NTPC-SAIL POWER COMPANY PVT.LTD.

ROURKELA PP-III EXPANSION

VOLUME – II

TECHNICAL SPECIFICATION FOR

220V DC Lead Acid / Ni-Cd BATTERY

SPECIFICATION NO: *PE-TS-427-508-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-427-508-E001
		VOLUME II
		REVISION 0 | DATE :
		SHEET 1 OF 1

CONTENTS

TOTAL NO. OF SHEETS =42 (INCLUDING COVER/ SEPARATOR SHEETS)

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

SECTION –I

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

1.1 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of **220V DC BATTERY**.

1.2 Standard technical requirements of the **220V DC BATTERY** are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I & Data Sheet-A.

1.3 The stipulations of Section-I, followed by those of Data Sheet-A, followed by Section-II shall prevail in case of any conflict between the stipulations of Section-I, Section-II & Datasheet-A.

2.0 BILL OF QUANTITIES:

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

3.0 SPECIFIC TECHNICAL REQUIREMENTS:

3.1 Technical /Quality/ Inspection:

S. No.	*Reference clause No. of Section II (if any)*	*Specific Requirement/ Change*
1		

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.

1.	Rated voltage (V)	:	220V DC
2.	Type of Battery	:	Lead-Acid Plante /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/ 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/ 170 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.	Arrangement of batteries on racks	:	Single tier for batteries having cell weight 50kg or more.
14.	Cable size to be terminated at Battery end	:	*2 Run-1Cx630 sq.mm*
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 :

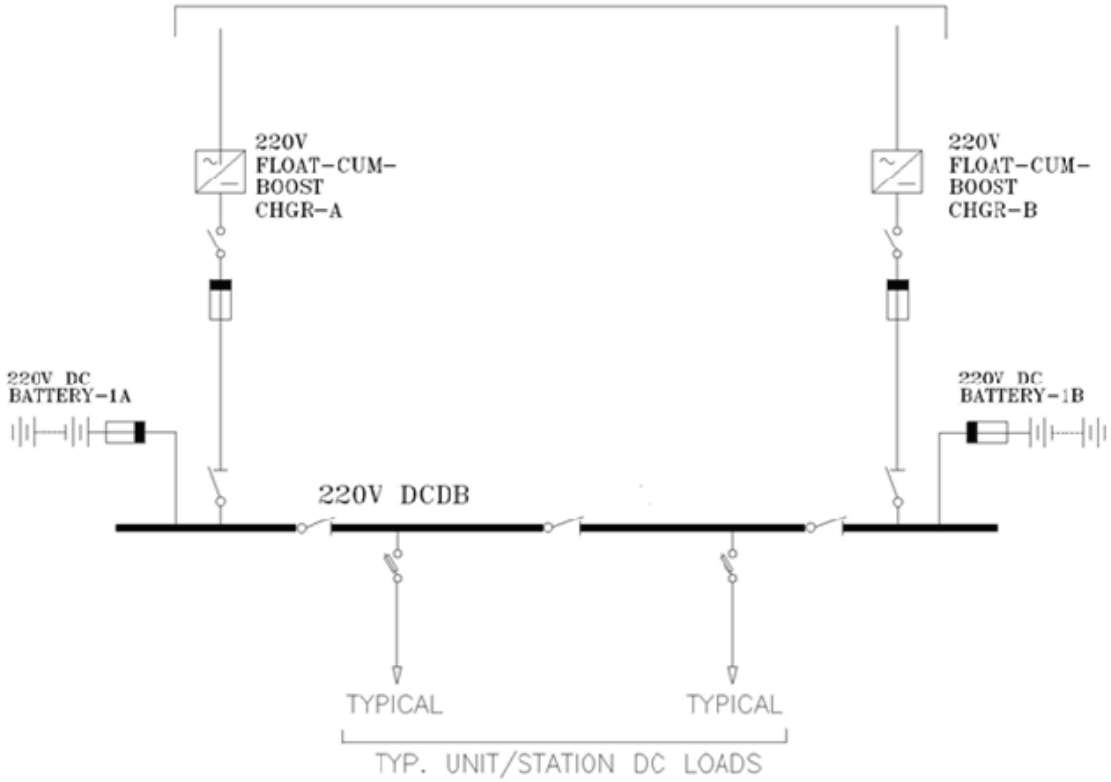
1. Suitable number of copper lugs for cable termination at battery terminals shall be provided by bidder as per cable size to be informed by BHEL during detailed engineering. Tentative size of cable is mentioned above at sl. no. 14.
2. Bidders stand guarantee that the rating offered at S. No. 12 shall 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.

