

# Battery Laser Welding 2026

Seven Quality Gates and the Buyer's Specification Sheet — NEGUP MACHINE

## Why the weld head decides PACK yield

A single battery pack carries thousands of welded joints, each conducting current, conducting heat and expected to survive a decade of vibration and thermal cycling. Because those joints sit inside sealed enclosures, a defective weld is not reworkable — it is scrap or a field failure. That single fact has moved process control, rather than raw laser power, to the centre of equipment purchasing decisions in 2026. Mobility Foresights puts the global battery laser welding market at roughly **USD 1.05 billion in 2026**, rising to **USD 3.1 billion by 2032 at a 19.8% CAGR**, with Asia-Pacific holding the dominant share of installed capacity (Mobility Foresights, September 2026).

Table 1 — The 2026 equipment market in numbers

| Battery laser welding market, 2026                    | USD 1.05 billion                                             | Mobility Foresights, Sep 2026 |
|-------------------------------------------------------|--------------------------------------------------------------|-------------------------------|
| Battery laser welding market, 2032F                   | USD 3.1 billion (19.8% CAGR)                                 | Mobility Foresights, Sep 2026 |
| Full-automatic lithium battery laser welding machines | USD 3.20B (2025) → 3.55B (2026) → 6.51B (2032F), 10.67% CAGR | 360iResearch, Sep 2026        |
| Lithium battery welding inspection systems            | USD 1.63B (2025) → 1.82B (2026) → 3.47B (2032F), 11.35% CAGR | 360iResearch, Sep 2026        |
| Cylindrical full-tab laser welding lines              | USD 310M (2025) → 340M (2026) → 620M (2034F), 9.4% CAGR      | Intel Market Research, 2026   |
| Line speed, cylindrical full-tab lines                | Above 220 mm/s; 1,200+ cells/min on 4680                     | Intel Market Research, 2026   |
| New installations using AI-optimised laser heads      | 68%, cutting cycle time by roughly 25%                       | Intel Market Research, 2026   |
| Integrated laser welding stations per gigafactory     | 20 to 40 at full capacity                                    | IndexBox, 2026                |
| Welding share of German e-mobility laser value        | 40–50%, growing 14–18%/yr to 2030                            | IndexBox, 2026                |
| Global laser welding equipment market                 | USD 12.84B (2026) vs 11.27B (2025), +13.9%                   | Chanye Shijie, Aug 2026       |
| China tab and busbar welding equipment demand         | +21.4% YoY, within a USD 4.96B market                        | Chanye Shijie, Aug 2026       |
| Capex for a fully automated cylindrical welding line  | Above USD 2 million; 3+ year payback                         | Intel Market Research, 2026   |

Tab-to-busbar welding carries the highest joint count per pack and is the largest single application by process volume. Green and blue wavelength sources, which absorb far better in copper than infrared, are the fastest-growing category (Mobility Foresights, September 2026).

Table 2 — Seven quality gates that decide PACK yield

| 1. Weldability study      | Joint-design and material-combination study before the purchase order, with production-representative trials | Documented weldability report plus destructive and non-destructive acceptance testing |
|---------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 2. Fixture and clamping   | Repeatable clamp pressure, clean tab surfaces, controlled dwell time after pre-treatment                     | Positioning deviation ≤ 0.2 mm                                                        |
| 3. Inline weld monitoring | Standard, not optional: coaxial multi-sensor head with real-time judgement                                   | 350–1,800 nm sensing; up to 800 kHz sampling; OCT weld-depth on premium systems       |
| 4. Contact resistance     | 100% measurement with four-point probe or micro-ohmmeter, logged per joint                                   | ≤ 50 μΩ; pack programmes often target < 0.15 mΩ                                       |

|                                  |                                                                                |                                                                                |
|----------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 5. Destructive pull test         | Per batch or per shift, plus a process-capability target on the distribution   | $\geq 80$ N tab welds; Cpk $\geq 1.67$                                         |
| 6. AI inspection plus root cause | 100% surface inspection; X-ray and metallography held in reserve               | $\geq 99.5\%$ defect recognition accuracy, validated against reference samples |
| 7. Traceability                  | Per-weld parameter set, operator, material lot and equipment ID written to MES | Queryable genealogy record for every joint (IATF 16949 style)                  |

**Table 3 — Reference system price bands (European market)**

| Standard single-beam fibre laser, 2–4 kW                                | 180,000–280,000           | Baseline welding capability, manual or semi-automatic load           |
|-------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------|
| Multi-beam / beam-oscillation with seam tracking and process monitoring | 300,000–550,000           | Dissimilar-material stability, copper joining, inline quality signal |
| Premium spec with OCT weld-depth monitoring and automated calibration   | Adds 30–50% to base price | Measured penetration depth and closed-loop control                   |
| Ultrafast laser, pulse duration below 10 ps                             | 400,000–800,000           | Precision structuring of electrode coatings and separator materials  |
| Installation, commissioning and process validation                      | Adds 8–15%                | Process qualification and acceptance documentation                   |
| Multi-system order, five units or more                                  | 10–20% discount off list  | Volume pricing on identical configurations                           |

Cost structure: the laser source accounts for 40–55% of total system cost, beam-delivery optics 15–25%, motion and automation 12–18%, control electronics and software 8–12% (IndexBox, 2026).

## Nine questions for your next welding-line RFQ

**Which wavelength, and why?** Ask the supplier to justify infrared, green or blue against your actual material stack.

**Is weld monitoring standard or optional?** Get the sensing channels, sampling rate and whether correction is closed-loop.

**How is lack of fusion detected?** Demand the 100% resistance method, the pass threshold and per-joint logging.

**What Cpk does the supplier commit to?** Pull-strength capability on production-representative samples predicts yield.

**How long is changeover between cell formats?** Modular fixturing and recipe management decide line flexibility.

**What is the fixture accuracy specification?** Sub-0.2 mm positioning with a documented maintenance interval.

**Which MES and fieldbus interfaces are native?** Per-joint logging should be configuration, not development.

**What is the laser source lead time?** High-power diode supply has eased, but confirm delivery in writing.

**What does process validation include?** Trials on representative materials plus documented handover and acceptance criteria.

NEGUP MACHINE builds the joining and verification sequence behind these gates: laser welding stations and precision spot welding equipment with fixturing for cylindrical, prismatic and pouch formats, module and PACK assembly lines, and the downstream test gates — the **NG-013 cell grading machine**, the **NG-014 pack aging machine** and PACK/module EOL comprehensive test systems. Tell us your cell format, joint type, target takt and yield requirement, and we will size the welding and inspection station to the process rather than to a datasheet.

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