(139)

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB 367 510 025	Rev 01	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	VSM	AA	VK
TITLE: 220V DC & 48V DC Battery		SIGN	-Sd-	-Sd-	-Sd-
		DATE	07-05-15	07-05-15	07-05-15
		GROUP	TBEM	W.O. No	83010

CUSTOMER	NTPC
CONSULTANT	----
PROJECT	400/220 KV SWITCHYARD Extn. AT FEROZ GANDHI UNCHAHAR THERMAL POWER PROJECT (1 X 500 MW)

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
01	13-07-15	AA 14/7/15	VK 13/7	VK 12/7/15	a) Section – 1 : Scope , Technical requirements and quantities : Ammended b) Section – 5 : Checklist : Ammended c) All other Sections shall remain same as in Rev 00

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AMENDMENT TO SECTION – 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of 220V DC & 48V DC Lead acid plante / Ni-Cad type Batteries complete with rack assembly and other accessories as required for trouble free operation of batteries.

This section covers the specific technical requirements of 220V & 48V Batteries. In case of any discrepancies between the requirements mentioned in this addendum and those specified in other setions of the specification, the specifications given herein shall prevail and shall be treated as binding requirements.

No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer .

1.1 The equipment is required for the following project.

CUSTOMER: NTPC .

CONSULTANT:

PROJECT: FEROZE GANDHI UCHAHAR THERMAL POWER PROJECT STAGE –IV (1X 500MW) Bharat Heavy Electricals Ltd.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

Parameter	220V DC	48 DC
Nominal Voltage Rating(V)	220	48
Cell designation	Stationary, Lead acid Type with plante positive Plates, High Discharge Rate type OR Stationary Nickel-Cadmium Pocket Plate High Discharge type	
Charging method	Float Charging during normal conditions and Boost charging of battery after emergency duty. The Battery shall float across charger through a suitable tap during Boost charging.	
No. of Cells per battery	As per requirement to meet the technical Specification	As per requirement to meet the technical Specification
Maximum Battery Bank Voltage	242	52.8
Minimum Battery Bank Voltage	198	43.2
Cell Float Voltage(Volt)	As per Manufacturer standard for float	As per Manufacturer standard for float

Section -1
Technical Specification
220V DC & 48V DC BATTERY

Parameter	220V DC	48 DC
	application	application
Min. Electrolyte temp. for Battery Sizing	15°C	
Min. Ambient design temperature	0°C	
Battery Charging Requirement	Battery shall be such that it can be charged from fully drained state to fully charged condition within 5 Hrs.	
BATTERY ROOM SIZE	8500x10500 mm, bidder to confirm that battery banks (under Clause 1.3 ,S.No 1 & 2) can be suitably accommodated in room size with 1.0 meter clear space from inside wall surface. Refer sketch of room, attached along with Section-II.	

For detailed technical requirement for Ni-Cad Battery / Lead Acid Plante Battery , please refer Section-1 Annexure-A
(Attached herewith)

1.3 QUANTITIES

1.3.1 MAIN QUANTITIES

Following are the quantities for Battery Bank complete with accessories, as per this specification.

S.No.	Description	Quantity (in Nos.)
1	220V, Battery bank complete in all respect meeting the load cycle requirement as per Technical Specification.	02
2	48V, Battery bank complete in all respect meeting the load cycle requirement as per Technical Specification.	02
3.	48V 425AH* , Lead acid Plante type high discharge battery bank complete in all respect.	02

Please Note :-

i) Refer Annexure-B of section 1 for 220V Load duty
ii) Refer Annexure –C of Section 1 for 48V Load Duty Cycle.
*** The battery size 425AH mentioned in S.No3 above is subject to change by +/- 20% before placement of Order.**

iii) The minimum size of batteries shall be as below (for S.No 1,2 above)
220V Battery - a) 400AH Lead Acid Plante Type
b) 250 AH Ni-Cd (KPH type)
48V Battery - a) 425AH lead acid plante Type
b) 390 AH Ni-Cd (KPL type).

iv) Each battery bank shall comprise of –

1) **Battery**
2) **Wooden Stand for battery Bank**
3) **Inter-cell connector for Battery bank**
4) **Electrolyte for first filling with 10% Extra**

v) Bidder to quote battery size meeting the load duty cycle requirement . The sizing calculation shall be submitted with offer for review.

vi) Ageing factor of 1.25 to be considered during sizing , temperature correction factor shall be as per manufacturers recommendation and relevant standards.

vii) The battery size quoted by bidder shall be with sufficient margin.

viii) The battery banks under S.No1 & 2 shall be evaluated together and will be procured from the same bidder.

ix) The battery bank under S.No3 will be evaluated separately and may be procured from same bidder as above / separate bidder.