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Make and Type		
2.0	AH capacity at 27º 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	

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 27º C		
23.0	Recommended specific gravity of electrolyte at 27º 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		

ANNEXURE-I

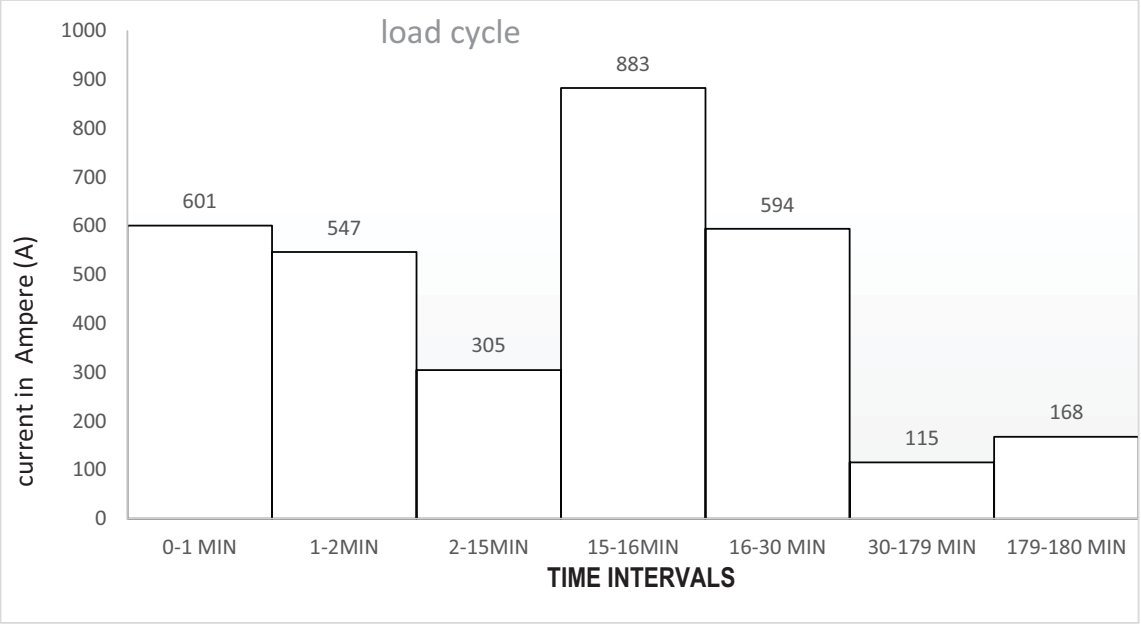
SINGE LINE DIAGRAM FOR 220V DC SYSTEM



ANNEXURE-II

LOAD DUTY CYCLE

LOAD DUTY CYCLE OF MAIN PLANT & ASSOCIATED STATION



Duration	0-1 min	1-2 min	2-15 min	15-16 min	16-30 min	30-179 min	179-180 min
Current	**601**	**547**	**305**	**883**	**594**	**115**	**168**

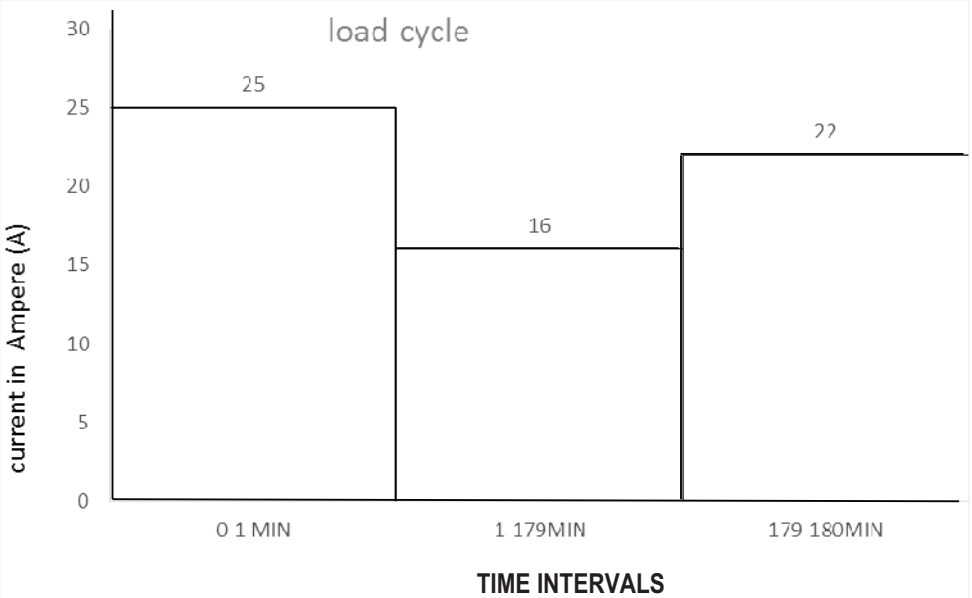
FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.0 for Lead-Acid/ 1.25 for Ni-Cd
2. MIN.ELECTROLYTIC TEMP. : 5 °C
3. END CELL VOLTAGE : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd
4. DESIGN MARGIN : 20%
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 Deg C

