CHAPTER 18: TECHNICAL SPECIFICATION FOR 220V DC BATTERY AND CHARGER

A. VALVE REGULATED LEAD ACID BATTERY

18.1. SCOPE :

(i) The scope covers the design, manufacture, assembly, testing at the manufacturer's works, delivery at site, installation, testing and commissioning of 220 V D.C. Maintenance free Valve regulated Lead Acid Battery and associated battery charger with provisions of both float and boost charging of battery along with necessary accessories, fittings, etc for 400kV, 220kV and 132 kV sub-stations.

Each battery shall have sufficient capacity considering continuous emergency and intermittent loads for the periods specified below and for all bays with the charger out of service:

a) Continuous DC load for protection, control, indications, alarms and interlock for 10 hours.

b) Emergency lighting loads for 10 hours.

c) Intermittent DC load for closing and tripping operation of Circuit Breakers, Isolators and Earth Switches. This load shall be determined considering simultaneous tripping of breakers on bus-bar protection. Duration of intermittent load shall be considered as one minute when the battery has reached the end cell voltage. Battery shall be of 2X100%capacity and shall have 20% spare capacity with matching 2x 100% battery charger. Supplier shall furnish characteristic curve for satisfactory operation and maintenance of battery under service condition.

Bidder shall select number of cells, float & boost voltage to achieve following system requirement:

System Voltage During Float	MaximumVoltage During Float operation	Minimum Voltage available when no charger working and battery fully discharged upto 1.85V per cell.	Minimum no of cells.
220V 48V	242V 52.8V	198V 43.2V	109V 24V

Bidder shall furnish calculation in support of selection of capacity as well as number of Cells, Float & Boost charger current / Voltages.

(ii) The scope also covers the design, manufacture, assembly, testing at the manufacturer's works of 48 V D.C. Maintenance free Valve regulated Lead Acid Battery, having minimum capacity of 300 AH and associated battery charger with provisions of both float and boost charging of battery along with necessary accessories, fittings etc.

Each battery shall have sufficient capacity for continuous DC supply to PLCC Terminals, Protection Coupler Units, Fiber Optic Terminals, EPAXes, Remote Terminal Unit (RTU) etc. as and when required as well as float charging current of the battery.

The battery shall consist of 24 number of cells, float & boost voltage to achieve a system voltage 48V. Battery shall be of 2x100% capacity andshall have 20% spare capacity with matching 2x 100% battery charger. Supplier shall furnish characteristic curve for satisfactory operation and maintenance of battery under service condition.

18.2. RATING OF BATTERY AND FUNCTION OF CHARGER:

D.C. Power Supply shall comprise a set of Battery (220V) of desired capacity, a Float charger and a Float cum Boost Battery Charger (minimum 60A) in parallel operation. In this mode the charger shall be required not only to continuously feed a variable load but also deliver trickle/boost charging current for the battery. Charger shall have 20% spare capacity. Battery will be capable of feeding the DC load requirement of the Sub-station in case of failure of the charger. Ampere-hour capacity of the battery shall be designed considering the current load and expected future load due to extension of the Sub-Station (if not specified, then minimum 3 nos of future bays are to be considered for each voltage class). A detailed design calculation for both battery & charger are to be submitted for approval.

18.3. TRICKLE / BOOST CHARGE VOLTAGE:

The trickle and Boost charge voltage per cell shall be as follows:

a) 220V Battery Bank

i) TRICKLE CHARGE: Per Cell Voltage 2.2 V to 2.25±0.02 V

ii) Boost charge voltage should vary between 2.23 to 2.3V/cell.

18.4. VOLTAGE / CURRENT REGULATION OF CHARGER:

Output voltage for float charging from battery charger shall be auto controlled by adjusting the firing angle of thyristor for float charger to keep the voltage variation within ± 1% from no load to full load and AC supply voltage variation of ±10% and frequency variation of ± 3% of 50 Hz. Manual control of output voltage shall also be possible through Auto/Manual selector switch.

The Boost / Quick charger shall be similar type as Float / Trickle charging equipment, but shall be provided with control arrangement for 'auto/manual' current regulation featureswith current adjustment setting upto 150%, necessary for quick charging. An automatic VOLTAGE controller for boost charging shall control the output VOLTAGE WITH CURRENT LIMIT AS LIMITED FOR RESPECTIVE BATTERY CAPACITY by adjusting the firing angle of the thyristor.