1.3.2 ACCESSORIES REQUIRED

The following accessories and devices required for maintenance and testing of batteries shall be provided for each set of battery bank: (Total of 6 Battery Bank)

Sl. no.	Description	Quantity (in Nos.) (Per battery bank)
1.	Hydrometer	2Nos
2.	Set of hydrometer syringes suitable for the vent holes in different cells	2Nos
3.	Thermometer for measuring electrolyte temperature	2Nos
4.	Specific gravity correction chart	2 Nos.
5.	Wall mounting type holder made of teak wood for hydrometer & thermometer	2Nos
6.	Cell testing Voltmeter(3—0-3V)	3Nos
7.	Alkali Mixing Jar	2Nos
8.	Rubber Aprons	5Nos
9.	Pair of rubber gloves	5Nos
10.	Set of Spanners	5Nos
11.	No Smoking notice for each battery room	2Nos
12.	Goggles (Industrial)	2Nos

13.	Instruction Card	5Nos
14.	Temperature card	5Nos

1.3.3 SPARES

Each Battery bank shall be supplied with following spares:

S.No.	Description	Quantity
1	Complete dry cell	2% or 2 Nos. Whichever is more
2	Inter cell Connector with Hardware	10% or 5 Nos. Whichever is more
3	Vent Plug	10% or 5 Nos. Whichever is more
4	Acid Level indicating float (for opaque containers only)	10% or 5 Nos. Whichever is more
5	Stand Insulator	10% or 5 Nos. Whichever is more
6	Cell Insulator	10% or 5 Nos. Whichever is more

Notes:

(i) Purchaser shall have the option to order any / no Spares.

1.3.4 SUPERVISION AT SITE

Bidder shall quote for the following supervision charges –

S.N	Supervision at Site	Unit	Qty.
1	Supervision of erection at site for 220V Lead Acid / Ni-Cad Battery Bank	Nos.	2
2	Supervision of erection at site for 48V Lead Acid / Ni-Cad Battery Bank	Nos.	2
3	Supervision of erection at site for 48V Lead Acid Battery Bank	Nos.	2
3	Supervision of testing and commissioning at site for 220V Lead Acid / Ni-Cad Battery Bank	Nos.	2
4	Supervision of testing and commissioning at site for 48V Lead Acid / Ni-Cad Battery Bank	Nos.	2
5.	Supervision of testing and commissioning at site for 48V Lead Acid Battery Bank	Nos.	2

1.4 TYPE TEST REPORTS

The 220V DC & 48V DC Lead acid plante type/ Ni-Cad Batteries to be supplied shall be of type tested design. During detail engineering, the Bidder / Contractor shall furnish for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. Date of bid opening is

15.11.2013. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

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

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

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

1.5 PRE QUALIFYING REQUIREMENTS – Technical

Sub-vendor should have manufactured and supplied at least two (2) numbers of minimum 220V, 1000AH rating high discharge type plante positive plate type battery (in case bidder offers Lead Acid plante type battery) or minimum 220V, 600AH rating high discharge type Nickel Cadmium battery (in case bidder offers Nickel Cadmium battery), at least one (1) each at two (2) different industrial installations, which should be in successful operation for at least two (2) years as on date of bid opening is 15.11.2013.

1.6 MANUFACTURING QUALITY PLAN

Manufacturer shall follow NTPC Manufacturing Quality Plan.

ANNEXURE-A

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CLAUSE NO.	TECHNICAL REQUIREMENTS

BATTERY

1.00.00 BATTERY RATINGS

1.	For Ni-Cd Type Battery	
a)	Battery Voltage	220V/125/110V/48 V DC
b)	No. of Cells	As per requirement
c)	Battery type	Stationary Nickel-Cadmium Pocket Plate High discharge type (KPH)
d)	Capacity for five(5)hour rate	As per requirement
e)	Nominal discharge voltage per Cell	1.2 V
f)	Float voltage	As per manufacturer's standards for float application
2.	**For Lead Acid Plante type Battery**	
a)	Battery Voltage	220V/125/110V/48 V DC
b)	No. of Cells	As per requirement
c)	Battery type	Stationary Lead Acid Plante high discharge type
d)	Capacity for ten(10)hour rate	As per requirement
e)	Nominal discharge voltage per cell	2.0 V
f)	Float Voltage	As per manufacturer's standards for float application

PART-A: NICKEL-CADMIUM BATTERY

2.00.00 CODES AND STANDARDS

2.01.00 All standards, specifications and codes of practice referred to herein, shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid.

In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:

IS : 10918 Specification for vented type Nickel Cadmium Batteries.

IS : 1069 Quality tolerances for water for storage batteries

Indian electricity rules

Indian Electricity Acts.

2.02.00 Equipment complying with other internationally accepted standards such as IEC., BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

3.00.00 GENERAL TECHNICAL REQUIREMENT

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

3.02.00 Construction Features

3.02.01 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.