LOAD DUTY CYCLE OF Make-up Water Pump House



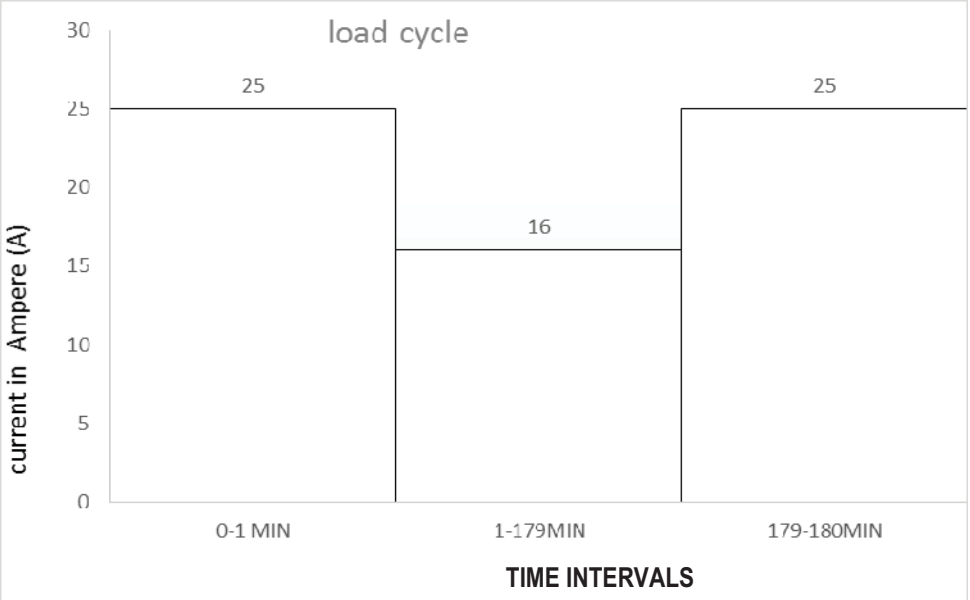
Duration	0-1 min	1-179 min	179-180 min
Current	25	16	22

ACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.0 for Lead-Acid/ 1.25 for Ni-Cd
2. MIN.ELECTROLYTIC TEMP. : 5 °C
3. END CELL VOLTAGE : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd
4. DESIGN MARGIN : 20%
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 Deg C



Duration	0-1 min	1-179 min	179-180 min
Current	25	16	25

FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

1. AGEING FACTOR : 1.0 for Lead-Acid/ 1.25 for Ni-Cd
2. MIN.ELECTROLYTIC TEMP. : 5 °C
3. END CELL VOLTAGE : 1.85V/cell for Lead-Acid/ 1.14V/cell for Ni-Cd
4. DESIGN MARGIN : 20%
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 Deg 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 (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.

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	Battery sizing calculation (Including battery catalogues, curves etc)	PE-V0-427-508-E202
3	Fault calculation & Connector sizing calculation	PE-V0-427-508-E203
4	General Arrangement drawing for Battery	PE-V0-427-508-E204
5	Bill of Material for the battery	PE-V0-427-508-E205
6	List of Mandatory Spares for battery	PE-V0-427-508-E206
7	O & M manual for battery	PE-V0-427-508-E207
8	Field Quality Plan for battery	PE-V0-427-508-E208
9	Type test reports for the battery	PE-V0-427-508-E209
10	Cable Termination arrangement for battery terminal	PE-V0-427-508-E210
11	Quality Plan for battery	PE-V0-427-508-E211
12	Battery room layout	PE-V0-427-508-E212

SECTION - II

STANDARD TECHNICAL REQUIREMENTS

CHAPTER-14.0
TECHNICAL SPECIFICATION FOR BATTERY

01.00.00

01.01.01

Battery shall be either Lead Acid Plante or Nickel Cadmium Type.

01.01.02 One set of special tools and tackle.

01.01.03

01.01.04 All relevant drawings, data and instruction manuals.

Note : Ratings, requirements, fittings and accessories of the equipment have been further detailed in this specification, enclosed drawings and annexure. Equipment shall be furnished in strict accordance with the same.

02.00.00 **GENERAL REQUIREMENTS**

02.01.00 Codes and Standards

Major standards, which shall be followed, are listed below. Other applicable standards for any component if not covered in the listed standard shall also be followed.

