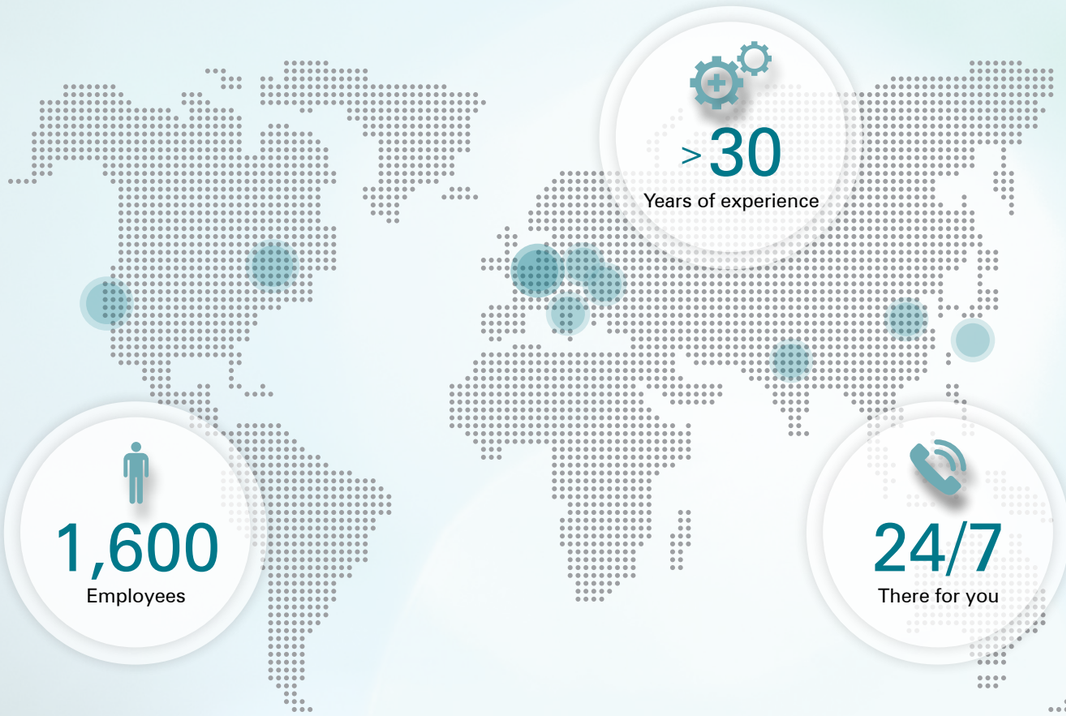
BLA SERIES

Lamination & Stacking of Cells

For safe and efficient batteries

GERMAN ENGINEERING – INTERNATIONALLY STAGED – GLOBAL REFERENCES



Manz AG

Established 1987
Headquarters in Reutlingen, Germany.
Additional branches in Slovakia, Hungary, Italy, China, Taiwan, the United States, and India.

Employees

approx. 1,600 employees worldwide, including around 500 engineers

Core technologies

Automation
Metrology
Laser processing
Wet chemistry
Roll-to-roll

Production solutions for lithium-ion batteries

AS A HIGH-TECH EQUIPMENT MANUFACTURER, MANZ DEVELOPS AND PRODUCES HIGHLY EFFICIENT PRODUCTION SOLUTIONS FOR LITHIUM-ION BATTERY CELLS, MODULES AND PACKS.

Manz AG is one of the leading suppliers of **production equipment for lithium-ion battery cells, modules and packs as well as for capacitors.** We have been setting global standards in this field for more than 30 years.

With our globally unique technology portfolio for the production of all current cell concepts — from wound button cells to stacked pouch cells — we play a major role in the continued development of lithium-ion battery technology.

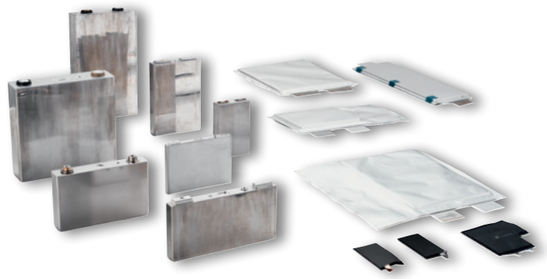
We offer our customers **individual machines for lab and pilot production, systems for small-scale and large-scale production as well as complete assembly lines and turnkey solutions** for manufacturing batteries. All system concepts are distinguished by their high production speed, high precision and reliability.

