUMENT NO. : PE-TS-421-508-E001
REV-0



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



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

SPECIFICATION NO. PE-TS-421-508-E001

VOLUME II

REVISION 0 DATE : 30.11.17

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COMPLIANCE CERTIFICATE

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

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

BIDDER'S STAMP & SIGNATURE



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**SECTION –I
SPECIFIC TECHNICAL REQUIREMENTS**



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1.0 SCOPE OF ENQUIRY

- 1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/ sub vendor's works, packing, despatch to site and supervision of E&C of 220V DC batteries as described in the various sections of this specification. The batteries shall generally conform to IEC/ IEEE. Erection and commissioning is not included in vendor's scope. However Vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.
- 1.2 Standard technical requirements of the **220V DC BATTERY** are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I & Data Sheet-A.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A, followed by Section-II shall prevail in case of any conflict between the stipulations of Section-I, Section-II & Datasheet-A.

2.0 BILL OF QUANTITIES:

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

3.0 SPECIFIC TECHNICAL REQUIREMENTS:

- 3.1 Technical /Quality/ Inspection:

S. No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	-NIL-	All documents, including the installation and operation and maintenance manuals as well as the related software shall be in fluent, legible English. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format.
2	-NIL-	Bidder should have manufactured and supplied at least ten (10) nos. 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 min. two (2) different industrial installations, which should have been in successful operation for at least two (2) years prior to 22.09.15. Note: Highest offered rating means AH rating of a battery cell.

- 3.2 Packing of the battery shall be sea-worthy. For sea-worthy packing of equipment/ items, specification of sea-worthy packing of export jobs enclosed (Doc. No. PE-TS-888-100-A001) is to be followed.



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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/ Fibre type
3.	Conforming to	:	IEEE/ IEC standards
4.	DC system Fault level & duration	:	25KA for 1 Sec
5.	Material of Battery Rack	:	Wooden/ Metal rack treated with three coats of anti-acid paints for acid resistance (for Lead-Acid Plante Type) or treated with alkali resistance powder (for Ni-Cd Pocket/ Fibre Type)
6.	Design Ambient Temperature	:	45 Deg. C
7.	Minimum Electrolyte Temperature to be considered for Battery Sizing	:	0 Deg. C
8.	No. of cells	:	108 for Lead Acid Battery/ 170 for Ni-Cd Pocket/ Fibre Type Battery
9.	End cell voltage	:	1.85V/cell (Lead Acid) / 1.14V/cell (Ni- Cd Pocket/ Fibre Type)
10.	Nominal Float voltage (V)	:	2.25 V/cell (Lead-Acid)/1.42V/cell (Ni-Cd Pocket/ Fibre Type)
11.	Boost voltage (Maximum) (V)	:	Bidder to furnish the detail along with offer
12.	AH Capacity of Battery	:	Bidder to furnish quoted AH capacity and battery sizing as per LOAD DUTY CYCLE (Annexure-II)
13.	Arrangement of batteries on racks	:	Single tier for batteries having cell weight 50kg or more
14.	Cable size to be terminated at Battery end	:	1C x 300 sq.mm (Cu)/ pole or 1C x 500 sq.mm (Cu)/ pole – to be decided during detailed engineering
15.	Tapping to be provided in battery	:	No
16.	Tapping to be provided at which cell (if Tapping is applicable)	:	NA
17.	Recommended boost charging rate	:	Bidder to furnish the detail along with offer
18.	Recommended trickle charging rate	:	Bidder to furnish the detail along with offer

Notes:

1. Suitable number of copper lugs for cable termination at battery terminals shall be provided by bidder as per cable size 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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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 relevant standard		
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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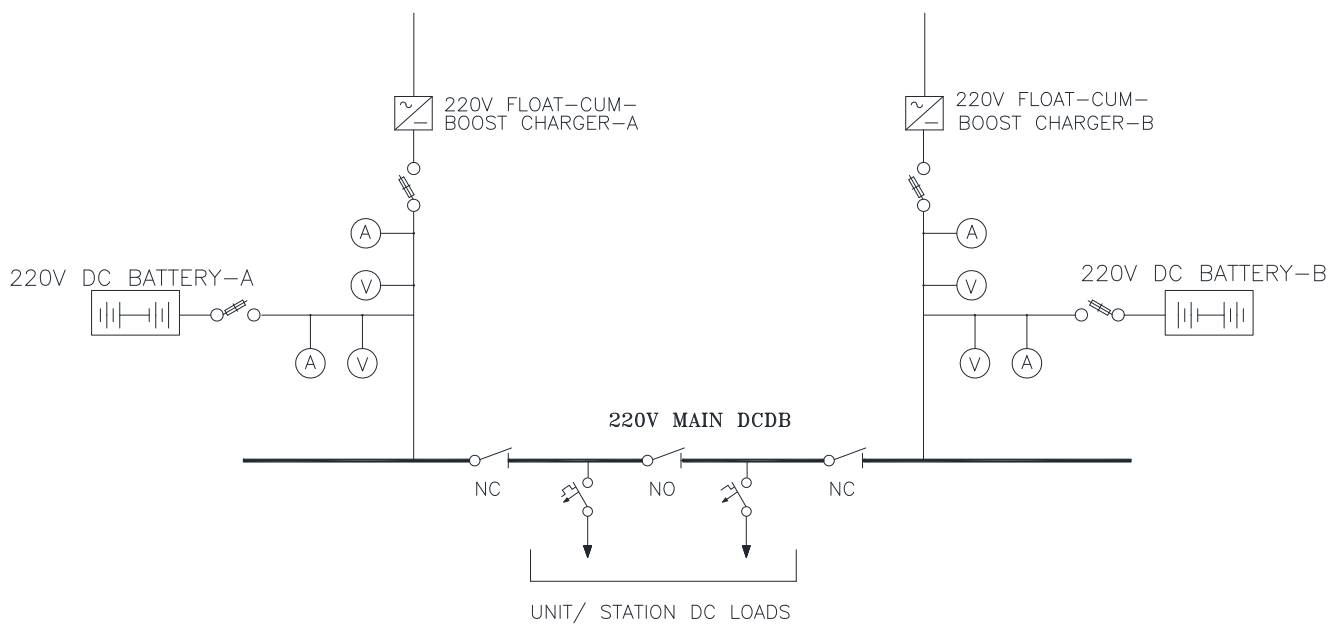
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ANNEXURE-I

