

**THE WEST BENGAL
POWER DEVELOPMENT CORPORATION LIMITED
2 X 500 MW SAGARDIGHI TPS
PHASE-II (UNIT # 3 & 4)**

VOLUME – IIB

***TECHNICAL SPECIFICATION FOR
220V DC BATTERY***

BHEL DOCUMENT NO. : PE-TS-373-508-E001, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA – 201301**



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 1 OF 53

CONTENTS

<u>S. NO.</u>	<u>CONTENTS</u>	<u>NO. OF SHEETS</u>
01	INSTRUCTIONS TO BIDDERS	01
02	DEVIATION SCHEDULE	01
03	PREAMBLE	01
04	SECTION – 'A' SCOPE OF ENQUIRY	01
05	SECTION – 'B' PROJECT INFORMATION	02
06	SECTION – 'C' SPECIFIC TECHNICAL REQUIREMENT	09
	ANNEXURE-A BOQ-cum-PRICE SCHEDULE	02
	ANNEXURE-I CUSTOMER'S TECHNICAL SPECIFICATION	25
	ANNEXURE-II LIST OF APPLICABLE STANDARDS	01
	ANNEXURE-III LOAD DUTY CYCLE-220V DC SYSTEM	01
	ANNEXURE-IV ONE LINE DIAGRAM FOR 220V DC SYSTEM	01
	ANNEXURE-V ACCESSORIES	01
	ANNEXURE-VI LIST OF STANDARD DELIVERABLES	01
	ANNEXURE-VII NO. OF DRGS/DOCS REQUIRED	01
07	DATASHEET-'A' DC BATTERY	01
08	DATASHEET-'C' DC BATTERY	02
09	SECTION – 'C' QUALITY PLAN	01

TOTAL NO. OF SHEETS =52 (INCLUDING COVER/ SEPARATOR SHEETS)

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 | DATE 09.11.2012

SHEET 2 OF 53

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. In line with clause no. 10.1 of Section-C, Volume-II-B of the specification, two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a. Battery sizing calculation with respect to load duty cycle as per Annexure-III of Section-C to be provided along with supporting documents for considered factors.
 - b. Unpriced Price Schedule (Annexure-A: BOQ & price schedule, as enclosed with the specification) with bidder's signature and company stamp.
 - c. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
 - d. A copy of previous sheet ("List Of Contents"), with bidder's signature and company stamp.
 - e. A copy of next sheet ("Deviation Schedule"), with "NO DEVIATION" and bidder's signature and company stamp.
 - f. A copy of Data Sheet-A, with required information and bidder's signature and company stamp.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the battery description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 3 OF 53

DEVIATION SCHEDULE

SL. NO.	CLAUSE NO.	DEVIATION	REASONS FOR DEVIATION

It is certified that the offer is fully in conformance to the specification requirements except for the deviations, which are specifically brought out in the above prescribed Deviation Schedule.

Signature & seal of Bidder's authorized representative



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 4 OF 53

PREAMBLE

1.0 The Tender documents contains three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:-

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATION**

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 **VOLUME – IIB**

This volume is sub-divided in to following sections:-


Section – A This section outlines the Intent of Specification

Section – B This section provides “Project Information”.

Section – C This section indicates Technical Requirements specific to Contract.

Data sheet - A :- Specific data and other requirements pertaining to the equipments.

Data sheet – C :- Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

	TECHNICAL SPECIFICATION FOR 220V DC BATTERY	SPECIFICATION NO. PE-TS-373-508-E001	
		VOLUME II B	
		SECTION -	
	2X500 MW SAGARDIGHI STPP	REVISION 0	DATE 09.11.2012
		SHEET 5 OF 53	

SECTION - A

SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of 220V DC Battery as mentioned in different sections of this specification for 2 X 500 MW SAGARDIGHI TPP (UNIT #3 & 4), WEST BENGAL.
- 2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Deviations, if any should be brought out very clearly on deviation sheet enclosed with specification only. Otherwise it will be presumed that the bidder's offer is in line with what has been stated/ asked for in this specification.
- 6.0 The offer should be complete with technical data, catalogue, brochures and drawings, as applicable.
- 7.0 Qualification data: In order to be able to present to the client the provenness of the equipment offered, the bidder is required to furnish elaborate details of experience, capabilities, reference list etc. in the offer.
- 8.0 The documents shall be in English language and MKS system of units.



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 6 OF 53

SECTION – ‘B’



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 7 OF 53

1. SOURCE OF COAL

The Power Station has been linked to Jhanjra, Chitra and Sarpi mines of Eastern Coal fields (ECL) and Panchwara & Damagoria for extension units.

Coal will be transported on broad-gauge line of Eastern Railways from the coal fields to the Power station in BOBRN rake loads.

Fuel oil (HFO/LDO) will normally be transported by railway oil tankers from nearest oil depot.

2. SOURCE OF WATER

The water requirement for the Power station will be met by drawing water from river Bhagirathi at a distance of 6 KM east of project site.

The Power station will operate on closed cooling system using Natural Draft Cooling Towers. In addition, all water conservation and recycling measures will be adopted to minimize requirement of makeup water.

3. ASH DISPOSAL AREA

The ash disposal area for the station is located about 1 Km from the plant site.

The Site Location Plan will give an idea of the locations of the site, colony, ash disposal area and rail and road connections.

4. SALIENT CLIMATOLOGICAL AND DESIGN DATA

Unless otherwise specified, the following design conditions shall be considered for the equipment offered:

- a) Design ambient dry bulb : 50 °C maximum, 5 °C minimum temperature
- b) Maximum relative humidity : 84%
- c) Average relative humidity : 73%
- d) Highest wet bulb temp. : 26.9 °C
- e) Average annual rainfall : 1389 MM
- f) Seismic zone : Zone-III as per IS-1893 latest revision
- g) Wind load : In accordance with IS-875 for a basic wind speed of 47 m/sec upto a height of 10 metres above mean ground level. For further details refer Volume II-G of this specification.
- h) Altitude : 34M above MSL.



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 8 OF 53

SECTION – C



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 | DATE 09.11.2012

SHEET 9 OF 53

SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE OF ENQUIRY

This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub-vendor's works, packing and despatch to site of 220V DC batteries as described in the various sections of this specification. The batteries shall generally conform to IS and IEEE . In this specification, as erection and commissioning is not included in vendor's scope, Vendor shall still not be absolved of his responsibility of establishing the correctness of equipment at site.

2.0 EQUIPMENT AND SERVICES TO BE FURNISHED BY THE BIDDER

The bidder shall supply the following equipment in accordance with the various sections of this specification. The Unpriced Price Schedule is enclosed as Annexure-A.

3.0 SERVICES AND EQUIPMENT TO BE EXCLUDED

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

4.0 CODES AND STANDARDS

Unless otherwise specified, the latest revisions of codes/standards specified in Annexure-II enclosed are applicable and shall be referred to.

5.0 DELIVERY: Ex-works delivery of equipment shall be as per NIT.

6.0 SYSTEM CONCEPT:

6.01 220V DC system for 2 X 500 MW SAGARDIGHI TPP (UNIT # 3 &4), shall be an Ungrounded system comprising of the following:

- i) 3 sets of batteries each with 1 x 100% float and 1 x 100% float cum boost charger.
- ii) Each battery sets connected with sectionalised DCDB to feed complete Unit & associated Station load (as per annexure-IV).

Each battery is sized to cater to complete unit & associated station loads. Each battery & associated charger is connected on one section of DCDB and the other



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 | DATE 09.11.2012

SHEET 10 OF 53

battery & associated charger is connected on another section of DCDB as indicated in One line diagram for 220V DC system in Annexure-IV. DC loads are distributed on each section to provide redundancy. Each battery will have to cater minimum capacity as per load duty cycle requirement enclosed as Annexure-III. Bidder to furnish calculations.

- 6.02 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.
- 6.03 The 220V DC system is designed to cater to 220V DC power requirement of control, protection, interlock, emergency DC lighting and emergency DC drives for power station.
- 6.04 The 220V batteries are sized considering emergency load cycle requirement of one (1) hours (as per Annexure-III) and design factors.
- 6.05 The voltage at load terminal will not exceed the limits of +10% (242V) and -15% (187V) of nominal system voltage for 220V DC system.
- 6.06 DC batteries shall be suitable for continuous operation for the design ambient temperature as defined in Datasheet-A.
- 6.07 Batteries and Chargers shall be connected to DC distribution board through single cores cables for each pole. Battery terminals shall be made suitable for above cable. Battery shall be provided with fuse for short circuit protection.
- 6.08 The equipment will be located indoor in a clean but hot, humid and tropical atmosphere.
- 6.09 Necessary accessories required for maintenance and testing of batteries shall be supplied with each battery bank as per enclosed Annexure-IV.
- 6.10 Batteries with cell weight more than 50 Kg shall be arranged in single tier arrangement. The bottom tier of the stand shall not be less than 150 mm above the floor.

