



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-378-316-015	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	DKS	SKS	RS/SKS
TITLE 220V & 48V Nickel Cadmium Fibre Plate Battery Bank with Fittings & Accessories		SIGN			
		DATE	03.11.2017	03.11.2017	03.11.2017
		GROUP	TBEM		
		WO No.	84007		
CUSTOMER	Tamilnadu Generation and Distribution Corporation (TANGEDCO)				
CONSULTANT	Desein Private Limited, New Delhi				

PROJECT	400kV GIS at 2x660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS
NOA Ref.	

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Remarks: Bidder to note that data and details of Guaranteed Technical Particulars shall not be reviewed during Technical Review, hence compliance of Technical Specification shall be bidder's responsibility.

Rev	Date	Altered	Checked	Approved	
Distribution				To	
				Copies	

Section 1: Scope, Technical Requirements and Quantities

1.1 SCOPE

This technical specification covers the requirements of design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to project site and supervision of erection, testing & commissioning of **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fittings & Accessories** including rack assembly, interconnectors, lugs and cables etc. as required for trouble free and complete operation of batteries.

This section covers the specific technical requirements of **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fittings & Accessories**. This constitutes minimum technical parameters for the above item as specified by the customer. The offered equipment/ item shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

The specification comprises of following sections,

Section-1 : Scope, Project specific technical requirements & Bill of Quantities.

Section-2 : Specific technical requirements for the equipment under scope of supplies.

Section-3 : Project Details and General technical requirements for all equipment under the Project.

Section-4 : Annexures (04nos.)

In case of any discrepancies between the requirements mentioned under different Sections, order of precedence shall be in the same order as listed above.

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

The equipment is required for the following project:

Name of the Customer : Tamilnadu Generation and Distribution Corporation (TANGEDCO)

Name of consultant : Desein Private Limited, New Delhi

Name of the Project : 400kV GIS at 2x660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

Specific technical requirements **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fittings & Accessories** shall be as follows,

Sl. No.	Parameter	220V Battery Bank	48V Battery Bank
1.	Battery type	Ni- Cd Fibre Plate type	Ni- Cd Fibre Plate type
2.	Nominal voltage rating	220V	48V
3.	Discharge capacity	600AH (5Hrs)	200AH (5Hrs)
4.	Ageing factor	1.25	1.25

Technical Specification for **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fitting & Accessories**

Sl. No.	Parameter	220V Battery Bank	48V Battery Bank
5.	Design margin	20%	20%
6.	Float charging voltage	1.40V to 1.42V	1.40V to 1.42V
7.	Boost charging voltage	1.54V to 1.70V	1.54V to 1.70V
8.	End cell voltage	Not less than 1.14V	Not less than 1.14V
9.	Nominal cell voltage	1.20V/cell	1.20V/cell
10.	Min. electrolyte temp. for battery sizing	15°C	15°C
11.	Ambient design temperature	50°C	50°C
12.	Maximum battery bank voltage	242V	52.80V
13.	Minimum battery bank voltage	198V	43.20V
14.	No. of cells per battery	170 nos.	37 nos.
15.	Cell designation	Stationary Nickel-Cadmium fibre plate type, high discharge type	
16.	Charging method	It shall be suitable for standby duty. It 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.	
17.	Battery rack	Mild steel frame with anti-alkali paint	
18.	Battery bank room size	Tentative battery room size shall be as per attached drawing, wherein battery bank shall be accommodated with 1.0meter clear space from inside wall surface.	

Note: For detailed technical requirement for Ni-Cd Fibre Plate type Battery Bank, please refer Section-2.

1.3 BILL OF QUANTITIES

Quantities for supply and services for **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fittings & Accessories** shall be as follows,

Sl. No.	Description	Unit	Qty
A.	Supply Items-Main Items		
1	220V, 600AH, Ni-Cd Fibre Plate (High discharge type) battery bank with fittings & accessories complete in all respect meeting the load cycle requirement as per technical specification.	Set	02
2	48V, 200AH, Ni-Cd Fibre Plate (High discharge type) battery bank with fittings and accessories complete in all respect meeting the load cycle requirement as per technical specification.	Set	02
3.	Battery health monitoring system (BHMS) with accessories for 220V battery bank (item sl. no.1) complete in all respect as per technical specification	Set	02

Technical Specification for **220V & 48V Ni- Cd Fibre Plate Battery Bank with Fitting & Accessories**

4.	Battery health monitoring system (BHMS) with accessories for 48V Battery bank (item sl. no.2) complete in all respect as per Technical specification	Set	02
B.	Supply Items-Mandatory Spares for 220V, 600AH, Ni-Cd Fibre Plate (High discharge type) battery bank		
5.	Battery cell (1 no. of each type)	Set	01
6.	Cell container (1no. of each type)	Set	01
7.	Level indicator (if applicable separately) (1 no. of each type)	Set	01
8.	Vent plugs (10 no. of each type)	Set	01
9.	Inter-cell connector (10no. of each type)	Set	01
10.	Set of nuts, bolts and washer (20no. of each type)	Set	01
C.	Supply Items-Mandatory Spares for 48V, 200AH, Ni-Cd Fibre Plate (High discharge type) battery bank		
11.	Battery cell (1nos. of each type)	Set	01
12.	Cell container (1nos. of each type)	Set	01
13.	Level indicator (if applicable separately) (1 no. of each type)	Set	01
14.	Vent plugs (10nos. of each type)	Set	01
15.	Inter-cell connector (10nos. of each type)	Set	01
16.	Set of nuts, bolts and washer (20nos. of each type)	Set	01
D.	Services		
17.	Supervision of erection, testing & commissioning at site for 220V, 600AH, Ni-Cd Fibre Plate (High discharge type) battery bank with fittings & accessories (item sl. no.1) complete in all respect.	Set	02
18.	Supervision of erection, testing & commissioning at site at site for 48V, 200AH, Ni-Cd Fibre Plate (High discharge type) battery bank with fittings & accessories (item sl. no.2) complete in all respect .	Set	02
19.	Supervision of erection, testing & commissioning at site for Battery health monitoring system (BHMS) with accessories for 220V battery bank (item sl. no.3) complete in all respect.	Set	02
20.	Supervision of erection, testing & commissioning at site for Battery health monitoring system (BHMS) with accessories for 48V battery bank (item sl. no.4) complete in all respect.	Set	02
21.	Type tests to be performed on (but not limited to) two cells of each battery bank as per technical specification/relevant IS/IEC.	Lot	02

Note:

1. Refer Annexure-1 &2 of section-1 for 220V & 48V load duty cycle.
2. Minimum size of batteries shall be as details mentioned in above BOQ. (Sl.no.1&2).
3. Bidder to quote battery size meeting the load duty cycle requirement. The sizing calculation in line with applicable IEEE shall be submitted with offer for review.
4. Special tools & tackles, which are sufficient and necessary for convenient election, commissioning maintenance & overhauling, if required, of the equipment shall be supplied free of cost and hence, its price shall be included in main equipment price.
5. Size of cable between battery and battery charger shall be informed during detail engineering.
6. The battery banks under (Sl.no.1&2) shall be evaluated together and will be procured from the same bidder.
7. The quantity for individual item may vary up to any extent, however total contract value shall not

vary more than +/- 30% during contract execution stage. It is also to be noted that any item can be completely/ partially deleted during detailed engineering stage.

1.4 TECHNICAL QUALIFYING REQUIREMENT & EXPERIENCE

The bidder shall submit the documentary evidence that equipment of highest offered rating or above has been manufactured by him and are in successful operation for more than two (2) years in two or more projects of similar nature on the original date of bid opening.

1.5 TYPE TESTING

The bidder shall submit the type tests reports for the tests conducted on the equipment identical or similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than five (5) years prior to supply under this contract. If any type test report is found to be technically unacceptable, such type test(s) shall be conducted by the bidder without any cost and delivery implication to BHEL/TANGEDCO.