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





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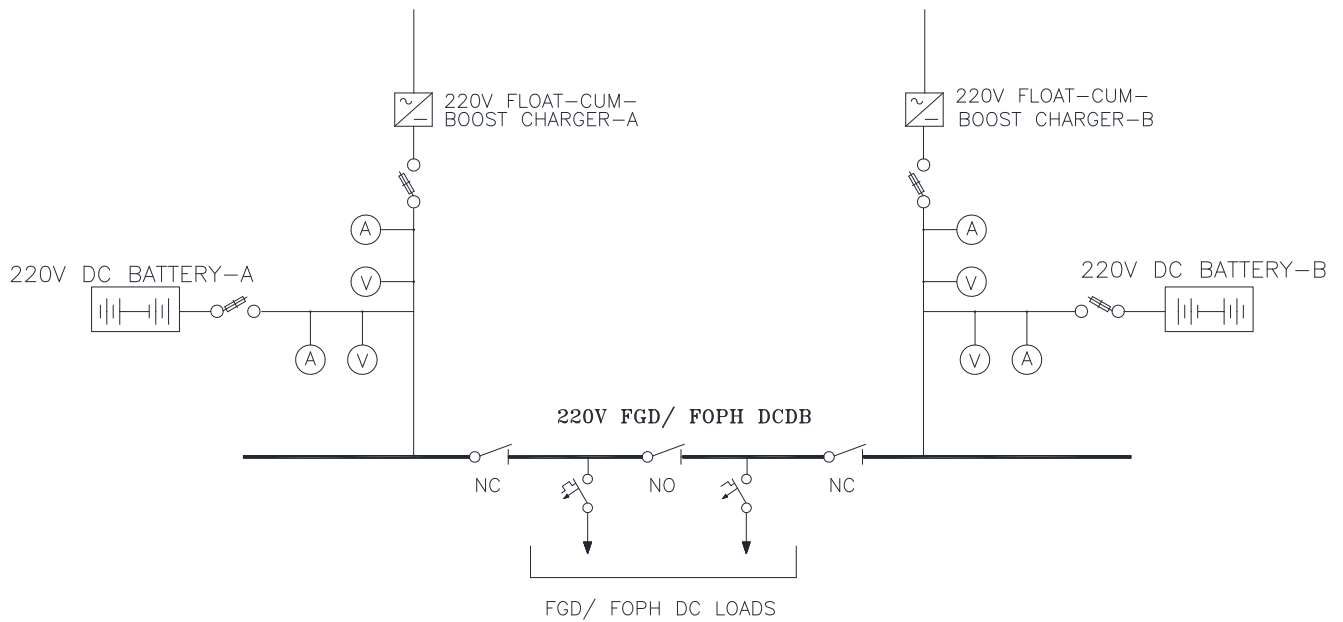
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SINGE LINE DIAGRAM FOR 220 V DC SYSTEM OF FGD/ FOPH





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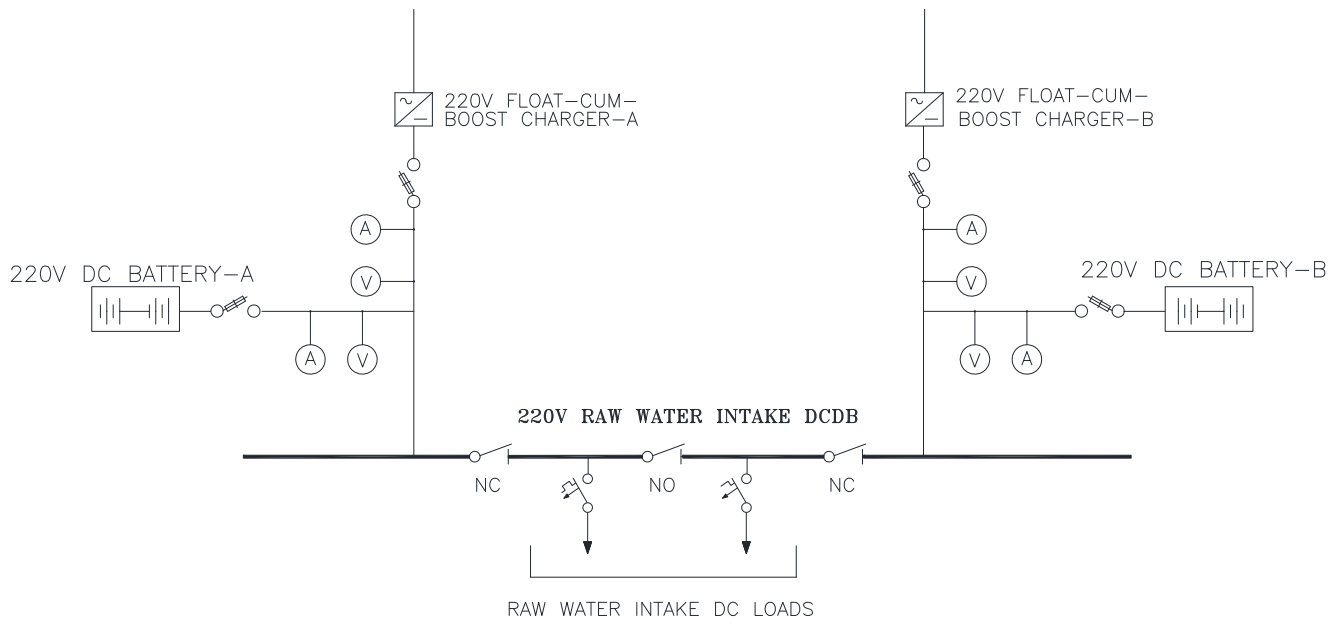
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SINGE LINE DIAGRAM FOR 220 V DC SYSTEM OF RAW WATER INTAKE





