BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	RD	VK	RS
TITLE		SIGN			
220V & 48V BATTERY BANK		DATE	26/06/14	10/7/14	11/7/14
		GROUP	TBEM	W.O. No	83001

CUSTOMER	RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD
CONSULTANT	TATA CONSULTING ENGINEERS LTD (TCE)
PROJECT	400kV SWITCHYARD AT 2 X 660 MW SURATGARH SUPER-CRITICAL THERMAL POWER STATION, STAGE-V, UNIT-7 & 8

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

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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 & 48V Lead Acid Plante-Type Battery Bank complete with rack assembly and other accessories as required for trouble free operation of batteries.

This section covers the specific technical requirements of Battery Bank. This constitutes minimum technical parameters for the above item as specified by the customer (RRVUNL). 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.

The equipment is required for the following project:

Name of the Project	:	**400kV Switchyard at 2x660 MW Suratgarh Super-Critical Thermal Power Station, Stage-V, Unit-7 & 8**
Name of Customer	:	**Rajasthan Rajya Vidyut Utpadan Nigam Ltd (RRVUNL)**
Name of the Consultant	:	**Tata Consulting Engineers Ltd (TCE)**

1.1 SPECIFIC TECHNICAL REQUIREMENTS

1.1.1 As per attached Annexure-1 (RRVUNL/TCE specification, 4 pages).

1.1.2 The details of the Lead Acid Plante-Type battery bank are tabulated below:

Nominal Voltage Rating (V)	220	48
Type of battery bank	Lead Acid Plante-type	
AH capacity of Battery	As per BOQ (may be subject to a change of +20% before the placement of order)	
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.**	
Discharge performance	High discharge type	
No. of Cells per battery	108	24
Maximum Battery Bank Voltage	242	52.8
Minimum Battery Bank Voltage	187	40.8
Cell Float Voltage(Volt)	2.25	
End Cell Voltage(Volt)	1.85	
Ageing Factor	1.00	
Min. Electrolyte temp. for Battery Sizing	7.2°C	
Min. Ambient design temperature	-2.8°C	
Max. Ambient design temperature	50°C	
Tap cell arrangement	To be provided	

1.1.3 All the accessories required for installation, testing and maintenance shall be supplied with the batteries. Bidder to also include in their offer, the accessories not listed in the specification but required for successful installation and testing of battery banks and same shall be brought in notice during tendering stage.

1.2 QUANTITIES

1.2.1 Main Equipment

Sl. No	Description	Unit	Quantity			
			Suratgarh S/S	Bikaner S/S *	Babai S/S *	Total
1.	220V, 670AH, Lead Acid Plante-Type Battery Bank complete with rack assembly and all accessories	Set	2	-	-	**2**
2.	Supervision of Erection, Testing & Commissioning of one set of 220V, 670AH Battery Bank	Lot	2	-	-	**2**
3.	48V, 600AH, Lead Acid Plante-Type Battery Bank complete with rack assembly and all accessories	Set	2	-	-	**2**
4.	Supervision of Erection, Testing & Commissioning of one set of 48V, 600AH Battery Bank	Lot	2	-	-	**2**
5.	48V, 200AH, Lead Acid Plante-Type Battery Bank complete with rack assembly and all accessories	Set	-	2	2	**4**
6.	Supervision of Erection, Testing & Commissioning of one set of 48V, 200AH Battery Bank	Lot	-	2	2	**4**
7	**Spares**					
7.1	Connectors with Nuts & Bolts (3% of total quantity)	S	1	1	1	**3**
7.2	Vent Plugs (3% of total quantity)	S	1	1	1	**3**
7.3	Cell container empty (4 Nos. of each size and rating)	S	1	1	1	**3**

Note:

Bidder to quote for both type of 48V battery banks as mentioned in Sl. No. 3 and 5 above, however, * marked items for Bikaner and Babai s/s may not be ordered.

