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TECHNICAL SPECIFICATIONS

OF

30 VOLT, 100 AH, VALVE REGULATED LEAD ACID BATTERY

BANK FOR 33/11 kV SUB STATION

Prepared by	Checked by	Checked by	Checked by	Approved by
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This Tender Specification for procurement of 30 Volt,100 AH, Valve Regulated Lead Acid Battery Bank may be subjected to the modification by the purchaser as per actual field requirement. Supplier to submit the Guaranteed Technical Particulars (GTP) and Drawings, after the award of the Contract, for approval of the Purchaser.

CLIMATIC AND ISOCERAUNIC CONDITIONS (CIC)

1.	The climatic and Isoceraunic conditions at the site of work are approximately given as under:	
	Description	Kashmir
i)	Max. temp of air in shade	30.6^0C
ii)	Min. temp of air in shade	-20^0C
iii)	Max. temp of air in sun	45^0C
iv)	Height above sea level (App.)	1600 Mtrs.
v)	Max. relative humidity	90%
vi)	Min. relative humidity	15%
vii)	Average no. of thunder storm days per year	54
viii)	Average rainfall	80 cm
ix)	Wind Zone	WZ – 3
x)	Average number of rainy days per year	106
xi)	Seismic Zone	SZ – 5
xii)	Area of installation	Heavy Snow Zone

2. **Communication and Transport:**

The nearest railway station is Jammu on the broad gauge line and is connected to the Divisional Stores by a metal road. The equipment is required to pass en-route through various tunnels on NH-44 (Nandni, Nashri and Jawahar Tunnel). The weights and maximum dimension of the packages suitable for transportation through tunnel route are as follows:-

1. Length = 7.0 m
2. Width = 3.0 m
3. Height = 4.55 m
4. Weight = 40 metric Ton

The supplier shall get the permissible weight and dimensions confirmed from the Highway Authorities before proceeding with the manufacture of the equipment. It willbe the responsibility of the supplier to ensure timely and proper delivery of the equipment on door delivery basis, at Srinagar, through road transport. The supplier shall also ensure that the weights and dimension of the packages which are suitable to be carried by road transport up to Srinagar.

3.	**Additional conditions**	
i	Permitted Noise Level	45dB
ii	Induced Electromagnetic disturbance	1.6kV
iii	Pollution class/ creepage distance	III/ 25mm/kV
iv	Isoceraunic Level (days/year)	50
v	Condensation	Occasional

TECHNICAL SPECIFICATION FOR 30 V,100 AH VALVE REGULATEDLEAD ACID BATTERY BANK

1. SCOPE:

i) This specification covers supply, design, manufacture, assembly, testing at manufacturer's works, packing and delivery of maintenance free 30V,100AH, valve regulated lead acid battery bank.

ii) It is not the intent to specify completely herein all details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the Bidder's guarantee in a manner acceptable to the Purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment, is not in accordance therewith.

iii) The equipment offered shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification or not.

2. SERVICE CONDITIONS:

Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the tropical conditions mentioned above in climatic and isoceraunic conditions.

3. General Nature of Climate:

Moderately hot summers and cold winters with moderate to heavy snowfall and freezing temperatures. The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

4. General Technical Requirements:

Unless otherwise specified elsewhere in this specification, the ratings, performance and testing of the ACDB and components mounted on it shall conform to the latest revisions of the following standards as mentioned in para 4.3 :

4.1. All material / components used in batteries shall be free from flaws and defects and shall conform to the relevant Indian standards and good engineering practice.

4.2. DC System shall consist of Valve Regulated Lead Acid Battery bank (100AH,15x2V).

4.3. Applicable standards: IS:1651, IS:1652, IS:15549:2005, BS:6290 part - IV, IEEE 1188 & IEC60896-2; 1995

5. General Requirements of Batteries:

The Battery bank of 30 V formed by connecting 15 no. 2V (nominal) cells of the rated capacity 100 AH in series. The manufacturer supplying the

cells/batteries as per this document shall be responsible to replace/repair free of charge, the battery/cell becoming faulty, owing to defective workmanship or material as per the provisions of the bid document.

