

KARNATAKA POWER TRANSMISSION CORPORATION
LIMITED

TECHNICAL SPECIFICATION

SECTION –

BATTERY AND BATTERY

CHARGER

TECHNICAL SPECIFICATIONS

SECTION – 5. 3 (A) PLANTE OR GRID PLATE TYPE BATTERY

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SECTION – 5.3 (A)
PLANTE OR GRID PLATE TYPE BATTERY

**TECHNICAL SPECIFICATIONS FOR BATTERY FOR 110kV,
66kV SUB- STATIONS 110 VOLTS, 200AH CAPACITY**

1.0 SCOPE:

- 1.1 This specification covers the supply of battery system to feed the protection equipments and emergency lights in 110kV and 66kV Sub-stations.
- 1.2 This specification covers design, manufacture, supply, assembly, shop testing at manufacturer's works before despatch & delivery at site, erection, testing and commissioning of 110V, 200AH storage Lead Acid, high cyclability, high discharge type battery.
- 1.3 The scope of supply shall include all parts and accessories, etc. which are necessary for erection, safe operation and maintenance of battery banks.

2.0 SPECIFICATION FOR 1 X 110 VOLTS, 200 AH BATTERY SETS:

- 2.1 As detailed in clause 1.0 above, the battery sets are required for 110kV and 66kV Sub-stations.
- 2.2 The batteries shall be complete in all respects.
- 2.3 The battery shall be of Lead acid with Plante type or Grid Plate - Flat Pasted type Positive plates and Grid Plate - Flat pasted type Negative plates confirming to IS : 1652/ IS 6304 latest version. The positive plates shall resist the foaming action of the current during charge & discharge & retain its strength, rigidity, shape dimensions over the operating life of the plates. The Battery shall be suited for a long life under continuous float operation and occasional discharge.
- 2.4 **TEMPERATURE CONDITION:**

The batteries are required to operate under the following temperature conditions.

Maximum temperature	50 degree centigrade
Minimum temperature	5 degree centigrade
Average rainfall	varies from 1000mm to 2000mm
Height above M.S.L.	Below 1000 mtrs.
Relative humidity	95%

2.5 STANDARD:

The batteries shall fully conform to the latest edition of following standards or any other equivalent international Standard.

A LIST OF RELEVANT STANDARDS IS GIVEN BELOW:

i.	IS-1652	Specification for stationery cells and batteries, lead Acid type with Plante Positive Plates.
ii.	IS-6304	Specification for stationery cells and batteries, Lead Acid type with Flat pasted Positive Plates.
iii.	IEC- 60896-11	Stationary Lead Acid Batteries – Vented type:
		General requirement & methods of test.
iv.	IS- 266	Specification for Sulphuric Acid
v.	IS- 6071	Specification for synthetic separators for lead acid batteries.
vi.	IS- 1069	Specification for quality tolerances water for storage batteries
vii.	IS- 1146	Specification for rubber and plastic containers for lead acid storage batteries.
viii.	IS- 8320	General requirements and methods of tests for lead- acid storage batteries.
ix.	IS-1885-Part-8	Electro technical vocabulary – stationary cells & batteries
x.	IEEE- 485	IEEE recommended practice for sizing large lead storage batteries for generating stations and sub-stations.
xi.	IS- 3116	Specification for sealing compound for lead acid batteries.
xii.	IS- 1248	Indicating instruments.

xiii.	IEEE – 484	Recommended design for installation.
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2.6 Design and Construction Details:

2.6.1 Rating:

The batteries are intended to supply power at 110V to the protection equipments in the sub-stations. Each battery set shall contain 55 cells of normal voltage of 2 volts. The batteries are required to supply indicating lamps, the coils & control scheme of breakers and disconnectors of GIS/AIS, relays & station emergency lighting etc. Batteries shall normally remain under floating condition with the trickle charger supplying the continuous load.

The following particulars shall be noted:

- | | | |
|----|--|--------|
| a) | Normal voltage | 110V |
| b) | Float charge voltage | 99-140 |
| c) | Boost/Equalizing charge voltage | 95-150 |
| d) | Ampere hour capacity 10 hours discharge rate | 200 AH |

2.6.2 CONTAINERS:

The Container material shall be of Halogen free SAN container and have Chemical & Electro- chemical compatibility shall be acid resistant, heat resistant, have good surface appearance & excellent transparency for ease of maintenance and shall have adequate mechanical strength to prevent bulging, cracking, etc. throughout their service life when operating under expected temperature range, static and dynamic loads and action of electrolyte. The material shall meet all the requirement of Plante/ Flat Pasted type batteries and be consistent with the life of battery. The container shall be low inflammable. The Tensile strength of material of container shall be such as to handle the internal pressure of the cells in worst working conditions. Cell shall not show any deformity or bulge on the sides under all working conditions. The containers shall be of robust construction and free from flaws, bubbles or foreign matter. The Container shall be capable of withstanding the rigours of transport, storage and handling. The containers shall conform to IS – 1146/Relevant standard.

The containers shall be mounted on insulator blocks. Routine and Acceptance tests shall be as per the requirements of IS- 1146/Relevant standard. The label attached to the containers shall be marked with the information as per requirements of Cl. No. 2.2 of the above standard. The supplier's/manufacture's test certificates shall be submitted by the tenderer for the scrutiny of the purchaser.

2.6.3 Cell Covers:

The covers shall be made of Halogen free SAN material compatible with container material, permanently fixed with the container & provided with vent plug. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant. It should be easily removable if the need arises.

2.6.4 END CELL TAPPING:

The tenders should clarify as to whether it is preferable to have end cell tapping arrangement in the battery banks in order to control the voltage of the load side, when the battery banks are being boost charged or not. If end cell tapping is recommended to regulate the voltage across load, battery set supplier should agree to supply necessary switch to cut-in /cut-out the cells and also supply end cells as loose item.

2.6.5 Terminal Posts:

Both the +ve and -ve terminals of the cells shall be of proper termination and shall ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid resistant and corrosion retardant material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve and -ve posts shall be clearly and unambiguously identifiable.

The battery terminals shall be brought out in a junction box to be mounted on the battery stands.

2.6.6 Connectors, Nuts & Bolts, Heat shrinkable sleeves:

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate non-corroding lead or copper connectors of suitable size shall be provided to enable connection of the cells. Copper connections shall be suitably lead coated or fully rubber moulded to withstand corrosion due to sulphuric acid at a very high rate of charge or discharge.

Nuts & Bolts for connecting the cells shall be made of copper, brass or stainless steel. Copper or brass nuts & bolts shall be effectively lead coated or rubber moulded to prevent corrosion. Stainless steel bolts and nut can be used without lead coating.

The connectors shall be of suitable cross-section to withstand all the working conditions including 1 min. discharge rate as well as short circuit condition.

All inter cell connectors shall be protected with heat shrinkable silicon sleeves for reducing the environmental impact including a corrosive environment.

2.6.7 SEPARATORS:

Microporous separators shall be used, which shall have high acid absorption capability, resistant to sulphuric acid, have good insulating properties and shall not exhibit any tendency to swell or shrink at temperature encountered during operation. Separators shall have adequate mechanical strength. The design of separator shall ensure that there is no misalignment during normal operation and handling. These shall permit free flow of electrolyte and would not be affected by chemical reaction inside the cell & shall last for indefinite time. The internal resistance factor of separators shall assure high discharge characteristics under all operating conditions.

2.6.8 VENT PLUG:

Vent plugs shall be provided in each cell. They shall be anti-splash type, preferably with more than one exit hole which shall allow the gases to escape freely, but shall effectively prevent acid particle or spray from coming out. On removal, the plugs shall permit drawing of the electrolyte sample for servicing, for topping up the cells and for checking of electrolyte level.

2.6.9 SEDIMENT SPACE:

Sufficient sediment space shall be provided beneath the plates to accommodate any plate deposit, which shall accumulate at the bottom of the cell over a reasonable life of battery without short circuiting the plates.