3.02.02 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.

3.02.03 Plates

CLAUSE NO.	TECHNICAL REQUIREMENTS
	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.
3.02.04	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.
3.02.05	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.
3.02.06	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.
3.02.07	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 contractor. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Contractor shall furnish necessary sizing calculations to prove compliance to the same. Suitable number of Inter-rack connectors shall be supplied by the Bidder to suit the battery room layout during detailed engineering.
3.02.08	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.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	Wherever racks are transported in dismantled conditions, match markings shall be provided to facilitate easy assembly.
3.02.09	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
4.00.00	**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.
5.00.00	**TESTS**
5.01.00	GENERAL The Contractor 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 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.
5.02.00	Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.
5.03.00	Commissioning Checks: All tests as listed below shall be carried out on sample cell selected at random by the employer at site after completion of installation. (a.) Physical Examination (b.) Dimensions, Mass & layout (c.) MARKING (d.) Polarity and absence of short circuit.

CLAUSE NO.	TECHNICAL REQUIREMENTS

(e.) Air pressure test

(f.) Ampere - hour capacity

(g.) Retention of charge

(h.) Insulation resistance

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

PART-B: LEAD –ACID PLANTE BATTERY

6.00.00 CODES & STANDARDS

6.01.00 All standards, specification and codes of practice, referred to herein, shall be the latest edition including all applicable official amendments and revisions as on date of opening of bid.

In case of conflict between this specification and those (IS Codes Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:

IS : 266	Specification for sulphuric acid
IS : 1069	Specification for water for storage batteries
IS : 1146	Specification for rubber & plastic containers for lead acid storage batteries.
IS : 1652	Specification for stationary cells and batteries, lead acid type (with plante positive plates).
IS : 3116	Specification for sealing compound for lead acid batteries.
IS : 8320	General requirements and methods of tests for lead acid storage batteries.
IS : 6071	Specification for synthetic separators for lead acid batteries.
	Indian Electricity Rules
	Indian Electricity Acts

6.02.00 Equipment complying with other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

7.00.00 GENERAL TECHNICAL REQUIREMENTS

7.01.00 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.

CLAUSE NO.	TECHNICAL REQUIREMENTS

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 & number of cell for 110V shall be 54.

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

7.02.00 Construction Features

7.02.01 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.

7.02.02 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.

7.02.03 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.

7.02.04 Sediment Space

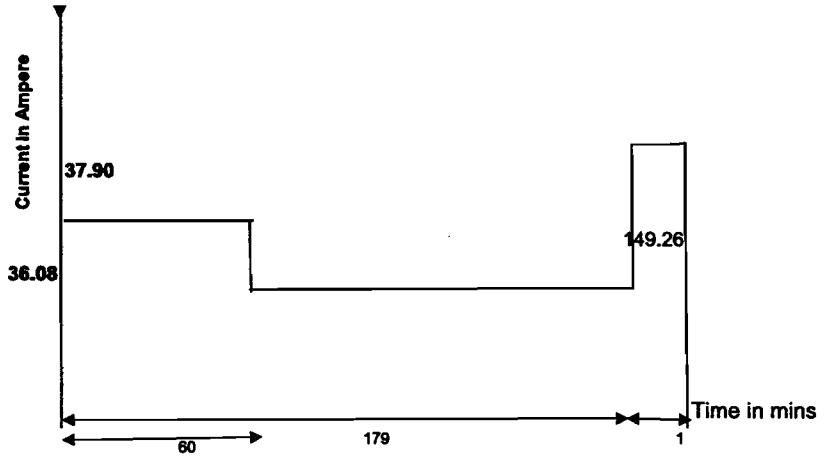
Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.02.05	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.
7.02.06	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.
7.02.07	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 contractor. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective Batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Contractor shall furnish necessary sizing calculations to prove compliance to the same.
7.02.08	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.
7.02.09	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

CLAUSE NO.	TECHNICAL REQUIREMENTS
8.00.00	TESTS
8.01.00	GENERAL The Contractor 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.
8.02.00	Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.
8.03.00	Commissioning Checks: All tests as listed below shall be carried out on sample cell selected at random by the employer at site after completion of installation. 1) Verification of markings. 2) Verification of dimensions. 3) Test for capacities for 10 hrs discharge rate alongwith the test for voltage during discharge. The Contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.

