

Commercial Systems Engineering Reference Manual: Tier-1 LFP Battery Storage Platform

PRODUCT IDENTIFICATION

This engineering reference manual formally defines the architecture, performance envelope, and safety systems of our latest-generation Commercial Battery Energy Storage System (BESS). Designed for high-duty C&I, micro-grid, and PV-storage-charging infrastructure, this platform integrates Tier-1 prismatic LFP cells with a proprietary liquid thermal management system. The system is delivered as a fully integrated, factory-assembled unit, optimized for peak shaving, demand response, and backup power applications, ensuring a 20-year operational design life.



INTERNAL BESS TOPOLOGY

The internal architecture is structured around a high-voltage DC bus, managed by a three-level BMS. This centralized topology connects battery racks in parallel to a bi-directional PCS. The PCS features a SiC-based design for enhanced efficiency and grid-forming capability. All power and control connections are pre-wired, terminating at standard IP65-rated junction boxes for simplified site integration.

THERMAL PROTECTION MECHANISMS

The system employs an advanced liquid cooling architecture, circulating a dielectric fluid through cold plates embedded within each battery module. This ensures cell temperature uniformity within $\pm 2^{\circ}\text{C}$, significantly enhancing cycle life and safety. A multi-level protection strategy includes:

- Cell-level overcurrent and over-temperature fusing.
- Module-level gas detection and pressure relief vents.
- Rack-level pyro-fuses for rapid DC isolation.
- System-level fire suppression with aerosol and FM-200 agent.

OPERATIONAL ADVANTAGES

Key operational advantages include a high round-trip efficiency of 92%, a

modular capacity range from 215 kWh to over 1 MWh per block, and seamless parallel expansion. The intelligent EMS enables dynamic demand charge management and can be configured for time-of-use arbitrage, peak shaving, and participation in frequency regulation markets.

SPECIFICATION MATRIX

The core specifications are detailed in the matrix below, covering electrical, mechanical, and environmental parameters for standard configurations.

Parameter	Specification
Nominal Capacity	215 kWh / 372 kWh per cabinet (standard configurations)
System Voltage	768 V DC / 1500 V DC (optional high-voltage variant)
Cooling Method	Active Liquid Cooling (Dielectric Fluid)
Cell Chemistry	Tier-1 LFP (Prismatic)
Operating Temperature	-20°C to 55°C (derated above 45°C)
Ingress Protection	IP65 (outdoor rated)
BMS Protocol	Modbus TCP/IP, CAN 2.0, IEC 61850
Round-Trip Efficiency	>92% (DC to AC)
Cycle Life	>6000 cycles at 80% DoD (25°C)

Weight	Approx. 2,800 kg per 215 kWh cabinet
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REGULATORY COMPLIANCE

This system is fully compliant with UL 9540, UL 1973, IEC 62619, and IEC 62477-1. It has successfully passed rigorous thermal runaway propagation tests (UL 9540A) and is certified for installation in NFPA 70-compliant environments. The design is also compliant with IEEE 1547 and IEEE 2030.5 for grid interconnection.