7.0 OTHER TECHNICAL REQUIREMENTS

7.1 Lead-Acid Batteries

- a) Batteries shall be stationery storage Lead Acid Plante high discharge type conforming to IS-1652/IEC60896-11. The batteries shall meet the 'Load Duty Cycle' requirements under all site-operating conditions as specified. IEEE 485



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 | DATE 09.11.2012

SHEET 11 OF 53

should be the principle for sizing the battery including following temperature corrections factors. The batteries shall be boost charged at about 2.75V per cell (maximum) and float charged at about 2.2V per cell.

b) Containers:

Containers shall be made of transparent glass, suitable robust, heat resistant, leak proof, non-absorbent, acid resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pinholes etc. Electrolyte level lines shall be marked on containers in case of translucent containers. The marking for the electrolyte level shall be for upper & lower limits on the container. Container shall be SAN container closed/sealed lid type. Lid and sealing compound shall be non-cracking type. The container made of 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 shall be such that no acid particle gets entrapped due to acid creep as a result of capillary action and it shall be possible to remove and refix the sealing to carry out maintenance.

c) Vent Plugs:

Vent plugs shall be provided in each cell. They shall be anti splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent 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 from topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

d) Plates:

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load. The construction of plate shall be as per IS-1652/ IEC 60896-11.

The separators shall maintain the electrical insulation between the plates and shall permit free flow of electrolyte. Proper arrangement to keep end plates in position shall be furnished. Separators shall be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked.



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 12 OF 53

e) Sediment Space:

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

f) Electrolyte:

The electrolyte shall be prepared from battery grade Sulphuric Acid conforming to IS-266 and distilled water conforming to IS-1069. The cells shall be shipped in dry uncharged condition and electrolyte shall be supplied separately in non-returnable containers. 10% extra electrolyte shall be furnished as accessory to cover spillage in transit or during erection.

g) Connectors and Fasteners:

Lead or lead coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts, clamps and washers shall be lead coated with minimum thickness 0.025 mm to prevent corrosion. The thickness of lead coating shall be measured as per appendix-F of IS-6848. All the terminals and inter-cell connectors shall be fully insulated or shrouded. End take of connections from positive and negative poles of batteries shall be done through single core cable having stranded COPPER conductor and FIRE SURVIVAL CABLES. The bidder shall supply lead coated bent copper plate, tubular copper lugs, teak wood clamp, bolts, nuts, washers, etc. for termination of these cables on batteries. Suitable numbers of inter rack connectors shall be supplied by the bidder to suit the battery room layout during detailed engineering. Calculation for sizing of connectors and fasteners shall be furnished during detail engineering .

All connectors and lugs shall be capable of continuously carrying the 10 hours discharge current of respective batteries and through fault short circuit current, which the battery can produce and withstand for the period of one minute. The successful bidder shall furnish necessary sizing calculations to prove the compliance for the same at contract stage.

h) Battery Racks:

The batteries shall be supported on best quality teakwood racks. The racks shall be free standing type mounted on porcelain insulators. The batteries racks and supports for cable termination shall be coated with three coats of anti-acid paint of approved shade. The nameplates, resistant to acid, for each cell shall be attached on the necessary racks.

Wherever racks are transported in dismantled conditions, match makings shall be provided to facilitate easy assembly.



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 13 OF 53

- i) Following information shall be indelibly marked on outside of each cell:
- Manufacturer's name and trade marks
 - Country and year of manufacturer
 - Manufacturer type designation
 - AH capacity at 10 hour discharge rate
 - Serial number
- j) Positive and negative terminal posts shall be clearly and indelibly marked for easy identification.
- k) Following minimum information shall be given on the instruction cards:
- Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate
 - Maintenance instructions
 - Designation of cell in accordance with IS-1652
 - Storing conditions of electrolyte

8.0 PERFORMANCE GUARANTEE

- 8.1 Bidders shall guarantee that battery offered shall meet the 'Load Duty Cycle' requirements as stipulated in this specification and as confirmed by them in technical data sheets. In case the performance of battery at site is not as per the performance guarantee, the bidder will have to replace the battery at site free of cost.
- 8.2 Make of components shall be subject to BHEL approval.

9.0 INSPECTIONS & TESTING

- 9.1 Equipments offered shall be of type tested design. The bidder shall confirm compliance to quality plan enclosed with the specification, which is subject to customer/ BHEL approval and the inspection shall be carried out based on this approved Quality Plan (QP no. PE-QP-999-508-E002, rev.00).
- 9.2 All acceptance and routine tests as per IS-1652 shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the materials shall be deemed to be included in the bid price.
- 9.3 a) Following type tests are to be carried out on two cells of the battery:
- Discharge performance test at low temperature.
 - Ampere hour & watt hour efficiency test.



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 14 OF 53

- Endurance test.

In addition to the tests mentioned above, tests mentioned in Annexure-I of the Technical Specification are also to be taken care of.

Cost of cells required for carrying out type test shall be included in type test charges.

b) Acceptance test :

- Test for voltage during discharge.
- Test for capacity.

9.4 The bidder shall indicate cost of carrying out all the Type tests as specified in the specification. The charges for each of the Type tests shall be given separately in price schedule (refer cl. no. 9.3).

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

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

10.0 DOCUMENTATION

10.1 By all Bidders alongwith technical offer:

- Battery capacity calculations along with battery performance curves, Capacity calculation curves, derating factors for ambient temperature and float charging factor
- Unpriced Price Schedule (Annexure-A as enclosed with the specification) with bidder's signature and company stamp.
- A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
- A copy of sheet "List Of Contents" with bidder's signature and company stamp.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 15 OF 53

- (v) A copy of sheet "Deviation schedule" with NO DEVIATION and bidder's signature and company stamp.
- (vi) A copy of sheet "Data Sheet-A" with required information and bidder's signature and company stamp.

10.2 Final documents to be submitted after award of contract shall be decided during kick-off meeting and bidder to agree the same without any commercial/ delivery implications. However, tentative list of documents is given below (also refer Annexure-VI):

10.3 No. of prints to be submitted by vendor after award of contract shall be as specified under Annexure-VII.

10.4 Instruction Manuals

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

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

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



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 | DATE 09.11.2012

SHEET 16 OF 53

10.5 Bidder shall furnish field quality plan detailing out the specific quality control procedure covering receipt of material/equipment and handling at site, storage, erection, commissioning, post commissioning etc.

11.0 TOOLS AND TACKLE

Tools & tackle which are essential to facilitate assembly, adjustments, maintenance & dismantling of equipment shall be provided as part of equipment supplied. The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.

12.0 AS-BUILT DRAWINGS

Though only supply of equipment is under bidder's scope, bidder may note that all as-built correction (as given by purchaser to vendor) shall have to be incorporated in the originals by the vendor and copies of the as-built corrected drawings / documents as per requirement shall be submitted by the vendor.

13.0 Statutory and regulatory requirements as per IE rule 1956 with amendment - 3 rule 1986, rules Nos. 35, 42, 50 & 51 shall be adhered to.

14.0 CUSTOMER TECHNICAL SPECIFICATION

Customer technical specification is enclosed in Annexure-I form part of technical specification and shall be complied with.

1. Customer's technical specification for Battery and Battery charger (6 Pages, Vol.II-F2/S-III of Technical Specification No. DCPL-K8A07).

In case of ambiguity between section-C and customer specification, customer specification shall prevail.