18.5. CLIMATIC CONDITIONS:

The equipment to be supplied against the specification shall be suitable for satisfactory continuous operation under the climatic condition mentioned in chapter 2 of this bidding document.

18.6. DESCRIPTION OF BATTERY:

Type:

The DC batteries shall be VRLA (Valve regulated Lead Acid) type & shall be Normal Discharge type and shall conform to IS 15549:2004/ IEC 60896-21 & 22:2004/ BS 6290- PART IV/ IEEE-1188 standard. These batteries are to be factory-filled, charged & shall be suitable for a long life under continuous float operations & occasional discharges. The 220V DC system is unearthed system. The offered battery shall be compact and shall require no maintenance. All safety equipment required for installation shall be provided by the manufacturer.

Constructional requirements:

The design of battery shall be as per field proven practices. Partial plating of cells is not permitted. Paralleling of cells externally for enhancement of capacity is not permitted. Protective transparent front covers with each module shall be provided to prevent accidental contact with live module/ electrical connections.

Plates:

Positive plates shall be made pasted type using high purity corrosion resistant alloy for deep discharge, durability, maintenance free, long life both in cyclic as well as in float applications. The Grids are of Semi Radial Squarish grid to reduce internal resistance and travel current in shorter time. Negative plates shall be heavy duty, durable flat pasted plate using lead alloy pasted Semi Negative Squarish Grid. Negative plates shall be designed to match the life of Positive plates & combination of positive & negative plates shall ensure long life, durability & trouble-free operation of battery. Computer controlled/ PLC operated in-house equipment should be deployed for preparation of lead oxide and paste to ensure consistency in paste quality & properties.

Containers:

The container material shall have chemical & electro-chemical compatibility & shall be acid resistant and shall conform to UL-94/ ASTM-D-2863 standard. The material shall meet all the requirements of liquid station lead-acid batteries and be consistent with the life of battery. The container shall be fire retardant and transparent. The porosity of the container shall be such as not to allow any gases to escapeexcept from the regulation valve. The tensile strength of the material of the container shall be such as to handle the internal cell pressure of the cells in the worst working condition. Cell shall not show any deformity of bulge on the sides under all working conditions. The container shall be capable of withstanding the rigorous of transport, storage and handling. The containers shall be enclosed in a steel painted tray/rack with minimum earthing provision.

For identification, each cell/module shall be marked in a permanent manner to indicate the following information:

(i) Cell Serial Number

(ii) Positive & Negative, embossed on the cover

(iii) Month & Year of Manufacturing

Cell Covers:

The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container by Hermetic Heat-Sealing technique. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant. Fixing of Pressure Regulation Valve & terminal posts in the cover shall be such that the seepage of electrolyte, gas escapes and entry of electro-static spark are prevented.

Separators:

The separators used in manufacturing of battery cells, shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid & shall have good insulating properties. Sufficient separator overlap & PVC shield protection in bottom edges of the plates is to be provided to prevent short circuit formation between the edges of adjacent plates. The design of separators shall ensure that there is no misalignment during normal operation & handling.

Pressure Regulation Valve:

Each cell shall be provided with a pressure regulation valve. The valve shall be self-re- sealable. The vent plug shall be made with suitable grade of fire-retardant plastic material. Each valve opening shall be covered with flame barrier capable of preventing the ingress of flame into the cell interior, when the valve opens & hydrogen/ oxygen gas mixture is released. The valve unit shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand the internal cell pressure specified by the manufacturer.

Terminal Posts:

Both the +ve & -ve terminals of the cells shall be capable of proper termination & shall ensure its consistency with the life of the battery. The terminals shall have lead plated adequate solid copper/ brass core cross-section to avoid overheating at maximum current load. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid resistant & corrosion retarding 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 & -ve posts shall be clearly and unambiguously identifiable.

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 coated copper connectors of suitable size shall be provided to enable connection of the cells. Copper connections shall be suitably lead coated to withstand corrosion due to sulphuric acid/fumes 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 to prevent corrosion. Stainless steel bolts & nuts can be used without lead coating.

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

More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on the battery terminals.

Necessary insulating supports for termination of these cables on batteries shall also be supplied by the bidder.

18.7 All cell connectors shall be capable of continuously carrying the 30 min. discharge current of the respective batteries and shall be capable to carry 4KA for 1 sec.The inter-cell connectors shall be capable to carry minimum 10KA for 1 sec.

