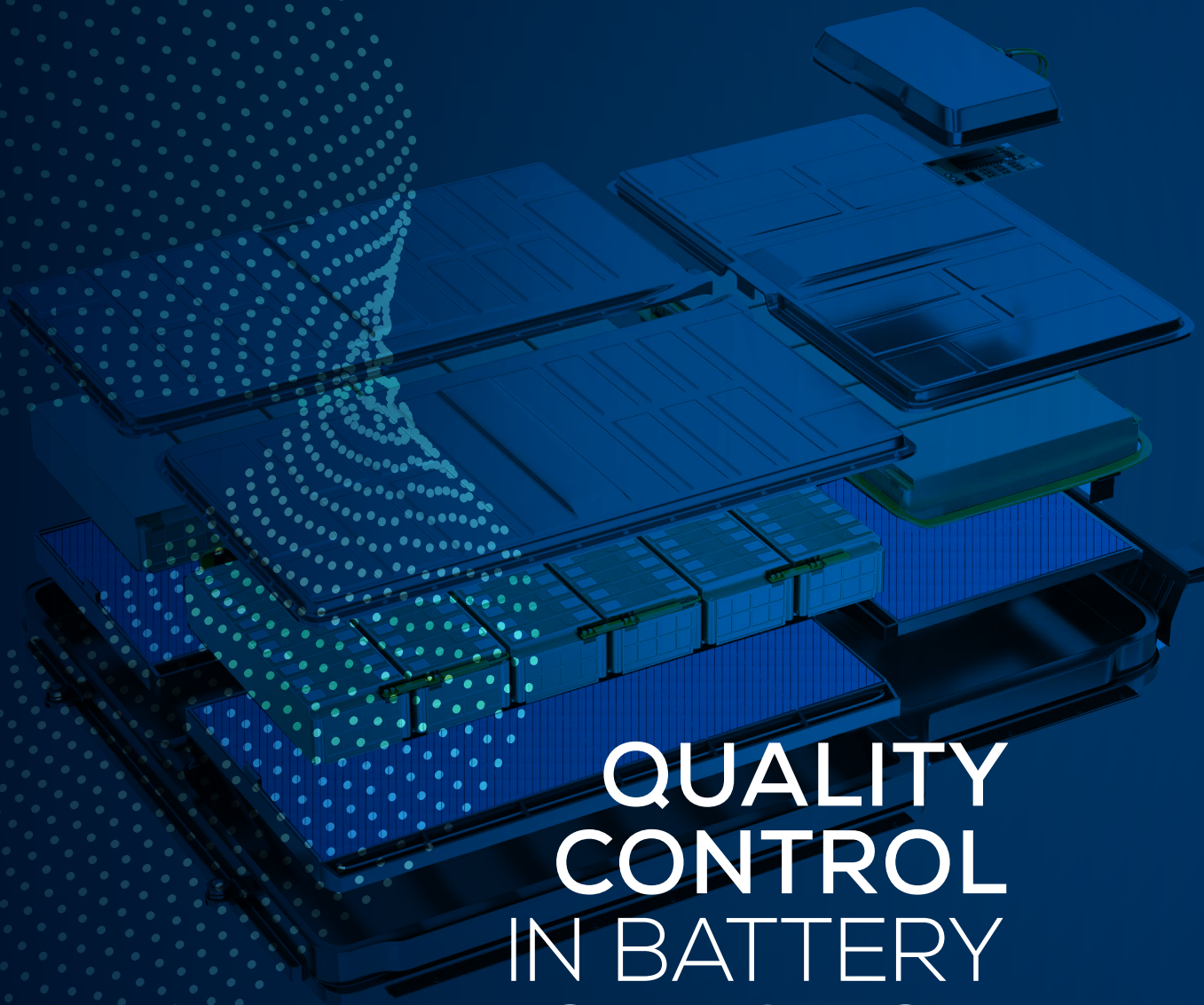




MARPOSS



**QUALITY
CONTROL
IN BATTERY
PRODUCTION**

QUALITY CONTROL IN THE PRODUCTION OF BATTERY SYSTEMS

Production of **Li-ion batteries** requires strict adherence to stringent quality standards for safety and reliability. Meticulous attention to measurement, inspection and testing is mandatory throughout the production chain, from electrode manufacturing to individual cells, modules and pack assembly.