Our **product portfolio** covers the following markets:

- Production solutions for lithium-ion batteries and (super) capacitors in the field of **E-mobility**
- Production solutions for lithium-ion batteries and capacitors in the field of **stationary energy storage** for private households and photovoltaic large systems
- Production solutions for lithium-ion batteries in the field of **electronic end units** such as tablet PCs, mobile phones and Notebooks

Our performance spectrum spans from battery cell production (**cell assembly**) to the assembly of individual battery cells in a battery system (**pack assembly**).

We accompany you from the initial idea to the final production process and are at your side during planning, projecting, construction and installation of your production line. In addition, we support you with our comprehensive know-how through the setup and commissioning of the system, with user training, remote maintenance and after-sales service.



Lamination & Stacking Process— Our Milestones

Lamination & Stacking is a technology, originally developed and refined by Manz, for producing high quality stacked multi-layer lithium-ion battery cells.

1996
Manz invents the lamination technology for lithium-polymer batteries and designs the first lamination machine.

1998
Manz develops the mono- and bi-cell lamination and stacking process for consumer applications.

2005
Manz develops the mono- and bi-cell lamination and stacking process for large size cells for the automotive industry.

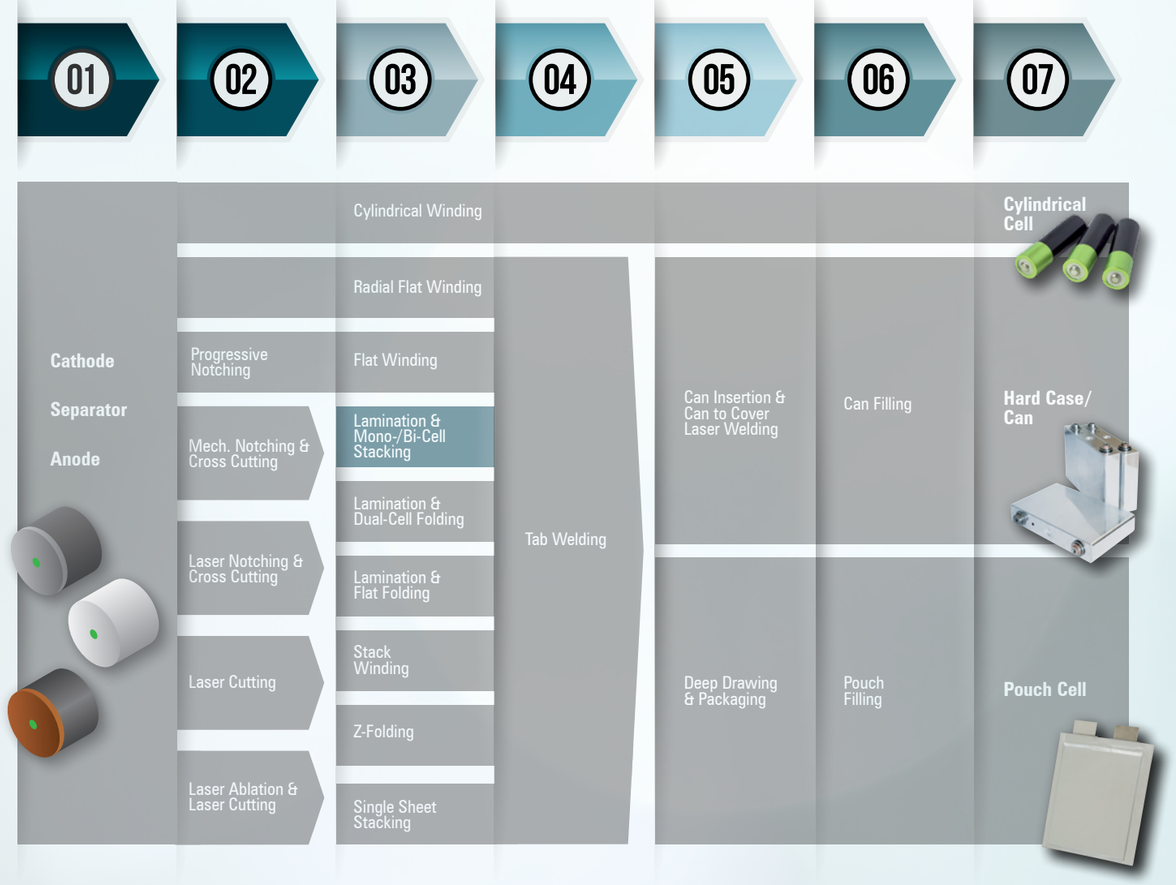
2014
Manz further develops the monocell lamination and stacking technology to produce batteries with an odd shape geometry for consumer electronics.

2018
Manz develops the high-speed modular lamination *BLA* series for stacked cells for automotive and electronics applications.