220 V PLANTE BATTERY& BATTERY CHARGER SIZING CALCULATION

Duty curve for 220V Battery –400kV Yard of Unchahar TPP Stage-IV



LOAD & CORROSPONDING DURATIONS			
LOAD A1(Amps.)	38	60 min	Continous Load + emergency Lighting in control room
LOAD A2(Amps.)	36	119min	Continous Load
LOAD A3(Amps.)	149.26	1 min	Momentary load + Continous Load

Max. Ambient Temperature =	50 °C
Min. Ambient Temperature =	0 °C
System Voltage =	220 VDC at battery end
Max. Voltage= (sys. vol. +10%) =	242 VDC at battery end
Min. Voltage = (sys. vol. -10%) =	198 VDC at battery end
Cell Float Voltage =	2.25 VDC
Nominal Cell Voltage =	2.00 VDC
Min. expected electrolyte Temperature - t	15.0 °C
Temperature correction factor as per Battery Manufacturer's recommendation	

No. of Cells = Max. DC / Float Voltage =	107.56 nos.
Hence no. of cells required =	108 nos.
Hence no. of cells selected =	108 nos.
Calculated End Cell Voltage = min. DC vol./ no. of cells =	1.83 V

Taking ECV at 1.85V the min. battery voltage becomes 199.8V which is more than the desired min. voltage of 187.0V. Hence,

Selected End Cell Voltage (ECV) =		1.85 VDC	
Maximum Battery Bank Voltage =		242 VDC	
Minimum Battery Bank Voltage =		199.8 VDC	
No. of Cells =		108 Nos.	
Permissible voltage drop (from battery to loads) = 199.8 - 187	=	12.8	V

BATTERY SIZE:

The battery size shall be calculated as per above Load duty cycle to meet the load requirements.

220 V DC BATTERY CHARGER SIZING CALCULATION

Float Charger Rating

Continuous load (36A) + 25% of Continuous Load = 45.10 A

Total Continuous Load = 45.10 A (1)

Trickle charging current considered @ 2.5 mA per AH

Total Float current = Total Continuous Load (45.10A) + Trickle Charging current considered 2.5mA per AH

Boost Charger Rating

Boost charger rating is selected at 15% of AH capacity of battery

The rating of charger is decided as per higher current rating (Float mode or boost mode).

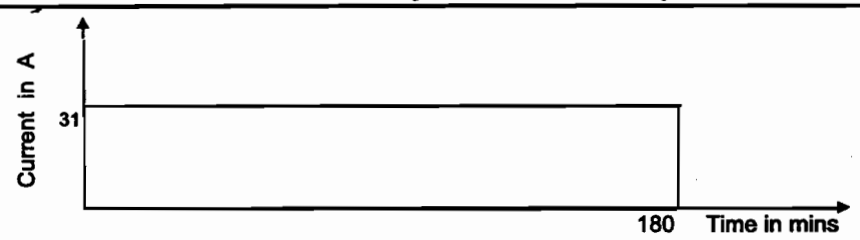
Reference Standards:

IEEE-485 IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applicaations
IS-8320 General requirements and methods of test for lead acid batteries
IS-1652 Stationary cells and batteries, lead acid types - plante type
IS-266 Specification sulphuric acid

48 V PLANTE BATTERY& BATTERY CHARGER SIZING CALCULATION

Duty curve for 48V Battery –400kV Yard of Unchahar TPP Stage-IV

Duty Curve for 48 V Battery



LOAD & CORROSPONDING DURATIONS		
LOAD A1(Amps)	31	180 min

Max. Ambient Temperature =	50 °C
Min. Ambient Temperature =	0 °C
System Voltage =	48 VDC at battery end
Max. Voltage= (sys. vol. +10%) =	52.8 VDC at battery end
Min. Voltage = (sys. vol. -10%) =	43.2 VDC at battery end
Cell Float Voltage =	2.25 VDC
Nominal Cell Voltage =	2.00 VDC
Min. expected electrolyte Temperature - t	15.0 °C
Temperature correction factor as per	Battery Manufacturer's recommendation

No. of Cells = Max. DC / Float Voltage =	23.47 nos.
Hence no. of cells required =	24 nos.
Hence no. of cells selected =	24 nos.
End Cell Voltage = min. DC vol./ no. of cells =	1.80 V

Taking ECV at 1.85V the min. battery voltage becomes 44.4V which is more than the desired min. voltage of 40.8V. Hence,

Selected End Cell Voltage (ECV) =	1.85 VDC
Maximum Battery Bank Voltage =	52.8 VDC
Minimum Battery Bank Voltage =	44.4 VDC
No. of Cells =	24 Nos.

BATTERY SIZE:

The battery size shall be calculated as per above Load duty cycle to meet the load requirements.

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48 V DC BATTERY CHARGER SIZING CALCULATION

Float Charger Rating

Continuous load (31A) + 25% continuous load = 38.75 A

Total Continuous Load = **38.75 A** **(1)**

Trickle charging current considered @ 2.5 mA per AH

Total Float current = Total Continuous Load (38.75A) + Trickle Charging current considered 2.5mA per AH

Boost Charger Rating

Boost charger rating is selected @15% of AH capacity of battery

The rating of charger is decided as per higher current rating (Float mode or boost mode).