GAUGING & TESTING FOR R&D LABORATORIES

The increasingly widespread use of rechargeable batteries in the automotive sector pushes more and more the research activities, with development of new chemistries aimed at improving performance and safety, as well as reducing production costs.

In addition to a comprehensive range of products and applications dedicated to process control, Marposs also provides dedicated solutions for laboratory analysis and control.

- **M-EET** is a gauge for measurement of volumetric expansion and contraction of electrodes during charge/discharge cycles, due to Li-ion insertion/de-insertion
- **LABSENSE**, specifically designed for Li-ion electrode sample analysis in laboratories, combines ultrasonic technology with chromatic confocal sensors to precisely determine basis weight, thickness and density

MEASUREMENT & INSPECTION IN ELECTRODE MANUFACTURING

The production of cathodes, anodes & separators using Roll to Roll processes is one of the most important steps in the manufacturing chain. Marposs acts as a global partner for the supply of turnkey solutions, integrating various proprietary technologies to guarantee complete quality and process control.

- **Basis Weight** measurement utilizing radiation-free, ultrasonic technology (C-Frame or O-Frame scanners, including patented multi-sensor options)
- **Thickness and Edge geometry** measurement based on **chromatic confocal** technology
- **Surface defects** visual inspection, through **machine vision** technology and **A.I.** evaluation techniques

QUALITY CONTROL IN CELL ASSEMBLY

Equally important, to guarantee battery performance and safety, are the subsequent cell assembly phases. Rechargeable batteries are extremely sensitive to moisture and other contaminants.

Checking **sealing integrity** of **cells** is therefore fundamental in order to guarantee safety and reliable performance.

- Applications based on **helium** as tracer gas in **vacuum chamber** for leak testing of open cells, before electrolyte filling.
- Manual or fully automatic machines for leak testing by direct **electrolyte tracing** in vacuum chamber of the finished cell, after filling and sealing, or after formation, degassing and final sealing.

End of Line checks then verify all functional parameters to guarantee product quality

- Thickness cell measurement by contact or non-contact (confocal) technology
- Surface defects visual inspection. **Insulation cell coating thickness** measurement by **interferometric** technology
- **Hi-Pot** electrical insulation testing complete cells by conductive foam surface contacting
- **OCV, ACIR, DCIR** or complete **EIS cell** tests and classification according to different requirements

MODULE AND PACK QUALITY CHECK

Applications for checking and selection of cells entering the module assembly line, is the first fundamental step to guarantee quality, reliability and performance.

The ever-increasing attention to safety-related issues leads to the need to verify the perfect **sealing** of the **battery pack** at various stages of the process. Different leak testing methods are proposed, starting from the production phases of components such as **trays, covers, chillers** and **cooling plates**, and then continuing in the final phases of assembly of the cooling circuit and of the **battery pack**.

- Equipment and complete applications for global leak test by **air mass flow** and **differential pressure decay** methods
- Automatic machines for global leak test by helium tracing in **accumulation** or **vacuum chamber**
- Manual or **robot sniffing** applications for leak point identification, including in off-line repair stations
Applications of **Organic Tracer Gas** as alternative method for leak measurement and localization
- **Helium recovery systems**