Indian Standards	Title	International & Internationally Recognized Standards

IS : 1652	Stationary cells and batteries, Lead acid batteries with Plante' positive plates	IEC896-1
IS : 266	Sulphuric acid	
IS : 8320	General requirements and methods of tests for lead-acid Storage batteries	
IS : 1146	Specification for rubber and plastics container for lead acid storage batteries	
IS : 6071	Synthetic separator for lead acid batteries	
BS-6290	Lead acid stationary cells and batteries. Specification for High Performance Plante' cells	
IS : 1885 (Part-15)	Electrical vocabulary, primary cells and batteries	
IS : 1069	Quality Tolerances for Water for storage batteries	IEC-60050
	IEEE Recommended practice for sizing for lead acid batteries for stationary application	IEEE-485
	IEEE Recommended practice for installation design and installation of vented lead acid Batteries stationary application	IEEE-484
IS : 10918	Specification for vented type Nickel Cadmium Batteries	
IS : 1069	Quality tolerances for water for storage batteries	
ANSI-C37.90a	Guide for surge withstand capability tests	
IS:5	Colours for ready mix paints.	
IS : 694	PVC Insulated Cable for working voltages upto and including 1100V.	
IS : 1248	Specification for Direct acting indicating analogue electrical measuring instruments.	
IS:13947 Part-1	Degree of protection provided by enclosures for low voltage switch gear and control gear.	
IS : 13947	Specification for low voltage switch gear and control gear	
IS : 3231	Electrical relays for power system protection.	
IS : 3842	Application guide for Electrical relays for AC System	
IS : 3895	Mono-crystalline semi-conductor Rectifier Cells and Stacks	
IS : 4540	Mono crystalline semi-conductor Rectifier assemblies and equipment.	

IS:6005	Code of practice for phosphating of Iron and Steel.
IS:6619	Safety Code for Semi-conductor Rectifier Equipment.
IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto 1000 V AC or 1200 V DC.
IS : 9000	Basic environmental testing procedures for electronic and electrical items.
IS:13703	Low voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC.
EEUA-45D	Performance requirements for electrical Alarm Annunciation System
	Indian Electricity Rules
	Indian Electricity Act.

03.00.00 **DESIGN CRITERIA**

03.01.00

03.01.01

03.01.02 For configuration of DC System, please refer to attached single line diagram (Annexure-1)

03.01.03 The batteries and chargers shall be installed indoor in a clean but hot, humid and tropical atmosphere.

03.01.04 The battery and charger combinations shall be such as to ensure continuity of D.C. supply at load terminals without even momentary interruption.

03.01.05 For continuous operation at specified ratings, temperature rise of the various components of battery and charger shall be limited to the permissible values as stipulated in relevant standards.

03.01.06

03.01.07 Ampere hour capacity for Lead acid battery shall be as specified designed for 10 hours discharge rate with final voltage per cell 1.85V.

For faster discharge rate, the permissible continuous load with final discharge voltage 1.85V / Cell shall be based on the following :

Discharge Time	AH capacity in % of rated 10 Hr. capacity
10 hrs.	100%
5 hrs.	67%
3 hrs.	60%
1 hr.	33%

03.01.08

03.01.09

03.01.10

03.01.11

03.01.12

03.01.13

03.01.14

03.01.15 The batteries & chargers shall be so designed that the maximum fault level on DC DB is limited to 25KA (Indicative only; the actual value shall be decided by the bidder after substantiating the same by calculation.)

03.01.16

For faster discharge rate, the permissible continuous load with final discharge voltage1.14V / Cell shall be based on the following :

Discharge Time	AH capacity in % of rated 5 Hr. capacity
5 hrs.	100%
3 hrs.	70%
1 hr.	30%

03.02.05 All acceptance and routine tests as per Quality Plan shall be carried out by the manufacturer. Charges for Type Tests, routine and acceptance tests for all the materials shall be deemed to be included in the bid price.

The Capacity test and test for voltage on battery during discharge shall be carried out at site on completion of E&C and immediately prior to putting battery in service. Necessary testing equipment required for testing at site (including site visit) shall be arranged by bidder. Charges shall be as per Supervision of E&C Charges

For all components / materials, for which type test reports have been asked as per relevant standard, such Type tests should have been carried out on identical components / materials. In absence of such type tests reports or in case such reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.

03.03.00

03.03.01

03.03.02 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.

03.03.03

PART- A : NICKEL CADMIUM BATTERY

05.00.00 GENERAL TECHNICAL REQUIREMENT

05.01.00 Equipments

(a) DC Batteries shall be stationary Nickel Cadmium Pocket plate type (KPH) conforming to IS:10918. The batteries shall be high discharge performance type as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.