Reference Standards:

IEEE-485 IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applicaations
IS-8320 General requirements and methods of test for lead acid batteries
IS-1652 Stationary cells and batteries, lead acid types - plante type
IS-266 Specification sulphuric acid

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Annexure – D

(114)

CLAUSE NO.	Quality Assurance	NTPC

POWER SUPPLY SYSTEM

ITEMS \ TESTS	Visual/dimension/rating/ Paint Adhesion/ Thickness (R)	General arrangement/BOM/make of components /Mimic ®	Efficiency ,regulation(R)	Input voltage variation (A)	Out put voltage and frequency adj.range(A)	Premilinary light load test(R)	Load transfer retransfer test (R) *	AC input faliure and return test (R)	Parralel operation and current divison(R)	Relative harmonic content(R)	Restart with PRI A.C and battery (separately)(R)	System transfer and retransfer (R)*	Asynchronous transfer(R)	Ripple content(R)	Load limiter operation (R)	IR/HV(R)	Tests as per standard &specification (R)&(A)
UPS/CONVERTER (IEC-146 PT-4)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VOLTAGE STABILISER	Y	Y	Y	Y	Y					Y		Y				Y	
LEAD ACID BATTERY (TUBLAR)-IS-1651																	Y
LEAD ACID BATTERY (PLANTE)-IS-1652																	Y
NICKEL CADMIUM BATTERY(IS-10918/IEC-623)																	Y

R-Routine Test A- Acceptance Test Y – Test applicable

* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded .

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

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SECTION 2

EQUIPMENT SPECIFICATION

2.1 GENERAL

This section covers the general technical requirements of 220V DC & 48V DC Lead acid plante type Batteries. In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements. Requirements of Section-1 shall take precedence over all sections.

2.2 GENERAL TECHNICAL SPECIFICATIONS

As per NTPC Technical Specifications enclosed as below:

i) FGUTPP-IV (1X500MW) EPC package, Technical Specification: Section-VI, Part-B, Technical Specifications, Sub Section-B-27, BATTERY, Page 1 to 8.
REFER ANNEXURE-A OF SECTION-I.

- The cells shall be suitably packed in wooden cases so as to avoid any loss or damage during transit.
- The packing wood shall be as per IS:190 - 1991 Grade I & IS:6662 - 1980, Grade III & IV.
- The base of the case shall be made of wooden batons & planks giving necessary reinforcement.
- Thickness of plank shall be minimum 25 mm and width shall not be less than 150 mm. The planks shall be fixed touching each other.
- Top cover will have a layer at 175 micron thick polyethylene sheet. The sheet should project about 150 mm on all the four sides at the top cover.
- Loose item such as connectors, copper rods, hardware, insulators and accessories etc. shall also be packed in cases.

Shipping Documents

1. **Inside the Case**

The shipping documents including drawings (as applicable) storing instructions etc. should be placed in a polyethylene bag and nailed at the top of one of the side walls. The position should be easily visible and accessible.

2. **Outside the Case**

The shipping documents should be put in a polyethylene bag and covered with a sheet metal cover, nailed on the outside of the case, near the top of one of the sides.

3. **Closing the top**

Place the top cover in such a way that the polyethylene sheet lining faces inside. Nail the top cover to the four sides securely by using good quality nails of suitable size.

4. **Strapping of the Case**

Steel strips of minimum 20-25 mm width to IS:5872 , should be strapped round the case, tensioned and crimped. There should be at least two straps per case and these should be across the top and the base. Use same size of strap at the corners. Their number should be adequate to strengthen the case.

1. Battery Layout
2. Guaranteed Technical Particulars
3. Drawing showing constructional details of the cell
4. GA of Stand
5. Cable Termination detail
6. Battery characteristics as follows :
   a) Curve showing cell volts Vs. time at different discharge rates.
   b) Curve showing cell volts Vs. time at different charging currents.
   c) Ampere - hours capacity Vs years of service.
7. Technical literature/manuals on all major components
8. Bill of materials indicating complete list of materials, accessories, spares, components, makes of components, quantities and rating.
9. Type test reports in case the equipment has been type tested already.
10. Temperature correction curve
11. Capacity calculation curve for different ECV at different time periods
12. Instruction manual and cards

The instruction manual giving instruction for initial treatment and routine

maintenance during service shall be supplied as per relevant standard.

The following information shall be provided on the instructions cards:

i) Designation of cell.
ii) AH capacity
iii) Nominal voltage
iv) Instruction for filling initial charges
v) Normal and finishing charging rate
vi) Maintenance Instructions.

Note – Except document at Sl. no. 12, all other documents shall be submitted at the tender stage.