ANNEXURE-A
2X500 MW SAGARDIGHI TPS UNIT # 3 4
BOQ cum PRICE SCHEDULE for 220V DC BATTERY

Sr. No.	Item code	Item Description	Unit	Quantity	Remarks
(A)	MAIN ITEMS				
1.0	508-11013-A	LEAD ACID PLANTE 220V BATTERY1	Nos.	3	220V DC, AH capacity to be decided by bidder as per Annexure-II of Section-C, 1.85 ECV, 110 cells, Lead-Acid Plante high discharge battery with 100% electrolyte +10% extra electrolyte, all accessories listed, suitable termination arrangement and metal/teakwood racks
1.1		LIST OF ACCESSORIES WITH EACH BATTERY SET	sets	3	Part of item 1.0
1.1.1		Battery log Book	Nos.	1	
1.1.2		Printed instruction sheet	Nos.	2	
1.1.3		Cell testing voltmeter (3-0-3V) complete with leads.	Nos.	1	
1.1.4		Rubber syringe Hydrometer suitable for specific gravity reading	Nos.	1	
1.1.5		Pocket thermometer (digital type)	Nos.	3	
1.1.6		Thermometer (0 to 100 cent.) with specific gravity correction scale.	Nos.	1	
1.1.7		Cell bridge connector	SETS	1	
1.1.8		Electrolyte resistant plastic funnels and plastic jugs.	Nos.	2	
1.1.9		Battery racks suitable for accomdating the cells coated with paint	SET	1	
1.1.10		Insulator (with 5% extra) rubber pad etc. for rack	SET	1	
1.1.11		Plastic filling bottle for filling up	Nos.	2	
1.1.12		spanners	Nos.	2	
1.1.13		10% extra quantity of Electrolyte in non-returnable containers.	LOT	1	
1.1.14		rubber hand gloves	Nos.	4	
1.1.15		Cell lifting straps	Nos.	2	
1.1.16		Inter cell, inter tie and interbank connectors as required for complete installation	SET	1	
1.1.17		Self- adhesive PVC stickers for cell numbering	NOS	10	
1.1.18		Goggles	NOS	2	
2.0	508-11007-A	E & C SPARES	Set	1	
2.1		Intercell connector	Nos.	5	
2.2		Vent plug	Nos.	5	
2.3		Gloves	Set	2	
3.0	508-11029-A	TYPE TEST	LOT	1	
3.1		Ampere hour and watt-hour efficiency test	LOT		
3.2		Endurance tests	LOT		
3.3		Discharge performance test at low temperature.	LOT		
4.0	508-11000-B	DC LEAD ACID BATTERIES-MS	Set	1	
4.1		Battery cell (Uncharged, Dry)	Nos.	10	
4.2		Interconnecting cell strips	Nos.	10	
4.3		Vent plug	Nos.	5	

ANNEXURE-A
2X500 MW SAGARDIGHI TPS UNIT # 3 4
BOQ cum PRICE SCHEDULE for 220V DC BATTERY

4.4		Teak wood cable clamps with hardware	Nos.	2	
4.5		Hydrometer	Nos.	1	
4.6		Rubber gloves	Pair	1	
4.7		Voltmeter for measuring cell voltage (Center zero type)	Nos.	1	
4.8		Insulated socket spanner with handle	Nos.	1	
4.9		Thermometer	Nos.	1	
(B) OPTIONAL ITEMS					
1.0	508-11024-A	SUPERVISION OF COMMISSIONING	No.	1	
2.0	508-11025-A	SUPV.OF E&C	SET	1	

ANNEXURE - I

VOLUME : IIF/2

SECTION-III

TECHNICAL SPECIFICATION
FOR
BATTERY AND BATTERY CHARGER

BIDDER TO NOTE THAT ONLY BATTERY PORTION OF
THE SPECIFICATION IS APPLICABLE. BATTERY CHARGER
IS NOT APPLICABLE.

CONTENT

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.00.00	INTENT OF SPECIFICATION	V.II-F2/S-III : 1
2.00.00	SCOPE OF SUPPLY	V.II-F2/S-III : 1
3.00.00	GENERAL REQUIREMENTS	V.II-F2/S-III : 2
4.00.00	DESIGN CRITERIA	V.II-F2/S-III : 2
5.00.00	SPECIFIC REQUIREMENTS	V.II-F2/S-III : 5
6.00.00	TESTS	V.II-F2/S-III : 14
7.00.00	SPECIAL TOOLS & TACKLES	V.II-F2/S-III : 16
8.00.00	SPARES	V.II-F2/S-III : 16
9.00.00	TESTS DRAWINGS, DATA & MANUALS	V.II-F2/S-III : 16
ATTACHMENTS		
ANNEXURE-A	RATINGS AND REQUIREMENTS	V.II-F2/S-III : 19
ANNEXURE-B	FITTING & ACCESSORIES AND LIST OF ALARM/ ANNANCIATION/ INDICATION	V.II-F2/S-III : 21

VOLUME : IIF/2

SECTION-III

TECHNICAL SPECIFICATION
FOR
BATTERY AND BATTERY CHARGER

1.00.00 **INTENT OF SPECIFICATION**

1.01.00 This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply and delivery, properly packed for transport to site of BATTERY AND BATTERY CHARGER complete with all accessories for efficient and trouble-free operation.

1.02.00 The scope of work shall also include the supervision of erection, testing, commissioning and putting into successful commercial operation of all equipment furnished under this specification.

1.03.00 In the event of any discrepancy with listed documents, the stipulation of this specification shall govern.

2.00.00 **SCOPE OF WORK**2.01.00 **Scope of Supply**

2.01.01 Type, rating and connections of the equipment listed below are detailed in the subsequent clauses of the specification and attached Annexure. The equipment shall be offered in strict compliance with the same.

- a) 220V station battery for main plant of Plante Type : Four (3) sets.
- b) 220V battery charger, each comprising one (1) float charger and one (1) float cum boost charger : Four (3) sets.

2.01.02 Each set of battery and battery charger shall be supplied complete with fittings and accessories as per list furnished elsewhere in this specification.

2.01.03 Base channel frame, floor channel sill and kick plates for all floor-mounted charger panels, complete with holding down bolts and nuts.

2.01.04 One (1) sets of special tools and tackles.

2.01.05 Mandatory Spare parts

- 2.01.06 Recommended spare parts for three (3) years operation
- 2.01.07 All relevant drawings, data and instruction manuals

3.00.00 **GENERAL REQUIREMENTS**

3.01.00 **Codes and Standards**

- 3.01.01 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.
- 3.01.02 Equipment and material conforming to any other standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.
- 3.01.03 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

4.00.00 **DESIGN CRITERIA**

4.01.00 **Design Basis**

- 4.01.01 DC system shall provide reliable sources of DC power supply for control, indication, protection and annunciation of plant equipment. In addition, it shall also provides emergency DC loads and emergency lighting loads on failure of AC supply.

The 220V D.C. system comprises of three (3) sets of storage battery to be located in powerhouse (Unit # 3, Unit # 4 & one (1) for common system) Battery Room. Common system DC facilities shall be of same capacity as of Unit#3 or Unit #4. Common system DCDB located in power house Battery room shall be interconnected with full capacity tie with unit # 3 & Unit # 4 DCDB, so that in case of failure of any battery, common standby battery can take over the load requirement as shown in single line diagram K8A07-DWG-E-102.

DC power for switchyard shall be fed from existing switchyard battery and DCDB. Bidder shall provide new DCDB and complete DC power distribution arrangement as required for successful operation for the extended bays of 400 KV switchyard. Also Bidder to check the AH capacity of existing battery and DC system, whether the same can be sufficient to meet the additional load requirement for this phase, otherwise bidder shall provide the switchyard battery and DC system and the suitable location for the same shall be decided during detail engineering stage. The take out price for battery/battery charger shall remain valid till the execution of contract.

All sets of batteries mentioned above shall be lead acid PLANTE type and complete with associated float charger and float-cum-boost charger for each battery bank. In addition one no spare float cum boost charger shall also be provided.

- 4.01.02 The battery shall be sized to meet emergency load duty cycle requirements. 220V D.C. system provides reliable sources of D.C. power for control, indication, protection and annunciation of power plant equipment. In addition, it provides for the following emergency loads/services on failure of A.C. supply.
- 4.01.03 The procedure for estimating battery capacities shall be as per guide-lines stipulated in latest revision of IEEE Std. 485 for Lead acid Battery. Derating factor for prolonged float charging shall be duly taken into account, as applicable, in estimating battery capacity.
- While estimating battery capacities, aging margin as per relevant standard, temperature correction factor as per manufacturer's standard and a design margin of 20% shall be considered.
- 4.01.04 The battery and charger combination shall be such as to ensure continuity of DC supply at load terminals at all times without even momentary interruption.
- 4.01.05 Further the voltage at Battery terminals shall not exceed the limits of +10% and -15% of the nominal system voltage at any time during the duty cycle.
- 4.01.06 For continuous operation at specified ratings, temperature rise of the various components of battery & battery charger shall be limited to the permissible values stipulated in the relevant standards and/or this specification.
- 4.01.07 The equipment will be installed indoor in a clean but hot, humid and tropical atmosphere. For the purpose of estimating battery capacities, the maximum and minimum temperatures shall be considered as 50°C and 5°C respectively and relative humidity of 85% shall be considered.
- 4.01.08 The battery and battery charger capacity given in this specification and its annexure are indicative only. The bidders shall check the capacity and ratings based on the attached duty cycle requirement and other design stipulations and submit the offer accordingly. Sizing calculations along with relevant supporting document regarding selection of different factors shall be furnished with the bids.
- 4.01.09 The float charger shall be sized to carry the total DC continuous load and the trickle charging current of the battery plus a 25% margin.. The charger shall also be capable of delivering the rated load under the specified voltage and frequency variations of incoming AC supply.
- 4.01.10 The float-cum-boost charger shall be sized to restore the fully discharged battery to full charge condition in ten (10) for lead-acid battery with 25% margin over maximum charging rate or to operate as a float charger with duty requirement, whichever is greater.