1.2.2 Accessories Required

Each Battery bank shall be complete with rack assembly and accessories required for installation, maintenance and testing of batteries, including but not limited to the following:

Sl. No.	Description	Quantities
1.	±3 volts DC voltmeter with built-in discharging resistor and suitable leads for measuring cell voltage	1 No.
2.	Hydrometer for measuring specific gravity of electrolyte in steps of 0.005	1 No.
3.	Set of hydrometer syringes suitable for the vent holes in different cells	1 No.
4.	Filler hole thermometer fitted with plug and cap and having specific gravity correction scale	1 No.
5.	Pocket Thermometers	3 No.
6.	Acid resisting funnels	3 No.
7.	Acid resisting Jugs of adequate capacity	2 No.
8.	Cell Lifting Straps	2 No.
9.	PVC Spill trays under the battery cells	1 Set
10.	Specific gravity correction chart	2 No.
11.	Wall mounting type holder made of teak wood for hydrometer thermometer	1 No.
12.	Rubber apron	2 No.
13.	Pair of rubber hand gloves	4 No.
14.	Set of spanners	1 No.
15.	No smoking notice	1 No.
16.	Goggles (industrial)	1 No.
17.	Instruction card	10 No.
18.	Minimum and maximum temperature indicator for each battery room	1 No.
19.	Alkali Mixing Jar	1 No.
20.	Connectors along with associated nuts, bolts and washers / Bridging clamps	2 Sets
21.	Acid level indicator float	2 No.
22.	First Aid Box	1 No.
23.	Vent Plugs (for each type of battery)	10 No.

Sl. No.	Description	Quantities
24.	Acid resistant battery racks	1 Lot
25.	Porcelain insulators, rubber pads, trays, etc.	1 Lot
26.	Set of lead coated inter-cell, inter-tier and inter-bank connectors as required for the complete installation	1 Lot
27.	Electrolyte for first filling + 10% Extra	1 Lot

Notes:

Notwithstanding the list of accessories and devices detailed under this specification, the Supplied battery banks shall be freestanding on floor & complete in all respect for erection, Installation & putting into service.

1.3 TESTS

1. All routine and acceptance tests shall be conducted as per the relevant standards.

2. Capacity test and test for voltage during discharge shall be carried out at site on completion of installation and commissioning and immediately prior to putting the battery in service.

3. **Type Tests:**

   The offered equipment should have been successfully type tested as per relevant IS/IEC and valid test reports shall be submitted. Bidder shall submit valid reports of type tests for battery banks carried out within **five years from 03.12.2012**. If these tests have been conducted more than 5 years prior from **03.12.2012** or do not have valid test report, the type test shall be repeated without cost and delivery implication to BHEL/RRVUNL.

1.4 INSTALLATION, COMMISSIONING & TESTING

Manufacturer of Battery shall supervise the installation and commissioning and perform commissioning tests as recommended in O&M manual / or relevant standards. All necessary instruments, material, tools and tackles required for installation, testing at site and commissioning are to be arranged by bidder.

ANNEXURE - 1

1. 220V DC SYSTEM

1.1 220V DC power supply is the most reliable source of power supply for control, protection, interlock and annunciation requirements of the power station during the normal running of the plant as well as for a safe shut down at the time of the total power supply failure. For arranging the 220V DC supply for the above, the following shall be provided.

a) 2 X 100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for each unit to cater to respective unit DC loads.

b) 2 X 100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided to cater to station DC loads.

c) 2 X 100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for 400kV switchyard..

d) 2 X 100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for coal handling DC loads.

e) 2 X 100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for ash handling DC loads.

f) 1×100% rated 220V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 220 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for Construction power supply requirements.

g) 2 X 100% rated 48V DC Lead Acid Plante type batteries with associated 2 X 100% Float cum Boost battery chargers, 48 V DC Distribution Boards (DCDBs) & associated accessories shall be provided for River water system DC loads.

h) For systems not covered above, DC power supply shall be taken from the nearest available DC source.

1.2 Sizing

1.2.1 220V DC Battery shall be rated to cater to the following loads with minimum duration as indicated. The design of the DC system shall be such that the variation in the DC system voltage is limited to +10% to -15% of the nominal

voltage of 220V. Number of cells, ampere hour to be realised as per the requirement.

a) Momentary load (Loads consuming DC power for 1 minute or less)

i) Tripping load of GCB, 400kV ,11kV , 6.6 kV and 415V breakers

ii) Starting current of all DC drives

iii) Solenoid valves

iv) In rush current of excitation system.

b) Emergency load (Loads consuming DC power for more than 1 minute but less than or equal to 2 Hours)

i) Running current of essential DC motors

ii) Emergency lighting

c) Continuous Load (Loads consuming DC power for more than 3 Hours but less than or equal to 10 Hours)

i) Indicating lamps on switchgear and control & relay panels

ii) control room emergency lighting

iii) Auxiliary relays

1.2.2 The battery shall be sized in accordance with the latest version of IEEE 485-considering temperature correction factor, contingency, ageing factor and suitable design margin. The ageing factor for Plante type Batteries shall be one (1).