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	NTPC Ltd.
b)	Engineer/Consultant/ Inspector	NTPC Ltd.
c)	Project Title	Feroze Gandhi Unchahar Thermal Power Station Stage IV : 400/220kV Switchyard
d)	Project Location	Place: Bounded by Khnapur, Faridpur & Khaliqpur villages. District: Raebareli State: U.P.
e)	Latitude & Longitude	North: 25°54'50" and East: 81°19'50"
f)	Nearest Railway Station	Unchahar
g)	Distance of project location from the Railway station	2 Km (approx.)
h)	Nearest Major Town	Mustafabad
i)	Distance of the town from the project site	3 Km.
j)	Nearest commercial airport	Lucknow
k)	Distance of airport from the project site	110 Km
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters
d)	Pollution Severity	Heavily polluted (With Coal dust & Fly ash) and Highly Corrosive environment.
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed "Vb" at ten meters above the mean ground level.	47 m/ sec
g)	Category of terrain	Cat –2
h)	Risk Coefficient "K1"	1.07

3.1.1 SYSTEM PARAMETERS:

completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

The equipment to be furnished under this specification shall conform to latest issue with all amendments of standards and/ or codes specified under respective section heads. The standards mentioned in the specification are not mutually exclusive or complete in them, but intended to complement each other. The supplier shall also note that list of standards presented in this specification is not complete. Whenever necessary the list standards shall be considered in conjunction with specific IS/IEC. When the specified requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards which ensure equivalent or better performance that specified in the standards referred under section shall also be acceptable.

In case governing standards for the equivalent for the equipment is different from IS/ IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard of relevant extract of the same. The equipment conforming to standards other than IS/ IEC shall be subject to Purchaser's approval.

In addition to codes and standards specifically mentioned in the relevant technical specifications also refer [redacted].

The full names of the codes and standards mentioned in abbreviations under various equipment heads are as follows:

BS	British Standards
IEC/ CISPR	International Electro-technical Commission
IS	Bureau of Indian Standards
ISO	International Organization for Standards
NEMA	National Electric Manufacturers Association

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

[redacted]

The following procedure for submission and review/approval of the drawings, data,reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' shall be submitted for review and approval of Employer before award of contract. The Contractor shall have to prepare and submit any other drawings and reference documents in addition to the drawings contained in the list, if so required during engineering stage as felt necessary by the Employer. Number of copies of the list for the distribution shall be as mutually agreed between Contractor and Employer.

c. All drawings (including those of sub vendors') shall bear at the right hand bottom corner the 'title block' with all relevant information duly filled in. The format of title block shall approved by Engineer within thirty (30) days after the letter of award. The Contractor shall give this format to his sub vendor along with his purchase order for sub vendor's compliance. The size of title block basic format and its contents shall not be changed. All drawings shall be in English language. All dimensions shall be in metric units.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Contractor shall resubmit the drawings approved under Category II and III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.)

g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.

e. The manuals shall include the following
a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carrieddaily, weekly, monthly & at longer intervals to ensure trouble free operation.

f. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.

g. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.5.5 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Two (2) bound sets alongwith 4 CD-ROMs of all drawing.
c. All documents/designs in two (2) copies as noted above.
d. Contractor shall also furnish two (2) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish one (1) sets of film reproducibles or CD-ROMs of all as-built drawings as decided by the Employer.
e. The Contractor shall also furnish three (3) copies of instruction manuals (after approval) for all the equipments.

3.5.6 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval seven bound copies of all type and routine test reports shall be submitted to Employer.

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

[redacted]

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

[redacted]

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-31
c. Installed in covered area: IP-52
d. Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

3.9 RATING PLATES, NAME PLATES AND LABELS

3.9.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.

3.9.2 The equipment nameplate should preferably be of stainless steel. In case of aluminium, it should be at least 2mm thick. The inscription on the nameplate shall be engraved and no punching shall be accepted except for equipment serial number and year of manufacture. These nameplates shall be black with white engraved lettering.

3.9.3 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.9.4 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.9.5 Name plates of cubicles and panels may be made of non-rusting metal or 3 ply lamicoid.

3.9.6 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.9.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component'

3.13 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.13.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

3.13.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

3.13.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities starting from receipt of materials/equipment at site.

3.13.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

3.13.5 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards

Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

3.13.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

3.13.18 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub vendor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.13.19 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.13.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.13.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.13.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.13.23 Environmental Stress Screening

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1. The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

3.14.1 Typical contents of Quality Assurance Document are as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
iv) Type test report (wherever applicable).
v) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
vi) Heat Treatment Certificate/Record (Time- temperature Chart)
vii) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure). CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

3.14.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

3.14.3 Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory. The Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing finalizing the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
i) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.15 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer not later than 1 month after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above.