Flame Arrestors:

Each cell shall be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge & discharge. Material of the flame arrestor shall not affect the performance of the cell.

Battery Bank Stand:

All batteries shall be mounted in a suitable metallic stand/ frame. The frame shall be properly painted with the acid resistive paint & should have protection against harmful effects due to tropical environment. The suitable insulation shall be provided between stand/ frame and floor to avoid the grounding of the frame/ stand. The jointing of the frames should not leave crevices and ensure proper and tight fit.

Numbering tags for each cell shall be attached to the racks. Provision for clamping outgoing cables shall be kept.

18.7. CAPACITY REQUIREMENTS:

When the battery is discharged at 10-hour rate, it shall deliver 80% of Rated Capacity (corrected at 27°C) 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 (1.75 V/cell) within 10hrs up to 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.

The capacity (corrected at 27°C) shall also not be less that Rated capacity & not more that 120% of Rated capacity before any cell in the battery bank reaches 1.75 V/cell. The battery voltage shall not be less than the following values, when a fully charged battery is put to discharge at a rate of 1/10th of the Rated Capacity:

(a) After SIX minutes of discharge: 1.98V/cell

(b) After SIX hours of discharge: 1.92V/cell

(c) After EIGHT hours of discharge:1.85V/cell

(d) After TEN hours of discharge: 1.75V/cell

Loss in capacity during storage at an average ambient temperature of 35°C 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%. However, the battery to be manufactured and to be delivered at site in such a way that load can be connected with the battery within 15 days from date of installation, date of initial charging is to be mentioned on the battery.

18.8. EXPECTED BATTERY LIFE

The battery shall be capable of giving 1200 or more charge/discharge cycles at 80% Depth of Discharge at an average temperature of 27°C. 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.

18.9. ASSOCIATED EQUIPMENTS & ACCESSORIES (For each set of battery):

a)	Best quality metallic stand/frame	as per Clause 18.6.
b)	Stand insulators	+5% extra
c)	Inter row connectors	Appropriate quantity
d)	Inter tier connectors	Appropriate quantity
e)	Centre-zero (3-0-3) volts DC Voltmeter	: 1 No
f)	Torque wrench/ Spanners	: 1 No
g)	Connection hardware, such as strips, bolts, nuts	(with 5% extra)
h)	Cable clamps with hardware	
g)	Connection hardware, such as strips, bolts, nuts	(with 5% extra)
i)	Cell numbering tags with fixing arrangement	
j)	Two sets of special tools and tackles for connecting terminals of the battery	
k)	Any other accessories not specified but required for satisfactory operation.	Free-standing portable eye wash equipment, etc.

18.10. TYPE TEST OF BATTERY:

The Bidder/ Supplier shall supply type tested battery as per IS 15549:2004/ IEC 60896-21 & 22 over the range of at least one capacity per design. The Bidder/ Supplier shall submit necessary evidences enclosed during detailed engineering.

Sr. No.	DESCRIPTION
1	Gas Emission
2	High Current Tolerance
3	Short Circuit Current & DC Internal resistance
4	Protection against Internal Ignition from External Spark source
5	Protection against Ground Short Propensity
6	Content & Durability of required marking
7	Material Identification
8	Valve Operation
9	Flammability Rating of Material
10	Intercell Connector Performance
11	Discharge Capacity
12	Charge Retention during Storage
13	Float Service with Daily Discharge for reliable mains power
14	Recharge behavior

Sr. No.	DESCRIPTION
15	Service Life at an operating temperature of 40°C for brief duration exposure Time
16	Impact of Stress Temperature of 60°C for brief duration exposure time with 3hrs discharge test
17	Abusive Over Discharge
18	Thermal Runaway Sensitivity
19	Low Temperature Sensitivity
20	Dimensional Sensitivity at Elevated Internal Pressure & Temperature
21	Stability against Mechanical abuse of units during installation

18.11. Routine Test:

Physical Examination Test

Visual Inspection

Dimensions, Mass & Layout

Marking & Packing

18.12. ACCEPTANCE TEST OF BATTERY

Polarity Marking

Verification of Dimensions

Test of AH Capacity

LIST OF FACTORY & SITE TESTS FOR BATTERY

Sr. No	TEST	FACTORY TESTS	SITE TESTS
1	Physical Verification	YES	YES
2	Capacity Test on the cell at 1/10th of Rated Capacity, corrected at 27°C	YES	
3	8hrs Charge & 15mins Discharge Test at Full Rated Load		YES

B. BATTERY CHARGERS

18.13. SCOPE:

(i) Battery Charger for 220V/110V DC Battery Bank:

The DC system for 220V DC is unearthed. The Battery Chargers as well as their automatic regulators shall be of static type and shall be compatible with liquid station lead-acid batteries. All battery chargers shall match with the battery and shall be capable of continuous operation at the respective rated load in float charging mode while supplying the DC load. The chargers shall also be capable of Boost charging the associated DC battery at the desired rate.