All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bidder's scope.

Optional Type Test Requirement-Type test charges shall be optional. These charges shall be valid for the entire period of the contract. BHEL/TANGEDCO reserves the right to delete the optional type tests at any time of contract.

The bidder shall successfully carry out the type tests (but not limited to) on two cells of the battery, even if the Bidder submits type test certificates for Purchaser's review and approval. The bidder shall indicate the charges for each of these type tests separately and the same shall be considered for the evaluation of the bids. The type test charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by BHEL/TANGEDCO.

1.6 QUALITY PLAN

The successful bidder shall submit the QP for BHEL/ TANGEDCO approval. In case bidder has reference QP agreed with TANGEDCO, same can be submitted for specific project after award of contract for BHEL/ TANGEDCO's approval. There shall be no commercial implication to BHEL on account of QP approval.

All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price.

1.7 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, provided by the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each item in accordance with the applicable IEC/IS and the material shall be offered for final inspection by BHEL/TANGEDCO in

accordance with agreed quality plan with 3 weeks' advance information. The charges for these shall be deemed to be included in the equipment price.

1.8 PACKING

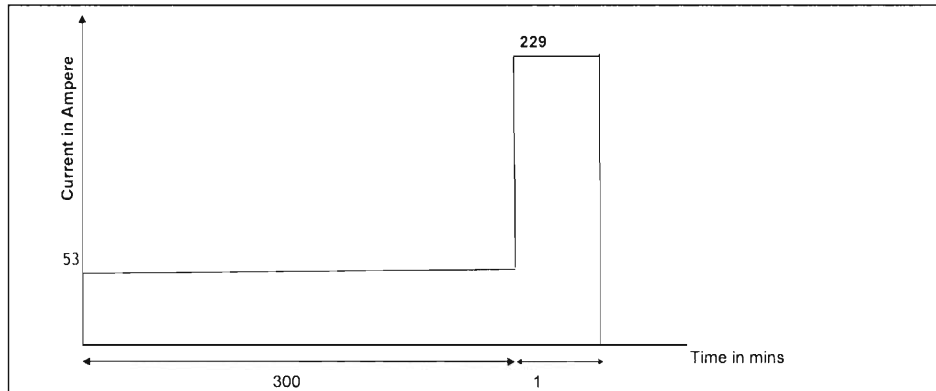
The material shall be packed in such a way to ensure protection against damage during transit, storage for prolonged periods and handling.

PROJECT- 2X660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS. CHENNAI-120

ANNEXURE-1

Duty Curve for 220 V Battery Bank

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



LOAD & CORRESPONDING DURATIONS		
LOAD A1(Amps.)	53.38	300 min
LOAD A2(Amps.)	228.53	1 min

(It includes continuous load and one breaker momentary closing load)

(It includes continuous load, one breaker closing load and momentary tripping load)

Factorrs to be considered for Battery Sizing

- 1 Ageing Factor: 1.25
- 2 Design Margin: 1.20
- 3 Ambient Temperature: 50°C
- 4 Relative Humidity : 85%
- 5 Minimum Electrolyte Temperature: 15°C
- 6 Emergency Lighting has been considered for a period of 1 Hour.
- 7 All continuous DC Loads & Control panels, Interlocking coils of isolators including requirement for switchyard and future bays has be considered for duration of 2+3 hours.

Note:

Bidder has to take Ageing Factor & Design Margin in their sizing and selection of Ni-Cd Battery. No deviation is acceptable on ageing Factor.

Reference Standard

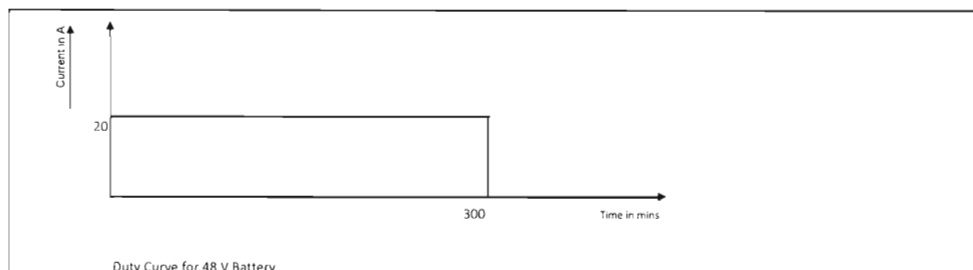
1. IEEE1115(1992): Ni-Cd Battery Sizing Calculation
2. IEC 60623 - Secondary cells and batteries containing alkaline or other non-acid electrolytes - Vented nickel-cadmium prismatic rechargeable single cells

PROJECT- 2X660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI-120

ANNEXURE-2

Duty Curve for 48V Battery Bank

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



LOAD & CORRESPONDING DURATIONS	
LOAD A1(Amps)	20

Factorrs to be considered for Battery Sizing

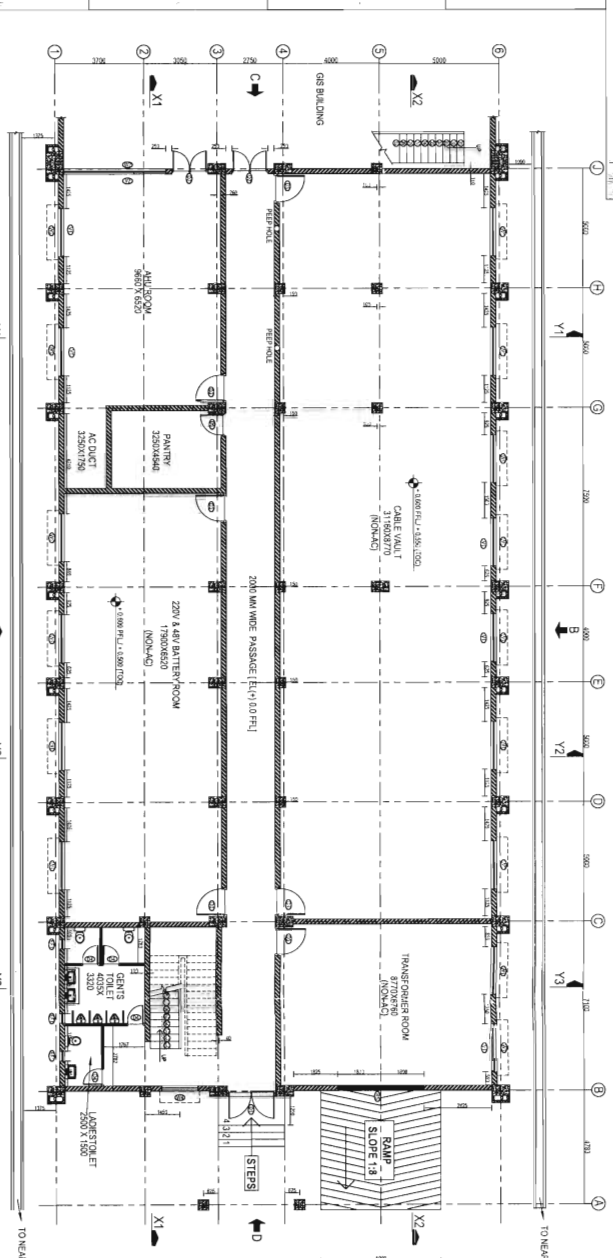
- 1 Ageing Factor: 1.25
- 2 Design Margin: 1.20
- 3 Ambient Temperature: 50°C
- 4 Relative Humidity : 85%
- 5 Minimum Electrolyte Temperature: 15°C
- 6 Emergency Lighting has been considered for a period of 1 Hour.
- 7 All continuous DC Loads & Control panels, Interlocking coils of isolators including requirement for switchyard and future bays has be considered for duration of 2+3 hours.

