

Prismatic Aluminum Case Battery Laser Welding System

Item Number: DH11



Introduction

Integrated laser welding system for prismatic aluminum case batteries combines top cover full seam and sealing pin welding with precise fixturing vision inspection protective gas and dust extraction for consistent high quality production in advanced battery manufacturing lines worldwide.

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Application	Description	Key Benefit
Prismatic lithium battery top-cover assembly	Performs laser pre-welding and full-seam welding between the top cover and aluminum case using top-surface datum positioning.	Supports controlled seam geometry, with effective penetration of 0.5-1.2 mm and weld width of 0.8-1.4 mm.
Sealing-pin closure welding	Uses CCD capture, focus detection, optional four-quadrant pre-welding, and full welding for sealing-pin installation.	Delivers sealing-pin positional control and weld-seam offset ≤ 0.05 mm.
Battery pilot-line manufacturing	Supports manual cell loading, clamping, laser welding, inspection, and manual unloading for process development and pilot production.	Integrates two welding processes in one platform while supporting compatible battery formats.
Battery production-line operations	Provides a controlled workstation for repeated aluminum-case closure welding with monitored air pressure, gas flow, focus, and dust extraction.	Supports equipment-caused scrap performance of 99.5% qualification rate and equipment availability $\geq 95\%$.
Aluminum-case battery manufacturing	Welds aluminum cases with wall thicknesses of 0.4-0.8 mm while protecting enclosure surfaces and top-cover terminal plastic parts.	Helps achieve smooth, bright weld appearance with smooth transition to the base material.
Multi-format battery production	Accommodates compatible cells 12-60 mm thick, 80-170 mm wide, and 90-190 mm high through product-specific fixtures.	Enables fixture conversion in ≤ 30 minutes without reducing locating precision.

Parameter	Specification
Site-facing identifier	DH11
Applicable battery type	Prismatic aluminum-case battery
Reference battery format thickness	20-25 mm
Reference battery format width	100 mm
Reference battery format height	120 mm
Compatible battery thickness	12-60 mm
Compatible battery width	80-170 mm
Compatible battery height	90-190 mm
Integrated processes	Top-cover full welding / sealing-pin welding
Top-cover loading and unloading	Manual cell loading; manual cell unloading
Top-cover welding sequence	Fixture clamping; laser pre-welding; full welding
Sealing-pin loading and unloading	Manual cell loading; fixture clamping; manual sealing-pin installation; laser welding; manual inspection and unloading
Top-cover fixture arrangement	Traveling fixture clamping; vertical welding
Top-cover positioning datum	Top surface (top-cover surface)