4.02.00 **System Concept**

(PCA.CD-003.E839ELE3_BATTERY)

V.II-F2/S-III : 3

- 4.02.01 The basic system configuration along with a write-up on operation is given in the enclosed scheme diagram.
- 4.02.02 The battery charger shall be capable of providing the initial charging current as required for the battery.
- 4.02.03 The Float Charger (FC) will be normally ON, supplying the DC load current and at the same time trickle charging the battery. The characteristics shall be such that if load is high and exceeds the charger capacity, the excess load shall be supplied by the battery.
- 4.02.04 The Float-cum-Boost charger will be normally in stand-by (Auto Float/ Charge) mode and will cut into the circuit automatically-
- a) To provide occasional equalizing charge as required.
 - b) To take over the functions of float charger in case of its failure.
 - c) To operate in boost mode when battery voltage drops below a set value.
- 4.02.05 The float-cum-boost charger shall also have provision for float, equalizing and boost charging the battery through manual selection.
- 4.02.06 On failure of A.C. supply both float and float-cum-boost chargers will go out of service and battery will take over to supply emergency loads without any interruption.
- 4.02.07 If float charger fails, it will be annunciated in the control room and stand-by float charger of the float cum boost charger will have to cut into the circuit manually by double pole double throw switch to take over the function of float charger.
- 4.02.08 Output of the chargers shall be controlled automatically as well as manually. AUTO/MANUAL selector switch along with voltage/current setter shall be provided for this purpose.
- 4.02.09 Interlock shall be provided to ensure that the battery can be taken to boost mode only if the float charger is healthy and running. Suitable defeating arrangement shall also be provided for initial charging of the battery.
- 4.02.10 For ungrounded DC system, suitable ground fault detection system shall be provided in the battery charger panel to detect ground fault on either polarity for annunciation in charger panel.
- Capacity of each Power House batteries shall be so chosen that with one battery out of service, the other two shall be capable of carrying the total DC load, without any restriction in plant operation.

4.02.11 The batteries shall be so sized as to meet emergency load duty cycle requirements for one (1) hour. All momentary loads shall be treated as one-minute loads.

5.00.00 **SPECIFIC REQUIREMENTS**

5.01.00 **Layout**

5.01.01 The battery and battery charger will be located indoor only.

5.01.02 The Bidder shall confirm the suitability of the enclosed layout with the equipment offered. Alternatively the Bidder may propose his own layout to suit the space available.

5.01.03 While proposing the battery room layout, Bidder shall consider the following:

- a) Sufficient clearance space for attending individual cells.
- b) Sufficient clear space to accommodate a battery of identical capacity in future.

5.01.04 The Bidder shall also indicate his recommendation for battery room ventilation.

5.02.00 **Battery**

5.02.01 **General**

- a) Each set of battery shall consist of number of cells assembled together on mounting racks.
- b) The battery shall be flooded cell with Plante'
- c) The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load.

5.02.02 **Construction**

- a) Cell container shall be made of heat & electrolyte resistant, shock absorbing, tough translucent, polypropylene (SAN) having chemical and electrochemical compatibility. The cell shall be mechanically sturdy.
- b) The cell shall be provided with visual electrolyte level checks for ease in of maintenance. Electrolyte level markings shall be for upper and lower limits.
- c) Sufficient sediment space shall be provided so that the cells will not have to be cleaned out during normal life.

- d) Separator between plates shall permit free flow of electrolyte. Proper arrangement to keep end plates in position shall be furnished.
- e) Open type cells shall be provided with suitable spray arrestors and separate perforated transparent plastic covers; anti-splash type vent plug shall be provided for sealed-in type cell.
- f) For flooded cell, suitable mechanism and / or Ceramic Vent plug shall be provided to eliminate emission of acid mist during the float operation. The bidder shall also indicate and check the Gas emission rate of the battery in their offer for necessary design of the ventilation of the Battery Room. At least 10 air changes per hour shall be made for the battery room ventilation.
- g) The cells shall be supported on insulators fixed on to the rack with PVC/porcelain/hard rubber insulation and adequate clearance between adjacent cells.
- h) The cell terminals posts shall be provided with connector bolts and nuts, made of copper/ brass effectively coated with lead (for lead acid battery to prevent corrosion.
- i) Lead coated copper connectors for lead acid battery shall be furnished to connect up cells of Battery set.
- j) Positive and Negative terminal posts shall be clearly and indelibly marked for easy identification.
- k) Bent copper plates, tubular copper lugs, teakwood clamp, bolts, nuts, washers, etc. shall be furnished for connection of outgoing copper conductor cables.
- l) The battery shall be shipped uncharged for flooded cell with the electrolyte furnished in a separate non-returnable container. 10% extra electrolyte shall be furnished to cover spillage in transit or during erection.

5.02.03 **Battery Racks**

Battery racks for supporting battery cells with PVC/porcelain/hard rubber insulation shall be constructed of best quality teakwood (for lead acid battery), forming a rigid structure. Racks shall be painted with at least three (3) coats of electrolyte-resistant paint of approved shade. Racks shall be free standing

type, mounted on porcelain/ electrolyte –resistant high impact plastic insulators. Numbering tags for each cell shall be attached on to the racks.

5.03.00 **Battery Charger**

5.03.01 **General**

- a) The charger shall be natural air cooled, solid-state type with full wave, fully controlled, bridge configurations.
- b) The charger shall be provided with microprocessor based automatic voltage control, current limiting circuitry, smoothing filter circuit and soft-start feature, under/ over voltage protection and earth fault detection.
- c) Voltage / current control shall be stepless, smooth and continuous. Voltage control shall be possible either in "Auto " mode or in " Manual" mode. An "auto- Manual" selector switch shall be provided for this purpose.
- d) The charger shall be self-protecting against all AC and DC transients and steady state abnormal currents and voltages.
- e) Charger AC input and DC output shall be electrically isolated from each other and also from panel ground.
- f) Isolation shall also be provided between power and control circuits.
- g) Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output. These transducers shall have twin-channel output of 4-20mA and will be used for analog inputs to central DDCMIS/ EDMS. ECP shall also have Current & Voltage measurement of each battery Charger.
- h) Radio frequency suppressor/screening shall be provided with the charger to limit the noise level/interference to radio and other communication equipment to be installed in the same building.
- i) The design of the equipment will be such that during the period both trickle charger unit and boost charger units are working independently, the tap connection from various taps of the battery cell to the load circuit should not involve any circulating current.

5.03.02 **Construction**

- a) The charger shall comprise a continuous line up of free-standing, floor mounted sheet steel panels, with access from both from front as well as from rear.

- b) In between float and float-cum-boost charger panels, a central panel shall be provided. This panel shall house the battery terminals, load terminals, battery blocking diodes, meters, annunciator and indicating lamps.
- c) The panel shall conform to the degree of protection IP 42. Minimum thickness of sheet metal used shall be 2 mm for load bearing members.
- d) Access doors shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh. Door over 600 mm width shall be of double-leaf design.
- e) All equipment within the panels shall be arranged in modular units and laid out with sufficient space for easy maintenance.
- f) All indicating instruments, control switches etc. shall be flush mounted on the front face of the panels. However potentiometer shall be provided inside the panel. Nameplates of approved size and type shall be provided for all circuits and devices both at front & inside of the panel.
- g) All bus bar and bus connections shall be of high conductivity copper and adequately sized to limit the maximum temperature within the permitted value. All bus connection shall be silver plated.
- h) Heat –shrinkable insulating sleeves shall be provided for bus bars. All bus connections shall be color coded for easy identification.
- i) Bus bars shall be supported and braced to withstand the stress due to maximum short circuit current and also to take care of any thermal expansion.

5.03.03

Charger Equipment

- a) All power diode and control rectifiers shall be silicon type. Rectifier transformer shall be resin impregnated in vacuum , dry type, double wound with copper conductor and class-F insulated with temperature rise limited to class- B having off-circuit tap $\pm 2 \times 2.5\%$ on primary side. LC filter suppressor shall be provided in the output to minimize ripple content and to keep the value within the specified limit.
- b) The diode and bridge elements shall be liberally sized for forward current, minimum momentary overloads and voltage spikes. The current and peak inverse voltage (PIV) should be chosen accordingly. Wherever necessary power semiconductor device shall be provided with over current and over temperature protection by using special fuses.

Blocking diodes shall be fully rated and shall have redundancy so that failure of a single diode shall not incapacitate the system in any way.

- c) Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON and OFF position.
- d) AC Changeover switch shall be 3 position, 4 pole, load break type with 2 NO + 2 NC auxiliary contacts. The switch shall be installed in such a manner that the operating handle shall be accessible only after opening the front door.
- e) Double pole, double throw DC switch shall be load break type with 2 NO + 2 NC auxiliary contacts.
- f) Control switches shall be dust protected, heavy duty, switch board type complete with escutcheon plates. Contacts shall be silver plated, rated 10A at operating voltage.

Selector switch shall be maintained contact, lockable stay-put type with knob handle. Meter selector switch shall be four-position type.