Note:

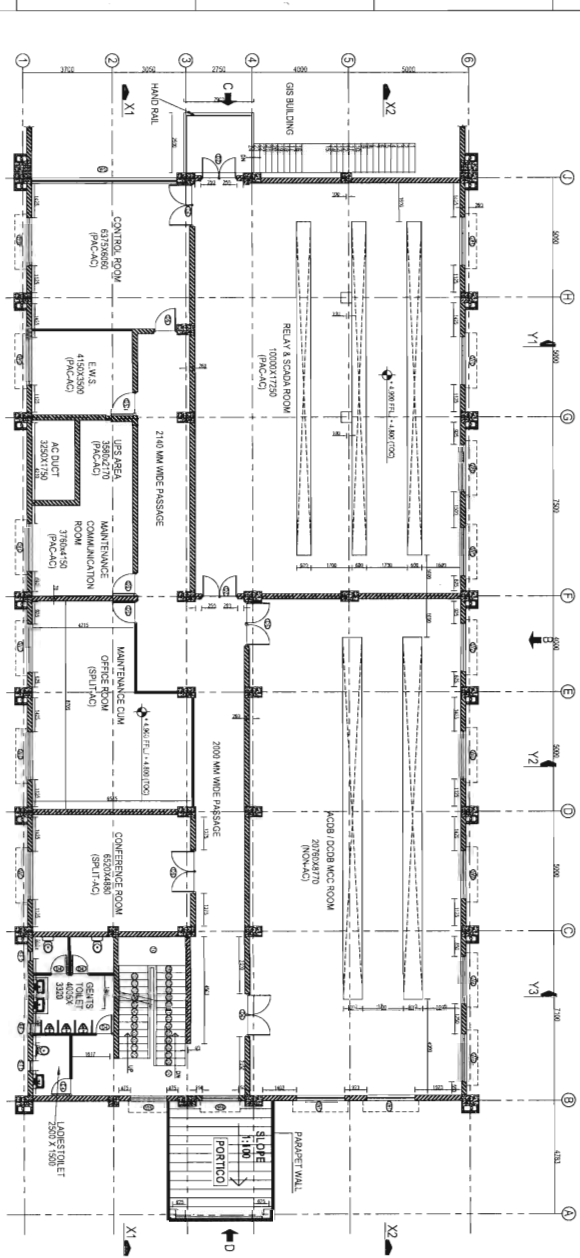
Bidder has to take Ageing Factor & Design Margin in their sizing and selection of Ni-Cd Battery. No deviation is acceptable on ageing Factor.

Reference Standard

1. IEEE1115(1992): Ni-Cd Battery Sizing Calculation
2. IEC 60623 - Secondary cells and batteries containing alkaline or other non-acid electrolytes - Vented nickel-cadmium prismatic rechargeable single cells



GROUND FLOOR PLAN A (+00.600 M)
SCALE 1:75



FIRST FLOOR PLAN (+4.900M)
SCALE 1:75

FOR REFERENCE PURPOSE ONLY

SCHEDULE OF DOORS, WINDOWS & OPENING OF GROUND FLOOR				
S.NO.	TYPE	SIZE	ILL. LVL.	QTY.
1.	RS	200X240	2400	1
2.	DS	200X240	2400	1
3.	DS	200X240	2400	2
4.	DS	200X240	2400	2
5.	DS	200X240	2400	2
6.	DS	200X240	2400	2
7.	DS	200X240	2400	2
8.	DS	200X240	2400	2
9.	DS	200X240	2400	2
10.	DS	200X240	2400	2
11.	DS	200X240	2400	2
12.	DS	200X240	2400	2

SCHEDULE OF DOOR & WINDOW OPENING				
S.NO.	TYPE	SIZE	ILL. LVL.	QTY.
1.	DS	200X240	2400	2
2.	DS	200X240	2400	3
3.	DS	200X240	2400	4
4.	DS	200X240	2400	4
5.	DS	200X240	2400	4
6.	DS	200X240	2400	4
7.	DS	200X240	2400	4
8.	DS	200X240	2400	4
9.	DS	200X240	2400	4
10.	DS	200X240	2400	4
11.	DS	200X240	2400	4
12.	DS	200X240	2400	4

- NOTES
1. ALL THE DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METER UNLESS SPECIFIED OTHERWISE.
 2. (a) 0.00M CORRESPONDS TO F.O.L.
 3. ALL THE LEVELS ARE FROM F.L.
 4. F.L. IS 10.00M R.L.
 5. DRAWINGS ARE NOT TO BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
 6. ALL DIMENSIONS ARE TO BE CHECKED ON SITE.
 7. IN THE EVENT OF ANY DISCREPANCIES OR DIFFERENCE BETWEEN ANY ARCHITECTURAL DRAWINGS AND STRUCTURAL ENGINEERING DRAWINGS OR ANY OTHER IMMEDIATE REF. SHOULD BE MADE TO THE ARCHITECT FOR CLARIFICATIONS PRIOR TO EXECUTION OF WORK.
 8. CONTRACTOR SHALL CHECK ALL LEVELS & DIMENSIONS WITH RESPECT TO EXISTING STRUCTURE LEVELS & DIMENSIONS BEFORE CASTING.
 9. WALL OPENING FOR CABLE TRAY & BUS DUCT TO BE CO-RELATED BEFORE EXECUTION/PROVIDED AS PER ELECTRICAL LAYOUT DRGS.
 10. M.S. RAILING SHALL BE PROVIDED 32MM DIAMETER.
 11. FALSE CEILING SHALL BE PROVIDED OF LIGHT WEIGHT MINERAL FIBRE TILE TYPE FALSE CEILING.

LEGENDS:

	220 THK. BRICK WALL
	115 THK. BRICK WALL
	COLUMN
	PROTECTION
	EXHAUST FAN
	F.O.L.
	FINISHED FLOOR LEVEL
	F.F.L.
	THK.
	THK.
	TOP OF PARAPET WALL
	TOP OF CONCRETE

PROJECT: 2 X 600 MW DANCE SRT SUPERHEATED STEAM PROJECT
A/SH DRG. OF MCHS. GRIND - 125

DESIGN SOLUTIONS INC.
520 AL 2ND FLOOR SECTOR 4, MADHUBAN, MADHUBAN - 154112

ARCHITECTURAL DRAWING

Section-2: Specific technical requirements for the equipment under scope of supplies**DC SYSTEM****1.00.00 GENERAL**

This system will provide power at 220V DC and 48 V, comprising of batteries, battery chargers and DC distribution Boards (for control, indication and protection of the plant. This system offers continuous power supply to all DC loads for plant normal operation. In addition it will also feed the critical D.C loads during emergency following total loss of AC supply in the plant.

2.00.00 CODES AND STANDARDS

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

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

IS: 10918: Specification for vented type Nickel Cadmium Batteries.

IS: 1069: Quality tolerances for water for storage batteries

IEEE: 1115: Recommended practice for sizing of Ni-Cd batteries for stationary applications.

Indian Electricity Rules

Indian Electricity Acts

Battery chargers shall be as per the following standards and codes:

For reference purpose only

ANSI-C 37.90a Guide for surge withstand capability tests

IS: 5: Colours for ready mix paints.

IS: 694: PVC Insulated Cable for working voltages upto and including 1100V

IS: 1248: Specification for Direct acting indicating analogue electrical measuring instruments.



