

Specifications for 500 kWh Lithium Iron Phosphate 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 planning to develop Battery based Energy Storage Systems (BESS) and hence it is inviting the battery manufactures to quote for supply of 500 kWh Lithium Ion battery along with BMS for the following one or multiple applications.

- 1) Output smoothening of SPV power output
- 2) Frequency regulation
- 3) Time shifting of energy generation and consumption
- 4) Peak load saving

2. Specification of the Battery:

Specification for battery & BMS are as given below

S.No	Parameter	Rating	Remarks
1	Cell Chemistry	LiFePO4	
2	Energy	500kWh	250 kW for 2 hours
3	Minimum Cycle Life at 80% DoD	3000 cycles	
4	Charge Cut-off Voltage	< 960V	
5	Discharge Cut-off Voltage	>620V	
6	Nominal Charge Current	Min 0.2C	
7	Nominal Discharge Current	Min 0.5C	
8	Monthly Self-discharge	<3%	
9	Response time	<75ms	
10	Cycle Efficiency	>90%	DC - DC
11	Atmospheric Temperature Range	5°C to 45°C	
12	Relative Humidity Range	90 %	
13	Enclosure	IP54	

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

S.No	Parameter
1	Maximum charge rate
2	Maximum discharge rate
3	Service Life
4	Tables of data or graphs a) Maximum charge power as a function of charge level b) Maximum discharge power as a function of charge level c) Charge capacity as a function of charge power d) Discharge capacity as a function of discharge power e) Charge energy as a function of charge power f) Discharge energy as a function of discharge power g) Energy efficiency as a function of power
5	Physical dimensions
6	Auxiliary Power Supply requirement
7	External Interfaces
8	Safety Precautions
9	Operating instructions and maintenance manual

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

Suitable BMS should be offered for reliable operation of the offered Lithium Ion 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:

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

The prospective supplier should provide the following details:

S.No	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	Hardware and software details		

4. Scope of work:

The scope of work shall include following, in complete conformity with above sections of the specifications:

- I. 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.
- II. Detailed mechanical drawing of the container showing the detailed equipment layout should be shared with BHEL.
- III. 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.
- IV. 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.

- V. 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
- VI. 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 distribution 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.
- VII. 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.
- VIII. Any other associated works/items not listed above, but required for integration of battery and BMS with BHEL make PCS for energy storage applications.

5. General Conditions:

- I. Offers for Battery & BMS are solicited from reputed OEMs for integrating with BHEL Power conditioning system.
- II. Erection of container and other grid connections are in the scope of BHEL. However, the Battery and BMS should be 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 integration of Battery & BMS with BHEL make PCS and SCADA to establish the operation of the total ESS system. Supplier should complete 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. Supplied Container should be complete in all aspects and should be directly erected on prepared pad or foundation as per vendor drawings. Container shall meet all safety requirements regarding working space, lighting, automatic fire protection, emergency etc.
- IV. The prospective supplier shall submit offer for commissioning charges separately along with the taxes applicable, which include commissioning of Battery & BMS, support to BHEL in integration of Battery & BMS with BHEL make PCS and SCADA to establish the operation of the total ESS system, performance tests at site and on-site training to operators
- V. The comprehensive warranty for Batteries & Battery Management System should be for at least 3 years from the date of commissioning. The prospective supplier shall submit Performance Bank Guarantee (PBG) for 10 % of the order value towards warranty for 3 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:
 1. At least 4 nos. of full charging and discharging cycles at rated energy and power level.
 2. Operation of BMS with all features.
 3. Maintenance and replacement functions.
 4. Data logging and display of BMS.
 5. Self-discharge.
 6. Safety features and alarm.
- VII. 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.
- VIII. The battery container should be self-sufficient with all safety and thermal management equipment including automatic fire protection system and all required sensors for safer and proper operation of the battery. The supplier should mention these equipment details in his offer.
- IX. Battery offered should comply to the following standards:
- i. IEC 62133 - Safe operation of portable sealed secondary cells and battery
 - ii. IEC 62281 - Safety during transportation or UN 38.3
 - iii. IEC 61959 - Mechanical tests
 - iv. IEC 61960 - Performance tests
 - v. IEC 61427-2 - General requirements
- OR
- i. UL-1642 or UL 1973
- IX. The bidder shall submit a detailed unpriced BOM to meet the requirements of tender specification.
- 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.