Ground fault detection switch shall be three-position type spring return to neutral.

- g) Push button shall be heavy duty, shrouded, push to actuate type with colored button and inscription plate. Each push button shall have 2 NO + 2 NC contacts, rated 10A at 240V AC and 0.5A at 220V DC.
- h) Contactor shall be air-break type with hand reset type thermal overload relays having in built temperature compensator and single phase preventor.
- i) Fuses shall be HRC type and furnished complete with fuse bases and fittings of such design as to permit easy and safe replacement of fuse element. Semi conducting device fuses shall be fast-acting. All upstream fuses shall be properly coordinated with corresponding down stream fuses.
- j) Indicating lamps shall be clustered of LEDs suitable for the duty involved. The body shall be made of polycarbonate Unbreakable lens. LEDs shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection.. Both lamps and lens shall be replaceable from front.
- k) Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, $\pm 1\%$ accuracy with zero adjuster on the front.
- l) Transducers shall have twin-channel output of 4-20mA and shall be used to provide analog inputs to central control room.

- m) Ground fault relay shall be provided to detect DC system ground.
- n) MCCB shall be provided to receive incoming AC supply.
- o) Charger shall be equipped with LCD display, so the system or particular module operation parameters can be locally or remotely viewed / monitored. Following parameters to be displayed:
 - Input AC voltage
 - Input AC current
 - Charging voltage
 - Charging current
 - Load voltage
 - Load current
 - Battery voltage
 - Battery current

5.03.04 Alarms

- a) Solid-state, audio visual annunciation system shall be provided for battery chargers. Annunciation system shall operate on 220V DC.
- b) One (1) minimum twelve-points alarm facia shall be provided on each float charger panel and float-cum-boost charger panel, complete with proper actuating devices, circuitry, legends, push buttons (Accept, Reset and Test) and hooter.
- c) Each central panel shall be provided with one (1) minimum eight point alarm facia complete with proper actuating devices, circuitry, legends, push- buttons (Accept, Reset and Test) and hooter.
- d) The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.
- e) Each time a window lights up, a master relay will get energized to provide group alarm signals for Owner/Purchaser's remote panel.
- f) The requirements of indication/metering/alarms are given in the annexure.
- g) The alarm shall be compatible with central DCS/EDMS/SAS

5.03.05 Meters

Charger panel shall be provided with the following meters:

- a) Input voltmeter (0 – 500 V AC) with voltmeter selector switch.
- b) Output DC voltmeter at each charger output.
- c) Output DC voltmeter at battery output.
- d) Output DC ammeter at each charger output (0 – 150% of rated full load inverter output)
- e) Battery charging / discharging ammeter.

5.03.06 **Transducers**

Each battery charger shall be provided with one (1) no. voltage transducer and one (1) no. current transducer for monitoring the DC output.

Charger panel shall be provided with the following transducers:

- a) DC voltage transducer at each charger output.
- b) DC current transducer at each charger output.
- c) DC voltage transducer at battery output.

5.03.07 **Controls**

The following manual controls shall be provided on the front of each charger panel :-

- a) Charger ON/OFF push button.
- b) Selection of float or boost charge in case of float-cum-boost charger.
- c) Voltage setters for setting the output of float/ equalizing / boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.
- d) Ground fault detection switch with indicating lamps.
- e) Current limit setter/ charging rate.
- f) Under/ Over voltage relay including battery earth fault monitoring relay.
- g) Acknowledge-Reset-Test push buttons for annunciation system. The color of reset buttons shall be BLACK.

5.03.08 **Lamp/Space heaters/receptacles**

(PCA.CD-003.E839ELE3_BATTERY)

V.II-F2/S-III : 11

- a) The charger panels shall be provided with :-
- Internal illumination lamp with door switch , the lamp shall be located in the ceiling and guarded with protective cage.
 - Space heater with thermostat control
 - 3 pin 6A receptacle with plug
 - Communication plug.
- b) Lamp, heater and receptacle circuits shall have individual ON-OFF MCCBs and shall be suitable for 240V AC supply.

5.03.09 **Wiring/Cabling**

- a) The panels shall be completely wired-up. All wiring shall be routed through wiring troughs.
- b) Wiring shall be done with flexible, 1100V grade, PVC insulated switchboard wires with stranded copper conductors of 2.5 mm² for control and current circuits and 1.5 mm² for voltage circuits.
- c) Each wire shall be identified, at both ends, with interlocking type permanent markers bearing wire numbers as per Bidder's Wiring Diagrams. AC / DC wiring shall have separate color-coding.
- d) Wire termination shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals
- e) All spare contacts of relays, timers, auxiliary switches and other devices shall be wired up to the terminal block.
- f) Gland plate shall be of 3 mm thick, non-magnetic material and suitable for single-phase cable entry from bottom. Cable terminal board with cable lugs and double compression cable glands shall be provided in each panel for termination of incoming and outgoing cable.

5.03.10 **Terminal Block**

- a) 1100V grade, multi way terminal block complete with mounting channel, binding screws and washers for wire connections and marking strip for circuit identification shall be provided for terminating the panel wiring. Terminals shall be stud type, suitable for terminating 2 nos. 2.5 mm² stranded copper conductor and provided with acrylic insulating cover.

- b) Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished. Separate terminal blocks shall be used for AC/ DC wiring termination.
- c) Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- d) Terminal blocks used for interface with DDCMIS via termination cabinet shall be suitably sized to facilitate proper termination of interconnecting cables.

5.03.11 **Grounding**

- a) The charger panels shall have fully rated ground bus with two ground terminals, one at each end.
- b) Each terminal shall comprise two-bolt drilling with G.I. bolts, nuts and bimetallic washers for connecting to 50x6 mm G.I. flat. Ground bus shall be bolted to the panel structures, effectively grounding the entire assembly. The cases of meters, relays and switching devices shall be grounded through sheet steel structure.
- c) Wherever, the schematic diagrams indicate a definite ground at the panel, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.

5.03.12 **Tropical protection**

- a) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- b) Screens of corrosion resistant material shall be furnished on all ventilating louvres to prevent the entrance of insects.

5.03.13 **Painting**

- a) The sheet metal of the panels shall be thoroughly cleaned by chemical agents (7-tank process) as required to produce a smooth clean surface free of scales, grease and rust.
- b) Both interior and exterior surfaces of the panels shall be powder coated and finished with two (2) coats of paints of approved shades..
- c) The paint shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or removed by abrasion due to normal handling.
- d) Sufficient quantity of touch up paint shall be furnished for application after installation at site.

5.03.14 **Nameplate**

- a) Name plate shall be provided for each panel and for each equipment/device mounted on it.
- b) The material shall be anodized aluminum/ lamicoid, 3mm thick, with white letter on black background.
- c) Name plate shall be held by self-tapping screws. The size of name plates shall be approximately 20mm x 75mm for equipment and 40mm x 150mm for panels.
- d) Name plates for panels shall be provided both on the front, rear and also inside the panels.
- e) Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices both inside and outside the panel.
- f) Instrument and devices mounted on the face of the panels shall also be identified on the rear with the instrument / device number. The number may be painted on or adjacent to the instrument or device case.
- g) Caution notice of suitable metal plate shall be affixed at the back of each panel.
- h) Bus bar clamp-on sensor, 2 x 4 In. (50 x 101mm) opening-maximum
Direct current : 50A

6.00.00 **TESTS**

6.01.00 All equipment and components thereof shall be subject to shop tests as per relevant IS standards. The tests shall included but not limited to :-

6.01.01 Following type tests on two cells of the battery shall be carried out by the Bidder, even if the Bidder submits type test certificates for Purchaser's review and approval.

- a) Discharge performance test at low temperature.
- b) Ampere-hour test & watt-hour efficiency test.
- c) Endurance test.

The cost of above tests, if any, shall be quoted separately.

6.01.02 Following minimum tests shall be performed on each battery charger.

- a) Dielectric tests.
- b) Voltage regulation check from 0 to 100% load with $\pm 10\%$ input voltage variation.
- c) Ripple content measurement.
- d) Heat run test on current limiting value.
- e) Functional test.

6.01.03 All other routine tests shall be carried out on each equipment as per relevant standard.

6.02.00 **Tests Witness**

6.02.01 Tests shall be performed in presence of Purchaser's representative, if so desired by the Purchaser.

6.02.02 The supplier shall give at least fifteen (15) days' advance notice of the date when the tests are to be carried out.

6.03.00 **Test Certificates**

6.03.01 Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of the Purchaser.

6.03.02 The equipment shall be dispatched from works only after receipt of Purchaser's written approval of the test reports.

6.03.03 Bidder shall submit type test reports for the type tests as per relevant standards on identical equipment in type and rating. Reports older than five (5) years shall not be acceptable.

In case the type test reports are not submitted or the reports are not approved by the Purchaser, the Bidder shall conduct the type tests on the offered equipment at Bidder's risk and cost within the schedule specified herein. No deviation in this regard is acceptable.