3.16 INSPECTION, TESTING & INSPECTION CERTIFICATE

3.16.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.17 PACKAGING & TRANSPORTATION

3.17.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a) The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.

b) The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c) The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d) The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.

e) Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked "Spare Parts Only". They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f) The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.17.2 Transportation

a) The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b) All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer's recommendations. Employer shall have the right to decide the items that should be air freighted and Employer's decision shall be binding on Contractor.

3.17.3 Insurance

a) The Contractor shall insure all shipments and works at his own expense for not less than the

3.19.6 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.19.7 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.19.8 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.20 TERMINAL BLOCKS

3.20.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.20.2 The terminal blocks shall be of 650 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.20.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.20.4 The terminals shall be provided with marking tags for wiring identification.

3.20.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. Aluminium conductor
Circuits
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor.

3.20.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.21 Wiring

3.21.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

3.21.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.21.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires

3.24.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS: 2208 and suitable to mount on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.

3.25 MOTORS

3.25.1 Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

3.25.2 Enclosures

a) For motors to be installed outdoor, the motor enclosure shall have degree of protection IP: 55. For motors to be installed indoor, i.e. inside a box, the motor enclosure shall be dust proof equivalent to IP: 44.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting condensation or other causes from all pockets in the motor casing.

3.25.3 Operational Features :

a) Continuous motor ratings (name plate rating) shall be at least suitable for the driven equipment at design duty operating point of driven equipment that will arise in service.
b) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the given system.

3.25.4 Starting Requirements

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops.
b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
c) The locked rotor current shall not exceed six(6) times the rated full load current for all motors subject to tolerance given in IS:325.
d) Motors when started with driven equipment imposing full staring torque and supply voltage conditions specified shall be capable of withstanding at least two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by a least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Contractor shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated. The speed switch shall be capable of withstanding 120% of the rated speed in either directions of rotation.

3.29.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: 2544 / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.

3.29.2 Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.29.3 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.29.4 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.29.5 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.29.6 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.29.7 Contractor shall make available data on all the essential features of design including the method of assembly of shells and metal parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

3.29.8 Post type insulators shall consist of a porcelain part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.

3.29.9 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.29.10 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued; porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.29.11 Bushings, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/ sample test in accordance with relevant standards.

3.29.12 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.30 TYPE, ROUTINE & ACCEPTANCE TESTS:

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
	ANNEXURE – A
	CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
1.00.00	**General** Unless otherwise stipulated; all equipment together with its associated connectors, where applicable, shall be tested for external Corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).
2.00.00	**Test Levels:** The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.
3.00.00	**Test Methods for RIV:** RIV tests shall be made according to measuring circuit as per International Special-committee on Radio Interference (CISPR) Publication 16-1 (1993) Part-I. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 MHz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts. Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein. In measurement of RIV temporary additional external corona shielding may be provided. In measurement of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals. Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% for the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 420kV 7 220KV is listed in the detailed specification together with maximum permissible RIV level in microvolts. The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities. The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.

CLAUSE NO. / FEATURES	TECHNICAL REQUIREMENTS
	ANNEXURE – B **SEISMIC WITHSTAND TEST PROCEDURE** The seismic withstanding test on the complete equipment (Except BPI) shall be carried out along with supporting structure. The Bidder shall arrange to transport the structure from his Contractor's premises/Owner's sites for the purpose of seismic withstand test only. The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser.

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

Sl. No.	ITEM DESCRIPTION	UNIT	220V	48V
1	Manufacturer's name			
3	Type of battery			
4	Manufacturer's catalogue reference			
5	Guaranteed Ah Capacity of battery at 27° C at 10 hour discharge rate with end of discharge voltage 1.85V per cell.	Ah		
6	Nominal voltage rating	V/cell		
7	Short circuit current for a short circuit at battery terminals	kA		
8	Duration for which battery can withstand short circuit current			
9	Cells: 1. No. of cells per battery 2. Type of the cell 3. Cell designation 4. Material of container 5. Overall dimensions of each cell 6. Sediment space (mm) 7. Net dry weight 8. Weight of cell with electrolyte 9. Recommended maximum period of storage before the first charge 10. Recommended cell centre to centre distance (mm)			
10	Inter cell connector: i) Material of connector ii) Type of insulation if provided			
11	Plates: i) No. of positive plates per cell ii) Type of positive plate iii) Type of negative plate			
12	Separator i) Type ii) Material			
13	Electrolyte i) Amount of electrolyte for first filling ii) Sp. gr. of electrolyte at 27 °C. - at the time of first filling - at the end of full charge - at the end of discharge at 10-h rate iii) Maximum electrolyte temperature	Litre		
14	Total shipping weight of electrolyte for one battery unit.	Kg		