(b) DC batteries shall be suitable for standby duty. 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.

(c)

(d) Batteries should be suitable for continuous operation for the maximum ambient temperature of 50 Deg C.

05.02.00 Construction Features

05.02.01 Containers

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. Electrolyte level lines shall be marked on container in case of translucent containers.

05.02.02 Vent Plugs

Vent plugs shall be provided in each cells. They shall be antisplash 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.

05.02.03 Plates

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS:10918.

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 terminal posts shall be clearly marked.

05.02.04 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.

05.02.05 Cell Insulator

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on to the racks with adequate clearance between adjacent cells. Minimum distance between the adjacent cells shall be more than the bulge allowed for two cells in accordance with IS:1146.

05.02.06 Electrolyte

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

Necessary electrolyte for make-up shall be supplied separately.

05.02.07 Connectors and Fasteners

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 bidder. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Bidder shall furnish necessary sizing calculations to prove compliance to the same. Suitable number of Inter-rack connectors shall be supplied by the Bidder to suit the battery room layout during detailed engineering.

05.02.08 Battery racks

Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/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.

05.02.09 Manufacturer's Identification System

The following information shall be indelibly marked on outside of each cell.

(a.) Manufacturers' name and trade marks

(b.) Country and year of manufacture.

(c.) Manufacturer type designation.

(d.) AH capacity at 5 hour discharge rate.

(e.) Serial number

06.00.00 **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.

07.00.00 **TESTS** : Alongside Section 7.00.00, Also refer attached Quality Plan for Testing Requirements. In case of any conflict, Quality Plan shall prevail.

07.01.00 **GENERAL**

The Bidder shall submit for Owner's approval the reports of all the type tests as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries) carried out within last ten years from 02.04.2015 and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

07.02.00 Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.

07.03.00 Commissioning Checks: Supervision of Supplier's representative may be required during E&C of battery at site.

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 - hour capacity

(g.) Retention of charge

(h.) Insulation resistance

PART-B: LEAD –ACID PLANTE BATTERY

8.00.00 **GENERAL TECHNICAL REQUIREMENTS**

8.01.00 **Equipments**

DC Batteries shall be stationary lead acid Plante positive plate type conforming to IS:1652. The battery shall be high discharge performance type. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered. DC Batteries shall be suitable for standby duty. 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 2.7 volts per cell maximum and float charged at about 2.25 V/cell.

The number of cells for the 220 Volts shall be 107.

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

8.02.00 **Construction Features**

8.02.01 **Containers**

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. Electrolyte level lines shall be marked on container in case of transparent containers. Float type level indicator shall be provided in case of opaque containers. The stem portion of the float should be long enough to prevent falling of the float inside the container even if there is no electrolyte in the container. The marking for the electrolyte level should be for the upper and lower limits. The material of level indicator shall be acid proof and oxidation proof. Container shall be closed/sealed lid type. Lid and sealing compound shall be non-cracking type. The container made of hard rubber and plastics shall be type tested as per IS : 1146. 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 get 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.

8.02.02 Vent Plugs

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

8.02.03 Plates

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS : 1652 as applicable.
The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked.

8.02.04 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.

8.02.05 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.

8.02.06 Electrolyte

The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS:266 and distilled water conforming to IS:1069. The cells shall be shipped dry uncharged. The electrolyte shall be supplied separately.

8.02.07 Connectors and Fasteners

Lead or Lead coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. The thickness of lead-coating of connectors should not be less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX F of IS:6848 (latest edition). All

the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded copper conductors and PVC insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the bidder. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective Batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Bidder shall furnish necessary sizing calculations to prove compliance to the same.

8.02.08 Battery racks

Wooden racks for all the batteries shall be provided. These racks shall be made of good quality first class seasoned teak wood in line with CPWD specification. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries 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. 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.

8.02.09 Manufacturer's Identification Systems

The following information shall be indelibly marked on outside of each cell.

(a.) Manufacturer's name and trade marks

(b.) Country and year of manufacture.

(c.) Manufacturer type designation.

(d.) AH capacity at 10 hour discharge rate.

(e.) Serial number

9.00.00 TESTS : Alongside Section 9.00.00, Also refer attached Quality Plan for Testing Requirements. In case of any conflict, Quality Plan shall prevail.

9.01.00 GENERAL

The Bidder shall submit for Owner's approval the reports of all the type tests as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/IS 1652 (for lead-acid plante batteries) carried out within last ten

years from the date of bid opening and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The complete type test reports
shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

9.02.00 Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.