1.2.3 **Battery Chargers:**

1.2.3.1 Each Float cum Boost charger (FCBC) shall be calculated from the following, whichever is higher.

(a) Float Charger: Continuous load on the DC bus with 25% margin+ Trickle charging current+ Full load current of highest rated DC motor

(b) The Boost charger unit shall be rated such that the battery can be charged from fully discharged condition within 10 hours.

1.3 The 220V DCDB of each unit will be provided with two incomers and a bus coupler.

1.3.1 Under normal conditions, Bus coupler will be kept open with each Float cum Boost charger will feed 50% of the total load and trickle charging current of the respective battery.

1.3.2 In case of total AC supply failure in the plant or power supply failure to the charger, the respective battery will meet the corresponding loads. In case one of the chargers require repair/maintenance, then all the DC loads are transferred to the healthy battery charger by isolating the corresponding incomer to the DCDB and closing the bus coupler. During this period, if there

is an AC supply failure, the battery which is connected to the healthy charger will feed 100% loads.

1.3.3 After restoration of AC supply, the fully/partly discharged battery will be recharged one at a time using the corresponding boost charger. During this time, the charger will be disconnected from the loads, by opening the DCDB incomer and 100% of the loads will be fed from the other charger.

2. **48 V DC System**

2.1 2x100% batteries with 2 sets of 100% rated float cum boost chargers and DC switchboard for catering to the DC loads of PLCC equipment for the sending end.

2.2 2x100% batteries with 2 sets of 100% rated float cum boost chargers and DC switchboard for catering to the DC loads of PLCC equipment for the receiving end.

3. **SPECIFIC REQUIREMENTS**

3.1 The Batteries shall be lead acid Plante type with transparent containers capable of high discharge performance as per Table – 2 of IS:1652 for Plante cells.

3.2 The battery shall be closed top or sealed in type. Open type cells are not acceptable.

3.2.1 All the accessories required for testing and maintenance shall be supplied with the batteries along with electrolyte for first filling. These shall also include ± 3 volts DC voltmeter with suitable leads for measuring cell voltage and hydrometer for measuring specific gravity of electrolyte in steps of 0.005.

3.3 **220V and 48 V Battery Charger**

3.3.1 The float cum boost charger offered shall be static type with silicon controlled rectifiers and diodes, complete with resistor/capacitor network for surge protection, connected in three phase full wave bridge circuit.

3.3.2 Charger shall have provision for manual control if the auto mode fails. Load limiting features shall be provided. The charger shall be designed for adequate short time over load to take care of the starting of the largest DC motor/testing of lamps, etc. with other DC loads connected to bus.

3.3.3 The chargers shall be provided with automatic voltage regulation in float mode and automatic constant current regulation in boost mode.

3.3.4 The charger shall essentially comprise the following items:

- One (1) moving coil DC voltmeter and ammeter of size 96x96 mm of suitable range for float cum boost chargers. Necessary shunts for local and remote metering shall be provided.
- One (1) moving coil centre zero ammeter, with shunt, size 96 x 96 mm to read discharge / charge current of the battery.

3.3.5 Fault indicating lamps shall be provided on the charger cubicle and following initiating contacts shall be provided for remote alarm for each of the float cum boost chargers. The alarms shall be provided on the CRT in the common control room.

- Main AC failure
- AC input fuse blown
- DC output fuse blown
- U/V and current limit protection
- Over voltage protection
- Overcurrent protection
- Filter condenser fuse blown
- Rectifier fuse blown
- In addition to the above, any additional indication/alarms considered necessary during the detailed engineering shall also be provided.