- IS: 13947 Pt-1: Degree of protection provided by enclosures for low voltage switch gear and control gear.
- IS: 13947: Specification for low voltage switch gear and control gear
- IS: 3231: Electrical relays for power system protection.
- IS: 3842: Application guide for Electrical relays for AC System
- IS: 3895: Mono-crystalline semi-conductor Rectifier Cells and Stacks
- IS: 4540: Mono crystalline semi-conductor Rectifier assemblies and equipment.
- IS: 6005: Code of practice for phosphating of Iron and Steel
- IS: 6619: Safety Code for Semi-conductor Rectifier Equipment.
- IS: 6875: Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages up to 1000 VAC or 1200VDC
- IS: 9000: Basic environmental testing procedures for electronic and electrical items.
- IS: 13703: Low voltage fuses for voltages not exceeding 1000 V AC, 1500VDC.
- EEUA-45D Performance requirements for electrical Alarm Annunciation system

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

3.00.00 DESIGN CRITERIA

3.01.00 Duty Cycle

The duty cycle shall be decided based on following considerations:

1. Momentary load (1 minute)
 - a) Tripping/closing load of breakers
 - b) Starting current of DC drives
 - c) Solenoid valves
 - d) Excitation system
2. Emergency load & Continuous load (2 hours)
 - a) Running currents of DC motors (emergency oil pump, jacking oil pump, seal oil pump)



- b) Emergency lighting
- c) PA system
- d) Annunciation (20 %)
- e) Indicating lamp of switchgears and control panels
- f) Control room emergency lighting
- g) Auxiliary relays
- h) Numerical relays

3.02.00 Sizing Criteria

Following factors shall be considered while carrying out battery sizing calculations:

- a) Ageing factor- 1.25
- b) Design margin- ~~4.0~~ 1.20
- c) State of charge- 0.9

End cell voltage shall not be less than 1.14 V per cell.

~~Float charger will be rated to cater the following:~~

- ~~(a) Trickle charging current of the battery~~
- ~~(b) Continuous load on the DC bus~~
- ~~(c) Full load current of the largest DC motor~~
- ~~(d) 25% margin on Total.~~

~~The boost charger unit shall be rated such that the battery can be charged from fully discharged condition within 10 hours.~~

3.03.00 220 V DC power supply is required for supplying power to essential unit auxiliaries, control, protection, interlock and annunciation. As such the following shall be provided:

- ~~a) 2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for main plant and station loads of each unit.~~
- ~~b) 2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for Coal Handling plant.~~



- c) ~~2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for Ash handling plant.~~
- d) ~~2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for Water Treatment plant and RO Plant.~~
- e) 2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for 400 kV GIS.
- f) ~~2 X 100% set of 220V Ni-Cd battery with associated SMPS based modular float cum boost charger for 33/11 kV Switchgear at ICHS stage I & Sea Water intake.~~
- g) ~~2x100% rated 48 V Ni-Cd battery with redundant SMPS based float cum boost charger and a common DCDB for EPABX system.~~

3.04.00 In addition to the above, one no. spare float cum boost charger shall also be provided for above described system (a).

3.05.00 The unit auxiliaries for which emergency power supply from the DC storage battery is required are listed below:

- a) minimum emergency lighting system for reduced illumination during failure of main power supply
- b) ~~Hydrogen seal oil system~~
- c) ~~TC bearing oil system (emergency lubricating oil pump)~~
- d) ~~Aux control supply for 11 KV unit and station SWGRs and 3.3 KV & 415 V SWGRs~~
- e) Electrical protection system
- f) ~~Turbine DC Jacking oil pumps (for main turbine & BFP turbine)~~
- g) Any other emergency load considered necessary.

3.06.00 General Technical Particulars for Battery and Battery Chargers

1.0	DC SYSTEM		
1.1	Type of charger		Combined float cum boost



1.2	DC system voltage (Nominal)		220 V
1.3	DC system earthing		Unearthed
1.4	Ambient design temperature	^o C	50
2.0	BATTERY DETAILS		
2.1	Battery Type		Ni-Cd fibre plate type
2.2	Nominal cell voltage	V	1.2
2.3	End cell voltage	V	1.14
2.4	Discharge capacity	Hr	5
2.5	Ageing factor		1.25
2.6	Design margin		20%
2.7	Float charging voltage		1.4V to 1.42 V
2.8	Boost charging voltage		1.54 to 1.7 V

3.0	BATTERY CHARGER DETAILS		
3.1	DC voltage setting adjustment of AVR for float charging		± 10% of nominal voltage
3.2	Voltage stabilization for constant voltage regulator	(i)	±1% of set DC voltage for ± 10% voltage and +3% to



			-5% frequency variation in power supply
		(ii)	$\pm 5\%$ during transients
3.3	DC current adjustment for boost charging		30% to 100% of maximum boost charging current
3.4	Current stabilization for constant current regulator for boost charger		$\pm 2\%$
3.5	Minimum permissible p.f. at rated continuous load		0.8
3.6	Permissible ripple content at rated continuous load		1% maximum
3.7	Degree of protection		IP 42

4.00.00 GENERAL TECHNICAL REQUIREMENTS FOR EQUIPMENTS

4.01.00 Batteries

4.01.01 Type

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

DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell.



Minimum battery back up duration shall be 2 hours and shall be in line with battery duty cycles applicable for power plant emergency supplies. In addition 20% margin shall be provided.

The nominal discharge voltage/cell shall be 1.2V.

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

4.01.02 Construction Features

a) Manufacturer's Identification system:

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

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

b) Containers

Containers shall be made of polypropylene or equivalent plastic material. Containers shall be robust, heat resistance, leak proof, non absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.

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 alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.



d) Plates

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

The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion.

The positive and negative terminal posts shall be clearly marked.

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) Cell Insulator

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

g) Electrolyte

The electrolyte shall be prepared from battery grade potassium hydroxide conforming to BS: 1069/IEC 60993

The cells can be shipped either in charged condition or in dry condition

Necessary electrolyte for make-up shall be supplied separately.

h) Connectors and Fasteners

Nickel coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively Nickel coated to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded aluminium conductors and XLPE insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective



batteries and through fault short circuit current which the battery can produce and withstand for the period declared.

i) **Battery racks**

Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor.

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

The Battery shall be provided with earth leakage detector. The battery distribution board should have earth leakage monitoring equipment for the DC feeders taking off from the panel.

j) **Load Banks**

A separate resistor load bank shall be provided for testing of batteries.

Load Bank shall be resistive/reactive type and shall be suitable for testing the generator on full load. The load bank shall be suitable for outdoor application with degree of protection IP 55. Load bank shall be fully automatic with provision for manual operation.

Constructional features:

The load bank shall be fan cooled constructed from 2.5 mm zinc coated steel incorporating removable panels for easy access to resistors and fan. The whole assembly shall be mounted onto a fully hot dipped galvanized base. The control and electrical cabinet shall be part of the load bank and shall have doors with lift off hinges and security type locks. All screws, nuts and bolts shall be zinc plated and secured with vibration proof washers and thread locking adhesive.

The load bank shall be constructed as a free standing unit and be self supporting, vermin proof; with front, side and end panels forming uniform planes without



protrusions or sharp edges. Provision shall be made for lifting the unit by the use of crane slings, rollers and fork lift trucks.

The load bank control cabinet doors shall be fitted with neoprene wire reinforced gasket. An anti-condensation heater protected by HRC fuse shall be provided in the control panel.

Load resistors shall be stainless steel, fully moisture-sealed and weather proof IP 65 degree of protection. Resistors shall be calibrated within 5% of their rated value and tested to 2 kV.

Cooling fans shall be adequately sized for cooling bank to maintain cabinet temperature at no more than 20°C above ambient temperature. The fans shall have electrical interlocks against fan failure, reverse rotation, air restriction or load bank high temperature. A 5 minute timer shall be provided to run fans after load shutdown.

4.02.00**Battery Charger**

For reference purpose only

4.02.01**General**

- a) The charger shall be natural air cooled, SMPS mode type (microprocessor based only) with full wave, fully controlled, bridge configurations. (SMPS modules shall be $n+2$, n is no. of modules for rated capacity)
- b) The charger shall be provided with automatic voltage regulation, current limiting circuitry, smoothing filter circuit and soft-start feature.
- c) Voltage control shall be stepless, smooth and continuous.
- d) The charger shall be self-protecting against all A.C. & D.C. transients and steady state abnormal currents and voltages.
- e) Charger A.C. input and D.C. 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) In case of chargers, both negative and positive isolations shall be achieved.