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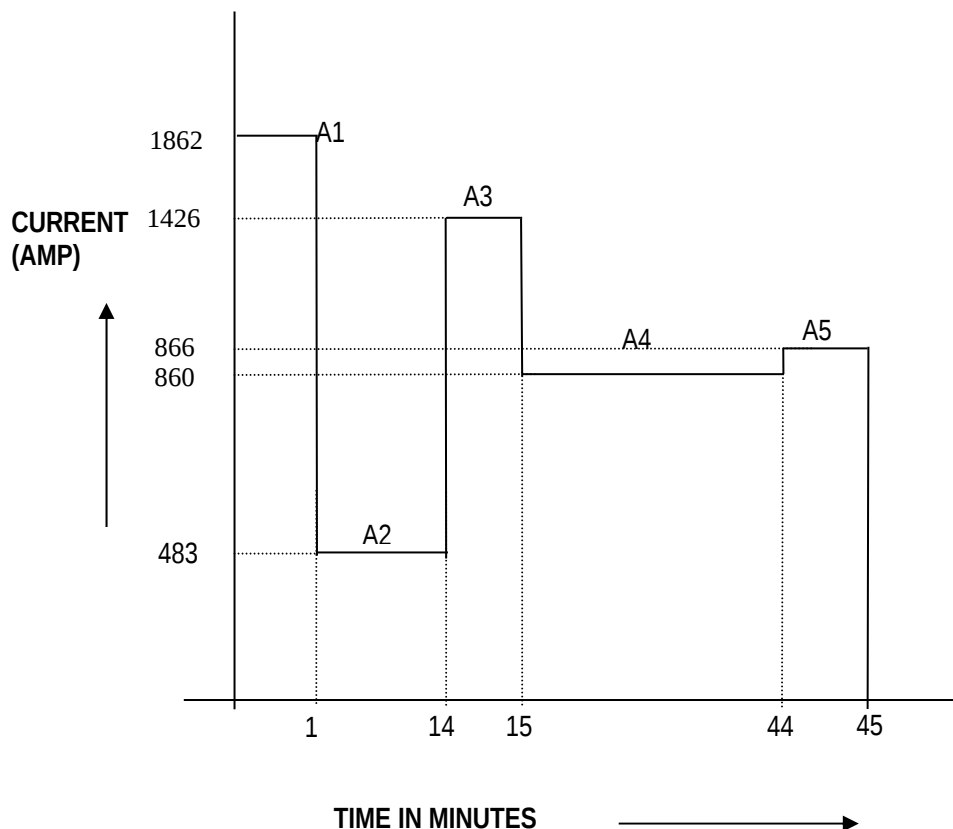
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ANNEXURE-II

**LOAD DUTY CYCLE
LOAD DUTY CYCLE OF MAIN PLANT & ASSOCIATED STATION**



Duration	0-1 min	1-14 min	14-15 min	15-44 min	44-45 min
Current	1862	483	1426	860	866

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|--|
| 1. AGEING FACTOR | : 1.0 for Lead-Acid/ 1.25 for Ni-Cd |
| 2. MIN.ELECTROLYTIC TEMP. | : 0 °C |
| 3. END CELL VOLTAGE | : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd |
| 4. DESIGN MARGIN | : 1.1 |
| 5. TEMPERATURE CORRECTION FACTOR | : IEEE 485 for Lead Acid and IEEE 1115 for Ni-Cd |
- shall be the principle for sizing the battery including temperature correction factor.

Note:

- Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 25 °C.
- Due to maximum AH capacity limitation, bidder can offer battery with parallel banks. However, because of layout constraint, bidder can offer maximum of 2 banks in parallel.