3.3.6 A Charger schematic is attached with this specification for bidder's guidance. Ref. Drg No. TCE-5750-EL-SK-2002.This is only indicative and Vendor should further develop the scheme

3.3.7 For all the above alarms, a group alarm for each charger shall be provided on the back up panel.

3.3.8 The charger shall be provided in air conditioned room otherwise forced cooling shall be provided to dissipate the heat developed within the panel.

3.4 The offered batteries and chargers shall comply with the technical requirement table given below:

4. TESTS FOR BATTERIES

4.1 All routine and acceptance tests shall be conducted as per the relevant standards. Type test certificates for tests conducted on identical design and capacity of the Battery shall be submitted for review. If type tests have not been done or the certificates are found to be not in order by purchaser then these type tests shall be conducted on one set of Battery to be supplied for this project.

4.2 Capacity test and test for voltage during discharge shall be carried out at site on completion of installation and commissioning and immediately prior to putting the battery in service.

5. TESTS FOR BATTERY CHARGERS

5.1 The following routine tests shall be conducted at Vendor's works:

SECTION 2

EQUIPMENT SPECIFICATION

2.1 GENERAL

This section covers the general technical requirements of Lead Acid Plante-type high discharge battery bank.

2.2 APPLICABLE STANDARDS

The Lead Acid Plante-type battery shall conform to the following Indian / International standards except as modified in this section of specification:

Sl. No.	Standard	Details
1.	Stationary cells and batteries, lead-acid type with Plante positive plates	IS:1652:1991
2.	Reagent grade water	IS : 1070 : 1992
3.	Potassium Hydroxide, Code of Safety	IS : 6954
4.	Potassium Hydroxide, Technical and Analytical	IS : 6831
5.	Electro-technical Vocabulary, Secondary Cell & Batteries	IS:1885:1965 Part 8
6.	Wooden separators for lead-acid storage batteries.	IS : 652 : 1960
7.	Synthetic separators for lead-acid batteries.	IS : 6071 : 1986
8.	Code of practice for phosphating of iron and steel.	IS : 6005 : 1970
9.	Colours for ready mixed paints and enamels	IS : 5 : 1994
10.	General requirements and methods of test for lead acid storage batteries.	IS : 8320:1982
11.	Quality tolerance for water for storage batteries.	IS : 1069 : 1993
12.	Specification for sulphuric Acid	IS 266
13.	Indicating instruments	IS: 1248

2.3 DESIGN AND CONSTRUCTIONAL FEATURES OF BATTERY

2.3.1 Batteries having complete cell weight of 50kg or more shall be arranged in single tier. The batteries which are interconnected to serve as standby to each other shall be located in separate rooms.

All inter cell connectors and terminals of battery shall be fully insulated/shrouded.

Batteries and chargers shall be connected to DC distribution boards (DCDBs) through single core cables for each pole. The main HRC fuses on battery and charger output shall have alarm contacts. The battery fuse shall be located close to battery in the battery room.

One set of variable metallic resistor and shunt suitable for carrying out discharge tests (10 hour discharge rate) on all batteries shall also be supplied.

2.3.2 CELL TERMINALS

All cell terminals shall have adequate current carrying capacity and shall be of lead alloy or lead alloy reinforced with copper core inserts. Cell terminal posts shall be equipped with connection bolts having acid resisting bolts and nuts.

2.3.3 CONTAINER

Containers shall be made of glass or hard rubber or suitable plastic material or glass fiber reinforced plastics or lead lined wood. Containers shall be robust, heat resistant, leak proof, non-absorbent, acid resistant and free from flaws. Glass containers shall be transparent. 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 marking for the electrolyte level should be for the upper, normal and lower limits. The material of level indicator shall be acid-proof and oxidation proof.

2.3.4 The 220 V DC system is unearthed and 50 V DC system is +ve earth system.

2.3.5 The battery plates shall be of such thickness and strength that these shall not buckle during extreme operating conditions.

2.3.6 BATTERY RACKS

Wooden racks shall be for single tier arrangement for all batteries. These racks shall be made of good quality teak wood. They shall be free standing type mounted on porcelain/hard rubber insulators. As a safeguard against dislocation during earthquake the racks shall be rigidly supported and anchored. The arrangement shall be subjected to the approval of the Owner. Battery racks and wooden supports for cable terminations shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags for each cell shall be attached on to the battery racks.