2.6.10 HYDROMETERS:

Hydrometers suitable for floating in any Cell in the battery, & with a reasonably long scale permissible for the depth of the cell & capable of reading specific gravity 1.1 to 1.3 with sub-divisions 0.005 shall be provided. A wall mounting type teak wood holder for the hydrometer shall also be supplied.

2.6.11 ELECTROLYTE:

The full quantity of electrolyte required for the first filling with 10% extra shall be included in the offer. The electrolyte shall be supplied in Non-returnable acid resisting jars. The electrolyte shall generally conform to IS - 266 or equivalent international standards. The electrolyte shall have Specific gravity as per manufacturer's recommendation at 27°C. Sufficient quantity of distilled water conforming to IS - 1069 shall be supplied in non-returnable containers to correct the level of electrolyte during initial testing & commissioning.

2.6.12 SUPPORTING RACKS OR STILLAGE FOR BATTERY BANK:

All batteries shall be mounted on a suitable teakwood/ FRP stand. The stand shall be properly painted with the acid resistant paint. Suitable insulation shall be provided between stand/frame and floor to avoid the grounding of the frame/stand.

The Battery layout arrangement (single / double / step tier) is required to suit battery room dimensions as indicated in the layout plan of the station.

2.6.13 MARKING ON OUTSIDE OF EACH CELL:

- a. Name, type and trade mark of manufacturer.
- b. Country and year of manufacturer.
- c. Capacity at 10Hr discharge rate.
- d. Upper and lower electrolyte level.
- e. Serial number.
- f. Type of container.
- g. Polarity marking as per relevant IS
- h. Reference standard of battery.

2.7 CAPACITY REQUIREMENT:

When the battery is discharged at 10 hour rate, it shall deliver 100% of C (Where C is rated capacity, corrected at 27 degree Celsius) before any of the cells in the battery bank reaches 1.85 V/cell.

The battery shall be capable of being recharged from the fully exhausted condition (1.85 V/cell) within 10 Hrs upto 90% state of charge. All the cells in a battery shall be designed for continuous float operation at the specified float voltage throughout the life.

Loss in capacity during storage at an average ambient temperature of 35 degree Celsius for a period of 6 months shall not be more than 60% and the cell/battery shall achieve 85% of its rated capacity within 3 charge/discharge cycles and full rated capacity within 5 cycles, after the storage period of 6 months. Voltage of each cell in the battery set shall be within 0.05V of the average voltage throughout the storage period. Ampere hour efficiency shall be better than 90% and watt hour efficiency shall be better than 80%.

2.8 EXPECTED BATTERY LIFE:

The battery shall be capable of giving 800 or more charge/discharge cycles at 80% depth of discharge (DOD) at an average temperature of 27 degree Celsius. DOD (Depth of discharge) is defined as the ratio of the quantity of electricity (in ampere-hour) removed from a cell or battery on discharge to its rated capacity.

The battery sets shall have a minimum expected life of 20 years at float operation.

2.9 ACCESSORIES:

The following battery accessories shall be supplied.

Item	Quantity
a) Cell testing Voltmeter (range -3 -0- +3 volts) accuracy class 0.5 or better	1 No.
b) Rubber apron	2 Nos.
c) Rubber shoes (Knee height)	2pairs
d) Thermometer (mercury/ alcohol type) (0° to 100 ° C) with separate gravity correction chart	2Nos.
e) Acid resistant funnels	2 Nos.
f) Insulated socket s with handle panners	1 Set
g) Acid resistant jars 2 Ltrs capacity	2 Nos.
h) Rubber Gloves	2pairs
i) Rubber Siphon	2 Nos.
j) Special tools required for connecting the terminals of batteries	2 Sets
k) Hydrometers with syringe suitable for vent holes	2Nos
l) Wall mounting type holder for Hydrometer & Thermometer	2Nos
n) Pipette	1No

2.10 MAXIMUM SHORT CIRCUIT CURRENT:

The Bidder shall state the maximum short circuit current of each battery along with the safe duration in seconds which it can withstand. Methods, proposed to be adopted for protecting batteries from the short circuit conditions should also be stated to avoid damage to the battery and loss to the associated equipment.

2.11 VENTILATION:

The bidder shall indicate in his bid the requirements of ventilation in the battery room. The battery shall operate satisfactorily over the entire range of the temperature and humidity indicated in this specification without affecting its normal life. If any special ventilation requirements are necessary the same shall be indicated.

2.12 CHARGING:

The bidders shall state whether an equalizing charge is recommended for the battery. If so, the equalizing charge voltage, current, duration and the interval

between the equalizing charging shall be specified in the Data sheet. Bidder shall also indicate the requirements for boost charging

2.13 PACKING:

All materials shall be securely packed, crated & protected against mechanical damage in conformity 'With manufacturer's standard practice.

2.-14 INSTRUCTION MANUALS:

Eight sets of instruction manuals for installation, commissioning, charging and maintenance instruction along with its soft copies in CD/DVD's shall have to be furnished.

2.16 Type Test of Battery:

2.16.1 Type tested Batteries shall be offered. The type test reports shall not be older than Ten (10) years as on the last date of submission of bid.

a) For Batteries manufactured in India:

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

b) For Batteries manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.
In case of in-house type tested imported equipment of foreign OEM, the term "Purchasing Utility" covers the foreign Utility who has purchased that equipment

Contractor shall submit type test reports of following tests as per latest version of IS 1652, IS 6304 & IEC 60896-11.

- a) Verification of constructional requirements.
- b) Verification of dimensions.
- c) Test for capacity.
- d) Test for retention of charge.
- e) Endurance Test.
- f) Verification of marking.
- g) AH and Watt H efficiency test.
- h) Test for suitability for floating battery operation.
- i) Short circuit & internal resistance measurement.
- j) Test for voltage during discharge.

Tests shall be conducted in accordance with IS1652, IS 6304 & IEC 60896-11.

2.16.2 List of Factory & Site tests for Battery:

Sl.No.	Test	Factory Tests	Site Tests
1.	Physical verification		Yes
2.	Test for capacity for 10 hours discharge rate along with the test for voltage during discharge	Yes	Yes

2.17 Installation & Commissioning:

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

2.18 DRAWINGS AND OTHER DOCUMENTS:

The tenderer shall submit the following drawings/ documents along with his offer failing which the offer is liable for rejection.

- a). General battery arrangement, proposed size of individual and over all dimensions along with sectional views showing all connections etc.
- b). Pamphlets and technical literature giving detailed information of the batteries offered.

Contractor shall submit following documents for approval:

- (a) Data sheet / GTP as per Annexure-I
- (b) GA of cell and layout drawing
- (c) Discharge data for 10 Hour, 8 Hour, 3 Hour, 2 Hour, 1 Hour, 15 minutes and One minute indicating capacity factors for end cell voltage of 1.75 V & 1.85 V.
- (d) Temperature correction factors.
- (e) Installation & Commissioning instructions.
- (f) O&M manual.

2.19 GUARANTEED TECHNICAL PARTICULARS:

The Guaranteed technical particulars, as called for in the 'Annexure' shall be furnished along with the tender.