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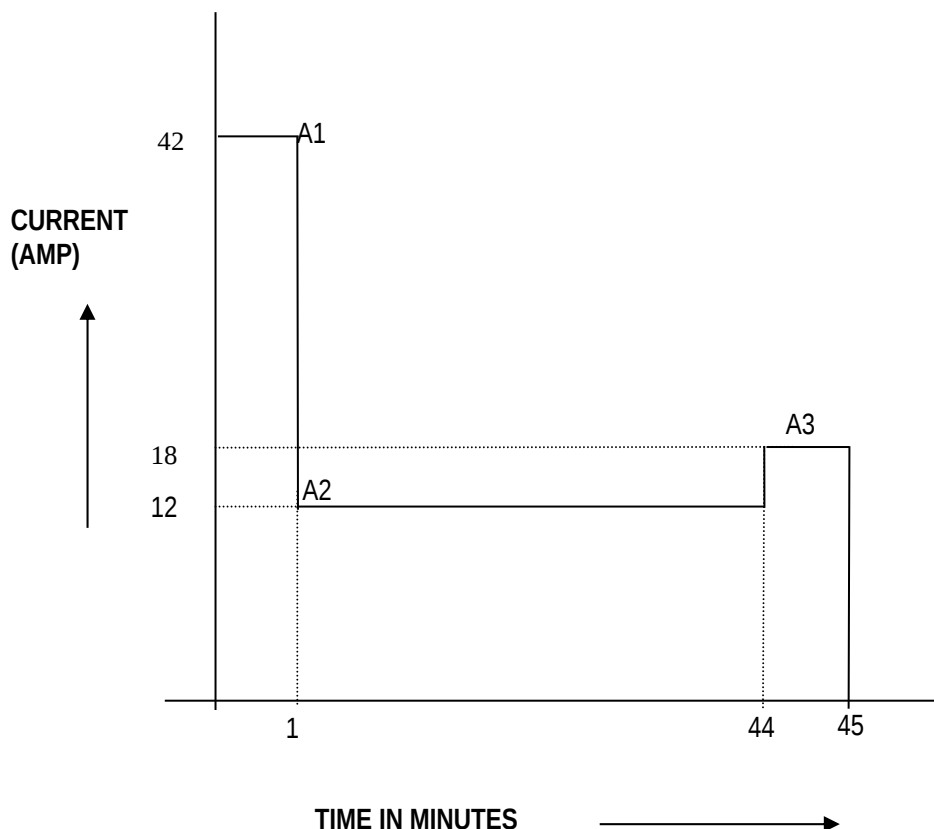
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LOAD DUTY CYCLE OF FGD/ FOPH



Duration	0-1 min	1-44 min	44-45 min
Current	42	12	18

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|---|
| 1. AGEING FACTOR | : 1.0 for Lead-Acid/ 1.25 for Ni-Cd |
| 2. MIN.ELECTROLYTIC TEMP. | : 0 °C |
| 3. END CELL VOLTAGE | : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd |
| 4. DESIGN MARGIN | : 1.1 |
| 5. TEMPERATURE CORRECTION FACTOR | : IEEE 485 for Lead Acid and IEEE 1115 for Ni-Cd shall be the principle for sizing the battery including temperature correction factor. |

Note:

Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 25 °C



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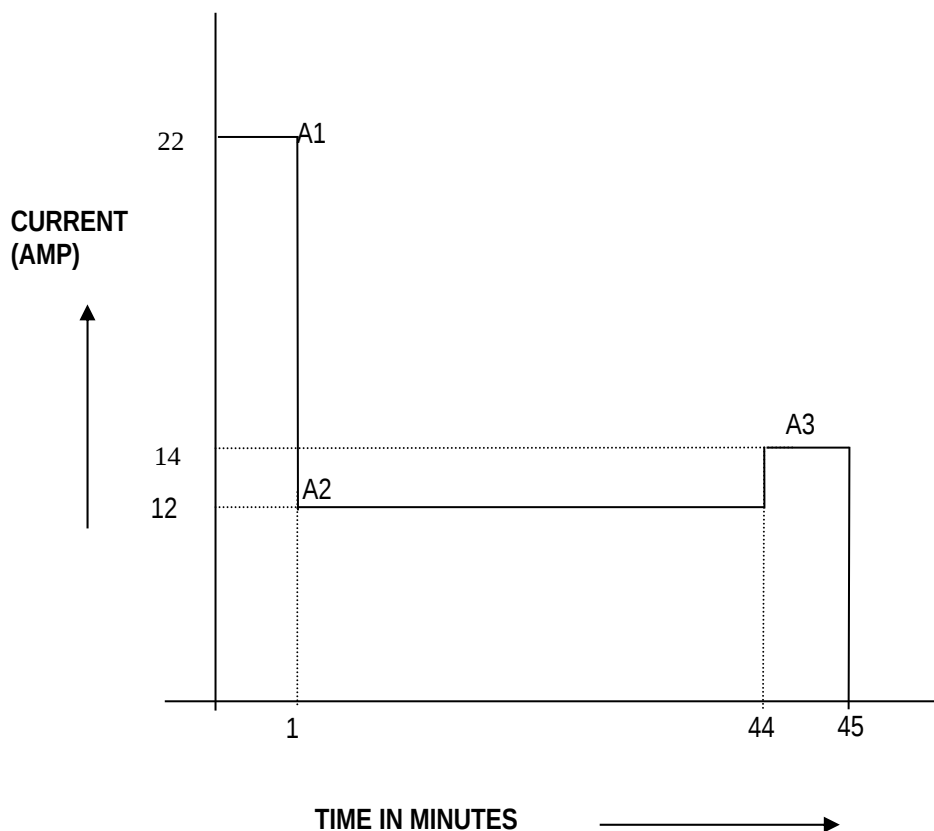
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LOAD DUTY CYCLE OF RAW WATER INTAKE



Duration	0-1 min	1-44 min	44-45 min
Current	22	12	14

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|--|
| 1. AGEING FACTOR | : 1.0 for Lead-Acid/ 1.25 for Ni-Cd |
| 2. MIN.ELECTROLYTIC TEMP. | : 0 °C |
| 3. END CELL VOLTAGE | : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd |
| 4. DESIGN MARGIN | : 1.1 |
| 5. TEMPERATURE CORRECTION FACTOR | : IEEE 485 for Lead Acid and IEEE 1115 for Ni-Cd |
- shall be the principle for sizing the battery including temperature correction factor.