The batteries being supplied under this specification shall be capable to meet the load cycle as indicated in section 1 with adequate margin for temperature correction and ageing.

The fittings and accessories to be supplied with each battery set shall be as listed in Section-1.

2.3.7 ELECTRODE PLATES

The Plante positive plate shall be of the pure lead lamelle type with plante formation. Negative plate shall be pasted construction and of good workmanship. 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. The positive

and negative terminal posts shall be clearly marked.

2.3.8 SEPARATORS

The separators shall have mechanical strength to withstand handling through assembly and the stresses likely to be met in the battery during service. The separators shall have a micro-porous structure with an overall porosity of at least 50% and shall conform to the relevant I.S.

2.3.9 CONNECTORS AND FASTENERS

Lead or lead coated connectors shall be used for connecting up adjacent cells, rows and end take off. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. End take off connectors shall be provided for end connection from positive and negative poles of the batteries to the power cables. More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on the battery terminals. The cable will be single core having stranded aluminium conductor and PVC insulation, which will be arranged by the owner separately. Necessary wooden 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 minute discharge current of the respective batteries and shall be capable to carry 15 kA for 1 sec.

2.3.10 SEDIMENT SPACE

Sufficient sediment space shall be provided so that cells will not have to be cleaned out during normal life.

2.3.11 CELL INSULATOR

Each cell shall be separately supported on porcelain or hard rubber insulators fixed on to the racks with adequate clearance between adjacent cells.

2.3.12 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 and uncharged. The electrolyte for initial filling shall be furnished separately. Required quantity of electrolyte for first filling with 10% extra shall be supplied in non-returnable containers.

2.3.13 VENT PLUGS

Vent plugs shall be provided in sealed type cells. They shall be of anti-splash type, having more than one exit hole and shall allow the gases to escape freely but shall prevent acid from coming out. Open type cells shall be provided with suitable arrestors to prevent spilling of electrolyte.

2.3.14 MANUFACTURER'S IDENTIFICATION SYSTEM

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

1. Manufacturer's name and trade mark
2. Country and year of manufacture
3. Manufacturer's type designation
4. AH capacity at 10 hr. discharge rate
5. Serial number
6. Upper and lower electrolyte level in case of transparent containers.

2.4 TESTS

In accordance with the stipulations of the specification, the batteries shall be subject to type, acceptance and routine tests as per relevant IS/IEC.

In accordance with the requirements stipulated under section 3, the batteries should have been type tested as per IEC/IS and shall be subject to routine and acceptance tests in accordance with IS/IEC document. Type test reports of the tests conducted earlier on similar equipment shall be submitted. It is the responsibility of the supplier to get the test reports approved from the ultimate customer (RRVUNL) with no commercial implications to BHEL. If the valid type test reports are not available with the bidder then the tests shall be conducted by the bidder free of cost.

If the purchaser insists to re-conduct the type test, the same shall be conducted on chargeable basis, for that the bidder shall submit the test charges in the price bid.

Batteries shall conform to all type tests as per the latest issue of IS: 1652.

The following shall constitute type test and shall be carried out in the given sequence:

1. Verification of constructional requirements
2. Verification of marking
3. Verification of dimensions
4. Test for capacity and voltage during discharge
5. Ampere-hour and watt-hour efficiency tests
6. Test for retention of charges
7. Endurance test

The following shall constitute the acceptance tests:

1. Verification of marking
2. Verification of dimensions

3. Test for capacity
4. Test for voltages during discharge

All acceptance tests as required by the relevant Indian standards shall be carried out at site after completion of installation. The capacity tests shall be carried out for 10 hr. discharge rating. The contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments. If a battery fails to meet the guaranteed requirements the OWNER shall have the option of asking the contractor to replace the same with appropriate batteries at no extra cost and without affecting the commissioning schedule of the owner.

If successful bidder has not manufactured & commissioned the specified cell size, they must manufacture & test the prototype in advance and obtain owner's approval for the same.

Following type tests shall be carried out on each type of cell in the presence of owner's representative, if desired by the OWNER:

1. Capacity tests
2. Watt hour and AH efficiency tests

The contractor shall give at least three (3) weeks advance notice of the date when the tests are to be carried out. Three (3) copies of type test certificates shall be furnished to the OWNER for approval before the dispatch of the equipment from works. The cost of the cells to be used for type tests shall be included in the respective type test charges quoted by bidder. These cells shall not be supplied.

