

ANNEXURE-1

Specifications for 300 kWh Advanced Lead Acid Battery

1. Introduction:

BHEL is one of the leading engineering organisations in the world, contributing to society in the diversified fields in design, engineering, manufacturing and erection & commissioning of power generation equipment, power transmission system, transportation and industrial automation.

BHEL is considering the development of energy storage systems and hence it is inviting the battery manufactures to quote for supply of 300 kWh Advanced Lead Acid battery along with BMS for the following one or multiple applications.

- i. Output smoothening of SPV power output
- ii. Frequency regulation
- iii. Time shifting of energy generation and consumption
- iv. Peak load saving

2. Pre-Qualification criterion:

The prospective supplier should have supplied / commissioned an Advanced Lead acid battery system (single system) of rating at least 100 kWh with BMS in the last two years and should have been in operation for the last one year as on enquiry date. Documentary evidence against the same shall be submitted by the supplier. Offers not meeting the above criteria will not be considered.

3. Specification of the Battery:

Table (1)

S.No	Parameter	Rating	Remarks
1	Type of Battery	Advanced lead Acid with Lead Carbon Chemistry	
2	Energy	300kWh	The battery should able to give 100 kW of power for 3 hours
3	Minimum Cycle Life at 60% DoD	2500 cycles	
4	Charge Cut-off Voltage	< 900V	
5	Discharge Cut-off Voltage	> 600V	
6	Nominal Charge Current	$\geq 0.3C$	
7	Nominal Discharge Current	$\geq 0.3C$	
8	Monthly Self-discharge @ 25 °	<3%	
9	Cycle Efficiency	$\geq 90\%$	
10	Operating Temperature Range	0°C to 45 °C	

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11	Relative Humidity Range	90 %	
12	Design Life	>= 10 years	
13	Enclosure	IP54 Container	

In addition to the above, data of the following parameters are to be furnished by the supplier for further design of the system.

Table (2)

S.No	Parameter
1	Maximum charge rate
2	Maximum discharge rate
3	Service Life
4	Tables of data or graphs a) Discharge capacity as a function of discharge rate b) Charge retention during storage c) Battery Charging Curves d) Battery Life Cycles as a function of Depth of discharge e) Battery Life Cycles as a function of Discharge rate f) Energy efficiency as a function of power g) Design Life as a Function of Temperature h) Discharge capacity as a function of Temperature
5	Physical dimensions
6	Auxiliary Power Supply requirement
7	External Interfaces
8	Safety Precautions
9	Operating instructions and maintenance manual

4. Specifications for the Battery Management System (BMS):

Suitable BMS should be offered for reliable operation of the offered advanced lead Acid battery under normal and abnormal operation. The offered BMS must provide display, data logging, protection, diagnostic, and communication with SCADA or PCS etc. features for reliable operation of the battery.

The offered BMS should be able to communicate with BHEL make PCS and SCADA system for charging /discharging of battery with protection. The prospective vendor shall provide the following information:

- List of Battery Parameter available to BHEL SCADA system
- Mode of communication for transfer of BMS data to BHEL make SCADA system

The prospective supplier should provide the following details:

Table (3)

SN o	Operations of BMS	Yes/No	Remarks
1	Protection and Control i. Thermal management ii. Operating between safe current and voltage limits iii. Communication/Shutdown on detection faults iv. Protecting cells from the internal degradation and capacity fade v. Providing optimal charging patterns vi. Balancing cells throughout the stack vii. Protection alarms/indications		
2	Measurement i. Measurement of SOC		
3	Monitoring i. Battery bank Current, Voltage and SOH monitoring ii. 1000VDC isolation working voltage iii. 24x7 remote monitoring of battery performance		
4	Data recording i. Event recording and storage features ii. Display of important parameters like voltage, current, SOC and healthiness of the battery		
5	Any other parameter which is not specified, but required for the safe operation of battery		
6	Communication interface required to interface required to interface with BHEL PCS and SCADA system.		

5. Scope of work:

- i. The scope of work shall include following, in complete conformity with above sections of the specifications:
- ii. Design, manufacturing and supply of specified battery along with BMS in an IP54 protected container. Suitable space should be provided in the container to mount BHEL PCS. Details of the BHEL PCS will be shared.
- iii. Detailed mechanical drawing of the container showing the detailed equipment layout should be shared with BHEL.
- iv. The supplied container should have necessary thermal management system by incorporating required air-conditioning and ventilation system. For this purpose, the prospective supplier should also consider the heat loss of BHEL PCS. Heat loss/volume of inlet air in case of exhausting the air outside the container will be provided by BHEL.
- v. The supplied system shall have required protection system for safe operation of battery and BMS .The prospective supplier should submit the details of protection system proposed. The container housing battery and BMS shall meet all the safety requirements regarding working space, lighting, emergency etc.