6.03.04 Routine test certificates for components like contactors, relays, instruments, SCR / PWM transistors, Diodes, Condenser, Potentiometer, semi-conductors, push buttons etc. shall also be furnished for Purchaser's review and approval.

7.00.00 **SPECIAL TOOLS & TACKLES**

7.01.00 A set of special tools & tackle which are necessary or convenient for erection, commissioning, maintenance and overhauling of the equipment shall be supplied.

- 7.02.00 The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.

8.00.00 SPARES

- 8.01.00 The Bidder shall submit a list of recommended spare parts for five (5) years satisfactory and trouble free operation, indicating the itemized price of each item of the spares.
- 8.02.00 Mandatory spares shall be furnished as per list furnished elsewhere in this specification.

9.00.00 DRAWINGS, DATA & MANUALS

- 9.01.00 Drawings, Data and Manuals shall be submitted with the bid and in quantities and procedures as specified in general Conditions of Contract and/or elsewhere in this specification for approval and subsequent distribution after the issue of Notice to Proceed.
- 9.02.00 **To be submitted with the Bid**
- 9.02.01 Proposal sheets duly filled in.
- 9.02.02 Dimensional Battery room layout drawing.
- 9.02.03 General Arrangement drawing of Charger panels.
- 9.02.04 Typical foundation plan.
- 9.02.05 Bill of material.
- 9.02.06 Battery cell voltage characteristics and data for different discharge rates.
- 9.02.07 Battery Sizing calculation in the format of IEEE
- 9.02.08 Type test certificates as per requirement of this specification.
- 9.02.09 List of makes of various items / components shall be submitted for Purchaser's approval.
- 9.02.10 Leaflets and catalogues of different equipment and accessories including write up on features of different components along with data sheets, curves, tables etc.
- 9.03.00 **To be submitted for Purchaser's Approval and Distribution**

(A) : 'Approval Category'

(R) : 'Reference Category'

- 9.03.01 Guaranteed technical particulars (A) and quality assurance plan (A/Approval by owner)
- 9.03.02 Battery and Charger sizing calculation. (A)
- 9.03.03 Sizing calculation of charger main equipment, viz. SCRs, rectifier transformer etc. (A)
- 9.03.04 Fault current calculation for battery & battery charger. (A)
- 9.03.05 Dimensional battery layout drawings in plan & sections. (A)
- 9.03.06 Take-off terminals connection details. (A)
- 9.03.07 Dimensional general arrangement drawings of Battery charger clearly showing device dispositions, cable entry, space requirements etc. (A)
- 9.03.08 Charger foundation plan and loading. (A)
- 9.03.09 Sectional views of battery charger panels. (R)
- 9.03.10 Charger schematic diagram along with write-up. (A) and wiring diagrams with wire no., equipment / device no. etc (R)
- 9.03.11 Detailed bill of materials (R)
- 9.03.12 Test reports. (A)
- 9.03.13 Transport / shipping details such as method of packaging, dimension & weight of package, part list etc. (R)
- 9.03.14 Any other relevant drawing or data necessary for satisfactory installation operation and maintenance. (R)

- 9.03.15 Instruction manuals on Battery and Battery Charger.

The manual shall clearly indicate the salient features of each equipment, storage and installation method, operation and maintenance procedure, check-up and tests to be carried out before commissioning of the equipment and during maintenance.

- 9.04.00 The Bidder may note that the drawings, data and manuals listed are minimum requirement only. The Bidder shall ensure that all the necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.

9.05.00 The drawings and document marked with (A) above are of 'Approval' category and are subject to review by Purchaser. Those marked (R) are for 'reference' category.

The Purchaser may also review the documents marked (R) if found necessary. The Bidder shall note that the approval of drawings & documents by the Purchaser does not relieve him of his contractual obligation.

9.06.00 All drawings shall be prepared by using Auto CAD, approved version and documents shall be generated using MS Office. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and documents shall be submitted in CD in Auto CAD (approved version) and MS office format as applicable for Purchaser's future reference.

RATINGS & REQUIREMENTS

1.0	BATTERY		Lead-Acid
1.1	Application	:	station battery
1.2	Design Ambient temperature	:	
	a) Maximum	:	50 ..°C
	b) Minimum	:	5 °C
1.3	Type	:	Plante
1.4	Nos. of Cells per Battery	:	110
1.5	Battery nominal voltage	:	2.0V
1.6	Battery capacity at 27°C	:	Decided by bidder, however, Calculation shall be furnished for Approval.
1.7	Proposed Method of working	:	
	a) Float charging (normal)	:	2.20 Volt / cell.
	b) Equalising Charge (occasional)	:	2.33 Volt / cell.
	c) Boost charging/cell (after complete discharge)	:	2.75V / cell (max'm.)
1.8	Intermediate tapping	:	As required
1.9	Mounting	:	Wooden racks
1.10	Terminal Connection	:	Through single core fire survived cables. Actual size of cable shall be as per design calculation (approved by owner).

NOTE: Items 1.4 & 1.7– Bidder to justify with details, if his recommended values are different from the values specified in this specification.

- 2.1 Charger : Float charger & Float-cum-boost charger
- 2.2 Type : Solid-state, full wave, fully controlled with microprocessor based AVR, three-phase bridge, suitable for continuous duty application.
- 2.3 Enclosure : Sheet steel enclosure, IP-42.
- 2.4 **A.C. Input**
- a) Supply : 415V, 3 phase, 50 Hz, 4 wire.
 - b) Voltage variation : $\pm 10\%$
 - c) Frequency variation : $\pm 3\%$
 - d) Combined volt + frequency variation : 10% (absolute sum)
 - e) Short-circuit level : 50 KA r.m.s. symmetrical.
 - f) System earthing : Solidly earthed.
- 2.5 **D.C. Output**
- a) Float charger : (Maximum Continuous DC load + float charging battery) plus 25% margin. Output voltage adjustable between 230-240 V.
 - b) Boost charger : Restoring fully discharged battery to full charge condition in 10 Hours for Lead-Acid battery, with 25% margin over maximum charging rate. O/p voltage adjustable between 260-285 V.
- 2.6 **Performance Requirements**
- a) The output voltage of the charger shall be regulated within $\pm 1\%$ of the set value for any load variation from 0 to 100% and A.C. input voltage and frequency variations as indicated above in sl. No. 2.4 above.
 - b) The ripple content in charger DC output shall be limited to 1% (rms) with or without battery.
- 3.0 **Fault Level for DC system** : 25 KA

FITTINGS & ACCESSORIES

1.0 BATTERY

Each set of battery shall be equipped with fittings and accessories as listed below.	
1	One battery log book.
2	Two copies of printed instruction sheet.
3	One no. cell testing voltmeter (3-0-3 volts) complete with leads.
4	One no. rubber syringe type hydrometer suitable for specific gravity reading.
5	Three nos. pocket thermometer.(Digital type)
6	One no. thermometer (0 to 100°) with specific gravity correction scale.
7	One set cell bridging connector.
8	Two nos. each Electrolyte resistant plastic funnels and plastic jugs
9	Battery racks suitable for accommodating the cells coated with paint.
10	insulator (with 5% extra), rubber pad etc. for rack.
11	Two nos. plastic filling bottle for filling up.
12	One pair of spanners.
13	Requisite quantity of electrolyte with 10% extra in non-returnable containers.
14	Two pairs of rubber hand gloves.
15	Two nos. cell lifting straps.
16	One set of inter cell, inter tie and interbank connectors as required for complete installation.
17	Self adhesive PVC stickers for cell numberings
18	Goggles.
NOTE:	Any other accessories if required for satisfactory operation of the complete battery system shall also be included in Bidder's offer and to be supplied accordingly.

2.0 LIST OF ALARMS

2.1 Each Float charger and Float-cum-Boost charger panel shall be provided with one (1) minimum ten-point annunciation facia. Alarm points shall include :

- a) A.C. supply failure
- b) D.C. Voltage low
- c) D.C. Voltage high
- d) D.C. System ground
- e) Charger overload
- f) SCR fuse blown
- g) Filter fuse blown
- h) D.C. output fuse blown

2.2 The central panel shall be provided with one (1) minimum eight-point annunciation facia. Alarm points shall include:

- a) Battery on boost charge
- b) Float charger fail
- c) Float-cum-boost charger in float mode.
- d) Battery earth fault
- e) Main A.C. fail

2.3 Initiating contacts, wired to two terminals, shall be provided for group annunciation of "Battery Charger Trouble" in remote control room.

2.4 Initiating contacts for all alarm points shall also have electrically separate spare set of contacts wired to the terminal block for future use.

2.5 All alarm contacts shall be rated 0.5A at 220V D.C. and 5 Amp. at 240V A.C.

2.6 In addition to the alarm points mentioned above, any other alarm point, if required for battery and charger, shall be provided.