4.02.02**Interlocks**

Necessary interlock shall also be provided to avoid accidental boost mode operation when loads are connected to the bus.



4.02.03

General Technical Requirement

- a) The Battery Chargers as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Nickel-Cadmium fibre plate Batteries while supplying the DC loads
- b) Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging.
- c) All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/ current control, whether automatic or manual. Means shall be provided to avoid current/ voltage surges of harmful magnitude/ nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition.
- d) Soft start features shall be provided to build up the voltage to the set value slowly within fifteen seconds. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall not damage the charger, nor shall it cause blowing of any of the charger fuses. The charger shall not trip on overload or external short circuit. After clearance of fault, the charger voltage shall build up automatically when working in automatic mode.
- e) When on automatic control mode during Trickle charging, the Charger output voltage shall remain within $(\pm)1\%$ of the set DC value for AC input voltage variation of $(\pm)10\%$, frequency variation of $(+)-3$ to $(-)-5\%$, a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified. Step less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode



- f) During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be vernier type.
- g) Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere shall be less than fifteen seconds.
- h) Momentary output voltage of the Charger, with the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change.
- i) The Charger manufacturer may offer an arrangement in which the voltage setting device for Trickle charging mode is also used as output voltage limit setting device for Boost charging mode, and the load limiter of the trickle charging mode is also used as Boost charging current setting device.
- j) Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.
- k) The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided in the DC distribution board for remote annunciation.
- l) Necessary separation walls for the UPS charger, panels and the batteries in battery room shall be provided.



4.02.04 Contactors

All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. The operating coil shall be rated for 400 Volts AC.

4.02.05 Thermal Overload Relay

A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor.

4.02.06 Charger shall be SMPS type and shall have following features:

- Pulse width modulation
- High frequency DC/AC converting
- Voltage stabilization tolerance: $\leq \pm 0.5\%$
- Current stabilization tolerance: $\leq \pm 0.5\%$
- Ripple coefficient: $\leq 0.05\%$
- Power factor: ≥ 0.92
- Efficiency: $\geq 92\%$
- Standby mode: N+1 module online
- MTBF: $\geq 100,000$ h
- Remote control functions
- Modular Design
- LCD Control Display Panel
- Multi-Point Monitoring
- Remote Communication
- Software Programmable (PLC Based)
- AC Ripple $< 0.5\%$
- Dynamic Response < 100 micro. sec.
- THD $< 5\%$
- Enhance earth fault monitoring
- Tunable Output
- Intelligent float boost & equalize charging
- Temperature compensated charging for VRLA
- Calculating battery charge/ discharge capacity
- Discharge calculation with K factor & temperature compensation
- Monitoring of each DC feeder status
- Total control on each charging module
- Storing historic alarms
- Remote communication with RS 232 & 485
- Individual cell monitoring
- Ground fault identification suitable for opto-coupler loads
- Identifies faulty feeders



- Monitors insulation level of feeders
- Both positive & negative monitoring

4.02.07 Instruments

DC voltmeter, DC ammeter and AC voltmeter in 96 mm square shall be provided for all Chargers. The instruments shall be flush mounted type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustments. The instruments shall be of 1.5 accuracy class.

4.02.08 Air Break Switches

All Chargers shall have AC input and DC output switches of air break, single throw, load break and fault make type. The contacts of the switches shall open and close with a snap action. Switches shall be rated for 120% of the maximum continuous load. 'ON' and 'OFF' position of the switch shall be clearly indicated.

4.02.09 Control and Selector switches

Control and selector switches shall be of rotary stay-put type with escutcheon plates showing the functions and positions. The switches shall be of sturdy construction and suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred. The contact ratings shall be at least the following:

- Make and carry continuously – 10 Amps.
- Breaking current at 220 V DC – 0.5 Amp. (Inductive)
- Breaking current at 240 V AC – 5 Amp at 0.3 p.f.

4.02.10 Annunciation System

a) One (1) fifteen points alarm facia shall be provided on each charger panel, complete with proper actuating devices, circuitry and legends for the following:

1. A.C. supply failure
2. D.C. voltage lows for Boost & float charger separately
3. D.C. voltage high for boost & float charger separately



4. D. C. System grounds
5. Battery on Float
6. Battery on boost
7. Charger overload for boost charger separately
8. DC output fuse blown for boost & float charger separately.
9. Charger failure
10. Two 2 nos. spare
11. Load limiter operated
12. Any other alarm point, if required for battery charger shall be provided.

Note: Initial contacts for alarm points shall have electrically separate spare set of contacts wired up to the terminal block for future use.

- b) 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.
- c) Each time a window lights up, a master relay will get energised to provide group alarm signals for Owner's remote panel.

4.02.11 Following minimum indications shall be provided

1. DC supply healthy
2. Control supply ON
3. Charger power supply ON
4. Charger DC output healthy
5. Float charger ON
6. Float charger Fail
7. Boost charger in operation
8. Float cum boost charger in boost mode
9. Float cum boost charger in float mode
10. SMPS Module failed

4.02.12 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 and boost chargers. The alarms shall be provided on the E D M S / DDCMIS.



- Main AC failure
- Charger AC input fuse blown
- Charger DC output fuse blown
- Charger U/V and current limit protection
- Charger Over voltage protection
- Charger Over current protection
- Charger Filter condenser fuse blown
- Charger Rectifier fuse blown
- Tap Contactor off
- DC Voltage
- Charger Current & Voltage
- DC System ground
- Battery on Boost
- Battery on Float
- SMPS Module failed

4.02.13 Blocking Diode

Blocking diode shall be provided in the output circuit of each Charger to prevent current flow from the D.C. Battery into the Charger.

4.02.14 Construction

- a) The charger shall comprise a continuous line up of free-standing, floor mounted sheet steel panels, with all access from the front.
- b) The panel shall conform to the degree of protection IP-42. The panels shall be manufactured from cold rolled sheet steel of minimum 2 mm thickness with doors and base frame of minimum 2.5 mm thick cold rolled sheet.
- c) Access doors shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh.
- d) All equipment within the panels shall be arranged in modular units and laid out with sufficient space for easy maintenance.
- e) Switches, meters, relays etc. shall be flush mounted on the front of the panels. Nameplates of approved size and type shall be provided for all circuits and devices.



4.02.15 Charger Equipment

- a) All power diodes and control rectifiers shall be silicon type. Rectifier transformers shall be dry type, double wound, with copper conductor and class-B insulation. The maximum temperature of the class-B insulation shall be limited to that of class-A insulation.
- b) Blocking diodes shall be fully rated and redundant 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) Changeover switch shall be 3 position, 4 pole, load break type with minimum 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) Contactors shall be air-break type. Thermal overload relays shall have in-built single phasing preventer.
- f) Fuses shall be HRC type and arranged for easy replacement. Semiconducting device fuses shall be fast-acting.
- g) Indicating Lamps shall be LED type.
- h) Meters shall be 96 x 96 mm switchboard type, 90 deg scale, antiglare glass, 1% accuracy with zero adjuster on the front.
- i) Rectifier transformer for float-cum-boost charger shall be provided with 2x2.5% taps on the primary side.

4.02.16 Controls

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

- a) Selection of float, equalizing or boost charge.
- b) 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.
- c) Current limit setter.
- d) Alarm window reset button.

4.02.17 Lamp/Space Heater/Receptacle

- a) The charger panels shall be provided with:



1. Internal illumination lamp with door switch.
 2. Space heater with thermostat control.
 3. 3-pin 5A receptacle with plug.
- b) Lamp, heater and receptacle circuits shall have individual switch fuse units.