Under normal operating conditions the charger should give a D.C. output equal to the steady demand load for signal lamps, auxiliary relays etc. plus an output to trip coils and closing coils of the circuit breakers and relays as and when required as well as float charging current of the battery. Charger shall have 20% spare capability.

(ii) Battery Charger for 48V DC Battery Bank:

The charger shall be suitable for charging the battery and supplying the load simultaneously. The entire charger scheme shall be divided in two sections, "float charger section" and "float-cum-boost charger section". The float-cum-booster charger shall be suitably operated either in float mode or in boost-cum-standby float charger mode. The float charger and the float-cum-Boost Charger shall have adjustable output current 60 Amps D.C. for 300 AH for float charging and 60 Amps DC for boost charging. Charger shall have 20% spare capability.

Under normal operating condition, with the input AC supply present, the float charger section' shall supply the DC load and also float the battery by trickle charging and the "float cum boost charger section" shall be kept off. The maximum demand load on the charger shall be 60A for 300AH Battery.

18.14. GENERAL DESCRIPTION FOR CHARGERS:

a) The 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. When on automatic control mode during float charging, the chargers output voltage shall remain within + 1% of the set value, for AC input voltage variation of + 10%, frequency variation of + 5% a combined voltage and frequency variation of + 10% and a DC load variation from zero to full load.

b) The battery chargers shall have constant voltage characteristics throughout the range (from zero to full load) at the floating value of the voltage so as to keep the battery fully charged but without harmful overcharge and designed to provide fully automatic voltage stabilization and current limitation for charging.

c) The chargers shall have load limiters having drooping characteristics, 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 characteristics 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.

d) 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 float charging output range specified. Step less adjustments of the Load-limiter setting shall also be possible from 80% to 100% of the rated output current for charging mode.

e) During Boost Charging, the Battery Charger shall operate on constant voltage with current limit mode (when automatic regulator is in service) to restrict battery charging current as specified. After completion of boost charging this float cum boost converter section either goes standby mode or float mode as desired by the system.

f) The Charger manufacturer may offer an arrangement in which the voltage setting device for Float charging mode is also used as output voltage limit setting device for Boost charging mode and the Load-limiter of Float charging mode is used as current setting device in boost charging mode for Float cum Boost Converter section. For Float charger section shall provide separate arrangement.

g) 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 level, when they are not connected to a battery.

h) MCCB

All Battery Chargers shall have sufficient MCCBs on the input side to receive cables from two sources.

Mechanical interlock should be provided such that only one source shall be closed at a time. It shall be of P2 duty and suitable for continuous duty with breaking capacity minimum 25KA at 415V AC. MCCB’s should have auxiliary contacts for annunciation.

i) Rectifier Transformer

The rectifier transformer shall be continuously rated, dry air cooled (A.N) an of class F insulation type. The rating of the rectifier transformer shall have 10% overload capacity. The transformer shall be of suitable rating to comply with maximum output with minimum input voltage.

j) Rectifier Assembly

The rectifier assembly shall be fully/half controlled bridge type and shall be designed to meet the duty as required by the respective charger. The rectifier shall be provided with heat sink having their own heat dissipation arrangements with natural air cooling. Necessary surge protection devices and rectifier type test acting HRC fuses shall be provided in each arm of the rectifier connections.

k) Instruments

One AC voltmeter and one AC ammeter along with selector switches shall be provided for all chargers. One DC voltmeter and DC ammeter (with shunt) shall be provided for all chargers. The instruments shall be of 96 mm X 96 mm square dial & shall be flush type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustment. The instruments shall be of 1.5 accuracy class. In addition to the above a centre zero voltmeter with selector switch shall also be provided for 220 V Chargers for testing purpose.

l) Air Break Switches

One DC output switch shall be provided in all chargers. They shall be air break type suitable for 500 Volts AC/ 250 V DC. The contacts of the switches shall open and close with a snap action. The operating handle of the switch shall be fully insulated from circuit. ‘ON’ and ‘OFF’ position on the switch shall be clearly indicated. Rating of switches shall be suitable for their continuous load. Alternatively, MCCB’s of suitable ratings shall also be acceptable in place of Air Break Switch.