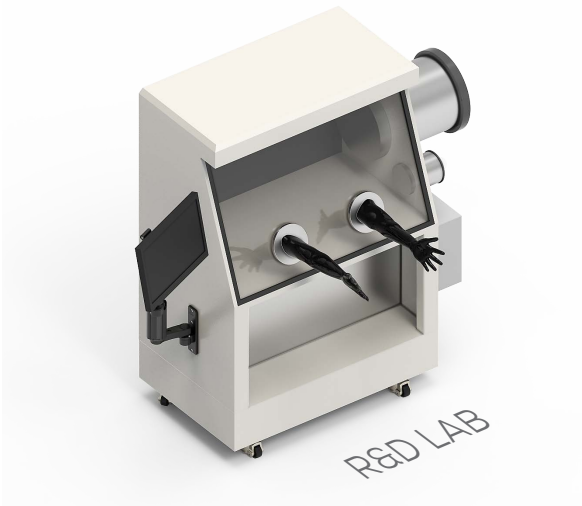
In addition to Seal Integrity verification, **End of Line quality checking** must include control of electrical insulation of the housing, measurement of main functional parameters such as OCV, Internal Impedance and Pack Capacity, as well as functionality of BMS

- **Insulation** measurement and electrical rigidity test. Electrical continuity test
- **OCV** check and comparison with internal measurement. OCV homogeneity and cells temperature control
- Fully configurable **pulse power test**
- Firmware flashing. Functional check of **BMS**
- HVIL safety functionality check.
- Verification of SOH and internal logic of CMC
- Measurement of module and pack capacity, with statistical analysis and control charts