4.02.18 Wiring/Cabling

- a) The panels shall be completely wired-up. All wiring shall be routed through wiring troughs. Wires shall be ferruled at both ends for identification.
- b) Panels shall have removable gland plates at the bottom for cable entry. All incoming/outgoing cables shall be terminated in suitable terminal blocks.
- c) Control terminal blocks shall be box-clamp type ELMEX 10 mm² or approved equal. 20% spare terminals shall be furnished.
- d) Wiring shall be done with 1100 V grade PVC armoured, multi strand FRLS cables. Minimum wire size shall be 2.5 mm² stranded copper conductor.

4.02.19 Printed circuit Boards (PCB)

PCB shall be made of glass epoxy of 1.6 mm thick, fire resistant, bonded with 99.8% pure copper foil, free of wrinkles, blisters, scratches and pinholes. The contact surface of the edge connectors of the PCBs shall be plated with hard gold to a minimum thickness of 5 microns. Component identification shall be printed on PCB by silk screen method. All PCBs shall be tropicalised & marked.

4.02.20 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 M10 G.I. bolts and nuts and shall be suitable for connecting to 50 x 6 mm G.S. flat.

4.02.21 Painting

The panels shall be finished in Siemens grey shade (shade RAL 7032) with two coats of synthetic enamel paint. The panels shall have a matt finish to prevent any glare from



surface due to illumination. Inside panels painting shall be as per shade RAL 7032.

4.02.22**Name Plate**

- a) Nameplates shall be provided for each panel and for each equipment/device mounted on it.
- b) The material shall be anodized aluminium/lamicoid, 3 mm thick, with white letters on black background.
- c) Nameplates shall be held by self-tapping screws. The size of nameplates shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for panels.
- d) Nameplates for panels shall be provided both on the front rear and also inside of 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 & outside of panel.
- f) Instruments 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 on suitable metal plate shall be affixed at the back of each panel.

5.00.00**BATTERY HEALTH MONITORING SYSTEM (BHMS)**

Each set of battery shall be equipped with a battery health monitoring system. BHMS shall be microprocessor based system with hardware and software to monitor the condition of each battery system. It should be possible to analyze the minimum and maximum voltage values of each battery cell so that any damage to battery shall be prevented by pr-active maintenance.

In general the BHMS shall be able to monitor following conditions during a partial discharge against stored characteristics for the type and capacity of battery:

- 1. Excessive current during charging or discharging
- 2. Short circuit
- 3. Over voltage-Overcharging
- 4. Under voltage-Exceeding preset depth of discharge (DOD) limits
- 5. Over heating- Exceeding the cell temperature limit
- 6. Pressure build up inside the cell



The system should be able to test, analyze and predict the battery performance, computing remaining capacity and battery efficiency. The BHMS shall compensate for cell temperature and discharge load current throughout the discharge cycle. The system shall have a programmable event log which shall be secured in the event of total power failure for atleast a period of six months. In addition to local indication and control, the battery monitoring shall also include RS 485 output port to enable battery parameters and alarms to be monitored from plant DDCMIS / EDMS / SAS

7.00.00 LIST OF TESTS TO BE CONDUCTED**7.01.00 Shop Tests**

All equipment and components thereof shall be subject to shop tests as per relevant IS standards.

7.01.01 Type tests shall be performed on two cells of each battery.**7.01.02 Tests on battery charger.** For reference purpose only
Following 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) D.C short circuit test to prove ability of current limit.
- f) Measurement of transient overshoot/undershoot during switching ON/load throw-off.
- g) Current limiter operation.
- h) Dynamic response test - overshoot/ undershoot in output voltage of the charger as a result of sudden change in load from 100% to 20% and 20% to 100% shall be measured with the batteries connected and disconnected. Output voltage of the charger connected with battery shall be within 94% to 106% of the voltage setting in above conditions and shall return to, and remain, within the limits specified as mentioned elsewhere, in less than 2 seconds (as applicable).



- 7.01.03 h) Test for annunciation system
Routine tests on component parts.
- 7.01.04 a) Burning test for PCB's. Assembled PCB burning test at 70 Deg.C. for seventy-two (72) hours with loaded condition.
- b) Rapid temperature cycling tests at 70 Deg.C. and 0 Deg.C for thirty (30) minutes at each temperature for (five) 5 cycles.
- 7.01.05 Routine and type test certificates for components like contactors, relays, instruments, SCR/PWM transistors, Diodes, Condenser, Potentiometer, semi-conductors, push buttons to be furnished for review whenever required.
- 7.01.06 All routine tests as per applicable standards shall be conducted on the DC board.
- Copy of all type test certificates on identical boards issued by authorized test agency shall be furnished.
- 7.02.00 Test Certificates**
- 7.02.01 Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of Owner.
- 7.02.02 The equipment shall be dispatched from works only after receipt of Owner's written approval of Test Report.
- 7.02.03 Type test certificate on any equipment, if so desired by the Owner, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

8.00.00 DRAWINGS, DATA & MANUALS

Following drawings & documents are to be submitted by the Contractor:

- i. Dimensional battery layout diagram in plan & section.
- ii. Connection details of take-off terminals.



- iii. Dimensional general arrangement drawings of battery charger, clearly showing device dispositions, cable entry, space requirement, etc.
- iv. Sectional views of battery charger panels.
- v. Charger foundation plan and loading.
- vi. Charger schematics and wiring diagrams.
- vii. Technical particulars for the switchboard.
- viii. Descriptive literature/pamphlets on switchboard.
- ix. Write up on switchboard construction
- x. Single line diagram showing ratings of all the buses, incomers, ties etc.
- xi. Test reports
- xii. Detailed bill of materials.
- xiii. Any other relevant drawing or data necessary for satisfactory installation, operation, and maintenance.
- xiv. Instruction manuals of battery and battery Charger.
- xv. The manual shall clearly indicate method of installation, check-ups, and tests to be carried out before commissioning of the equipment.
- xvi. The Tenderer may note that the drawings, data and manuals listed above are minimum requirement only. Tenderer shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with their bids.



SECTION – 3

PROJECT INFORMATION AND GENERAL TECHNICAL REQUIREMENTS

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CHAPTER 1

PROJECT SYNOPSIS

1.0 GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1320 MW (2 units of 660 MW each) Coal Based Thermal Power Station at Katupalli. This is an expansion of North Chennai Thermal Power Station (NCTPS) and located on some portion of the ashdyke of NCTPS.

1.2 Location

The proposed site for main power plant is located near Ennore port (approx 5 kms).
The nearest Railway station is at Athipattu Pudunagar (approx 5 kms)
All weather road from Pattamandri on the Thiruvottiyur-Ponneri district highway is the nearest road access.
The nearest airport is at Chennai at a distance of 60 km.

1.3 NA

1.4 PROJECT INFORMATION

Project Title : **2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS**

Owner : **TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

LOCATION

The site is located near Vayalur Village, Ennore

Latitude	:	13°17' N to 13°18' N
Longitude	:	80°18' E to 80°19' E
Distance from Chennai City	:	35 km
Nearest Airport is at Chennai at a		
Distance of	:	60 km
Nearest Seaport is	:	Ennore
Nearest Railway Station is	:	Athipattu Pudunagar (approx 5 kms)

Meteorological Condition

Climate : Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

Climatological data	:		
Ambient temp. (°C)	:	Annual Maximum Mean Temp	41.5(°C)
	:	Annual Minimum Mean Temp	24(°C)
	:	Design Ambient temperature	50(°C)
Relative Humidity	:	Maximum 100% Minimum 36% Design 75%	
Annual Rainfall	:	Maximum 2540 mm Average 1600 mm Minimum 1175 mm	
Prevailing Wind Direction	:	Nov to Jan – From NW & NE Feb to Mar – From East & SE Apr to May – From South & SE June – From SW July to Aug – From NW Sept to Oct – From SE & SW Wind Speed 11.8 kmph (avg) 50 kmph (max)	
Seismic Zone	:	Seismic Zone III as per IS:1893-2002	

	minimum 0.16 g horizontal	
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1.5

1.7

Access to Site

Site is well connected to all weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

CHAPTER – 2

GENERAL TECHNICAL REQUIREMENTS

1.00.00 ELECTRICAL SYSTEM PARTICULARS

1) Standard voltage levels

The standardized voltage levels as shall be adopted as specified elsewhere in this specification.