ANNEXURE

GUARANTEED TECHNICAL PARTICULARS:

Sl. No.	PARTICULARS	Units	110V, 200AH Battery sets
1	Type of Cell		
	Plante/Grid plate		
2	Type reference:		
3	Nominal Voltage per cell	Volts	
4	Manufacture's Name		
5	Standards to which battery is manufactured		
6	IS Nomenclature		
7	Number of cells in the battery bank		
8	Nominal Voltage of Battery	Volts	
	Declared Capacity at 27 degree C upto 1.85 ecv		
	i). Initial	Ah	
9	ii). Rated	Ah	
	iii). End of Life	Ah	
10	Rated Capacity at minimum ambient temperature	Ah	

11	Rated Capacity at maximum ambient temperature	Ah	
12	Capacity in AH at various end cell voltages and duration of discharge		
		E. C. V.	
	5 minutes	1.62	
	15 minutes	1.65	
	30minutes	1.69	
	45 minutes	1.71	
	1 hour	1.75	
	2 hour	1.78	
	3 hour	1.80	
	4 hour	1.81	
	5 hour	1.82	
	6 hour	1.83	
	7 hour	1.83	
	8 hour	1.84	
	9 hour	1.84	
	10 hour	1.85	
13	Open circuit voltage of each battery cell		
	a). Fully charged		
	b). Floating condition		
	c). When completely discharged at		
	i). 10hr. rate		
14	Maximum momentary current for 1 min till 1.60 e.c.v.		
15	Expected life of battery under normal operation & maintenance conditions	Years	
16	Internal Resistance of each cell (IR)	milli	

		ohms	
	a). at Fully charged condition		
	b). at Fully discharged condition		
	c). at Floating condition		
17	Total Resistance of Battery including inter connectors between the cells	Ohms	
18	Loss in Capacity in 21 hours due to self discharge	%	
19	Recommended Charging rate for		
	a). Float charging		
	i. Limit current	A	
	ii. Voltage	V	
	b). Boost Charging		
	i. Starting Current	A	
	ii. Finishing current	A	
	iii. Voltage	V	
	Trickle Charging Rate		
20	i. Minimum	mA	
	ii. Maximum	mA	
	Equalizing Charge		
21	a). Voltage	V	
	b). Current	A	
	c). Duration	Hrs.	
	d). Interval between successive equalizing charge	Months	
22	a). Time to full charge at finishing rate only	Sec	
	b). Time to full charge at higher starting rate	sec	
	c). Time for full charge to charge by two step charging at starting up and	Sec	

	finishing rates		
	Recommended Specific gravity of Electrolyte at 27deg. C		
23	a). for first filling b). at full charge c). when Battery is discharged at 10 hours rate		
	Permissible max. temperature of electrolyte		
24	a). During Initial Charging b). During Normal Charging	deg C deg C	
	a.Amount of electrolyte and Specific gravity at 27 deg. C		
25	for first filling b) Electrolyte conforms to Standard		
	Overall dimensions		
26	i). Each cell L x W x H (tolerance of +/-2mm in each case) ii). Complete Battery	mm mm	
27	Distance between cell centres	mm	
28	Quantity of Electrolyte per cell	litres	
29	Quantity of Electrolyte for battery (including 10% extra)	litres	
	Weight (+/-5%)		
30	Each cell i). without acid ii). With acid	Kg kg	
	Complete Battery i). without acid	Kg	
31	ii). With acid	kg	

32	Total shipping weight of Battery units	Kg	
	Material and type of Plates		
33	(i). Positive Plates		
	a). Material and Type		
	b). Height of Positive Plate	mm	
	c). Thickness of Positive Plate	mm	
	d). Area of Positive Plate	Sq.m	
	e). No. of positive plates per cell		
	f). Whether positive plates of individual cells are interchangeable		
	(ii) Negative Plates		
	a). Material and Type		
	b). Height of Negative Plate	mm	
	c). Thickness of Negative Plate	mm	
	d). Area of Negative Plate	Sq.m	
	e). No. of Negative plates per cell		
	f). Whether Negative plates of individual cells are interchangeable		
34	Material and type of Separators		
	a). Material and Type		
	b). Thickness of separator	mm	
35	Clearance between bottom of the plate and the bottom of the container	mm	
36	Clearance between top of the plates and top of container	mm	
37	Clearance between edges of plates and inner surface of container	mm	
38	Sediment space (depth)	mm	
39	Whether explosion vents are offered		
40	Type of Vent and Filling Plugs		

41	Container		
	a). Thickness of Container	mm	
	b). Material of Container & Type		
	c). Outside dimensions (L x B x H)		
42	Cover		
	a). Type of cover		
	b). Material of cover		
43	Connections		
44	Material of Inter-Cell Connectors		
45	Thickness of Inter-Cell Connections	mm	
46	Method of connection		
47	a). Inter-row, Inter-tier connectors and end take-offs furnished? b). Description, Size, current rating, Type & Material		
48	Connection hardware with 5% extra furnished?		
49	Material of Bolt, Nut and Washer for inter-cell and Cable Connections		
50	Cell insulators provided. If yes, material of insulator	Yes/No	
51	Racks a). Number of racks per battery b). Number of cells per rack c). Type of racks d). Material of rack e). Dimensions of the racks f). Net weight g). Shipping weight		

52	Racks provided with a). Numbering tags for cells b). Insulators c). Whether anti acid coating is provided		
53	Insulator with 5% extra furnished for a). Cell b). Stand		
54	Ventilation requirements		
55	Cubic content of battery rooms	m ³	
56	Gas generation per single cell per hour	Lit	
57	No. of air exchanges required per hour		
58	Standard Maintenance accessories provided	Yes/No	
59	Gasification Voltage per Cell	Volt	
60	Recommended Max. period of cell storage before the first Charge (After Installation and filling of Electrolyte)		
61	Recommended Storage life of Battery (dry shelf life)		
62	Does the battery meet the required duty cycle curve	Yes/No	
63	Short circuit current at Battery terminals when a). Float at 2.1 Volts/Cell b). Boost charge to 2.75 Volts/Cell		
64	Time for which the Battery can withstand short circuit at terminals.		
65	Dimensioned layout drawings of the rack & battery to be attached with the tender.	Yes/No	

VOLUME – IIA
SECTION – 5.3 (B)
NICKEL CADMIUM BATTERY

TECHNICAL SPECIFICATIONS FOR BATTERY FOR 110kV AND 66kV SUB-STATIONS -110 VOLTS, 200AH CAPACITY

1.0 SCOPE:

- 1.1 This specification covers the supply of battery system to feed the protection equipments and emergency lights in 110kV and 66kV Sub-stations.
- 1.2 This specification covers design, manufacture, supply, assembly, shop testing at manufacturer's works before despatch & delivery at site, erection, testing and commissioning of 110V, 200AH stationary Nickel Cadmium Pocket plate, medium discharge type battery.
- 1.3 The scope of supply shall include all parts and accessories, etc. which are necessary for erection, safe operation and maintenance of battery banks.

2.0 SPECIFICATION FOR 1 X 110 VOLTS, 200 AH BATTERY SETS:

- 2.1 As detailed in clause 1.0 above, the battery sets are required for 110kV and 66kV Sub-stations.
- 2.2 The batteries shall be complete in all respects.
- 2.3 The battery shall be stationary Nickel Cadmium Pocket Plate type confirming to IS : 10918/IEC: 60623 latest version. The batteries shall be medium discharge performance type.

For the purpose of design, an ambient temperature of 50°C and relative humidity of 95% shall be considered.

2.4 TEMPERATURE CONDITION:

The batteries are required to operate under the following temperature conditions.

Maximum temperature	50 degree centigrade
Minimum temperature	5 degree centigrade
Average rainfall	varies from 1000mm to 2000mm
Height above M.S.L.	Below 1000 mtrs.
Relative humidity	95%

2.5 **STANDARD:**

The batteries shall fully conform to the latest edition of following standards or any other equivalent international Standard.

A LIST OF RELEVANT STANDARDS ARE GIVEN BELOW:

- i. IS-10918 - Specification for Vented type Nickel cadmium batteries.
- ii IS-60623 - Secondary cells and Batteries containing Alkaline or other Non-acid Electrolytes – Vented Nickel-Cadmium prismatic rechargeable single cells.
- iii IS- 1069 - Specification for quality tolerances for water for storage batteries.
- iv. Indian Electricity rule.
- v. Indian Electricity Act.
- vi. IEEE – 1115 - IEEE recommended practice for sizing Nickel – Cadmium batteries for stationary application

2.6 **Design and Construction Details:**

2.6.1 **Rating:**

The batteries are intended to supply power at 110V to the protection equipments in the sub-stations. 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.

The 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 volts per cell. Batteries shall also be suitable for continuous operation for the maximum ambient temperature as specified elsewhere in the technical specification.