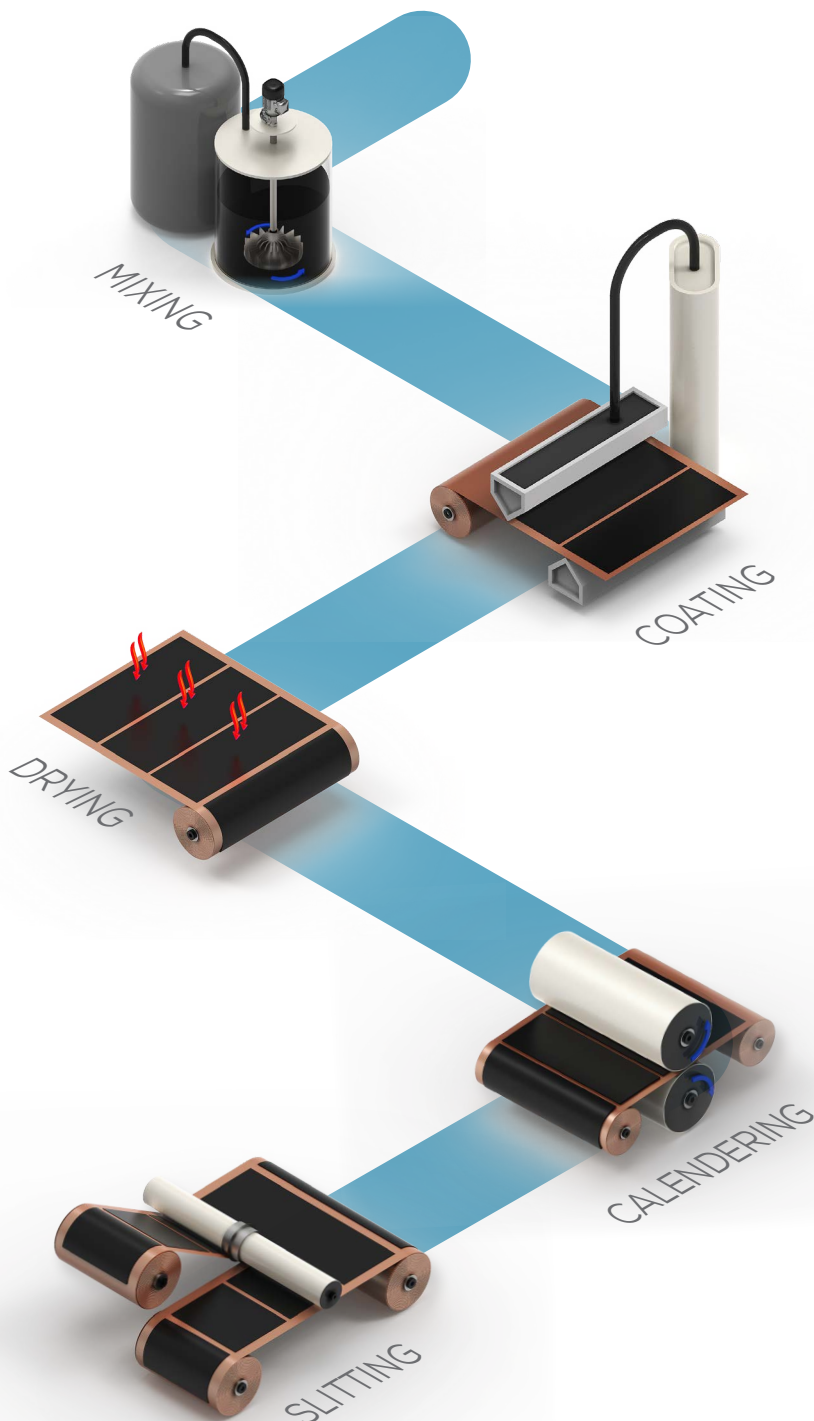
R&D LAB / ELECTRODE MANUFACTURING

1



LABORATORY

- Dilatometric analysis of electrodes
- Thickness & basis weight measurements



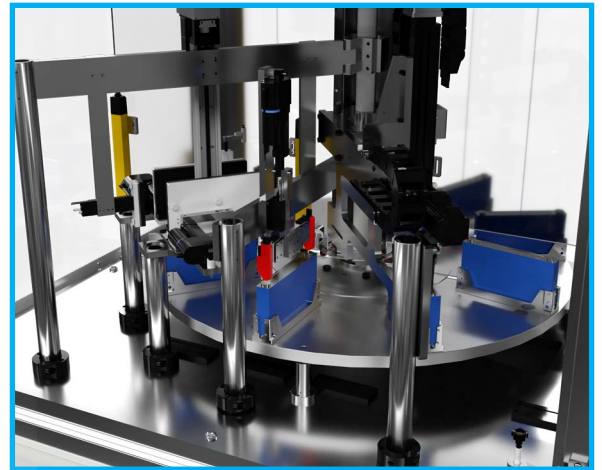
R2R PROCESS

- In-line basis weight and thickness measurement
- Visual inspection