15	Total shipping weight of one battery unit (without electrolyte)	Kg		
16	Racks i) No. of racks per battery ii) No. of cells per rack iii) Material and finish of rack Paint shade Alkali / acid resistant coating detail			
17	Recommended boost charging current	A		
18	Recommended boost charging voltage	V/cell		
19	Recommended float charge voltage	V/cell		
20	Float charging trickle current	A		
21	Recommended equalize charge rate - Current - Voltage per cell - Duration for equalize charging - Frequency of equalize charging	 A V/cell		
22	Internal resistance of each cell Fully charged condition Fully discharged condition			
23	Recommended air changes per hour			
24	Battery Charge-Discharge Curves Enclosed	Yes / No		
25	Applicable Standards	IEC		

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SECTION-5

CHECKLIST FOR LEAD ACID BATTERY BANK

Put a tick mark on 'YES' if the specified requirement is met, or put a tick mark on 'NO' if the specified requirement is not met and give comments in the remark column

1. TECHNICAL REQUIREMENTS

Sl. No.	Parameters	Required Value 220V BATTERY (BOQ S.No 1)	Required Value 48V BATTERY (BOQ S.No2)	Required Value 48V BATTERY (BOQ S.No3)	Bidder's Confirm-ation	Reasons for non compliance
1.	Manufacturer's Identification System	As per clause 3.02.09/ 7.02.09 Annx-A	As per clause 3.02.09/ 7.02.09 Annx-A	As per clause 7.02.09 Annx-A	YES	
2.	Battery Type	Ni-Cad / Lead Acid plante	Ni-Cad / Lead Acid plante	Lead Acid plante	YES	
3.	Battery Voltage	220V	48V	48V	YES	
4.	Design Ambient Temperature	50deg. C	50deg. C	50deg. C	YES	
5.	Max. Battery Bank Voltage	242V	52.8V	52.8V	YES	
6.	Min Battery Bank Voltage	198V	43.2V	43.2V	YES	
7.	Nominal Discharge Voltage per cell	1.2V/2V	1.2V/2V	2V	YES	
8.	Nominal voltage per cell	2.0V	2.0V		YES/NO	
9.	Cell container	As per clause 3.02.01/ 7.02.01 Annx-A	As per clause 3.02.01/ 7.02.01 Annx-A	As per clause 7.02.01 Annx-A	YES/NO	

SECTION-5

10.	Vent Plugs	As per Clause 3.02.02 /7.02.02 Annex-A	As per Clause 3.02.02 /7.02.02 Annex-A	As per Clause 7.02.02 Annex-A	YES	
11.	Plates , Sediment Space , Cell insulator	As per 3.02.03/04/05 or 7.02.03/04/05 of Annex-A	As per 3.02.03/04/05 or 7.02.03/04/05 of Annex-A	As per 7.02.03/04/05 of Annex-A	YES/NO	
12.	Electrolyte	As per clause 3.02.06/7.02.06 Annx-A	As per clause 3.02.06/7.02.06 Annx-A	As per clause 7.02.06 Annx-A	YES/NO	
13.	Connectors and Fasteners	As per clause 3.02.07/ 7.02.03 Annx-A	As per clause 3.02.07/ 7.02.03 Annx-A	As per clause 7.02.03 Annx-A	YES/NO	
14.	Battery Racks	As per clause 3.02.08/ 7.02.08 Annx-A	As per clause 3.02.08/ 7.02.08 Annx-A	As per clause 7.02.08 Annx-A	YES/NO	
18.	Arrangement for connection for cell tapping provided for continuity during boost charging?	Yes	Yes		YES/NO	
20.	Accessories as per clause 1.3.2 of section-1 included in the scope of supplies	YES	YES		YES/NO	
21.	Mandatory spares quoted in line with clause 1.3.3 of section-1	YES	YES		YES/NO	

22.	Supply of electrolyte for first filling plus 10% extra with the battery bank	YES	YES		YES/NO	
23.	All routine & acceptance tests to be conducted	As per clause 8.02.00	As per clause 8.02.00		YES/NO	

24. Sizing Calculation for deciding Ampere hour rating of battery as per specified duty cycle (Annexure B,C) has been submitted along with offer for review.

YES/NO

2. TYPE TESTS

SECTION-5

1. Whether the offered equipment has been type tested within Ten years from the date of bid opening **(Date of bid opening is 15.11.2013)** and valid reports are available.

YES /NO

2. If yes, furnish the report number.

Sl. No.	TESTS	REPORT NO.	YES/NO
1.	Test for capacity and voltage during discharge		
2.	Ampere hour and watt-hour efficiency test		
3.	Test for loss of capacity		
4.	Endurance test		

3. If case, the reports are not found complete / valid at contract stage, such type tests shall be carried out without any cost / delivery implication.

YES

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