The following particulars shall be noted:

- a) Normal voltage 110V

b)	Float charge voltage	99-140
c)	Boost/Equalizing charge voltage	95-150
d)	Ampere hour capacity for discharge rate as specified in IS 10918/IEC 60623 for medium discharge type battery.	200 AH

2.6.2 CONTAINERS:

The Containers shall be made of polypropylene plastic material and translucent for electrolyte visual inspection. Containers shall be robust, heat resistant, 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.

2.6.3 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/IEC as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. The positive and negative terminal posts shall be clearly marked.

2.6.4 END CELL TAPPING:

The bidder should clarify as to whether it is preferable to have end cell tapping arrangement in the battery banks in order to control the voltage of the load side, when the battery banks are being boost charged or not. If end cell tapping is recommended to regulate the voltage across load, battery set supplier should agree to supply necessary switch to cut-in /cut-out the cells and also supply end cells as loose item.

2.6.5 Terminal Posts:

Both the +ve and -ve terminals of the cells shall be of proper termination and shall ensure its consistency with the life of the battery. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an alkali resistant and corrosion retardant material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve and -ve posts shall be clearly and unambiguously identifiable.

The battery terminals shall be brought out in a junction box to be mounted on the battery stands.

2.6.6 Connectors, Nuts & Bolts, Heat shrinkable sleeves:

Nickel coated copper connectors shall be provided 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 0.02mm. All the terminals and cell interconnectors shall be fully insulated or have insulation shrouds. End take off connectors from positive and negative poles of the batteries shall be provided for end connections to the power cables. More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on battery terminals. The cable will be single core having stranded copper conductor and PVC insulation. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective Batteries and through fault short current which the battery can produce and withstand for the period specified.

All intercell connectors shall be protected with heat shrinkable silicon sleeves/PVC shrouds for reducing the environmental impact.

2.6.7 SEPARATORS:

The separators shall be alkali resistant, polypropylene material having good insulating properties and shall not exhibit any tendency to swell or shrink at temperatures encountered during operation. Separators shall have adequate mechanical strength. The design of separator shall ensure that there is no misalignment during normal operation and handling. These shall permit free flow of electrolyte and would not be affected by chemical reaction inside the cell & shall last for indefinite time. The internal resistance factor of separators shall assure high discharge characteristics under all operating conditions.

2.6.8 VENT PLUG:

Vent plugs shall be provided in each cell. They shall be anti-splash type, preferably with more than one exit hole which shall allow the gases to escape freely, but shall effectively prevent alkali particle or spray from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. On removal, the plugs shall permit drawing of the electrolyte sample for servicing, for topping up the cells and for checking of electrolyte level.

2.6.9 SEDIMENT SPACE:

Sufficient sediment space shall be provided beneath the plates to accommodate any plate deposit, which shall accumulate at the bottom of the cell over a reasonable life of battery so that the cells will not have to be cleaned during normal life and prevent shorts within the cells.

2.6.10 HYDROMETERS:

Hydrometers suitable for floating in any Cell in the battery & with a reasonably long scale permissible for the depth of the cell & capable of reading specific

gravity of the electrolyte shall be provided. A wall mounting type teak wood holder for the hydrometer shall also be supplied.

2.6.11 ELECTROLYTE:

The electrolyte shall be prepared from battery grade Potassium Hydroxide conforming to BS: 1069/IEC: 60993. The full quantity of electrolyte required for the first filling with 10% extra shall be included in the offer. The electrolyte shall be supplied in Non-returnable alkali resisting jars. The electrolyte shall have specific gravity as per manufacturer's recommendation at 27°C. Sufficient quantity of distilled water conforming to BS- 1069 shall be supplied in Non-returnable containers to correct the level of electrolyte during initial testing & commissioning.

2.6.12 SUPPORTING RACKS OR STILLAGE FOR BATTERY BANK:

Mild steel racks shall be provided for all Batteries. They shall be free standing type mounted on porcelain/hard rubber/PVC pad insulators/polypropylene insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50Kg 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 Battery layout arrangement (single/double/step tier) shall be finalized to suit battery room dimensions as indicated in the layout plan of the station and depending on the complete cell weight, during detailed engineering.

2.6.13 Cell Insulator: Each cell shall be separately supported on PVC/porcelain/hard rubber insulators/polypropylene insulators fixed on to the racks with adequate clearance between adjacent cells.

2.6.14 MARKING ON OUTSIDE OF EACH CELL:

- a. Manufacturer's Name and trade mark.
- b. Country of origin.
- c. Month and year of manufacture.
- d. Manufacturer's Type designation.
- e. Rated Ampere – hour capacity.
- f. Upper and lower electrolyte level.
- g. Serial number.
- h. Polarity marking as per relevant IS (shall be permanent & non-deteriorating)

2.6.15 Warning Marking:

The battery/cell shall be furnished with a warning plate located at the conspicuous place specifying the use of "ALKALINE ELECTROLYTE ONLY" (in block letters) and specifying the proper fill level of electrolyte. Marking shall be permanent and non-deteriorating.

2.6.16 The following details shall be provided along with the Battery:

- a) Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate. The instruction manual shall contain complete details of Battery set installation, testing, commissioning, maintenance during service life, Do's & Do Not's, trouble shooting, disposal procedure, etc.
- b) Designation of cell.
- c) Storing conditions of electrolyte.

2.7 CAPACITY REQUIREMENT:

When the battery is discharged at the rate specified as per IS 10918/IEC 60623 for medium discharge type battery it shall deliver 100% of C (Where C is rated capacity, corrected at 27 degree Celsius) before any of the cells in the battery bank reaches 1.0 V/cell.

The battery shall be capable of being recharged from the fully exhausted condition (1.0 V/cell) within 10 Hrs upto 90% state of charge. All the cells in a battery shall be designed for continuous float operation at the specified float voltage throughout the life.

Loss in capacity during storage at an average ambient temperature of 35 degree Celsius for a period of 6 months shall not be more than 60% and the cell/battery shall achieve 85% of its rated capacity within 3 charge/discharge cycles and full rated capacity within 5 cycles, after the storage period of 6 months. Voltage of each cell in the battery set shall be within 0.05V of the average voltage throughout the storage period. Ampere hour efficiency shall be better than 85% and Watt hour efficiency shall be better than 70% as per IS 10918.

2.8 EXPECTED BATTERY LIFE:

The battery shall be capable of giving 800 or more charge/discharge cycles at 80% depth of discharge (DOD) at an average temperature of 27 degree Celsius. DOD (Depth of discharge) is defined as the ratio of the quantity of electricity (in ampere-hour) removed from a cell or battery on discharge to its rated capacity. The battery sets shall have a minimum expected life of 20 years at float operation.

2.9 ACCESSORIES:

The following battery accessories shall be supplied with each battery set.

Item	Quantity
a) Cell testing Voltmeter (range -3 -0- +3 volts) accuracy class 0.5 or better	1 No.
b) Rubber apron	2 Nos.
c) Rubber shoes (Knee height)	2 pairs
d) Thermometer (mercury/ alcohol type) (0° to 100 ° C) with separate gravity correction chart	2 Nos.
e) Alkali resistant funnels	2 Nos.
f) Insulated socket spanners with handle	1 Set
g) Alkali resistant jars 2 Ltrs capacity	2 Nos.
h) Rubber Gloves	2 pairs
i) Hydrometers with syringe suitable for vent holes	2Nos
k) Wall mounting type holder for Hydrometer & Thermometer	2Nos
l) Pipette	1 No.
m) Rubber Siphon	2 Nos.
n) Special tools required for connecting the terminals of batteries	2 Sets

2.10 MAXIMUM SHORT CIRCUIT CURRENT:

The Bidder shall state the maximum short circuit current of each battery along with the safe duration in seconds which it can withstand. Methods, proposed to be adopted for protecting batteries from the short circuit conditions should also be stated to avoid damage to the battery and loss to the associated equipment.