- vi. The prospective vendor shall provide detailed civil drawings for erection of the container. The erection of the supplied container will be in the scope of BHEL
- vii. The cabling between Battery, BMS and any internal wiring is in the scope of the supplier. BHEL will provide single point auxiliary power supply at the location specified by the vendor. The distributions of power supply is in the scope of supplier. The power connections between (a) Battery to PCS, (b) Termination of PCS output connection to the outgoing terminals on container are in the scope of BHEL. However cable termination box on the container for outgoing power cable from the container is in scope of supplier.
- viii. Erection of container and other grid connections are in the scope of BHEL. The commissioning of Battery and BMS at BHEL premises is in the scope of supplier. However, the prospective supplier shall support BHEL in integration of battery and BMS with the BHEL make PCS and SCADA for charging/discharging of battery as per specified application. The prospective supplier shall provide required details of BMS for interface to PCS for the purpose of charging /discharging battery within the safe operating limits.
- ix. Any other associated works/items not listed above, but required for integration of battery and BMS with BHEL make PCS for energy storage applications.

6. General Conditions:

- i. Offers for Battery & BMS are solicited from reputed OEMs for integrating with Power conditioning system developed by BHEL.
- ii. The Battery and BMS should be installed and commissioned by the supplier at BHEL site, Hyderabad. As the PCS and other switch gear is under the scope of the BHEL, the prospective supplier should support BHEL in commissioning total ESS system. Supplier should complete erection and commissioning within 45 days of receipt of Intimation from BHEL.
- iii. The Battery & BMS shall be installed inside a container with sufficient provision of space for BHEL PCS. Container shall be designed to be a dropped shipped on to a properly prepared pad or foundation. When fully installed, BESS components, including all auxiliaries, (Air conditioning system, fire fighting system etc.) BHEL PCS, etc. as per design requirement shall be enclosed in a container. Container shall meet all safety requirements regarding working space, lighting, emergency etc.
- iv. The prospective supplier shall submit offer for erection & commissioning charges separately along with the taxes applicable, which include erection, commissioning, performance tests at site, on-site training to operators etc.
- v. The comprehensive warranty for Batteries & Battery Management System should be for at least 5 years from the date of commissioning. The prospective supplier shall submit

Performance Bank Guarantee (PBG) for 10 % of the order value towards warranty for 5 years plus 2 months claim period.

- vi. The vendor shall develop and submit a comprehensive Factory Acceptance Test (FAT) plan for Battery and BMS together, to BHEL for its review and approval. FAT shall be demonstrated to BHEL representative for compliance of specification, inclusive but not limited to following:
 - A. Visual inspection of equipment including dimensions and overall design.
 - B. Testing of sensors, metering and alarms
 - C. Testing of all control functions including remote control, monitoring and communication interfaces
 - D. Testing of system performance at rated energy, charging and discharging rates for the following:
 - a. At least 4 nos. of full charging and discharging cycles at rated energy and power level.
 - b. Operation of BMS with all features.
 - c. Maintenance and replacement functions.
 - d. Data logging and display of BMS.
 - e. Self-discharge.
 - f. Safety features and alarm.

Supplier should give minimum of 45 days notice to BHEL about readiness of system for testing. Travel and Hospitality for BHEL Inspectors will be to BHEL Account.

- vii. The battery container should be self-sufficient with all safety and thermal management equipment and all required sensors for safe and proper operation of the battery including hydrogen/hydrogen sulphide gas monitoring system. The supplier should mention details of these equipment in his offer.
- viii. The bidder shall submit a detailed unpriced BOM to meet the requirements of tender specification.
- ix. Battery offered should comply to the following standards:
 - A. IEC 61427-2 - General requirements
 - B. IEC 60896 21 - Methods of test
 - C. IEC 60896 22 – Stationary lead-acid batteries Requirements
- x. Vendor shall provide a list of recommended spares for the offered system. The prices of these spares shall be quoted separately as optional which will not be considered for the purpose of evaluation of the bid. BHEL reserves the right to place a separate purchase order for these recommended spares to be used after warranty period.