In addition to above requirement, each section of battery charger shall have at least two (2) nos. spare annunciation channels and window facia.


3.0 LIST OF INDICATIONS

3.1 The indications to be provided on each float charger and float-cum-boost charger panel shall include but shall not be limited to :

- a) Charger power supply ON
- b) Charger D.C. output healthy
- c) Control supply ON

3.2 The indications to be provided on the central panel of each charger set shall include but shall not be limited to:

- a) Annunciation D.C. healthy
- b) Float-cum-boost charger in equalising mode.
- c) Float-cum-boost charger in boost mode
- d) Float-cum-boost charger in float mode.

	TECHNICAL SPECIFICATION FOR 220V DC BATTERY	SPECIFICATION NO. PE-TS-373-508-E001	
		VOLUME II B	
		SECTION -	
	2X500 MW SAGARDIGHI STPP	REVISION 0	DATE 09.11.2012
		SHEET 44 OF 53	

ANNEXURE-II

LIST OF APPLICABLE STANDARDS (LATEST)

- | | | |
|-----|--|----------|
| 1. | STATIONERY LEAD ACID PLANTE BATTERY | IS 1652 |
| 2. | RECOMMENDED PRACTICE FOR SIZING LEAD ACID BATTERIES | IEEE 485 |
| 3. | SPECIFICATION FOR WATER FOR STORAGE BATTERIES | IS 1069 |
| 4. | SPECIFICATION FOR SULPHURIC ACID FOR LEAD ACID BATTERIES | IS 266 |
| 5. | RUBBER & PLASTIC CONTAINERS FOR LEAD ACID BATTERIES | IS 1146 |
| 6. | SYNTHETIC SEPARATORS FOR LEAD ACID BATTERIES | IS 6071 |
| 7. | SEALING COMPOUND FOR LEAD ACID BATTERIES | IS 3116 |
| 8. | METHODS OF TESTS FOR LEAD ACID BATTERIES | IS 8320 |
| 9. | SPECIFICATION FOR HIGH PERFORMANCE PLANTE'S CELLS | BS-6290 |
| 10. | ELECTRICAL VOCABULAR, PRIMARY CELLS AND BATTERIES. | IS:1885 |
| 11. | INDIAN ELECTRICITY RULES & INDIAN ELECTRICITY ACTS | |



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

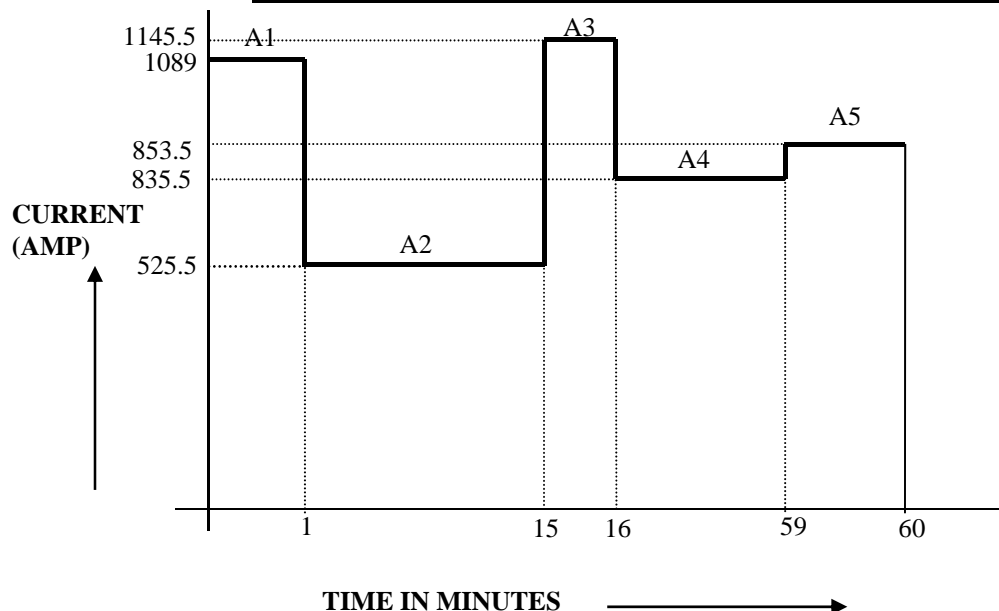
SECTION -

REVISION 0 DATE 09.11.2012

SHEET 45 OF 53

ANNEXURE-III

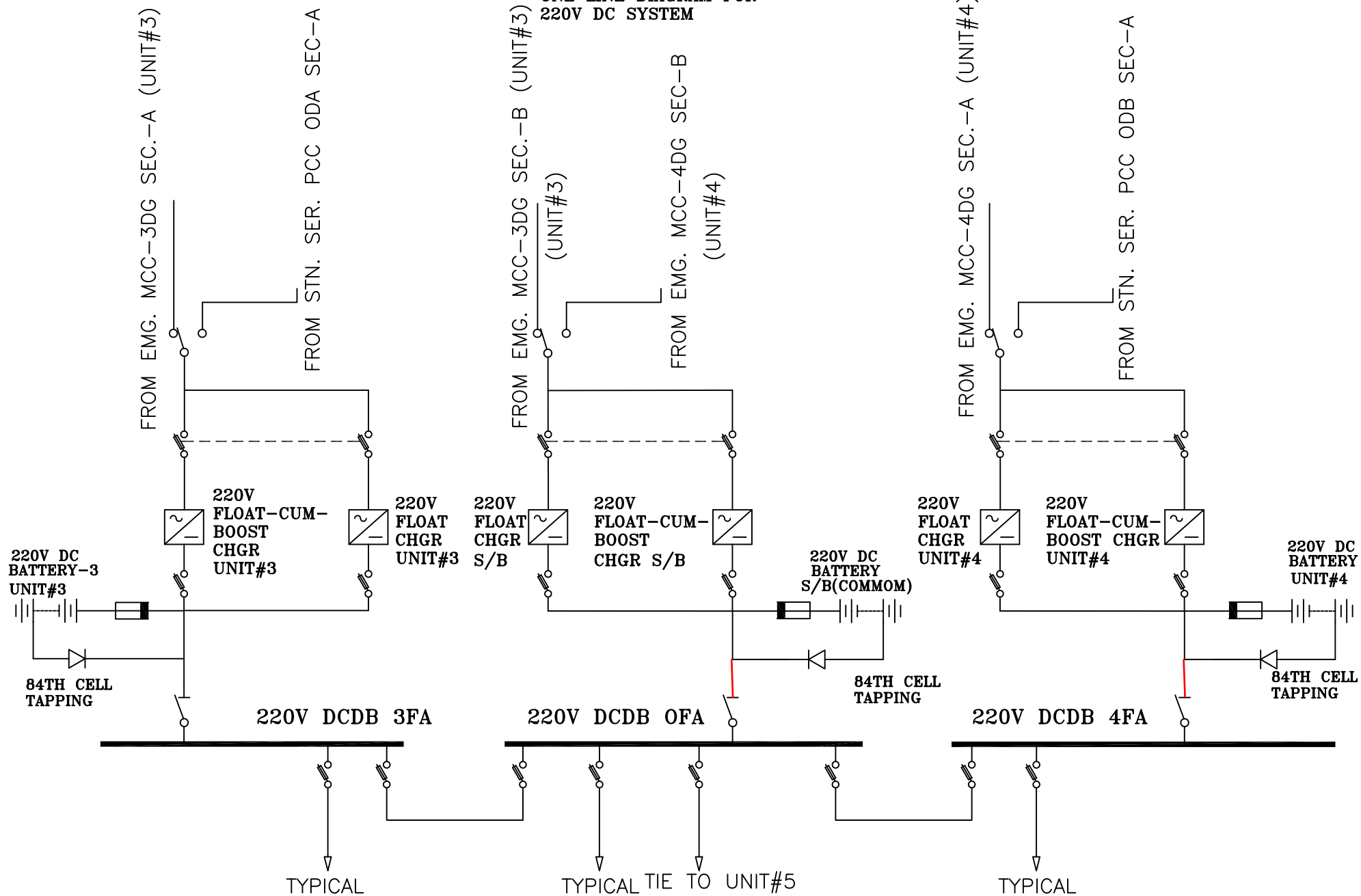
LOAD DUTY CYCLE & ONE LINE DIAGRAM - 220V DC SYSTEM



FACTORS TO BE CONSIDERED FOR BATTERY SIZING:

- | | |
|----------------------------------|----------------------|
| 1. AGEING FACTOR | : 1.0 |
| 2. TEMPERATURE CORRECTION FACTOR | : AS PER IEEE485 (*) |
| 2. DESIGN MARGIN | : 1.2 |
| 3. MIN.ELECTROLYTIC TEMP. | : 5° C |
| 4. END CELL VOLTAGE | : 1.85V PER CELL |
| 5. NUMBER OF CELLS | : 110 |

* : Supporting Calculation for temperature correction factor as per IEEE 485 may please be furnished for batteries which are not designed at 25°C.