9.03.00 Commissioning Checks: Supervision of Supplier's representative may be required during E&C of battery at site.

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 Bidder shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.

10.01.00 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.

11.04.00 DC HEALTH MONITORING SYSTEM

11.04.01 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. MEC/TS/11/E1/G24F/E/088. Each Battery set shall have its own independent DC Health Monitoring System.

11.04.02 DC Health Monitoring System shall measure and store the following parameters at predetermined time interval as 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.

11.04.03 **Technical Parameters**

a) Input Power Supply 230V AC(UPS) / 220V DC
b) Voltage Measurement Accuracy 0.5% or better
c) Current Measurement Accuracy 0.5% or better
d) Operating Temperature Range 0-50o C
e) Mounting Panel Mounting
f) IP Protection IP42

11.04.04 **Communication**

DC Health Monitoring System shall communicate with the Switchgear SCADA 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 SCADA system.The Cable required for connecting the cells to DC Health Monitoring System and DC Health Monitoring System to SCADA system shall also be under contractor's scope. DC FAIL alarm shall be generated and given in Central Control Room buzzer (Audio Visual Fascia).

11.04.05 **Software**

Necessary software for communication between DC Health Monitoring System and Switchgear SCADA 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.

FITTINGS & ACCESSORIES

Each Lead-Acid battery bank shall be furnished complete with the following :

BATTERY

a) First charge of electrolyte plus 10% extra

b) Teakwood racks with 3 coats of anti-acid paint.

c) Stand insulators plus 5% extra

d) Cell insulators plus 5% extra

e) Cell inter-connectors with 5% extra and end take-off with one no. extra

f) Lead-coated connection hardware plus 5% extra

g) Cell numbering tags with fixing arrangements

h) Teakwood cable clamps with hardware.

i) Six (6) extra cell with all accessories but without acid.

In addition to above, each Lead –Acid battery bank shall be furnished with a set of following accessories

a) One (1) inter-connector bolt wrench

b) One (1) hydrometer syringe

c) One (1) thermometer with plug & cap and with specific gravity correction scale

d) One (1) cell testing voltmeter with leads

e) Pocket thermometer

f) Acid resisting funnels

g) Acid resisting jugs of adequate capacity
h) Rubber aprons
i) Rubber gloves
j) Cell lifting straps
k) PVC spill trays under the battery cells
l) Bridging clamps
m) Spanner for cells
n) Float type level indicator
o) First aid box
p) Hydrometer
q) Wall Mounted Holder and Thermometer
r)Specific Gravity Correction Chart
s) Goggles
t) "No Smoking" Notice
u) Battery Log Book
v) Instruction card

Each Nickel –Cadmium battery bank shall be furnished with a set of following accessories:

a) M.S battery stand finished with 3 coats of black anti alkali paint complete with cell number plates and fixing arrangement. Suitable for triple row single tier arrangement in 3 step rack
b) Electrolyte for first filling including 10% spare quantity
c) Cell testing voltmeter 2-0-2 volt with complete with leads.
d) Mercury in glass chemical thermometer 0 -100 deg. C.
e) Goggles
f) Copper cell connectors (5 nos.)
g) Spanner for cells, alkali resistant funnel and 2 liter Jug, rubber syphon, gloves and apron.
h) Bridging clamps for cutting out individual cells in the event of defect.
i) "No Smoking" Notice
j) Instruction Cards
k) Battery Log Book
l) First Aid Box
m) Cable Clamps with Fixing Hardware
n) PVC Spill Tray under Battery Set

Each Ni-Cd Battery Bank shall be furnished with the following:

Electrolyte (sulphuric acid for first filling plus10% extra)
MS racks with 3 coats of anti alkali paints for 220V DC Battery
Stand insulators plus 5% extra
Cell interconnectors with 5% extra and end take-off with one no. extra
Lead coated connection hardware plus 5% extra
Cell numbering tags with fixing arrangement (1set)
Teakwood Cable clamps with hardware