5.1. 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. The cells shall be so designed as to be suitable for stacking.

The DC Batteries shall be Sealed Maintenance Free (SMF) Valve Regulated Lead- Acid (VRLA) type batteries and shall be designed to supply the required load and full AH.

These Batteries shall be suitable for a long life under continuous float operations and non- frequent discharges.

5.2. Cell Terminals:

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

5.3. Container:

The container material shall have chemical and electro-chemical compatibility and shall be acid resistant. The material shall meet all the requirements of VRLA batteries and be consistent with the life of battery. The container shall be fire retardant and shall have an Oxygen Index of at least 28%. The porosity of the container shall be such as not to allow any gases to escape except from the regulationvalve. 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 or 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 tray.

5.4. Cell Covers:

The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant and shall comply with the provisions set forth in clauses. 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.

5.5. Separators:

The separators used shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid and good insulating properties. The design of separators shall ensure that there is no misalignment during normal operation and handling.

5.6. Pressure Regulation Valve:

Each cell shall be provided with a pressure regulation valve. The valve shall be self re-sealing type and flame retardant. 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.

5.7 Terminal Posts:

Both the positive and negative terminals of the cells shall be capable 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 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 positive and negative posts shall be clearly and unambiguously identifiable. All exposed metal parts (connectors, terminals etc) shall be protected with heat shrinkable silicon sleeves for reducing the environmental impact including acorrosive environment.

5.8 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 to withstand corrosion due to sulphuric acid/fumes at a very high rate of charge or discharge. The lead plating on copper connectors shall not be less than 25 microns.

The area of cross-section of the connectors shall be rated at 2 Amp/mm^2 minimum at 6 hour rate of discharge.

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

All inter cell connectors shall be protected with heat shrinkable silicon 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.

5.9 Flame Arrestors:

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

5.10 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: 1651 or IS:1652 as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. The positive and negative terminal posts shall be clearly-marked.

5.11 Sediment Space:

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

5.12 Cell Insulator:

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

5.13 Electrolyte:

The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS: 266 and distilled water conforming to IS: 1069.

5.14 Battery Racks:

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 shall be kept.

6. Capacity Requirements:

When the battery is discharged at 10 hour rate, it shall deliver 80% of C (rated capacity, corrected at 27 ^{0}C) before any of the cells in the battery bank reaches 1.85 V/cell. The capacity (corrected at 27 ^{0}C) shall also not be less than 'C' and no more than 120% of C before any cell in the battery bank reaches 1.75 V/cell.

The capacity of the battery at rate of discharge other than 10 hour discharge rate shallbe as given below:

Rate of Discharge	Capacity expressed as % of Capacity at rate C/10	End cell voltage
C/1	50.0	1.70
C/2	63.3	1.70
C/3	71.7	1.74
C/4	78.2	1.74
C/5	83.3	1.75

C/8	95.0	1.75
C/10	100.0	1.75

The battery shall be capable of being recharged from the fully exhausted condition (1.75 V/cell) within 10 hours up to 90% state of charge. The battery design shall permit the charging of the battery at 2.45 V/cell (when two cells shorted). All the cells in a battery shall be designed for continuous float operation at the specified float voltage throughout the life.

The battery voltage shall not be less than the following values, when a fully charged battery is put to discharge at C/10 rate:

a) After Six minutes of discharge: 1.98 V
b) After Six hours of discharge: 1.92 V
c) After 8 hours of discharge: 1.85 V
d) After 10 hours of discharge: 1.75V

The supplier shall provide the Tables & Graphs showing relation of the closed circuit voltage, impedance and the residual capacity of each cell in the battery bank, when it is discharged to the end voltage of 1.75V/cell at C/10 and C/8 rate of discharge. The supplier shall also provide a table and graph showing the relation between theimpedance and residual capacity of each cell.

Loss in capacity during storage at an average ambient temperature of 35 ^{0}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 bank 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%.