Note:

Supporting Calculation for temp correction factor as per IEEE shall be furnished for batteries which are not designed at 25 °C

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ANNEXURE-III

DOCUMENTS REQUIRED ALONG WITH THE TECHNICAL OFFER

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

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ANNEXURE-IV

DOCUMENTS REQUIRED AFTER AWARD OF LOI

S. NO	DOCUMENT TITLE	DWG. / DOCUMENT No.
1	Data Sheet for battery	PE-V0-427-508-E201
2	General Arrangement Drawing for battery	PE-V0-427-508-E202
3	Battery sizing calculation (Including battery catalogues, curves etc.)	PE-V0-427-508-E203
4	Bill of Material for battery	PE-V0-427-508-E204
5	Field Quality Plan for battery	PE-V0-427-508-E205
6	List of E&C Spares for battery	PE-V0-427-508-E206
7	List of O&M Spares for battery	PE-V0-427-508-E207
8	List of Mandatory Spares for battery	PE-V0-427-508-E208
9	Quality Plan for battery	PE-V0-427-508-E903
10	O&M Manual for battery	PE-V0-427-508-E209
11	Fault calculation & Connector sizing calculation	PE-V0-427-508-E210
12	Type test reports for the battery	PE-V0-427-508-E211
13	Cable Termination arrangement for battery terminal	PE-V0-427-508-E212
14	Loose items to be shipped with battery	PE-V0-427-508-E213
15	Battery room layout	PE-V0-427-508-E214

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ANNEXURE-V

ACCESSORIES

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

1.1 Each battery is furnished with following items (FOR LEAD ACID BATTERY):

S. NO	DOCUMENT TITLE
1	Electrolyte (sulphuric acid for first filling plus 10% extra)
2	Wooden/ Metal racks properly treated with 3 coats of anti-acid paints
3	Stand insulators plus 5% extra
4	Cell interconnectors (Inter cell, Inter row & Inter bank connectors) with 5% extra and end take-off with one no. extra
5	Lead coated connection hardware plus 5% extra
6	Cell numbering tags with fixing arrangement (1 Set)
7	Cable clamps with hardware

1.2 Additionally, following set of accessories shall be provided with each battery bank separately (FOR LEAD ACID BATTERY):

S. NO	DOCUMENT TITLE	UOM	QUANTITY
1	Hydrometer (in step of 0.005)	Nos.	1
2	Set of hydrometer syringes (suitable for the vent holes in different cells)	Nos.	1
3	Specific gravity correction chart	Nos.	1
4	Thermometer for measuring electrolyte temperature	Nos.	1
5	Wall mounting type holder for hydrometer and thermometer	Nos.	1
6	Digital Cell testing voltmeter (3-0-3V)	Nos.	1
7	Rubber apron	Nos.	1
8	Pair of rubber hand gloves	Nos.	1
9	Set of spanners	Nos.	1
10	Cell lifting straps	Set	1
11	'No smoking' notice	Nos.	2
12	Goggles (industrial)	Nos.	1
13	Instruction card	Nos.	4
14	Pocket Thermometer (digital Type)	Nos.	1



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1.3 Each battery is furnished with following items (FOR NI-CD BATTERY):

S. NO	DOCUMENT TITLE
1	Electrolyte (sulphuric acid for first filling plus 10% extra)
2	MS racks properly treated with alkali resistance powder
3	Stand insulators plus 5% extra
4	Cell interconnectors (Inter cell, Inter row & Inter bank connectors) with 5% extra and end take-off with one no. extra
5	Nickel coated connection hardware plus 5% extra
6	Cell numbering tags with fixing arrangement (1 Set)
7	Cable clamps with hardware

1.4 Additionally, following set of accessories shall be provided with each battery bank separately (FOR NI-CD BATTERY):

S. NO	DOCUMENT TITLE	UOM	QUANTITY
1	Mercury in chemical glass Thermometer (0 - 100 Deg. C)	Nos.	1
2	Wall mounting type holder for thermometer	Nos.	1
3	Digital Cell testing voltmeter (3-0-3V)	Nos.	1
4	Rubber apron	Nos.	1
5	Pair of rubber hand gloves	Nos.	1
6	Set of spanners	Nos.	1
7	Cell lifting straps	Set	1
8	'No smoking' notice	Nos.	2
9	Goggles (industrial)	Nos.	1
10	Instruction card	Set	4
11	Rubber Syphon	Nos.	1



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SECTION-II

STANDARD TECHNICAL REQUIREMENTS



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SECTION-II

STANDARD TECHNICAL REQUIREMENTS



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1.0 INTENT OF SPECIFICATION

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

2.0 CODES & STANDARDS

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

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

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

4.0 SYSTEM CONCEPT

- 4.01 220V DC system shall be an ungrounded system comprising of two sets of batteries (2X100%) with 1x100% float cum-boost charger for each set of battery and one sectionalised 1X100% DCDB. The 220V DC system is designed to cater the control, protection, interlocking, emergency DC lighting & emergency DC drives, as applicable for (i) Main Plant, associated station area; (ii) FGD/ FOPH area; & (iii) Raw Water Intake area (excluding switchyard, CHP, AHP & Jetty areas. The typical single line diagram and load duty cycle for 220V battery and charger connections is enclosed as Annexure-I & Annexure-II respectively.