2.5 PACKING AND MARKING

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.

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.

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.

2.6 List of Documents to be Submitted at Tender and Contract Stage

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

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, equipments and services covered under other respective sections 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 hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd, Jaipur
b)	Consultant	Tata consulting Engineer Ltd, Bangalore
c)	Project Title	2X660MW Super –Critical Thermal Power Station, Stage –V, Unit 7 & 8 - 400kV Switchyard at Suratgarh
d)	Location	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan
e)	Altitude and longitude	Lattitude:29 deg. 10 min. N Longitude: 74 deg. 01 min. E
f)	Elevation above mean sea level	186 m(approximately)
g)	Transport Facilities	Suratgarh project is located 27 km from Suratgarh , 15 km from Suratgarh to Biradhwal on NH15, 12km in east from NH15.
h)	Postal Address	To follow
SITE CONDITIONS		
a)	Mean of daily maximum temperature	32.3 deg. C
b)	Mean of daily minimum temperature	19.6 deg. C
c)	Highest temperature recorded	50 deg. C
d)	Lowest temperature recorded	-2.8 deg. C
e)	Design ambient temperature for electrical equipment design	50 deg. C
f)	Relative humidity	Varies between 21 % and 81%
g)	Pollution Severity	Heavily Polluted
h)	Seismic zone	II

i)	Basic Wind speed	47 m/sec
j)	Annual mean wind speed	4km/hr
k)	Terrain category	2
l)	Annual average rain fall	312 mm

SYSTEM PARAMETERS

Nominal system voltage	**400 kV**	**11kV**
Highest system voltage	420 kV	12kV
Basic Impulse level(dry /wet)	1425kVP	75kVP
Power frequency withstand voltage	630kVrms	28kVrms
Switching Impulse withstand voltage	1050 kVP	NA
Rated short time current	50 kA for 3 sec	40 kA for 1 sec
Frequency	50 Hz	50 Hz
Creepage distance	31mm/kV	31mm/kV
System Earthing	Effectively Earthed	Effectively Earthed

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V ± 10%, 50 Hz, 3-phase 4 wire, solidly earthed with variation in frequency of ± 5%
1 phase A.C power supply	240V ± 10%, 50 Hz, 1-phase , 2 wire , AC supply with variation in frequency of ± 5%
D.C. power supply	220V ±15%, 2-wire ungrounded 48V ±10%, 2 wire system positively earthed

Combined variation of voltage and frequency shall be +/- 10%

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out within last **five years from the date of opening of the tender** (i.e. 03.12.2012) as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/ similar components /equipment/systems to those offered / proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.3 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood 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.

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 component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him. All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All the steel works shall be thoroughly cleaned of rust , scale , oil , grease, dirt and scarf by pickling , emulsion cleaning , etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints . After application of the primer, two coats of finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be **glossy white** and exterior of the treated sheet steel shall be **shade 631 of IS 5 /RAL 7032** for all switchboard /MCC/distribution board , control panels etc.

Sufficient quantities of touch paint shall be furnished for application at site. All the indoor cubicles shall be the same as exterior surface and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the 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 interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM. Average weight of zinc coating shall be **750gm/sq.m.**

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-42

c) Installed in covered area IP:52

d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads,

for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **650 V** grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4,** Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with **test links and isolating facilities.** The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible..

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel . Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled . The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along

with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project atleast 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, RRVUNL contract no. and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 3 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	7	8	-
2	Drawings "As Built"	-	-	8	05
3	Type Test Reports	1	3	4	-
4	Erection Manuals	-	7	8	-
5	Operation and Maintenance Manuals	-	7	8	-
6	Manufacturing Quality Plan	1	7	8	-
7	Field Quality Plan	1	7	8	-
8	Inspection Test Reports	-	-	8	-

Soft copies of drawings at contract stage shall also be submitted in **PDF format.**

Drawings will also be submitted in CD in AUTOCAD package for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