7. Expected Battery Life:

The battery shall be capable of giving more than 1200 charge/discharge cycles at 80% Depth of discharge (DOD) at an average temperature of 27 ^{0}C. 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 bank shall have a minimum expected life of 10 years at float operation.

8. Chemical Requirements:

Oxygen recombination efficiency of cell/battery shall be higher than 95% for charge current C/10 under normal working conditions. The cell pressure shall be sufficient for 99% gas recombination when working at C/10 rate of charge and ambient temperature of 27 ^{0}C. Under normal operating conditions grid corrosion shall not be more than 0.05 mm/year.

Throughout its life, in the operating condition of C/10 rate of charge and

C/8 rate of discharge in average ambient temperature of 35 ^{0}C, shedding of battery active material shall not lead to short circuit. The growth of positive plate shall be less than 8% of the total plate area throughout the specified life.

While operating in the normal operating conditions, the cell or battery shall not lead to dry out, throughout the life of the battery. Manufacturer shall supply the necessary data to support the requirement. The battery shall not exhibit thermal runaway while working in the average ambient temperature of 35 ^{0}C, operating range of -10 to 38 ^{0}C, and at a charge rate of C/10 and discharge rate of C/8.

9. Marking on cells:

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

a) Manufacturer's name

b) Month and year of manufacture

c) Cell AH Capacity

d) Cell Designation

e) Date on which charge given before dispatch

f) Next due date for freshening charge.

10. Temperature for Tests:

The temperature range during the tests shall be within 20 to 35 degree Centigrade.

11. ASSOCIATED EQUIPMENTS & ACCESSORIES:

a)	Best quality metallic stand/frame:	1 No.
b)	Stand insulators +5% extra	Appropriate Quantity
c)	Inter tier connectors	- Do-
d)	Inter row connectors	14 No.+2 No. extra
e)	Cable Clamps with hardware	Appropriate Quantity
f)	Centre-zero (3-0-3) volts DC voltmeter	1 No.
g)	Connection hardwares such as strips, bolts, Nuts (with 5% extra)	Appropriate Quantity
h)	Cell number tags with fixing arrangement	15 No.

i) Torque wrench/ Spanners 1 No

j) Special tools and tackles for connecting 2 Sets
Terminals of battery
Any other accessories not specified but required for satisfactory operation of the battery bank is also to be supplied by the supplier.

12. TYPE TEST OF BATTERY:

a. The Bidder shall supply type tested battery as per IS 15549:2005/ IEC 60896-21 & 22 amended up to date.

S. No.	DESCRIPTION
1	Visual examination.
2	Checking of dimensions as per manufacturer's drawing.
3	Test for C10 capacity and voltage during discharge.
4	Test for C1 capacity and voltage during discharge .
5	Ampere hour and watt hour efficiency test.
6	Test for retention of charge.
7	Acid retention capability test on separators.
8	Wicking test on separators.
9	Test on vent seal operations.
10	Test for oxygen recombination efficiency.
11	Endurance life cycle test.

b. ACCEPTANCE TESTS OF BATTERY:

i) Physical Examination Test

ii) Visual Inspection

iii) Checking of dimensions as per manufacturer's drawing

iv) Test for Capacity

v) Test for Voltage during discharge

11. WARRANTY CLAUSE

The warranty shall remain valid for a period of eighteen (18) months from the date of delivery or twelve (12) months from the date of commissioning of Goods at Purchaser's destination. The Supplier warrants that all the Goods supplied under the Contract shall comply strictly with the Contract, shall be first class in every particular and shall be free from defects. The Supplier further warrants that all equipment, materials and supplies furnished by the Supplier for the purpose of the Goods are new, production of the most suitable grade and fit for their intended purposes.

12. CHALLENGE CLAUSE:

The Purchaser reserves the right to have the material, received after inspection by the authorized inspecting officer, again tested for any parameter(s) from approved/NABL accredited testing house/in house technique of the purchaser. The results if found deviating/unacceptable or in non-compliance with the approved GTP'S, the lot shall be rejected and bidder shall arrange to replace the rejected lot within thirty (30) days of such detection at his cost including to & fro transportation.