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- 4.02 The battery shall be designed to restrict maximum fault level on DCDB limited to 25kA.
- 4.03 In case of failure of AC, battery will meet the DC load requirement. After restoration of power, the float/float cum boost charger will continue to supply the loads as well as trickle charge the battery.
- 4.04 The 220V batteries shall be sized considering emergency load cycle requirement of 45 minutes and various factors as per Annexure-II.
- 4.05 The voltage at load terminal will not exceed the limits of +10% and -15% of nominal system voltage for 220V DC system.
- 4.06 Batteries shall be connected to DC distribution board through single cores copper cables. Battery terminals shall be made suitable for cable size to be informed during contract stage. Long barrel heavy duty copper lugs for cable termination at battery terminals shall be in the scope of bidder. Size of the cable shall be informed during detailed engineering.
- 4.07 The equipment will be located indoor but in a hot, humid and tropical atmosphere.
- 4.08 Necessary accessories required for maintenance and testing of batteries shall be supplied with each battery bank as per enclosed Annexure-V.

5.0 OTHER TECHNICAL REQUIREMENTS

5.1 Lead-Acid Batteries

- a) Batteries shall be stationery storage Lead Acid Plante high discharge type conforming to IEC 60896-11/ IEEE 485-1995. The batteries shall meet the 'Load Duty Cycle' requirements under all site-operating conditions as specified.
- b) Each set of battery shall consist of number of cells assembled together on mounting racks.
- c) The battery shall be flooded cell with Plante Lead acid. In the event of failure of any cell, there shall be no interruption in power supply to load.
- d) Containers:
Container shall be made of clear view SAN type, suitable robust, heat resistance, leak proof, non-absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container. The marking for the electrolyte level should be for the upper and lower limits. Container shall be closed / sealed lid type. The pole sealing arrangement should be such that no acid particle gets entrapped due to acid creep as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.



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e) Vent Plugs:

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

f) Plates:

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IEC 60896 as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked. The positive plates shall be supported from the ledges of the SAN container. They should not be supported at the bottom of container. Sufficient space shall be allowed to allow the creepage of the plates.

g) Sediment Space:

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

h) Electrolyte:

The electrolyte shall be prepared from battery grade Sulphuric Acid conforming to BS 3031 and distilled water conforming to BS 4974. The cells shall be shipped in dry uncharged condition and electrolyte shall be supplied separately in non-returnable containers. 10% extra electrolyte shall be furnished as extra fitting to cover spillage in transit or during erection.

i) Connectors and Fasteners:

Lead coated copper connectors shall be used for connecting up adjacent cells, rows and banks. The cell terminal post shall be provided with connector bolts, nuts, clamps, connectors and washers made of copper/ brass effectively coated with lead to prevent corrosion.

The thickness of lead coating shall be measured as per appendix-F of IS-6848/ equivalent IEC. All the terminals and inter-cell connectors shall be fully insulated or have insulated shrouds. End take of connections from positive and negative poles of batteries shall be done through single core copper cable having stranded copper conductor and XLPE insulation (Exact cable size to be informed during contract stage). The bidder shall supply lead coated bent copper plate, tubular copper lugs, clamps, bolts, nuts, washers, etc. for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering. Calculation for sizing of connectors and fasteners shall be furnished during detail engineering.

All connectors and lugs shall be capable of continuously carrying the 2 hour discharge current of respective batteries and through fault short circuit current,



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which the battery can produce and withstand for the period of one second. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage.

j) Battery Racks:

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

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

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

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

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

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

5.2 Ni-Cd Batteries

- a) DC batteries shall be Stationary, high discharge vented type Nickel-Cadmium batteries with pocket plates (KPH) conforming to IEC 60623/ IEEE 1115. The batteries shall be high discharge performance type. For the purpose of design an ambient temperature of 45 degree centigrade and relative humidity of 85% shall be considered. The plates will be designed for the maximum durability under all service conditions including high rate of discharge and rapid fluctuation of loads. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell. Batteries should



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be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

b) Containers:

Containers shall be made of polypropylene plastic material. Containers shall be 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.

c) Vent Plugs:

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

d) Plates:

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load. The construction of plate shall conform to latest revision of IEC 60623. The separators shall maintain the electrical insulation between the plates and shall permit free flow of electrolyte. Separators shall be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked.

e) Sediment Space:

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

f) Electrolyte:

The electrolyte shall be prepared from battery grade Potassium Hydroxide conforming to relevant BS 4974. Depending upon installation schedule, whether batteries to be dispatched charged or uncharged shall be decided by purchaser and informed to supplier during detailed engineering. Necessary electrolyte for makeup shall be supplied separately. However, there shall not be any commercial implication on account of this. In case batteries are shipped un-charged, the electrolyte shall be supplied in non-returnable containers. 10% extra electrolyte shall be furnished as extra fitting to cover spillage in transit or during erection.

g) Connectors and Fasteners:

Nickel coated copper connector shall be used for connecting up adjacent cells and rows. Bolts, nuts, clamps and washers shall be Nickel coated with minimum thickness of 0.02 mm to prevent corrosion. 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 cable having stranded Copper conductor and XLPE insulation. The bidder shall supply necessary supports and lugs for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering. All connectors and lugs shall be capable



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of continuously carrying the 45 minutes discharge current of respective batteries and through fault short circuit current which the battery can produce a withstand for the period declared. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage. The same shall be subject to customer's approval.

h) **Battery Racks:**

The batteries shall be supported on Mild Steel racks. The racks 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 alkali resistant powder of approved shade. The nameplates, resistant to alkali, for each cell shall be attached on the necessary racks. Wherever racks are transported in dismantled conditions, matchmakings shall be provided to facilitate easy assembly.