SECTION 4

GUARANTEED TECHNICAL PARTICULARS

Sl.No.	Description	220 V Battery	48V Battery
1.	Manufacturer's Name		
2.	Guaranteed AH. Capacity at ten hours discharge rate to 1.85 volts per cell at 27^0C		
3.	AH Capacity at one hour discharge rate to 1.75 volts per cell at 27^0C		
4.	Cell designation in accordance with Indian Standards		
5.	Applicable Indian Standards		
6.	Average life in years		
7.	Recommended range of float/boost charging voltage		
8.	Boost charging current		
9.	Open circuit voltage of cell when completely discharged at 27^0C		
	a) At ten hours discharge rate		
	b) At one hour discharge rate		
10.	Type of construction of positive plates		
11.	Type of construction of negative plates		
12.	Containers		
	a) Type		
	b) Material		
13.	Sediment space (mm)		
14.	Cell dimensions (mm)		

15.	Recommended cell center to center distance (mm)		
16.	Amount and specific gravity of electrolyte per cell required for first filling at 27^0C		
17.	Specific gravity of electrolyte when fully charged at 27^0C		
18.	Maximum electrolyte temperature that cell can withstand continuously without injurious effects		
19.	Battery Racks		
	a) Type of material		
	b) Outline dimensions (mm)		
	c) Whether anti-acid coating provided		
	d) Net weight (kg)		
20.	Insulators material (for racks and cells)		
21.	Weight per cell		
	a) Net dry weight (kg.)		
	b) With electrolyte (kg.)		
22.	Total shipping weight of acid for one battery unit (kg)		
23.	Total shipping weight of one battery unit (without electrolyte)		
24.	Short circuit current at Battery terminals		
25.	Time for which the battery can withstand short circuit at terminals		

26.	Internal resistance of each cell		
	a) Full charged condition		
	b) Fully discharged condition		
27.	Recommended air charges per hour		
28.	Aging Factor		

SECTION 5

CHECKLIST FOR LEAD ACID PLANTE 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.

A) TECHNICAL REQUIREMENTS

Sl. No.	Parameters	Data		Bidder's Confirmation	Remarks
		220V	**48V**		
1.	Type	Lead Acid Plante-Type, high discharge		YES/NO	
2.	Nominal Voltage Rating (V)	220V	48V	YES/NO	
3.	AH capacity at 27 degC at 10 hr discharge rate to end-cell voltage 1.85V per cell	As per BOQ (may be subject to a change of +20% before the placement of order)		YES/NO	
4.	Nominal voltage per cell	2.25V		YES/NO	
5.	End Cell Voltage for specified duty Cycle	1.85V		YES/NO	
6.	No. of Cells per battery bank	108	24	YES/NO	
7.	Cell container	Transparent		YES/NO	
8.	Type of Stand offered	Freestanding on floor complete with necessary hardware		YES/NO	
9.	Stand coating	As per specification		YES/NO	
10.	Arrangement for connection of cell tapping provided for continuity during boost charging	Yes		YES/NO	
11.	Applicable standard	IS-1652		YES/NO	
12.	Complete set of accessories as per specification included in the scope of supplies	YES		YES/NO	
13.	Supply of electrolyte for first filling plus 10% extra with the battery bank	Yes		YES/NO	
14.	All routine & acceptance tests to be conducted as per specification	Yes		YES/NO	

B) TYPE TESTS

i) Whether the offered equipment has been type tested as per specification within **five years from 03.12.2012** and valid reports are available. **YES/NO**

ii) In case the reports are not found complete / valid at contract stage, such type tests shall be carried out without any cost / delivery implication. **YES/NO**

C)

Sl.No.	Description	Confirmation of Supplier
1.	a) Bidder to confirm that there are no deviations and the offer is in full compliance with the specification. b) Bidder to confirm that there are no deviations in any other form such as comments, variations and/ or exceptions. c) Bidder to confirm that all drawings / data sheets/QP/ valid type tests reports/ all relevant information shall be submitted to BHEL for organising approval of ultimate customer.	
2.	Bidder to confirm that it will offer approved Make of the components and fitments at contract stage. In case the offered make is not approved by the customer, then alternate make shall be supplied without any commercial implications to BHEL.	
3.	Qualifying requirements, if any, mentioned in the tender document are being met	

Date:

Signature of the authorized representative of Bidder

Company Seal