2) Permissible variations:

The system unit/plant equipment shall be designed suitable for continuous operation with variation in voltage and frequency as indicated below:

3) Variation in voltage and frequency

	Voltage	Frequency
Permissible variation for power supply with rated Performance /rated current and control effectiveness maintained	+/- 10%	-5% to +3%
Permissible variation for control and regulation equipment with rated Performance and control quality maintained		

4) Basic insulation levels

Equipment shall be designed suitable for basic insulation levels as given below:

Nominal Voltage (kV)	BiL kV (peak)
400 kV	1425
33 kV	170
11 kV	75
3.3 kV	40

5) Symmetrical short circuit ratings

The three phase symmetrical short circuit ratings of the switchgear at different voltage levels shall be as indicated in the Table below:

S. No.	Voltage level	Symmetrical Breaking Capacity	Making Capacity
1.	400 kV	63 kA for 1 sec	163 kA
2.	33 kV	25 kA for 3 sec	62.5 kA
3.	11 kV	50 kA for 3 sec	125 kA
4.	3.3 kV	40 kA for 3 sec	100 kA
5.	415 V	50 kA for 1 sec	125 kA
6.	220 V DC	25 kA for 1 sec	-
7.	48 V DC	10 kA for 1 sec	

6) Criteria for selection of voltage levels for motors

Sr. No	Rating	Voltage Level
1	LV Motors- Up to 160 kW	415 V, 3 phase, 50 Hz
2	MV Motors- More than 160 kW and up to 1500 kW	3.3 kV, 3 phase, 50 Hz
3	HV Motors- Above 1500 kW	11 kV, 3 phase, 50 Hz

7) System Earthing

- i. 33kV/11 kV and 3.3 kV : Resistance grounded.
- ii. 415 V : Solidly grounded.

8) Degree of Protection:

Degree of protection for various electrical equipment shall be as follows:

S.No.	Equipment	Degree of Protection
1.	Marshalling Boxes, Panels, Motors located outdoor	IP55
2.	Electrical Equipment of CH System	IP55 with dust proof enclosure
3.	HV Switchgear	IP-4X for bus bar chamber, IP-6X for other compartments
4.	LV Switchgear	IP52 up to 1600 A and IP42 above 1600 A

2.00.00 GENERAL TECHNICAL PARTICULARS FOR EHV SYSTEM

(a)	Rated voltage	400 kV
(b)	Rated frequency	50 Hz
(c)	Rated short time current withstand capacity	63 kA rms for one (1) second
(d)	Rated one minute power frequency withstand voltage	650 kV rms between live terminals and earth b) 815 kV rms across isolating distance
(e)	Rated lightning impulse withstand voltage	a) 1425 kVp between live terminals b) 1425 (+240) kVp across isolating distance & earth.
(f)	Rated Switching Impulse withstand voltage	a) 1575 kVp (between phases) b) 900 (+345) (across isolating distance)
(g)	Phase to phase spacing	4000 mm
(h)	Rated terminal load	Adequate to withstand 100 kg static load as well as wind, seismic and short circuit forces without impairing reliability or current carrying capacity.
(i)	System neutral earthing	Effectively earthed
(j)	Support structure height	Adequate so that lowest part of support insulator of equipment is 2550 mm (minimum) from ground and/or plinth level.
(k)	Creepage distance	Minimum 31 mm / kV
(l)	Electrical Clearances	

Clearances shall be as given below and as per relevant statutory rules/codes.		
1.	Phase to earth	3500 mm
2.	Phase to phase	4000 mm
3.	Sectional clearance	6500 mm
4.	Ground clearance	8000 mm

3.00.00 NA

4.00.00 COMPLETENESS

4.01.00 Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant is provided.

4.02.00 All equipment furnished by the Bidder shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation & maintenance of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All similar standard components/ parts of similar standard equipment provided, shall be interchangeable with one another.

5.00.00 CODES & STANDARDS

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

- (a.) Bureau of Indian Standards (BIS)
- (b.) Indian electricity act
- (c.) Indian electricity rules
- (d.) Indian Explosives Act

- (e.) Indian Factories Act and State Factories Act
- (f.) Indian Boiler Regulations (IBR)
- (g.) Regulations of the Central Pollution Control Board, India
- (h.) Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- (i.) Pollution Control Regulations of Department of Environment, Government of India
- (j.) State Pollution Control Board.
- (k.) Rules for Electrical installation by Tariff Advisory Committee (TAC).
- (l.) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- (a.) Japanese Industrial Standards (JIS)
- (b.) American National Standards Institute (ANSI)
- (c.) American Society of Testing and Materials (ASTM)
- (d.) American Society of Mechanical Engineers (ASME)
- (e.) American Petroleum Institute (API)
- (f.) Standards of the Hydraulic Institute, U.S.A.
- (g.) International Organisation for Standardization (ISO)
- (h.) Tubular Exchanger Manufacturer's Association (TEMA)
- (i.) American Welding Society (AWS)
- (j.) National Electrical Manufacturers Association (NEMA)
- (k.) National Fire Protection Association (NFPA)
- (l.) International Electro-Technical Commission (IEC)
- (m.) Expansion Joint Manufacturers Association (EJMA)
- (n.) Heat Exchange Institute (HEI)

5.03.00 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Owner's approval, for which the Bidder shall furnish, alongwith the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned else

where in the specification together with the complete word to word translation of the standard that is normally not published in English.

~~5.04.00~~ NA

5.05.00 NA

5.06.00 NA

5.07.00 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Owner shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Bidder to bring to the notice of the Owner such changes and advise Owner of the resulting effect.

6.00.00 EQUIPMENT FUNCTIONAL GUARANTEE

6.01.00 The Equipment and Auxiliaries shall be capable of continuous operation in frequency range of 47.5 to 51.5 Hz.

DRAWING DOCUMENT SUBMISSION

4.1 DISCREPANCIES BETWEEN DRAWING AND SPECIFICATION:

Should there be any discrepancy between the specifications and/or schedule of prices and/or drawings or any inconsistency, error or omission in either of them, reference must be made to the BHEL/CUSTOMER for an explanation and the Supplier will be held responsible for any errors that may occur in the work through neglect of this precaution. The explanation of the BHEL/CUSTOMER shall be final and binding on the Supplier.

4.2 APPROVAL PROCEDURE

The scheduled dates for the submission of drawings as well as for, any data/information to be furnished by the Employer would be as per the following schedule. 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.	First Submission	Within 7 days from the date of LOI/PO
ii.	Approval/comments/by employer on Initial submission	Reasonable time
iii.	Resubmission	Within 7 days (whenever from date of comments required) Including both ways postal time.
iv.	Approval or comments	Within 2 weeks of receipt of resubmission.
v.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The supplier 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.

4.3 TITLE BLOCK

Following Title Blocks to be used in drawings at the time of drawing approvals

Project:	400kV GIS at 2 x 660 MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Chennai-120		
NOA No:	CE/P/SE/M/P/EE-10/E/P/F.2X660MW	ENNORE	SEZ
Customer :	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)		
Consultant	DESEIN PRIVATE LIMITED, NEW DELHI		
Contractor	BHARAT HEAVY ELECTRICALS LIMITED		

4.4 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

- 1) Drawings
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) List of Part Supplies with rating

Drawings & Documents submitted at the time of offer shall be subject to review at contract stage.

4.5 DOCUMENTATION SCHEDULE

Following Documentation schedule to be followed per project.

