

Advanced Battery Manufacturing Line Portfolio - Official Commercial BESS

Technical Overview & Datasheet

EXECUTIVE SUMMARY

The Advanced Battery Manufacturing Line Portfolio represents a fully integrated, turnkey ecosystem engineered for gigafactory-scale production of Tier-1 lithium iron phosphate (LFP) energy storage cells, modules, and complete battery energy storage system (BESS) cabinets. This portfolio encompasses every critical stage of the manufacturing value chain—from electrode slurry preparation and high-speed coating to automated stacking, laser welding, electrolyte filling, formation, and end-of-line testing. Designed for global energy storage vendors, independent power producers (IPPs), and utility-scale integrators, the portfolio delivers unmatched production throughput, yield consistency, and cell-to-pack traceability. Each manufacturing line is built on a modular, scalable architecture that supports rapid capacity expansion from 1 GWh to 10 GWh+ annually, ensuring future-proof investment protection.



SYSTEM ARCHITECTURE & SAFETY

The portfolio is structured around five core manufacturing subsystems: (1) Electrode Manufacturing Line — featuring dual-side simultaneous coating, high-precision calendering, and inline thickness measurement with closed-loop feedback; (2) Cell Assembly Line—integrating high-speed stacking, tab welding, and automatic optical inspection (AOI) for micro-defect detection; (3) Electrolyte Injection & Formation Line—utilizing vacuum-sealed filling stations and programmable formation cabinets with temperature-controlled channels; (4) Module & Pack Assembly Line — incorporating laser welding, busbar bonding, and BMS integration stations; and (5) End-of-Line Testing & Grading Line — performing capacity, internal resistance, self-discharge, and thermal runaway screening. Safety is embedded at every stage: explosion-proof solvent handling, real-time particulate monitoring, emergency inert gas suppression,

and full MES (Manufacturing Execution System) traceability down to the individual cell serial number.

KEY FEATURES

- Modular Line Architecture: Each subsystem operates as an independent module, enabling phased CAPEX deployment and seamless capacity upgrades without production interruption.
- Tier-1 LFP Cell Consistency: Advanced slurry mixing and coating tolerances of $\pm 1.5 \mu\text{m}$ ensure uniform electrode density, leading to cell capacity variation of less than 1.5% across production batches.
- AI-Driven Quality Control: Machine learning algorithms inspect weld quality, stack alignment, and electrolyte fill volume in real time, achieving a defect escape rate below 50 ppm.
- Smart Liquid Cooling Integration: The portfolio includes inline liquid cooling plate assembly and leak testing stations, compatible with both pouch and prismatic cell formats.
- Digital Twin & MES: Full digital thread from raw material lot to finished cabinet, with OPC-UA and MQTT interfaces for SCADA and ERP integration.
- Energy-Efficient Formation: Regenerative formation cabinets recover up to 85% of discharge energy, reducing formation electricity costs by over 40%.

COMPLIANCE & STANDARDS

The Advanced Battery Manufacturing Line Portfolio is designed to comply with the following international standards: ISO 9001:2015 (Quality Management), ISO 14001:2015 (Environmental Management), ISO 45001:2018 (Occupational Health & Safety), IEC 62619 (Safety of Industrial Secondary Lithium Cells and Batteries), UL 9540 (Energy Storage Systems and Equipment), UL 1973 (Batteries for Use in Stationary Applications), and CE Marking for European Union Machinery Directive. Each manufacturing line undergoes Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) in accordance with IEC 62933-5-2. Cleanroom environments for cell assembly are certified to ISO 14644-1 Class 7 (10,000 particles/m³).

TECHNICAL SPECIFICATIONS

The following table summarizes the key performance and configuration parameters of the standard Advanced Battery Manufacturing Line Portfolio. Custom configurations are available upon request.

Parameter	Specification
Annual Production Capacity	1 GWh to 10 GWh+ (modular scaling)
Cell Format Compatibility	Prismatic (VDA & custom), Pouch

Electrode Coating Speed	Up to 80 m/min (dual-side simultaneous)
Coating Thickness Tolerance	$\pm 1.5 \mu\text{m}$
Stacking Alignment Accuracy	$\pm 0.2 \text{ mm}$
Electrolyte Fill Volume Accuracy	$\pm 0.5\%$
Formation Energy Recovery	Up to 85%
Defect Escape Rate	< 50 ppm
Traceability Level	Cell-level serial number with full MES digital thread
Cleanroom Class (Assembly)	ISO 14644-1 Class 7
Line Footprint (1 GWh/yr)	12,000 m ² (approx.)
Line Footprint (10 GWh/yr)	85,000 m ² (approx.)
Installation Timeline	9–14 months from contract to first cell
Compliance Standards	ISO 9001, ISO 14001, ISO 45001, IEC 62619, UL 9540, UL 1973, CE

INDUSTRIAL DEPLOYMENT

Deployment scenarios for the portfolio include greenfield gigafactories, brownfield expansion of existing lithium-ion production facilities, and co-located BESS assembly plants adjacent to renewable energy generation sites.

The line footprint ranges from 12,000 m² for a 1 GWh/year configuration to over 85,000 m² for a 10 GWh/year facility. Typical installation timelines are 9–14 months from contract signing to first production cell, depending on local permitting and utility interconnection. The portfolio supports both manual-guided and fully automated guided vehicle (AGV) material handling, with optional overhead monorail systems for high-throughput electrode transfer.