2.11 VENTILATION:

The bidder shall indicate in his bid the requirements of ventilation in the battery room. The battery shall operate satisfactorily over the entire range of the temperature and humidity indicated in this specification without affecting its normal life. If any special ventilation requirements are necessary the same shall be indicated.

2.12 CHARGING:

The bidders shall state whether an equalizing charge is recommended for the battery. If so, the equalizing charge voltage, current, duration and the interval between the equalizing charging shall be specified in the Data sheet. Bidder shall also indicate the requirements for boost charging.

2.13 PACKING:

All materials shall be securely packed, crated & protected against mechanical damage in conformity with the manufacturer's standard practice.

2.14 INSTRUCTION MANUALS:

Eight sets of instruction manuals for installation, commissioning, charging and maintenance instruction along with its soft copies in CD/DVD's shall have to be furnished.

2.15 Type Test of Battery:

2.15.1 Type tested Batteries shall be offered. The type test reports shall not be older than Ten (10) years as on the last date of submission of bid.

a) For Batteries manufactured in India:

- i. The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

b) For Batteries manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

In case of in-house type tested imported equipment of foreign OEM, the term "Purchasing Utility" covers the foreign Utility who has purchased that equipment.

Contractor shall submit type test reports of following tests as per latest version of IS 10918 & IEC 60623.

- a) Physical examination.
- b) Dimensions, mass and layout.
- c) Marking.
- d) Polarity and absence of short circuit.
- e) Air pressure test.
- f) Ampere-hour capacity.
- g) Endurance test.
- h) Retention of charge.
- i) Discharge performance at low temperature.
- j) Life cycle test.
- k) Environmental tests.
- l) Insulation resistance.
- m) Dielectric.
- n) Storage.
- o) Discharge at 20°C.
- p) Discharge at +5°C and/or -18°C HT/LT testing.
- q) Discharge performance at high temperature.
- r) High rate currents.
- s) Charge acceptance at constant voltage.
- t) Electrolyte retention.

Tests shall be conducted in accordance with IS: 10918 & IEC 60623.

2.15.2 List of Factory & Site tests for Battery:

Sl. No.	Test	Factory Tests	Site Tests
1.	Physical verification		Yes
2.	Test for capacity for 5 hours discharge rate along with the test for voltage during discharge	Yes	—
3	Discharge test for 10 hours along with the test for Voltage during discharge	—	Yes

2.16 Installation & Commissioning:

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

2.17 DRAWINGS AND OTHER DOCUMENTS:

The tenderer shall submit the following drawings/ documents along with his offer failing which the offer is liable for rejection.

- a). General battery arrangement, proposed size of individual and over all dimensions along with sectional views showing all connections etc.
- b). Pamphlets and technical literature giving detailed information of the batteries offered.

Contractor shall submit following documents for approval:

- (g) Data sheet / GTP as per Annexure-I
- (h) GA of cell and layout drawing
- (i) Discharge data for 10 Hour, 8 Hour, 5 Hours, 3 Hour, 2 Hour, 1 Hour, 15 minutes and One minute indicating capacity factors for end cell voltage of 1.0 V & 1.1 V.
- (j) Temperature correction factors.
- (k) Installation & Commissioning instructions.
- (l) O&M manual.

2.18 GUARANTEED TECHNICAL PARTICULARS:

The Guaranteed technical particulars, as called for in the 'Annexure' shall be furnished along with the tender.

ANNEXURE

GUARANTEED TECHNICAL PARTICULARS:

Sl. No.	PARTICULARS	Units	110V, 200AH Battery sets
1.	Type of Cell		
2.	Nickel Cadmium		
	Type reference:		
3.	Nominal Voltage per cell	Volts	
4.	Manufacture's Name		
5.	Standards to which battery is manufactured		
6.	IS Nomenclature		
7.	Number of cells in the battery bank		
8.	Nominal Voltage of Battery	Volts	
9.	Declared Capacity at 27 degree C upto 1.0 ecv		
	i). Initial	Ah	
	ii). Rated	Ah	
	iii). End of Life	Ah	
10.	Rated Capacity at minimum ambient temperature	Ah	
11.	Rated Capacity at maximum ambient temperature	Ah	
12.	Capacity in AH at various end cell voltages and duration of discharge		Ah
		E.C.V.	
	5 minutes		
	15 minutes		
	30 minutes		

	45 minutes		
	1 hour		
	2 hour		
	3 hour		
	4 hour		
	5 hour		
	6 hour		
	7 hour		
	8 hour		
	9 hour		
	10 hour		
13.	Open circuit voltage of each battery cell.		
	a) Fully charged		
	b) Floating condition		
	c) When completely discharged at		
	i). 10Hr. rate		
14.	Maximum momentary current for 1 min till 1.0 e.c.v.		
15.	Expected life of battery under normal operation & maintenance conditions	Years	
16.	Internal Resistance of each cell (IR)	Milli ohms	
	a). at Fully charged condition.		
	b). at Fully discharged condition.		
	c). at Floating condition		
17.	Total Resistance of Battery including inter connectors between the cells	Ohms	
18.	Loss in Capacity in 21 hours due to self discharge	%	
19.	Recommended Charging rate for		

	a). Float charging		
	i. Limit current	A	
	ii. Voltage	V	
	a) Float charging		
	b) Boost charging		
	i. Starting Current	A	
	ii. Finishing current	A	
	iii. Voltage	V	
20.	Trickle Charging Rate		
	ii. Minimum	mA	
	ii. Maximum	mA	
21.	Equalizing Charge		
	a). Voltage	V	
	b). Current	A	
	c). Duration	Hrs.	
	d). Interval between successive equalizing charge	Months	
22.	a). Time to full charge at finishing rate only	Sec	
	b). Time to full charge at higher starting rate	Sec	
	c) Time for full charge to charge by two step charging at starting up and finishing rates	Sec	
23.	Recommended Specific gravity of Electrolyte at 27 deg. C		
	for first filling		
	b). at full charge		
	c). when Battery is discharged at 5 hours rate		

24.	Permissible max. temperature of electrolyte		
	a). During Initial Charging	deg C	
	b). During Normal Charging	deg C	
25.	a) Amount of electrolyte for first filling and Specific gravity at 27 deg. C		
	b) Electrolyte conforms to standard		
26.	Overall dimensions.		
	i). Each cell L x W x H (tolerance of +/-2mm in each case)	mm	
	ii). Complete Battery	mm	
27.	Distance between cell centres	mm	
28.	Quantity of Electrolyte per cell	litres	
29.	Quantity of Electrolyte for battery (including 10% extra)	litres	
30.	Weight (+/-5%) Each cell i). without acid	Kg	
	ii). With acid	kg	
31.	Complete Battery i). without acid	Kg	
	ii). With acid	Kg	
32.	Total shipping weight of Battery units	Kg	
33.	Material and type of plates		
	(i). Positive Plates		
	a). Material and Type		
	b). Height of Positive Plate	mm	
	c). Thickness of Positive Plate	mm	
	d). Area of Positive Plate	Sq.mm	
	e). No. of positive plates per cell		
	f). Whether positive plates of individual cells are interchangeable		

	(ii) Negative Plates		
	a). Material and Type		
	b). Height of Negative Plate	mm	
	c). Thickness of Negative Plate	mm	
	d). Area of Negative Plate	Sq. m	
	e). No. of Negative plates per cell		
	f). Whether Negative plates of individual cells are interchangeable		
34.	Material and type of Separators		
	a). Material and Type		
	b). Thickness of separator	mm	
35.	Clearance between bottom of the plate and the bottom of the container	mm	
36.	Clearance between top of the plates and top of container	mm	
37.	Clearance between edges of plates and inner surface of container	mm	
38.	Sediment space (depth)	mm	
39.	Whether explosion vents are offered		
40.	Type of Vent and Filling Plugs		
41.	Container		
	a). Thickness of Container	mm	
	b). Material of Container & Type		
	c). Outside dimensions (L x B x H)		
42.	Cover		
	a). Type of cover		
	b). Material of cover		
43.	Connections		
44.	Material of Inter-Cell Connectors		