LI-ION BATTERY PRODUCTION – MANZ TECHNOLOGY MATRIX

MANZ PROVIDES EQUIPMENT FOR ALL PRODUCTION STEPS RELATING TO THE MANUFACTURE OF LITHIUM-ION BATTERIES. WITH THE *BLA SERIES* ALL LAMINATION & STACKING PROCESSES ARE COVERED.

01	02	03	04	05	06	07
INPUT MATERIAL	**CUTTING**	**CELL ASSEMBLY**	**TAB WELDING**	**PACKAGING**	**FILLING**	**OUTPUT MATERIAL**
Anodes, cathodes and separators on a roll	Separation and stamping of electrodes	Laminating, stacking of individual electrodes or winding of stamped electrodes	Welding of electrodes and contacts	Incorporating stacks in aluminum cans or pouches and deep drawing of pouches	Filling with electrolytes into pouches or hard cases and sealing of pouches	Cylindrical, prismatic hard case or pouch cells



Lamination & stacking process for lithium-ion battery cells

WITH THE *BLA SERIES* MANZ OFFERS A HIGHLY RELIABLE AND FLEXIBLE SOLUTION FOR THE PRODUCTION OF SAFE LITHIUM-ION BATTERY CELLS.

The *BLA Series* is a **flexible, modular platform for laminating and stacking (roll-to-cell) mono- and bi-cells**. Thus, it covers an important step in the production of pouch cells or prismatic cells, which are mainly used in the electronics industry or in the area of e-mobility.

Stay flexible for future needs
The *BLA Series* is modular. Several **independent modules** are put together to perform the individual process steps: Unwinding of pre-notched electrodes (anode and cathode), cutting of electrodes and placing them on and between the separator for generating mono-cells or bi-cells, heat and press lamination, cutting and inspection of the mono- and bi-cells and stacking into a workpiece carrier.

Due to its modular design, the *BLA Series* is **freely configurable** — and thus suitable for both, as a **pilot line** and for **mass production**. Even **changes in product size or configurations (axial / radial)** can be easily implemented due to the high flexibility of the production line.

Increase your productivity
The continuous operation of the production line, which simultaneously processes four layers of material, makes the *BLA Series* **one of the fastest cell assembly processes** for stacked cells. With up to 400 mm/s material speed, the BLA series is at least twice as fast as any other alternative stacking machine.

During assembly of the cells, the *BLA Series* achieves a very high and stable process performance. Winding and unwinding units for continuous operation of the system as well as the web guide rollers ensure minimal stress and tension on the electrode/separator tracks and thus **high productivity of the system**.

Be on the safe side
The *BLA Series* places the electrodes on the separator with a guaranteed accuracy of ± 0.5 mm at a CP of > 1.3. Subsequently, the materials are laminated by heat and pressure to obtain a mechanically stable connection. **Lithium-ion batteries made from laminated and stacked sheets offer much greater safety than conventionally manufactured batteries** as the separator of the laminated cells shrinks less during battery operation. Thus, short circuits can be avoided in the peripheral areas of a single cell and the safety of the whole battery is increased.

The laminated cells are optically inspected and electrically tested before stacking, bad parts are immediately sorted out. Thus, scrap in the subsequent processes is held to a significantly low level and not only the manufacturing costs are substantially reduced, but also quality and safety of the end products are increased.

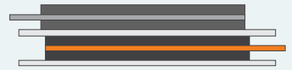
BLA Series— Battery Lamination & Stacking

Applications

- Pouch Cells, Hard Case Cells
- Consumer Electronics and Automotive Industry

Products

Mono Cell



Bi Cell

Configurations

Axial cell configuration

Radial cell configuration

Cathode Separator Anode

Increases profitability

Increases productivity

Increases the quality and safety of the battery cells

BLA SERIES—LAMINATION & STACKING LINE

Separator unwinding

Highly precise tension control, centrally clamped mandrel in 3" or 6" design, equipped with manual splice.

Electrode cutting and insertion

On-the-fly transversal cut with particle suction.

Belt protector

Covers the electrodes during the lamination process to avoid particle contamination.

Separator cutting

On-the-fly separation and onward transport of the laminated cells.

Electrical test

Measurement of isolation between electrodes.

Stacking on work-piece carrier

High accuracy positioning of the cell stack.

Anode and cathode unwinding

Highly precise tension control, centrally clamped mandrel in 3" or 6" design. Can be equipped with automatic splice to increase the overall efficiency.

Web alignment units

Increases cell capacity by optimizing the utilization of active material.

Lamination unit

Generates a solid and mechanically stable interface between electrodes and separators.

Belt protector

Avoids sticking of the separator onto the lamination unit.

Vision system

Inline quality inspection of each moni-/bi-cell, including full traceability of the product.

Reject station

Quick analysis of defects and effective scrap management.

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