Parameter	Specification
Top-cover repeated fixture positioning tolerance	± 0.02 mm, repeated clamping Master test
Master-to-clamping-plate gap after clamping	≤ 0.04 mm
Fixture movement requirement	Avoid sliding friction between clamping fixture and battery during positioning in different axial directions
Clamping-cylinder air-pressure control	Pressure monitoring and alarm; pressure fluctuation ≤ 0.05 Mpa
Fixture upper-surface to top-cover upper-surface height difference	1.5-2.0 mm
Top-cover fixture battery-contact material	Non-metallic
Top-cover shielding gas	Coaxial N ₂ , purity $\geq 99.99\%$
Top-cover gas-flow adjustment	Adjustable; resolution 0.1 L/min; flow monitoring and alarm
Laser-head height visualization resolution	0.05 mm
Automatic defocus measurement	Abnormal alarm; resolution ≤ 0.05 mm
Top-cover laser source	Ring-spot laser, 2KW+1KW
Laser line diameter	$> 100\mu\text{m}/600\mu\text{m}$
Laser cooling	Water chiller equipped
Laser-head and transmission-fiber laser-power fluctuation	$\leq 3\%$
Laser power linearity	≥ 0.99
Top-cover laser-head X/Y/Z repeated travel tolerance	± 0.02 mm
Top-cover welding speed	≥ 70 mm/s
Laser-head movement jitter amplitude	≤ 0.05 mm
Corner welding speed fluctuation	≤ 10 mm/s
Top-cover welding trajectory deviation	± 0.05 mm
Laser welding angle	Adjustable; 5~13° laser inclination
Top-cover effective weld penetration	0.5-1.2 mm
Top-cover weld width	0.8-1.4 mm
Top-cover pre-welding	Includes pressing function; 6-8 weld points before full welding
Top-cover seam pressure resistance	≥ 1.1 Mpa
Laser travel repeat accuracy	± 0.04 mm
Aluminum-case wall thickness	0.4-0.8 mm
Top-cover weld quality requirement	Flat and bright weld appearance and internal weld trace; smooth transition with base material; no incomplete welding, missed welding, over-welding, inclusions, pores, or burst points
Top-cover dust extraction	Included
Welding protection-gas device	Adjustable flow, angle, and distance; flow traceable
Emission-head extension beyond dust port	≤ 5 mm
Top-cover terminal dust-port air speed	≥ 15 m/s
Top-cover spatter protection	Welding station includes weld-slag protection; no weld-slag residue on aluminum-case surface
Dust-extraction main duct	Stainless-steel piping with adjustment valve for airflow and air-speed adjustment
Duct pressure monitoring	Main duct pressure gauge with real-time monitoring; linked to equipment control program; stop alarm for excessive or insufficient pressure
Top-cover protection cover	Fits tightly to top-cover surface during welding; protects terminal plastic parts and battery surface; no visible smoke residue
Sealing-pin lifting and fixture arrangement	Cylinder lifts to datum plate; mechanical limit; spring fixture
Sealing-pin datum-plate underside coating	0.1~0.3 mm Teflon coating for insulation at battery contact
Sealing-pin fixture accuracy	≤ 0.1 mm

Parameter	Specification
Sealing-pin post-location centering tolerance	± 0.5 mm
Sealing-pin height datum	Battery top cover
Sealing-pin position capture	CCD system; capture-positioning accuracy $\leq \pm 0.03$ mm
Sealing-pin automatic focus-detection resolution	≤ 0.02 mm
Sealing-pin pre-welding	Fixture automatically clamps battery; four-quadrant-point pre-weld; may be omitted according to process
Sealing-pin welding sequence	Full welding after pre-welding
Sealing-pin laser angle	Adjustable; 5~13° laser inclination
Sealing-pin weld penetration	> 0.5 mm
Sealing-pin spot diameter or molten-pool width	> 0.95 mm
Sealing-pin welding speed	≥ 6 mm/s
Sealing-pin seam pressure resistance	≥ 1.1 Mpa
Motor positioning and weld-seam offset	≤ 0.05 mm
Sealing-pin weld appearance	Smooth; no burrs, black spots, pits, or similar defects
Sealing-pin heat-affected zone	Temperature $< 80^{\circ}\text{C}$ at 2 mm from weld seam
Sealing-pin spatter protection	Protective cover protects battery from welding spatter; independently designed welding-station fixture ensures lifting consistency
Sealing-pin smoke extraction	Real-time smoke extraction with dust collector and stainless-steel piping
Sealing-pin terminal dust-port air speed	≥ 10 m/s
Sealing-pin laser-head movement stability	X/Y/Z-axis jitter amplitude ≤ 0.05 mm within speed range
Sealing-pin laser-head X/Y repeated travel accuracy	≤ 0.05 mm
Sealing-pin focus compensation	Focal distance monitored in real time; measured value compensated to welding Z axis
Product fixture changeover	≤ 30 min; simple installation and removal; does not affect fixture locating accuracy or equipment service life
Electrical supply	AC380 $\pm 10\%$
Compressed air	0.6MPa
Safety enclosure	Aluminum-alloy protective enclosure with organic-glass structure and organic-glass operating door
Ergonomic requirement	Good human-machine engineering performance
Qualification rate	99.5% (only product scrap caused by equipment reasons)
Equipment capacity or speed	≥ 120 PPM/10H, based on actual manual operating speed
Equipment availability	$\geq 95\%$ (failures caused only by equipment)