45.	Thickness of Inter-Cell Connections	mm	
46.	Method of connection		
47.	a). Inter-row, Inter-tier connectors and end take-offs furnished? b). Description, Size, current rating, Type		
48.	Connection hardware with 5% extra furnished?		
49.	Material of Bolt, Nut and Washer for inter-cell and Cable Connections		
50.	Cell insulators provided. If yes, material of insulator	Yes/No	
51.	Racks		
	a). Number of racks per battery b). Number of cells per rack c). Type of racks d). Material of rack e). Dimensions of the racks f). Net weight g). Shipping weight		
52	Racks provided with a). Numbering tags for cells b). Insulators c). Whether anti acid coating is provided		
53	Insulator with 5% extra furnished for a). Cell b). Stand		
54	Ventilation requirements		
55	Cubic content of battery rooms	m ³	
56	Gas generation per single cell per hour	Lit	

57	No. of air exchanges required per hour		
58	Standard Maintenance accessories provided	Yes/No	
59	Gasification Voltage per Cell	Volt	
60	Recommended Max. period of cell storage before the first Charge (After Installation and filling of Electrolyte)		
61	Recommended Storage life of Battery (dry shelf life)		
62	Does the battery meet the required duty cycle curve	Yes/No	
63	Short circuit current at Battery terminals when a). Float at 2.1 Volts/Cell b). Boost charge to 2.75 Volts/Cell		
64	Time for which the Battery can withstand short circuit at terminals.		
65.	Dimensioned layout drawings of the rack & battery to be attached with the tender	Yes/No	

SECTION – 5.3 (C)

BATTERY CHARGER

SECTION – 5.3 (C)

TECHNICAL SPECIFICATIONS FOR 110V BATTERY CHARGERS

Battery Charger - 110V, 200 AH

SECTION – i

1.00 Intent of Specifications:

- 1.01 This specification is intended to cover the design, manufacture, testing at works and supply of Battery charger equipments complete with all materials and accessories for efficient and trouble free operation including supervision of erection, testing, commissioning and putting into commercial operation.

2.00 Scope of Work:

2.01 Scope of Supply :

2.02 Type and rating of the equipment are detailed below :

Sl. No.	Particulars	
1	Related Voltage	110 V DC
2	Rated Ampere Hours	200 AH
3	<u>Boost charging current</u>	
	a) Finishing current b) Maximum current	7 A 30 A
4	<u>Trickle charge current</u>	
	a) Finishing current b) Maximum current	50 mA 250 mA
5	Continuous Load in Amps.	15A

6	<u>Voltage Variation</u>	
	Float charge condition	99 – 140V
	Boost charge condition	95 – 150V
	Across load	110 V
7	Ripple content – To be limited to less than 2%	

2.03 Each battery charger shall be furnished complete with accessories as listed in the annexure.

2.04 One set of special tools for each sub-station. Any relevant drawings, date and instruction manuals.

2.05 Scope of Service :

2.06 The services of an engineer experienced in erection and commissioning of the equipment of similar type and rating. The work includes but not limited to :

2.07 Complete checking of the materials at site and advising the purchaser of any discrepancy thereof.

2.08 Advice on procedure of erection to be followed.

2.09 Regular supervision and following up of erection work done by other.

2.10 Testing, Commissioning and putting the equipment into successful commercial operation.

3.0 General requirements :

3.01 Codes and Standards :

All equipments and materials shall be manufactured and tested in accordance with the latest applicable standards.

3.02 Completeness of Supply:

It is not the intent to specify completely herein all details of equipments. Nevertheless the equipment shall be complete and operate in all aspects and shall conform to highest standard of engineering, design and workmanship.

Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory and trouble free operation and maintenance of the equipments shall be furnished.

3.03 Climatic conditions :

The equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

a) Maximum ambient air temperature [Deg. C]	-	45
b) Minimum ambient air temperature [Deg. C]	-	5
c) Average daily ambient air temperature [Deg. C]	-	30
d) Relative humidity [%]	-	10-100
e) Average rainfall per annum [mm]	-	1000-3000/5000
f) Maximum altitude above mean sea level [Mtrs]	-	1000
g) Maximum wind pressure [Kg. / Sq. M]	-	150
h) Isoceraunic level [days / year]	-	46
i) Seismic level [horizontal acceleration]	-	0.3g

SECTION – ii

Details of Equipments

1.0 Design Criteria :

1.1 Design Basis :

- 1.01 The Battery Charger will constitute the D.C. power supply source for all station loads.
- 1.02 The equipment will be installed indoor in a clean but hot, humid and tropical atmosphere.
- 1.03 The Battery Charger combination shall be such as to ensure continuity of D.C. supply at load terminals at all times without even momentary interruption.
- 1.04 Further, the voltage at load terminals shall never exceed the limits of +10% and -15% of the nominal system voltage.

2 System concept :

- 2.1 The battery charging equipment shall be suitable for all modes i.e. for initial charging, trickle charging equalizing and hanging and boost charging.
- 2.2 The float charger will be normally ON, supplying the station load current and at the same time float charging the battery.
- 2.3 The characteristics shall be such that if load is high and exceeds the charger capacity, the excess load will be supplied by the battery.
- 2.4 The boost charger will be normally in stand by (auto equalizing charge) mode and will cut into the circuit automatically to provide occasional equalizing charge as required.
- 2.5 The arrangement of end cell tapping if required will be provided, so that while Boost charging the battery, if AC supply fail or float charger feeding loads develop trouble, required number of cells (minimum 110V) are connected across the load and part of the Battery continue to meet DC requirement till change over takes place and full battery is put across the load.

- 2.6 The boost charger shall also have provision for equalizing and boost charging the battery through manual selection.
- 2.7 On failure of the station A.C. supply both float and boost chargers will go out of service and battery will take over to supply station emergency loads without any interruption.

3.0 Technical Particulars :

The Technical particulars of the equipments are mentioned in the annexures.

4.0 Specific Requirements :

4.01 Layout

4.02 General :

- a) The charger shall be naturally, air cooled, Zener type thyristor controlled 3 phase full wave bridge configuration.
- b) The charger shall be provided with automatic voltage regulation, current limiting circuitry, high smoothing filter circuit with chokes and condenser etc. limiting and soft start feature.
- c) Voltage control shall be stepless smooth and continuous.
- 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 panel ground.
- f) Isolations shall be provided between power and control circuit.
- g) Cooling :

Natural air cooling shall be employed in all units suitable louvers with fine mesh or perforations are to be provided in the panels for this purpose. The use of fans etc., for including accelerated air flow is precluded. Oil cooled components are not acceptable.

h) Interface against Re-circuits :

The equipment shall be efficiently screened against interface to radio as also other communications equipment which may be installed in the same building. All the sources of noise shall be fitted with Re-suppressors generally in accordance with relevant IS/IEC.

4.03 Gen. Structural Features :

The battery charger with all its accessories shall be mounted in all cubicle preferably in the front access which should be rigid of the self supporting type and fabricated with frame work of angle iron fitted with folded sheet metal (2.0 mm thick) panels. The cubicle shall be adequately ventilated and its sides shall be flush and free from projections viz. bolt heads etc., The base of unit shall be such as to rest directly on the floor and distribute the loads as uniformly as possible over the floor area.

4.04 Indicating Instruments :

Indicating instruments shall be of flush mount type with a dust tight and vermin proof covers. The instrument shall be of 96 mm. sq. dials shall be white, with black numbers and lettering. Instruments shall be of accuracy class 1.5.

4.05 Regulation :

The DC output shall be maintained at $\pm 1\%$, for input variation of $+10\%$ to -15% from no load; to full load and in-put frequency variation from 47 Hz to 53 Hz. The power factor shall not be less than 0.65.

4.06 Wiring :

The internal power and control wiring of the charger shall be of adequate rating as recommended by cable manufacturers.