ONE LINE DIAGRAM FOR
220V DC SYSTEM



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 47 OF 53

ANNEXURE-V

FITTINGS / ACCESSORIES

Following accessories shall be provided for each battery bank:

S no	FITTINGS / ACCESSORIES	QTY (Nos.)
1	Battery log Book	1
2	Printed instruction sheet	2
3	Cell testing voltmeter (3-0-3V) complete with leads.	1
4	Rubber syringe Hydrometer suitable for specific gravity reading	1
5	Pocket thermometer (digital type)	3
6	Thermometer (0 to 100 cent.) with specific gravity correction scale.	1
7	Cell bridge connector	1 set.
8	Electrolyte resistant plastic funnels and plastic jugs.	2
9	Battery racks suitable for accomdating the cells coated with paint	1 set.
10	Insulator (with 5% extra) rubber pad etc. for rack	1 set.
11	Plastic filling bottle for filling up	2
12	spanners	1 pair
13	Requisite quantity of Electrolyte with 10% extra in non-returnable containers.	1 lot.
14	of rubber hand gloves	2 pair
15	Cell lifiting straps	2
16	Inter cell, inter tie and interbank connectors as required for complete installation	1 set
17	Self- adhesive PVC stickers for cell numbering	10
18	Goggles	2



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 48 OF 53

ANNEXURE-VI

SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.
1	Data Sheet for Battery	PE-V0-373-508-E201
2	General Arrangement drawing for Battery	PE-V0-373-508-E202
3	Fault calculation and connector sizing calculation	PE-V0-373-508-E203
4	Battery sizing calculation	PE-V0-373-508-E204
4	Quality Plan for Battery	PE-QP-999-508-E002
5	Type test reports for the Battery	PE-V0-373-508-E104
6	Type test procedure for the Battery	PE-V0-373-508-E105



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 49 OF 53

ANNEXURE-VII

No. OF DRAWINGS / DOCUMENTS REQUIRED FROM VENDOR

S. NO.	DESCRIPTION	No. hard prints/copies	No. of CD- ROMs	REMARKS
1	Master List of Drgs./ Docs.	10 Copies		
2	Docs. /drgs. submission schedule for approval	10 Copies		
3	Approved Docs. /Drgs. submission schedule for distribution	25 Copies	4 CD-ROMS	
4	Docs. /drgs. for approval (First submission)	10 copies	4 CD-ROMS	
5	Drgs. / docs. for approval (Second & subsequent submission till approval)	10 copies	4 CD-ROMS	
6	Final approval drgs. / docs. for Distribution	25 Copies	4 CD-ROMS	
7	Operation & Maintenance manual for approval	10 Copies		
8	Approved Operation & Maintenance Manual for distribution	25 Copies	4 CD-ROMS	
9	Type Test Certificates/ Reports	10 Copies		



**TECHNICAL SPECIFICATION FOR
220V DC BATTERY**

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 50 OF 53

DATASHEET -A

LEAD ACID PLANTE BATTERY

- | | | | |
|-----|--|---|--|
| 1. | Rated voltage (V) | : | 220V DC |
| 2. | Type of Battery | : | Lead Acid Plante
high discharge |
| 3. | Conforming to | : | IEEE/ IS standards |
| 4. | No. of cells & End cell voltage | : | 110 Nos.; 1.85V |
| 5. | Nominal Float voltage
(V) | : | 2.2 V/cell |
| 6. | Boost voltage (Maximum)
(V) | : | Bidder to furnish the detail
along with offer |
| 7. | Capacity at 10 hour rate | : | Bidder to furnish quoted AH
capacity and battery sizing
calculation along with offer |
| 8. | Intermediate Tapping | : | 84 th Cell |
| 9. | Minimum temp for which
battery capacity to be
selected | : | 5°C as minimum
electrolyte temp. |
| 10. | Arrangement of batteries
on racks | : | Single tier |
| 11. | Connection from battery
to DCDB | : | Cables |

Notes:

- Bidder shall furnish following along with offer
 - Battery capability curve.
 - Battery sizing calculation as per IEEE 485.
 - Supporting Calculation for temperature correction factor as per IEEE 485 may please be furnished for batteries which are not designed at 25°C.
 - Indicate value at sl. No. 6 & 7 above.
- Bidders stand guarantee that the rating offered at Sl No 7 shall meet 'Load Duty Cycle' as per Annexure-II of specification.



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001

VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 51 OF 53

DATA SHEET -C

Sr. No.	PARAMETER	UNIT	VALUE
1.0	Make and Type		
2.0	AH capacity at 27° C and end voltage		
2.1	At 10 Hr discharge rate	AH	
2.2	At 1 Hr discharge rate	AH	
3.0	Battery Discharge current		
3.1	At one minute rate	Amp	
3.2	At 30 minutes rate	Amp	
3.3	At 30 minutes rate at end voltage	Amp	
3.4	At 60 minutes rate	Amp	
3.5	At 60 minutes rate at end voltage	Amp	
4.0	Types of plates		
4.1	Negative plates		
4.2	Positive plates		
5.0	Method of connection between cells		
6.0	Voltage per cell at the end of charge at the finishing rate	V	
7.0	Recommended Trickle charge current	Amp	
8.0	Type and material of separators		
9.0	Material of container		
10.0	Type of container		
11.0	Internal resistance of cells	Ohms	
12.0	Total resistance of connectors	Ohms	
13.0	Insulator Material for		
13.1	Cells		
13.2	Racks		
14.0	Average life	Years	
15.0	Recommended boost charger rating for		
15.1	Charging in 8 hours	Amp	



TECHNICAL SPECIFICATION FOR 220V DC BATTERY

2X500 MW SAGARDIGHI STPP

SPECIFICATION NO. PE-TS-373-508-E001


VOLUME II B

SECTION -

REVISION 0 DATE 09.11.2012

SHEET 52 OF 53

15.2	Charging in 10 hours	Amp	
Sr. No.	PARAMETER	UNIT	VALUE
16.0	Allowable ripple content acceptable to battery (r.m.s)	%	
17.0	Hydrogen evaluation		
18.0	Cell designation in accordance with IS: 1651/1652		
19.0	Applicable standard		
20.0	Whether battery performance curve and calculation for capacities enclosed		
21.0	Recommended Maximum period of storage of Electrolyte before first charge		
22.0	Amount and specific gravity of electrolyte per cell required for first filling at 27° C		
23.0	Recommended specific gravity of electrolyte at 27° C		
23.1	When fully charged		
23.2	When fully discharged		
24.0	Container dimensions	(L X B X H)mm	
25.0	Distance between centres of cells when erected	Mm	
26.0	Terminal connectors		
26.1	Type		
26.2	Material		
27.0	Battery Racks		
27.1	Type & Material		
27.2	Outline dimensions	(L X B X H) mm	
27.3	Net weight	Kg	
28.0	Weight per cell	Kg	
28.1	Net dry weight	Kg	
28.2	Net weight with electrolyte	Kg	
29.0	Total shipping weight of one battery unit (without electrolyte)	Kg	
30.0	Taps provided at cell no.		
31.0	Connection from battery to charger (busbar/ cable)		
32.0	Recommended size of (busbar/ cable)		
33.0	Whether backup calculation furnished		

		QUALITY PLAN		CUSTOMER : Raichur Power Co. Ltd.		PROJECT:2X500 MW SAGARDIGHI TPS # 3 & 4		SPECIFICATION : PE-TS-373-508-E001				
				BIDDER/ : APPROVED VENDOR VENDOR		QUALITY PLAN NUMBER : PE-QP-999-508-E002 REV.00		NUMBER : SPEC: TECHNICAL SPECIFICATION TITLE FOR BATTERY				
		SHEET 1 OF 1		SYSTEM : 220V DC SYSTEM		ITEM : LEAD ACID BATTERY		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11		
1.0	FINISHED BATTERY / CELL	1.TYPE TEST	MA	TEST	IS:1651 & 1652/BHEL SPEC BSI:6290 Pt-4	IS:1651 & 1652/BHEL SPEC BSI:6290 Pt-4	IS:1651 & 1652/BHEL SPEC BSI:6290 Pt-4	INSPN REPORT	P	W,V	W,V	<div style="border: 1px solid black; padding: 5px;"> M: MANUFACTURER C: BHEL N: WBPDCCL P: PERFORM W: WITNESS V: VERIFICATION </div>
		2.ACCEPTANCE TEST	MA	TEST	-DO-	-DO-	-DO-		P	W	W	
2.0	ACCESSORIES	1.VISUAL AND DIMENSIONS	MA	TEST	100%	BHEL DRG	BHEL DRG	INSPECTION	P	W	W	
BHEL			PARTICULARS		BIDDER/VENDOR				BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									