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

- Manufacturers' name and trade marks
- Country and year of manufacture
- Manufacturer type designation
- AH capacity at 5 hour discharge rate
- Serial number

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

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

6.0 PERFORMANCE GUARANTEE

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



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7.0 INSPECTIONS & TESTING

- 7.1 Offered equipment shall be of type test design. The bidder shall confirm compliance to quality plan enclosed with the specification, which is subject to BHEL & end customer approval and the inspection shall be carried out based on this approved Quality Plan (QP No. PE-QP-999-508-E002).
- 7.2 All acceptance and routine tests as per relevant standards and as per QP (attached) shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.
- 7.3 Details of Type, routine and acceptance tests are mentioned below. **All factory tests shall be repeated at site.**

TYPE TEST OF LEAD-ACID BATTERY (AS PER IEC 60896-11)

Following type test reports (conducted within last 5 years from 22.09.15) on similar or higher rating of battery in an independent laboratory shall be submitted for customer's review:

- Capacity Test
- Test for suitability of battery floating operation
- Endurance test in charge/ discharge cycle
- Charge retention test
- Short circuit current and internal resistance determination
- AH & WH efficiency Test (as per IEC 60896-11/ IS 1652)

ROUTINE TEST OF LEAD-ACID BATTERY

Following routine tests shall be conducted for the battery:

- Visual inspection
- Insulation test
- Charge test & discharge test

All the above tests shall be repeated at site.

TYPE TEST OF NI-CD BATTERY (AS PER IEC 60623)

Following type test reports (conducted within last 5 years from 22.09.15) on similar or higher rating of battery in an independent laboratory shall be submitted for customer's review:

- Endurance test
- Charge retention test
- Capacity Test
- Electrolyte retention test
- Discharge test at low temperature

ROUTINE TEST OF NI-CD BATTERY



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Following routine tests shall be conducted for the battery:

- Visual inspection
- Insulation test
- Charge test & discharge test

All the above tests shall be repeated at site.

7.4 For all components / materials, for which type test reports have been asked as per relevant standard, such Type tests should have been conducted within last 5 years from 22.09.15 on similar or higher rating of components/ materials of battery in an independent laboratory only. In absence of such type tests reports or in case such reports are not found to be meeting the specification/ standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.

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

8.0 Instruction Manuals

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

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

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

		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT: 2 x 660MW MAITREE STPP TITLE			SPECIFICATION NO. PE-TS-421-508-E001			
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0			SPECIFICATION: TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY			
		SHEET 1 OF 3		SYSTEM: 220V DC SYSTEM			ITEM : LEAD ACID BATTERY			SECTION II		VOLUME II
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
1.0	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	IEC: 60896, BS 3031, BS 4974 & MFR's Std.	IEC: 60896, BS 3031, BS 4974 & MFR's Std.	Test Cert.	3/2	-	1	
1.2	SEPARATOR											
a)	Visual	Visual	MA	Visual	Random Sample	IEC: 60896 & MFR's Std.	IEC: 60896 & 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	IEC: 60896, IS:8320 & MFR's Std.	IEC: 60896, 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

		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT: 2 x 660MW MAITREE STPP		SPECIFICATION NO. PE-TS-421-508-E001				
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0		SPECIFICATION: TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY				
		SHEET 2 OF 3		SYSTEM: 220V DC SYSTEM		ITEM : LEAD ACID BATTERY		SECTION II		VOLUME II		
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	IEC: 60896, IS:6848 & Appd. Drg./Doc.	IEC: 60896, IS:6848 & Appd. Drg./Doc.	Test Cert.	3/2	-	1	
b)	Thickness of lead coating	Visual		Visual	-do-	-do-	-do-	-do-	3/2	-	1	
1.5	VENT CAP											
a)	Dimensional Conformance	Dimension	MA	Measurement	-do-	Refer Remarks#	Refer Remarks#	-do-	3/2	-	1	# Vent cap shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into vent to take electrolyte sample.
1.6	CONTAINER											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS:1146	IEC: 60896, IS:1146, IS:8320	IEC: 60896, 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 enduarncce test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
2.0	FINISHED BATTERY	Routine Test	CR	Elec. & Meas.	100%	IEC: 60896	IEC: 60896	Test Cert.	3/2	-	1	
3.0	FINAL INSPECTION											
3.1	Type Test #											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per ISO 2859	IEC: 60896	IEC: 60896	Inspection Report	3/2	1	-	# Conduction of Type Tests from S.No. (d) to (g) & others in Annexure-A shall be as per Annexure-A enclosed.
b)	Verification of Markings	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Verification of Dimensions	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Capacity & Voltage during discharge/ Discharge performance test at low temperature	Test	CR	As per IEC: 60896	-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

बी एच ई एल BHEL		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 2 x 660MW MAITREE STPP TITLE			SPECIFICATION NO. PE-TS-421-508-E001		
				BIDDER/ : VENDOR			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0			SPECIFICATION: TECHNICAL SPECIFICATION TITLE FOR 220V DC BATTERY		
		SHEET 3 OF 3		SYSTEM: 220V DC SYSTEM			ITEM : LEAD ACID BATTERY			SECTION II		VOLUME II
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
e)	AH & WH efficiency Test	-do-	CR	As per IEC: 60896	Sample Plan as per ISO 2859	IEC: 60896	IEC: 60896	Inspection Report	3/2	1	-	
f)	Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	-	1	-	
g)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	-	1	-	
h)	Tests on container as per Sl. No. 1.6 of the quality plan.	As per Sl. No. 1.6 of QP							3/2	1	-	Tests on container as per Sl. No. 1.6 of this document shall also be conducted during final inspcetion for customer witness. Tests shall be conducted on two(2) containers.
i)	Tests on sealing compound	All tests on Sealing compounds shall be type tested as per IS 3116.							3/2	1	-	
3.2	Acceptance Test											
a)	Verification of Markings	Visual	MA	Visual	Sample Plan as per ISO 2859	IEC: 60896	IEC: 60896	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 IEC: 60896	-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 in QP above, if equivalent IEC/ International standard is available, then bidder shall follow the same, else, Indian standard to be followed.