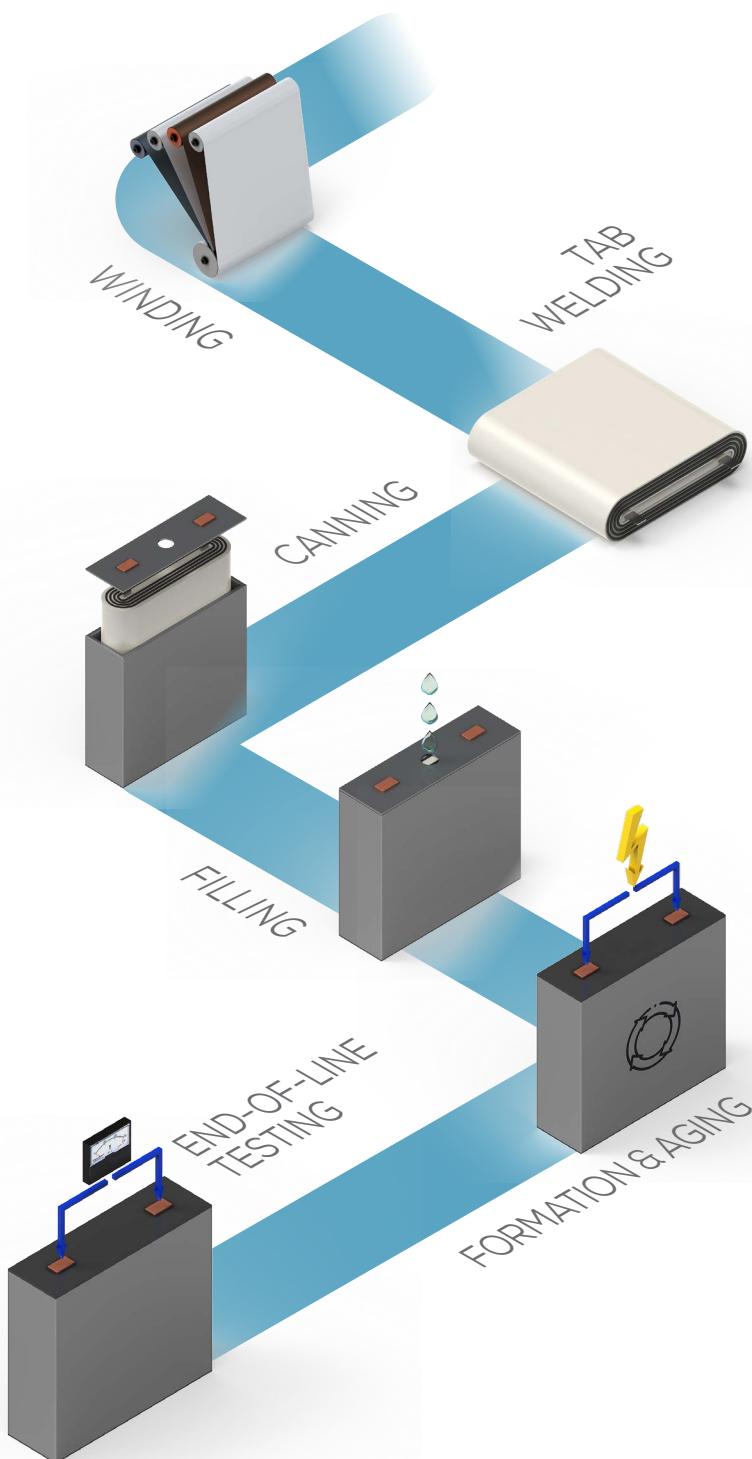
LEAK TESTING CELLS

- Helium tracing
- Electrolyte tracing

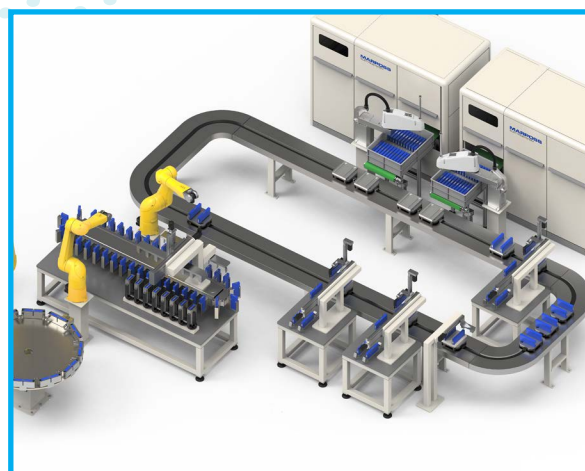


END-OF-LINE CHECK CELLS

- Hi-pot insulation test
- Electrical & functional testing
- Dimensional gauging
- Visual inspection
- Cells grading & sorting