The interconnecting cables or bus bars carrying load current from the main transformers secondary onwards up to and including DC output bus bars shall be of copper. Interconnecting leads in the control circuits and leads of filter capacitors shall also be of copper. Ends of all load current carrying cables shall be fitted with copper lugs of adequate rating and shall be soldered or crimped effectively to the conductor to ensure that the temperatures rise at the joints does not exceed that of the conductors. All cabling and wiring shall be neatly secured in position and adequately supported. All cables and wire carrying AC supply shall be kept separate from other cables. The colour scheme employed for the cabling and wiring shall be shown in the suppliers instructions manual. The colour scheme employ shall be as follows :

- i. For AC Circuits - Respective phase : Red, Yellow, Blue
Neutral: Green

- ii. For DC Circuit - Grey
"Earth" - Green

4.07 Earthing :

In the unit, two "Power Earth terminals shall be provided in effective electrical contact with cubicle frame work. All metal parts of the components of the unit which do not carry current shall be connected thereto.

4.08 Painting :

The frame work and the surface of the steel panels shall be sand blasted to remove rust, scales and foreign adhering matters. Then the parts shall be given primary coat of rust resisting paint which shall be followed by two coats of opalene green corresponding to shade No. 275 of 1S-05, 1978. The finishing coat shall be polished cellulose or equivalent. Any other standard approved method regarding painting could be adopted.

4.09 Components of the charger:

The charger operating on AC input voltage of 415 volts -15% to $+10\%$, three phase, 50hertz, $\pm 5\%$, to give a DC output ranging between 95V to 150V

The battery charger shall be supplied complete with all the devices including, but not limited to the following

- 1) a) One – Thyristor controlled bridge 3 phase Bridge rectifiers with simple smoothening circuits.
- 2) a) One – 3Ph naturally air cooled transformer liberally rated for the rectifier rating. The rectifier transformer shall be of class F type insulation. The rating of the rectifier transformer shall have 10% overload capacity. The material of the winding shall be Copper. – For Float Charger
- b) One – 3Ph naturally air cooled transformer liberally rated for the rectifier rating. The rectifier transformer shall be of class F type insulation. The rating of the rectifier transformer shall have 10%

overload capacity. The material of the winding shall be Copper. - For Boost Charger.

- 3) Coarse and fine controls for manual control.
- 4) Regulator complete with manual/automatic selector switch.
- 5) One – Selection switch for mode of charging i.e. float charging/boost charging.
- 6)
 - a) One – Voltmeter for AC input voltage.
 - b) One – Voltmeter for the D.C. output voltage.
 - c) One – Voltmeter for measuring boost charging DC voltage.
 - d) One – Voltmeter for measuring float charging DC voltage.

Ranges should match the voltage reading 0-150V.
- 7)
 - a) One – Ammeter with centre zero for measuring boost charging of DC.
 - b) One – Ammeter for measuring DC float charging current.
 - c) One ammeter for measuring load current.
 - d) One – Ammeter to measure trickle charging current.
 - e) One – Centre zero Ammeter to measure discharging current from the battery.

Ranges should match with the Current
- 8) One set – Ripple filtering device to limit the ripple content to less than 2%.
- 9) One change over device to automatically change the charger-operating mode from boost charge to float charge for a predetermined voltage condition. In the event of AC power supply failure or when the battery is being boost charged, available battery capacity shall be automatically transferred to the DC bus. In case of failure of any electronic component of the Auto controller of the charger, there must be always an alternate provision to operate the Charger in Manual Mode.
- 10)
 - a) Fuses for DC output and AC input shall be brought on the front of the panel and cutouts provided.

- b) Semi conductor devices, power failure, relay alarms on AC failure and to disconnect all internal charger loads from battery to prevent unnecessary discharging during power failure.
- 11) One internal cubicle light, operated on 230 V, single phase AC system with ON-OFF switch.
- 12) Two – Earthing lugs suitable for receiving 10 sq. mm copper conductor.
- 13) Cable glands for all external cables.
- 14) Printed circuits shall be accommodated in modules, plug in type and a similar modules shall be inter changeable in standard socket chassis.
- 15) Indicating lamps
 - 1. Across the phase and neutral of the AC supply to indicate the healthiness of AC supply.
 - 2. Across DC Voltage to indicate the supply “ON”.
- 16) Annunciation schemes :

A set of audible and visual alarm communication scheme with all necessary accessories to acknowledge reset and test scheme as also other necessary relays with the following facia windows.

 - i. AC Mains fail
 - ii. Float Charger DC Fail
 - iii. Boost Charger DC Fail
 - iv. DC Earth Fault
 - v. Float charger Rectifier fuse fail
 - vi. Float charger Filter fuse fail
 - vii. Float charger Blocking Diode fail
 - viii. Boost charger Rectifier fuse fail
 - ix. Boost charger Filter fuse fail
 - x. Boost charger Blocking Diode fail
 - xi. Float charger over voltage
 - xii. Float charger under voltage
 - xiii. Boost charger over voltage
 - xiv. Boost charger under voltage
 - xv. Load under voltage

- xvi. Load over voltage
 - xvii. 42nd cell blocking diode fail
 - xviii. Load Bus DC fail
 - xix. Boost charger over load
 - xx. Float charger overload
 - xxi. Under voltage of the battery
 - xxii. Over voltage of the battery
 - xi) }
 - xii) } As required.
- 17) a) Heat sink for boost charger.
- b) Heat sink for float charger.
- 18) MCCB 9 KA with O/L and short circuit protection for the following :
- a) Boost charger output.
 - b) Float charger output.
 - c) Battery Isolation.
 - d) AC input.
- 19) D.C. Distribution board for 4 Nos. of outgoing feeder. Each feeder shall be provided with 1 No. of 16 amps. of MCCB breaking capacity 5 KA.
- 20) Schematic Circuit diagram of the Float / Boost Charger with proper ferrule Nos. to be provided by means of anodized aluminium plate fixed at the convenient position inside the door of the Charger.
- All wiring done should have ferrule nos. as provided in the drawing.
- 21) Following potential free contacts shall be provided & terminated to TB for SCADA/SAS compatibility for charger:
- i. AC Mains Fail
 - ii. FC DC OV / UV
 - iii. BC DC OV
 - iv. LOAD OV / UV
 - v. FC DC Fail
 - vi. BC DC FAIL
 - vii. LOAD DC FAIL
 - viii. FC CAP FUSE FAIL
 - ix. BC CAP FUSE FAIL

- x. FC OVER LOAD
- xi. BC OVERLOAD
- xii. FC RECT. FUSE FAIL
- xiii. BC RECT FUSE FAIL
- xiv. BATTERY OV / UV
- xv. 42nd CELL BLK DIODE FAIL

22) Transducers shall be provided for SCADA/SAS. :

- i. Float charger out-put current.
- ii. Float charger out-put voltage.
- iii. Boost charger out-put current
- iv. Boost charger out-put voltage
- v. Load out-put current
- vi. Load out-put voltage
- vii. battery output Voltage
- viii. Battery output current

SECTION – iii

Other Terms and Conditions

1.00 TESTS OF FACTORY :

The equipment and panels shall be tested in accordance with relevant ISS or BS or equivalent standards.

1.01 ROUTINE TESTS :

During manufacture and on completion the equipment shall be subjected to routine tests in accordance with latest relevant standards.