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

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/ Discharge performance test at low temperature	IEC: 60896	No	Yes
		• AH & WH efficiency Test	IEC: 60896/ IS: 1652	No	Yes
		• Retention of Charge	IEC: 60896	No	Yes
		• Endurance Test	IEC: 60896	No	Yes
		• Test for suitability of battery floating operation	IEC: 60896	No	Yes
		• Short circuit current and internal resistance determination	IEC: 60896	No	Yes

* Type tests should have been conducted within last 5 years from 22.09.15 on similar or higher rating of battery in an independent laboratory.

		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 2 x 660MW MAITREE STPP TITLE			SPECIFICATION NO. PE-TS-421-508-E001			
				BIDDER/ : VENDOR			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.01			SPECIFICATION : TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
		SHEET 1 OF 4		SYSTEM: 220V DC SYSTEM			ITEM : NI CD BATTERY			SECTION II		VOLUME II	
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	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	CELL CONTAINER												
a)	Dimensional & constructional conformance	Visual	MA	IEC: 60623	Random Sample	IEC: 60623	IEC: 60623	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	IEC: 60623	Random Sample	IEC: 60623	IEC: 60623	Test Cert.	3/2	-	1		
b)	Material Conformance	Chemical	CR	As per EN 10025	-do-	As per EN 10025	As per EN 10025	-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 :		PROJECT: 2 x 660MW MAITREE STPP TITLE			SPECIFICATION NO. PE-TS-421-508-E001			
				BIDDER/ : VENDOR		STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.01			SPECIFICATION : TECHNICAL SPECIFICATION FOR 220V DC BATTERY			
		SHEET 2 OF 4		SYSTEM: 220V DC SYSTEM		ITEM : NI CD BATTERY			SECTION II VOLUME II			
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											# 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.
a)	Material Conformance	Chemical	CR	As per BS EN 13599	Random Sample	As per BS EN 13599	As per BS EN 13599	-do-	3/2	-	1	
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. / IEC: 60623	As per BHEL Spec. / IEC: 60623	-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				BIDDER'S/ VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									

		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 2 x 660MW MAITREE STPP			SPECIFICATION NO. PE-TS-421-508-E001			
				BIDDER/ : VENDOR			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.01			SPECIFICATION : TITLE			TECHNICAL SPECIFICATION FOR 220V DC BATTERY
		SHEET 3 OF 4		SYSTEM: 220V DC SYSTEM			ITEM : NI CD BATTERY			SECTION II		VOLUME II	
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	
1.6	Rubber Components (Gaskets & Sealing ring etc)												
a)	Material quality	Shore hardness	CR	-do-	-do-	-do-	-do-	-do-	3/2	-	1	Nickel plating thickness of steel strip shall be minimum 3 microns. By voltage measuremnet according to polarity	
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		
2.0	FINISHED BATTERY	Routine Test	CR	Elec. & Meas.	100%	IEC: 60623 & IS:8320	IEC: 60623 & 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 & IEC: 60623	Approved drg/ doc & IEC: 60623	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 ISO 2859	-do-	-do-	-do-	3/2	1	-		
BHEL			PARTICULARS		BIDDER/ VENDOR								
			NAME										
			SIGNATURE										
			DATE										
									BIDDER'S/ VENDORS COMPANY SEAL				

		STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: 2 x 660MW MAITREE STPP			SPECIFICATION NO. PE-TS-421-508-E001			
				BIDDER/ : VENDOR			STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.01			SPECIFICATION TECHNICAL SPECIFICATION FOR 220V DC BATTERY			
		SHEET 4 OF 4		SYSTEM: 220V DC SYSTEM			ITEM : NI CD BATTERY			SECTION II VOLUME II			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
e)	Air pressure test	Visual	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	# Conduction of Type Tests from S.No. (g) to (j) & others shall be as per Annexure-A enclosed.	
f)	Insulation Resistance	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-		
g)	Ampere-hour capacity	Test	CR	As per IEC: 60623	Sample Plan as per ISO 2859	-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 & IEC: 60623	Approved drg/ doc & IEC: 60623	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 ISO 2859	-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 IEC: 60623	Sample Plan as per ISO 2859	-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 in QP above, if equivalent IEC/ International standard is available, then bidder shall follow the same, else, Indian standard to be followed.													
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-A

QUALITY PLAN
STANDARD QP NO. : PE-QP-999-508-E002, REV. 0LIST 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	IEC: 60623	No	Yes
		• Endurance Test	IEC: 60623	No	Yes
		• Retention of Charge	IEC: 60623	No	Yes
		• Test for discharge performance at low temp.	IEC: 60623	No	Yes
		• Electrolyte retention test	IEC: 60623	No	Yes

*** Type tests should have been conducted within last 5 years from 22.09.15 on similar or higher rating of battery in an independent laboratory.**