MODULE & PACK ASSEMBLY



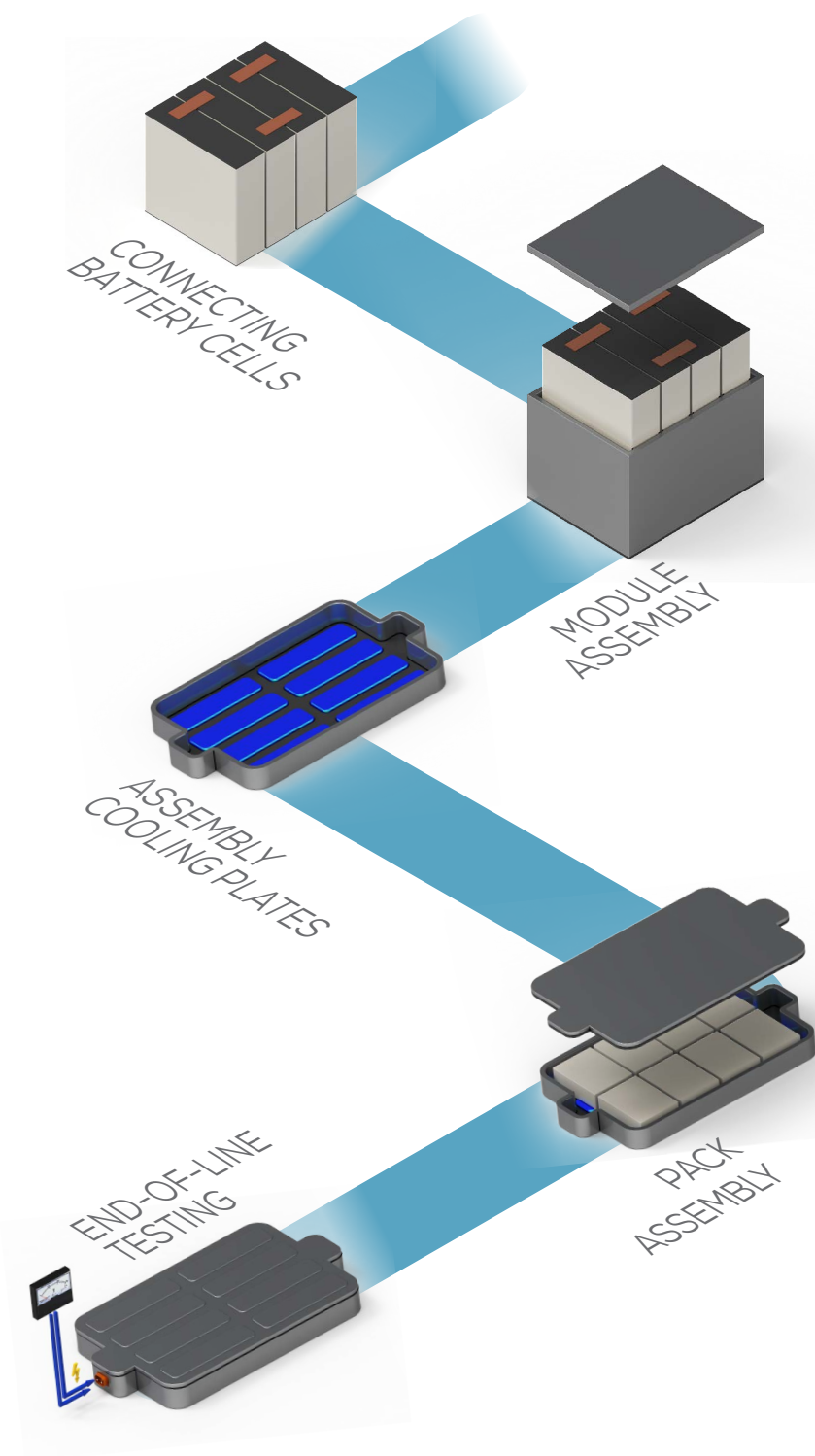
BEGINNING OF LINE CHECK & CELLS GRADING

- Hi-pot insulation test
- Electrical & functional testing
- Dimensional gauging
- Visual inspection



END-OF-LINE CHECK PACKS

- Leak testing
- Hi-pot insulation test
- Electrical & functional testing



MEASUREMENT, INSPECTION AND TEST FOR QUALITY AND PROCESS CONTROL



worldwide present in

34
countries

offices worldwide

80

exports

94%

approx.

3,500
employees

1,240

Italy

1,110

Asia

810

Rest of
Europe

340

Americas

30

key acquisitions since 2000

8%

resources invested in R&D

Marposs was founded in 1952 and since then has provided shop-floor solutions for the quality control in the production environment. Marposs' solutions include gauging equipment of mechanical components, before, during, and after the production process, monitoring solutions on machine tools, assembly, and testing systems, automatic machines, and checking stations for production lines.

Marposs is one of the main suppliers of the top automotive manufacturers, but operates as well in the aerospace, biomedical, hi-tech, and glass industries.

Marposs Group's employees are more than 3500, located around the world, with presence in thirty-four countries with more than eighty sales offices.



MARPOSS

For a full list of address locations, please consult the Marposs official website

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