	QUALITY PLAN	CUSTOMER : NSPCL Ltd.	PROJECT: 1 X 250 MW Rourkela TPS TITLE	SPECIFICATION NO. PE-TS-427-508-E001
		BIDDER/ VENDOR :	STANDARD QUALITY PLAN NO.- PE-QP-999-508-E002, REV.0	SPECIFICATION : 220 V DC Battery TITLE
	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 P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**											
1.1	(Pure Lead for Pos. plate, Lead Alloy for Neg. plate & Sulphuric acid)	Chemical	MA	Chemical Analysis	Random Sample	IS:1652, IS:266, IS:1069 & MFR's Std.	IS:1652, IS:266, IS:1069 & MFR's Std.	Test Cert.	3/2	-	1	
1.2	**SEPARATOR**											
a)	Visual	Visual	MA	Visual	Random Sample	IS:1652 & MFR's Std.	IS:1652 & MFR's Std.	Test Cert.	3/2	-	1	
b)	Physical	Physical		Physical	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Chemical	Chemical		Chemical	-do-	(For Synthetic IS : 6071)	(For Synthetic IS : 6071)	-do-	3/2	-	1	
d)	Electrical Resistance Test	Electrical		Electrical	-do-	-do-	-do-	-do-	3/2	-	1	
e)	Acceptance test Dimension, Volume Porosity, Wettability of separator	Test		As per Standard	-do-	-do-	-do-	-do-	3/2	-	1	
1.3	**TERMINAL POST**											
a)	Dimensional Conformance	Visual	MA	Visual	Random Sample	IS:1652, IS:8320 & MFR's Std.	IS:1652, IS:8320 & MFR's Std.	Test Cert.	3/2	-	1	
b)	Material Conformance	Chemical	CR	Chemical	-do-	-do-	-do-	-do-	3/2	-	1	
c)	Thread size depth & chamfer	Physical	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Surface finish & defects	Visual	MA	-do-	100%	-do-	-do-	-do-	3/2	-	1	
e)	Plating Quality	Thickness	CR	-do-	Random Sample	-do-	-do-	-do-	3/2	-	1	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

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

	QUALITY PLAN	CUSTOMER : NSPCL Ltd.	PROJECT: 1 X 250 MW Rourkela TPS TITLE	SPECIFICATION NO. PE-TS-427-508-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 P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.4	**CONNECTOR**											
a)	Dimension	Dimension	MA	Measurement	Random Sample	IS:1652, IS:6848 & Appd. Drg./Doc.	IS:1652, IS:6848 & Appd. Drg./Doc.	Test Cert.	3/2	-	1	
b)	Thickness of lead coating	Visual		Visual	-do-	-do-	-do-	-do-	3/2	-	1	
1.5	**VENT CAP**											
a)	Dimensional Conformance	Dimension	MA	Measurement	-do-	Refer Remarks#	Refer Remarks#	-do-	3/2	-	1	*# Vent cap shall be easily removed from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into vent to take electrolyte sample.*
1.6	**CONTAINER**											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS:1146	IS:1652, IS:1146, IS:8320	IS:1652, IS:1146, IS:8320	Test Cert.	3/2	-	1	
b)	Verification of Markings	Visual	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
c)	High Voltage Test	Electrical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
d)	Drops Ball Test	Mechanical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
e)	Plastic Yield Test	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
f)	Acid Resistance Test	Chemical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
g)	Hydraulic thrust enduarnce test	Physical	MA	-do-	-do-	-do-	-do-	-do-	3/2	-	1	
2.0	**FINISHED BATTERY**	Routine Test	CR	Elec. & Meas.	100%	IS:1652 & IS:8320	IS:1652 & IS:8320	Test Cert.	3/2	-	1	
3.0	**FINAL INSPECTION**											
3.1	**Type Test #**											
a)	Verification Constructional requirement	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	*# Conduction of Type Tests from S.No. (d) to (g) shall be as per Annexure-A enclosed.*
b)	Verification of Markings	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Verification of Dimensions	-do-	MA	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Capacity & Voltage during discharge	Test	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	

BHEL	PARTICULARS	BIDDER/ VENDOR	
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	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 : NSPCL Ltd.	PROJECT: 1 X 250 MW Rourkela TPS TITLE	SPECIFICATION NO. PE-TS-427-508-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 P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
e)	AH & WH efficiency Test	-do-	CR	As per IS:1652	Sample Plan as per IS:8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
f)	Retension of Charge	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
g)	Endurance Test	-do-	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
3.2	**Acceptance Test**											
a)	Verification of Markings	Visual	MA	Visual	Sample Plan as per IS: 8320	IS:1652	IS:1652	Inspection Report	3/2	1	-	
b)	Verification of Dimensions	Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	1	-	
c)	Test for Capacity	Capacity	CR	As per IS: 1652	-do-	-do-	-do-	-do-	3/2	1	-	
d)	Test for Voltage during discharge	Voltage during discharge	CR	-do-	-do-	-do-	-do-	-do-	3/2	1	-	
4.0	**ACCESSORIES**	Visual & Dimension	MA	Visual	100%	Appd. Drg./Doc.	Appd. Drg./Doc.	-do-	2	1	-	
5.0	**CABLE LUGS**	Visual	MA	Visual	100%	Appd. DataSheet	Appd. DataSheet	-do-	2	1	-	

NOTE:- Wherever IS is mentioned equivalent IEC is also acceptable. In case of any technical requirement not covered by IEC, technical requirement as per IS shall prevail.