1.02 TYPE TESTS :

- a) Type tested Batteries shall be offered. The type test reports shall not be older than Ten (10) years as on the last date of submission of bid.

i. For Batteries manufactured in India:

- a) The type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by the Government or the laboratories accredited by the National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- b) The type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- c) The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of NABL accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.

ii. For Batteries manufactured Abroad:

- a) Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of the country where the Type test has been conducted.
- ii. The type tests conducted in-house by a manufacturer shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests has been conducted in the presence of a representative of accredited laboratory or any of the purchasing utilities or CEA in that order. Such type test reports shall record the details of such witness including the signature/authentication in the type test report.
In case of in-house type tested imported equipment of foreign OEM, the term “Purchasing Utility” covers the foreign Utility who has purchased that equipment

- b) A) Type tests of battery charger:
 - Electromagnetic compatibility (EMC) Tests as per
 - a) IEC 61000-6-2, Generic standards – Immunity for Industrial environments – All Tests
 - b) IEC 61000-6-4, Generic standards – Emission standard for Industrial environment – All Tests
 - c) IEC 61000-4-10, Testing and measurement Techniques-Damped oscillatory magnetic field immunity test
 - d) IEC 61000-4-18, Testing and measurement Techniques – Damped oscillatory wave immunity test
 - Voltage regulation test
 - Load limiter characteristic test
 - Efficiency Tests
 - High voltage test
 - Temperature rise test
 - Short circuit test at no load at rated voltage for sustained short circuit.
 - Degree of protection test
 - Measurement of ripple by Oscilloscope
- c) Routine tests on Battery charger :-
 - i) Insulation resistance test
 - ii) Voltage regulation check from 0 to 100% load with $\pm 10\%$ voltage variation.
 - iii) Ripple content measurement
 - iv) Heat run test on current limiting value
- d) Routine tests on component parts and accessories as per relevant IS.

TEST WITNESS

Test shall be performed in the presence of Purchaser's representatives.

1.03 TEST CERTIFICATES

Certified reports of all the tests carried out at the work shall be furnished in 3 copies for approval of the purchaser. The equipment shall be dispatched from works only after the receipt of Purchaser's written approval of test reports.

2.0 Special Tools & Tackles :

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

3.0 **Spare :**

The tenderer shall submit a list of recommended spare parts for three years and satisfactory and trouble free operation indicating the itemized price of each item of spares.

4.0 **Drawings :**

4.01 **Tender Drawings :** Duplicate copies of the relevant drawings shall be submitted along with the tender.

4.02 **Contract Drawings :**

The supplier shall submit four copies of the following drawings for approval.

- i) Details of construction of cubicles and complete drawings of the switch board indicating full details of the location switches, instruments, relays, bus bars, cable glands, support etc.
- ii) Wiring and cabling diagram for all the circuits. All devices shall be numbered according to the international convention.
- i) Details of construction of boost and float charger.

4.03 **SUPPLIER SHALL FORWARD**

After the drawings are approved six copies of the drawing printed on 90 GSM paper shall be supplied for immediate use. The supplier should forward the drawings and literature as follows

- a) One set of reproducible originals and 12 sets of blue print copies of all approved drawings along with 12 sets of literature, commissioning and maintenance manuals to the office of the Chief Engineer, Electy., Tendering and Procurement, KPTCL, Kaveri Bhavan, Bangalore – 560 009 / concerned Zonal Chief Engineer Electricity.
- b) Four sets of blue print copies of all approved drawings along with four sets of literature and manual to consignees in respect of each of the stations.
- c) Non-supply or part supply of drawings, literature and manuals will be deemed as incomplete supply of switchboard.
- d) Foundation drawings indicating the details of foundation bolts cable entries and trenches, etc.,
- e) Elementary diagrams of all controls, metering, protection, annunciation and other circuits, panel wise. All devices shall be according to SA CODE.
- f) Schematic diagram's of PCB's and charger.

- g) Dimensional outline of charger drilling diagram and special mounting arrangement if any of each type of various devices.

5.0 INSPECTION:

All the tests and inspection shall be made at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and the purchaser at the time of purchase.

6.0 Packing :

The supplier shall provided such packing of goods as is required to prevent damage or deterioration during transport to their final destination, the packing shall be sufficient to withstand, without limitation, rough handling during transport and exposure to extreme temperature and open storage. The packing case, size, rates shall be taken into consideration, where appropriate, the remoteness of goods final destination and the absence of mechanized heavy handling facilities, at all points in transport.

7.0 Deviation from Technical Modification :

The tenderer shall furnish the details of deviation/modification proposed by him to improve overall performance of the system. The deviations shall be brought in the tender clause by clause as per Annexure.

8.0 Past Experience :

- 8.1 The tenderer shall also furnish the details of similar battery supplied by them so far giving order reference name and address of the customer etc. also indicating the period of commissioning.
- 8.2 Test reports for the test conducted in accordance with relevant ISS or BS or equivalent standards shall be supplied. Further the test certificates furnished shall pertain to test carried out not older than five year from the date of notification of bid.

Schedule of guaranteed Technical particulars of **110V, 200AH** Battery Chargers.

Sl. Particulars

No.

1. Manufacturer's type of designation :
2. Type of Rectifier and rating as per :
IS – 3895 with latest version.
3. Input AC supply.

- a) Voltage :
- b) Current :
- c) No. of Phases :
- d) Frequency :
- e) Power Factor :
- 4. Percentage Tap provided on the Transformer +/- & Voltage ratio of Transformer & KVA rating. :
 - i. For Boost Charger :
 - ii. For Float Charger :
- 5. Boost/Quick charge current
 - Minimum :
 - Maximum :
- 6. Float Charge Current
 - Minimum :
 - Maximum :
- 7. Trickle Charge Current
 - Minimum :
 - Maximum :
- 8. Whether Auto/Manual feature is provided. :
- 9. Whether voltage across load is constant while boost/quick charging the battery. :
- 10. Whether Automatic change over from boost charging mode to float charging is provided when AC failure takes place. :
- 11. a) Allowable limits to voltage variation on A.C. side for satisfactory charging :

of DC side.

- b) Type of device on AC side :
12. Instantaneous forward voltage drop
versus instantaneous current at rated :
service (a graph to be enclosed)
13. Type of voltage control for Boost Charger,
Float charger & Trickle Charger :
14. Instantaneous reverse current
versus instantaneous reverse volts :
at rated service (a graph to be enclosed)
15. Range of variation of DC voltage :
and device used for the same.
16. Rated DC output for
a) Boost Charger :
b) Float Charger :
17. D.C. output voltage regulation from
no load to full load. :
18. Maximum ripple content in % :
19. Maximum permissible temperature
rise over an ambient temperature :
20. Whether the charger is tropicalised :
21. Over load capacity. :
22. Duration of overload. :
23. Efficiency at
a) 25% Load. :
b) 50% Load :
c) 75% Load :
d) 100% Load :
24. Dimensions of the charger width x :

- Height x depth in mm
25. Weight of the charger in Kgs. :
26. Recommended spares :
27. List of major accessories provided :
28. Other Details, if any :
29. Rating & make of Thyristor :
30. Meters
- Ammeter / Voltmeter
- i) Type & Make
- ii) Size
- iii) Scale Range
- iv) Accuracy
31. Heat Sink for Boost Charger & Float
- Charger Whether provided :

Details of Components & Rating

- I DC Distribution Board
- i. Maker's Name :
- ii. Country of Manufacturer :
- ii. Number of Circuits with rating :
- II BUS BARS
- i. Sectional Area :
- ii. Material :
- iii. Current Carrying Capacity :
- iv Maximum Temperature rise over
45°C ambient with continuous
full load condition :
- v. Type of Supporting Insulator :
- III Small Wiring
- i. Type :
- ii. Size :

- IV Moulded Case (OR Equivalent)
- Air Break Switch & Fuse Units
- i. Type :
 - ii. Make :
 - iii. Normal Voltage :
 - iv. Normal Current :
 - v. Interrupting Capacity :
 - vi. Fusing Factor for fuses :
 - vii. Temperature rise of contact
under °C continuous full load
condition over 45° ambient
temperature :
 - viii. Material & Type of Contact :
- V Dimensions of Battery Charging Panel
(Including DCDB) :
- i. Width :
 - ii. Depth :
 - iii. Height :
- VI Dimension of DC Distribution Panel
- i. Width :
 - ii. Depth :
 - iii. Height :
- VII
- i. Number of Crates for Shipment,
Shipping Dimensions of the
largest crate :
 - ix. Whether equipments and the
Switchboards are tropicalized
or not :
 - iii. How is access provided to the
switchboard interior :

iv. Mounting Arrangements for cable
glands provided. :

Date :.....

Signature :.....

Place :.....

Designation:.....

Company:.....