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Hard Copy / Prints	Hard Copy / Prints	CDs
1	Drawings and Data Sheets	1	7	10	5
2	Drawings "As Built "	-	-	10	
3	Type Test Reports	1	7	10	
4	Erection Manuals	-	7	10	
5	Operation and Maintenance Manuals	-	7	10	
6	Manufacturing Quality Plan	-	7	10	
7	Field Quality Plan	-	7	10	

8	Inspection Test Reports	-	7	10	
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Supplier to submit Hard copies of the drawing to following address

To,

<Name of BHEL's concerned engineering official>

Bharat Heavy Electricals Limited
Transmission Business Group- Engineering Management
Advant Navis IT Business Park
Plot No.-7, Greater Noida Expressway,
Sector 142, **NOIDA**, Uttar Pradesh 201305

Note: Drawings will also be submitted in CD/DVD in Latest AUTOCAD version or any other CAD package along with conversion files for all major items.

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

ANNEXURE-A: SCHEDULE OF TECHNICAL DEVIATIONS

Bidder shall list out all technical deviation(s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason / Justification
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Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date:

Bidder's Stamp & Signature

ANNEXURE-B: COMPLIANCE CERTIFICATE

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

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

Date:

Bidder's Stamp & Signature

ANNEXURE-C: GUARANTEED TECHNICAL PARTICULARS

(To be submitted by the supplier at the contract execution stage)

1. Applicable standards :
2. Name of the Project :
3. Manufacture's name and address :
4. Battery type :
5. **GENERAL**
 - a. Make :
 - b. Type :
 - c. Reference Standard :
6. **RATING**
 - a. Rated Voltage (V) :
 - b. 5-hour rating at 27deg C to 1.14V/Cell (AH):
 - c. 1-hour discharge rate to 1.12V/Cell (A) :
 - d. 1-minute discharge rate to 1.12V/Cell (A) :
7. **PERFORMANCE**
 - a. Does the battery meet the required duty cycle curve? (Yes/No):
 - b. Cell voltage characteristics during duty cycle furnished? (Yes/No):
 - c. Minimum cell voltage during duty cycle (V):
 - d. AH efficiency at 5-hour discharge rate (%):
 - e. Expected life of Battery (Hrs):
 - f. 20% margin considered (Yes/No):
 - g. 25% ageing compensation factor considered (Yes/No):
8. **BATTERY CHARACTERISTICS**
 - a. Recommended charging rate for Volt/Cell (A):
 - i) Float charging :
 - ii) Boost charging in 10 hrs :
 - Start :
 - Finish :
 - b. Recommend specific gravity at 27deg. C
 - i) For first filling :
 - ii) At full charge :
 - iii) At end of 10-hour discharge :
 - c. Short-circuit current for a dead-short across battery terminals, when
 - i) Float charge at 1.4 Volt/Cell (KA) :
 - ii) Boost charge at 1.53-1.70 Volt/Cell (KA) :
 - d. Battery internal resistance (Ohm) :
 - e. Cell voltage characteristics during charging furnished? (Yes/No):
9. **CELLS**
 - a. Number of cells per battery :
 - b. Type of the cell :
 - c. Cell designation as per IS/IEC :
 - d. Material of the container :
 - e. Overall dimension of each cell (mm) :
 - f. Weight of complete cell
 - i) Without acid (Kg) :
 - ii) With acid (Kg) :

-
- g. Internal resistance of cell (Ohm) :
- 10. INTERCELL CONNECTOR**
- a. Intercell connector furnished? (Yes/No) :
- b. Type of intercell connector bolted/burned :
- c. Material of intercell connector :
- 11. PLATES**
- a. Number of positive plates per cell :
- b. Type of positive plate :
- c. Type of negative plate :
- d. Terminal Stand Material :
- 12. SEPARATOR**
- a. Type :
- b. Material :
- c. Thickness :
- 13. ELECTROLYTE**
- a. Amount of electrolyte for first filling
- i) Per cell (litre) :
- ii) Per set (litre) :
- d. First filling with 10% extra furnished? (Yes/No):
- e. Electrolyte conform to :
- 14. RACKS**
- a. Number of racks per battery :
- b. Number of cells per rack :
- c. Type of racks Rows/tiers :
- d. Material of rack :
- e. Racks provided with
- i) Numbering tags for cells :
- ii) Teakwood clamps for cables :
- f. Insulator with 5% extra furnished for
- i) Cell (Yes/No) :
- ii) Stand (Yes/No) :
- g. Inter-row, Inter-tier connectors and end take-off furnished? (Yes/No):
- h. Connection hardware with 5% extra furnished? (Yes/No):
- 15. DIMENSION & WEIGHTS**
- a. Overall dimension (L x B x H) (mm) :
- b. Approx. Weight (Kg) :
- c. Battery layout drawing furnished? (Yes/No) :

Date:

Bidder's Stamp & Signature

Annexure-D: Technical Checklist

(Checklist for information to be furnished with offer. Return this technical checklist as a part of technical offer duly signed. The offer may not be considered, if this checklist is not enclosed with this offer)

1. TECHNICAL REQUIREMENTS

Sl. No.	Parameters	220V Battery Bank	Bidder's Confirmation	48V Battery Bank	Bidder's Confirmation
1.	Manufacturer's identification	--	YES	--	YES
2.	Battery type	Ni- Cd Fibre Plate type	YES	Ni- Cd Fibre Plate type	YES
3.	Battery nominal voltage	220V	YES	48V	YES
4.	Discharge capacity	600AH for 5Hrs	YES	200AH for 5Hrs	YES
5.	Ageing factor	1.25	YES	1.25	YES
6.	Design margin	20%	YES	20%	YES
7.	Float charging voltage	1.40V- 1.42V	YES	1.40V -1.42V	YES
8.	Boost charging voltage	1.54V- 1.70V	YES	1.54V -1.70V	YES
9.	End cell voltage	Not less than 1.14V	YES	Not less than 1.14V	YES
10.	Nominal cell voltage	1.20V/Cell	YES	1.20V/Cell	YES
11.	Min. electrolyte temp. for battery sizing	15°C	YES	15°C	YES
12.	Ambient design temperature	50°C	YES	50°C	YES
13.	Maximum battery bank voltage	242V	YES	52.80V	YES
14.	Minimum battery bank voltage	198V	YES	43.20V	YES
15.	No. of cells per battery	170 nos.	YES	37 nos.	YES
16.	Cell container	Polypropylene / equivalent plastic material	YES	Polypropylene / equivalent plastic material	YES
17.	Battery racks	Mild steel frame with anti-alkali paint	YES	Mild steel frame with anti-alkali paint	YES

18.	All fittings & accessories are included in the scope of supplies	--	YES	--	YES
19.	All mandatory spares are included in the scope of supplies	--	YES	--	YES
20.	Special tools & tackles included in scope of supply	--	YES	--	YES
21.	Supply of electrolyte for first filling plus 10% extra with the battery bank.	Battery grade potassium hydroxide	YES	Battery grade potassium hydroxide	YES
22.	Erection, testing & commissioning is included in scope of supply.	--	YES	--	YES
23.	All routine & acceptance tests to be conducted	--	YES	--	YES
24.	Document for meeting qualifying requirements enclosed with the offer	--	YES	--	YES
25.	Sizing calculation for deciding AH rating of Battery as per specified duty cycle	--	YES	--	YES

2. TYPE TESTS

Whether Type test reports as per clause no. 1.5 of section-1 has been submitted.

YES/NO

If yes, kindly indicate report number as following details,

Sl. No.	Description of test	Report no. with date	Remarks, if any

If the valid type test reports are not available as per clause no. of section -I of technical specification with the bidder, then the type tests shall be conducted by the bidder without any price implication

YES/NO

Confirmation for optional type test as mentioned in clause 1.5 of section-1.

YES/NO

Date:

Bidder's Stamp & Signature