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/ VENDORS COMPANY SEAL

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

BHEL	**STANDARD QUALITY PLAN**		CUSTOMER :			PROJECT: 1 X 250 MW Rourkela TPS TITLE			SPECIFICATION NO. PE-TS-427-508-E001			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01			SPECIFICATION TITLE			TECHNICAL SPECIFICATION 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 P	AGENCY W	AGENCY V	REMARKS
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	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 enduarnce 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

BHEL	**STANDARD QUALITY PLAN**		CUSTOMER :			PROJECT: 1 X 250 MW Rourkela TPS TITLE			SPECIFICATION NO. PE-TS-427-508-E001				
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01			SPECIFICATION TITLE			TECHNICAL SPECIFICATION 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		
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**											# 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)	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 :			PROJECT: 1 X 250 MW Rourkela TPS TITLE			SPECIFICATION NO. PE-TS-427-508-E001			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01			SPECIFICATION TITLE			TECHNICAL SPECIFICATION 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
									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	
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

BHEL	**STANDARD QUALITY PLAN**	CUSTOMER :		PROJECT: 1 X 250 MW Rourkela TPS TITLE				SPECIFICATION NO. PE-TS-427-508-E001				
		BIDDER/ VENDOR :		QUALITY PLAN NUMBER: PE-QP-999-508-E002 REV.01				SPECIFICATION TITLE			TECHNICAL SPECIFICATION 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 P	W	V	REMARKS
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	-	
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	-	# Conduction of Type Tests from S.No. (g) to (j) shall be as per Annexure-A enclosed.
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			
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-A

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	YES	YES
		• AH & WH efficiency Test	IS:1652	YES	YES
		• Retension of Charge	IS:1652	NO	YES
		• Endurance Test	IS:1652	NO	YES

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	• Test for Capacity & Voltage during discharge	IS:10918	YES	YES
		• Test for discharge performance at low temp.	IS:10918	YES	YES
		• Retension of Charge	IS:10918	NO	YES
		• Endurance Test	IS:10918	NO	YES

The Bidder shall submit for Owner's approval the reports of all the type tests as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries) and IS-1652 (for Lead Acid batteries) carried out within last ten years from 02.04.2015 and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

In the absence of such type test reports, or in case such reports are not meeting the standards/ specification requirement, vendor shall carry out these type tests without any commercial and delivery implication to BHEL. Charges for type test mentioned in Annexure-A for Tests which are to be specifically conducted are deemed to be included in the bid price.

Annexure-B

QUALITY ASSURANCE

DC SYSTEM SQE_19

LEAD ACID BATTERY

ATTRIBUTES / CHARACTERISTICS ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimensions & Finish	Conformance to relevant part drg. & Manufacturer's standards	Chemical composition	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Paint Process checks, Paint Shade, Thickness, Adhesion & Finish	Constructional requirements as per NSPCL Spec.	Routine & acceptance tests as per relevant standard
Container & Lids (IS : 1146)	Y	Y						
Vent Plugs	Y	Y						
Sealing Compound (IS : 3116)		Y	Y					
Positive & Negative Plates		Y	Y					
Separators (IS : 6071)	Y	Y						
Electrolyte (Water / Sulphuric Acid) (IS : 1069 / 266)		Y	Y					
Inter-cell Connectors & Fasteners	Y	Y		Y				
Battery Stand	Y	Y			Y	Y		
Cell Insulators	Y	Y						
Stack Assembly	Y	Y						
Lead Acid Battery (IS : 1652)	Y						Y	Y

Note: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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Annexure-B

QUALITY ASSURANCE

Ni- Cd BATTERY								
ATTRIBUTES / CHARACTERISTICS **ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY**	Dimensions & Finish	Impact Strength	Conformance to relevant part drg. & Manufacturer's standards	Resistance to Alkali	Chemical composition	Nickel Plating thickness	Paint Shade, Thickness, Adhesion & Finish	Routine & acceptance tests as per relevant standard
Container & Lids	Y	Y	Y	Y				
Vent Plugs	Y		Y	Y				
Perforated Steel Strips	Y		Y	Y		Y		
Active Material for Positive & Negative Plates			Y		Y			
Separators	Y		Y	Y				
Electrolyte			Y		Y			
Inter-cell Connectors & Fasteners	Y		Y	Y		Y		
Battery Stand	Y			Y			Y	
Cell Insulators	Y		Y	Y				
Stack Assembly	Y		Y					
Ni-Cd Battery (IS : 10918)	Y							Y

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Makes of all major Bought Out Items will be subject to NSPCL approval.

Bharat Heavy Electricals Limited FS- Mktg Delhi

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