m) Fuses

All fuses shall be HRC Link type. Fuses shall be mounted on fuse carriers which are in turn mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type base. In such case one insulated fuse pulling handle shall be supplied for each charger. Fuse rating shall be chosen by the Bidder depending on the circuit requirement. All fuses in the chargers shall be monitored. Fuse failure annunciation shall be provided on the failure of any fuse.

n) Blocking Diode

Blocking diode shall be provided in the positive pole of the output circuit of each charger to prevent current flow from the DC battery into the charger. All the semiconductor devices shall be protected with power transient suppressor circuit.

o) Annunciation System

Audio-visual indications through bright LEDs shall be provided in all Chargers for the following abnormalities: -

(i) AC Power failure.

(ii) Rectifier/chargers fuse blown (separate for Float & Float cum boost).

(iii) Over voltage across the battery when boost charging.

(iv) Abnormal DC Bus voltage (High/Low)

(V) Charger Failure

(v) Any other annunciation if required

Potential free NO contacts of above abnormal conditions shall also be provided for common remote indication “CHARGER TROUBLE” in Owner’s Control Board. Indication for charger in float mode and boost mode through indication lamps shall be provided for chargers. A Potential free contact for float/boost mode shall be provided for external interlocks.

p) Name Plates and Marking

The name plates shall be white with black engraved letters. On top of each Charger, on front as well as rear ides, larger and bold name plates shall be provided to identify the Charger. Name plates with full and clear inscriptions shall also be provided on and inside of the panels for identification of the various equipment and ease of operation and maintenance.

q). The power factor shall be better than 0.8 lagging at full load and minimum efficiency at half-load is not less than 85% at rated line voltage. It shall be ensured that the harmonics due to Silicon controlled Rectifier commutation are not reflected back into the AC power supply.

18.15. Charger Construction

The Chargers shall be indoor, floor-mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Chargers shall be fabricated from 2.0mm cold rolled sheet steel and shall have folded type of construction. Removable gland plates for all cables and lugs for power cables shall be supplied by the Contractor. The lugs for power cables shall be made of electrolytic copper with tin coat. Power cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and drilling of gland plates. The Charger shall be tropicalized and vermin proof. Ventilation louvers, if provided shall be backed with screens. All doors and covers shall be fitted with synthetic rubber gaskets. The chargers shall have hinged double leaf doors provided on front and on backside for adequate access to the Charger’s internals. All the charger cubicle doors shall be properly earthed. The degree of protection of enclosure shall be at least IP-42 as per IS: 13947 Part-1.

All indicating instruments, control switches and indicating lamps shall be mounted on the front side of the Charger.

Each Charger shall be furnished completely wired up to power cable lugs and terminal blocks and ready for external connections. The control wiring shall be carried out with PVC insulated, 1.5 sq.mm. Stranded copper wires. Control terminals shall be suitable for connecting two wires, with 2.5 sq.mm stranded copper conductors. Each wire shall be continuous from end to end and shall not have any joint within itself. The insulation grade of the wiring shall be 1100 V grade. The colour of 3 Phase, 4 Wire AC. supply shall be red, yellow, blue and black for phases and neutral. The D.C. wiring shall be of the colour other than the above (preferably grey) with the +ve and -ve marking in the ferrule. All terminals shall be numbered for ease of connections and identification. Each wire shall bare a ferrule or tag on each end for identification. At least 20% spare terminals shall be provided for control circuits.

The insulation of all circuits, except the low voltage electronic circuits shall withstand test voltage of 2 KV AC for one minute. An air clearance of at least ten(10) mm shall be maintained throughout for such circuits, right up to the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

18.16. Painting of Charger

The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

The inside of the chargers shall be glossy white. Each coat of finishing synthetic enamel paint shall be properly staved. The paint thickness shall not be less than fifty (70) microns.

18.17. TESTS ON CHARGER

Battery Chargers shall conform to all type tests as per relevant Indian Standard. Performance test on the Chargers shall also be carried out on each charger as per specification. Rectifier transformer shall conform to all type tests in IS: 4540 and short circuit test as per IS: 2026. Following type tests shall be carried out for compliance of specification requirements: -

a. Voltage regulation test.

b. Load limiter characteristics test

c. Efficiency tests

d. High voltage tests

e. Temperature rise test

f. Short circuit test at no load and full load at rated voltage for sustained short-circuit.

g. Degree of protection test

h. Measurement of ripple by oscilloscope.

i. Temperature compensation feature demonstration

The contractor may be required to demonstrate to the OWNER that the chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristic, before dispatch as well as after installation at site. At site the following tests shall be carried out: -

(i) Insulation resistance test

(ii) Checking of proper annunciation system operation

If a Charger fails to meet the specified requirements, the Contractor shall replace the same with appropriate Charger without affecting the commissioning schedule of the Sub- Station, and without any extra cost to the OWNER.

The Contractor shall present for inspection, the type and routine test certificates for the following components whenever required by the OWNER.

(i) Switches

(ii) Relays/MCCBs

(iii) Instruments

(iv) DC fuses

(v) SCR

(vi) Diodes

(vii) Condensers

(viii) Potentiometers

(ix) Semiconductor

(x) Annunciator

(xi) Control wiring

(xii) Push buttons and contactors

Makes of above equipment shall be subject to Owner’s approval.

18.18. DOCUMENTATION

The successful bidder shall submit four sets of drawings for approval.

The following drawing shall be supplied with the tender: -

Outline drawings of all apparatus showing sufficient details to enable the purchaser to determine whether the design proposed can be installed satisfactorily or not. Wiring diagram of battery charger.

18.19 TECHNICAL PARAMETERS

Sl. No	DESCRIPTION	PARTICULARS
1	Type	VRLA
2	Conforming Standards	IS 15549:2004/ IEC 60896-21 & 22:2004/ BS 6290- PART IV/ IEEE-1188
3	System Voltage	220V
4	MaximumVoltageDuring Float operation	242V
5	Minimum Voltage available when no charger working and battery fully discharged upto 1.85V per cell	198V
6	Minimum no. of cell	109
7	Trickle charge voltage	2.2 V to 2.25±0.02V/cell
8	Boost charge voltage	2.23 to2.3V/cell
9	When a fully charged battery is put to discharge at a rate of 1/10th of the RatedCapacity, the battery voltage shall not be less than:	
	After SIX minutes of discharge1.98V/cell	1.98 V/cell
	After SIX hours of discharge1.92V/cell	1.92 V/cell
	After EIGHT hours of discharge1.85V/cell	1.85 V/cell
	After TEN hours of discharge1.75V/cell	1.75 V/cell
10	Battery life	1200ormorecharge/dischargecyclesat80%Depthof Discharge at an average temperature of 27°C

18.19(A): TECHNICAL SPECIFICATION FOR 220V DC BATTERY AND CHARGER

Sl. No	DESCRIPTION	PARTICULARS
1	Type	VRLA
2	Conforming Standards	IEC 60146, IEC 60478, IEC 60529, IEEE C57.12.01, ANSI C63.4, IEEE 446, NEMA
		250, NEMA PE5, NFPA 70
3	System Voltage	415V AC +/- 10% for 220V DC Battery & 240V AC +/- 10% for 48V DC Battery
4	Name of the Manufacturer	To be furnished by Bidder
5	Location of the Factory	To be furnished by Bidder
6	Type & Model of charger	To be furnished by Bidder
7	Total Dimension of Float cum Boost Charger in mm	To be furnished by Bidder
8	Minimum thickness of sheet (mm)	To be furnished by Bidder
9	Charger Characteristics	To be furnished by Bidder
10	Type of Rectifier with Model	To be furnished by Bidder
11	Capacity of Battery Charger in Amps	As per requirement
12	Float/Trickle charger current in Amps	To be furnished by Bidder
13	Boost/Quick charger current in Amps	To be furnished by Bidder
14	Voltage Regulation of Float charger (%)	To be furnished by Bidder
15	Ripple content (%)	To be furnished by Bidder
16	Schematic & GA drawings submitted	Yes/No
17	List of Alarms	To be furnished by Bidder
18	Audible noise at any point 150 centimeters from any vertical surface	Not exceeding 65dBA
19	Any other relevant information	To be furnished by Bidder

18.19 (B): The Battery Charger shall have Dual Source AC Input (AC Input 1 and AC Input 2) with individual MCCB and shall be provided with Auto Changeover arrangement.

18.19 (C): The Battery Charger shall have an IP Rating of IP42 or better. The Charger shall be type tested for IP42 or better rating.