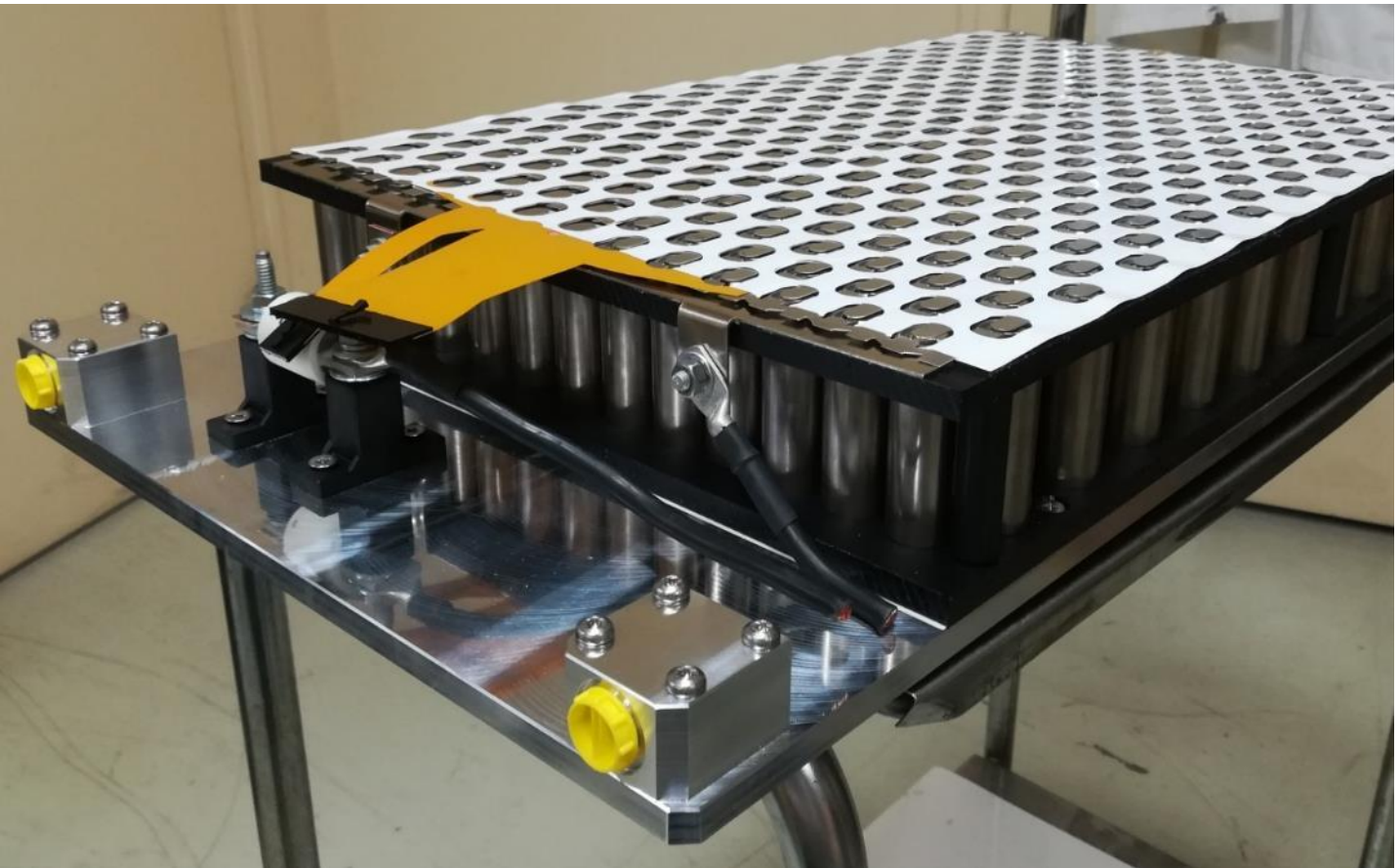
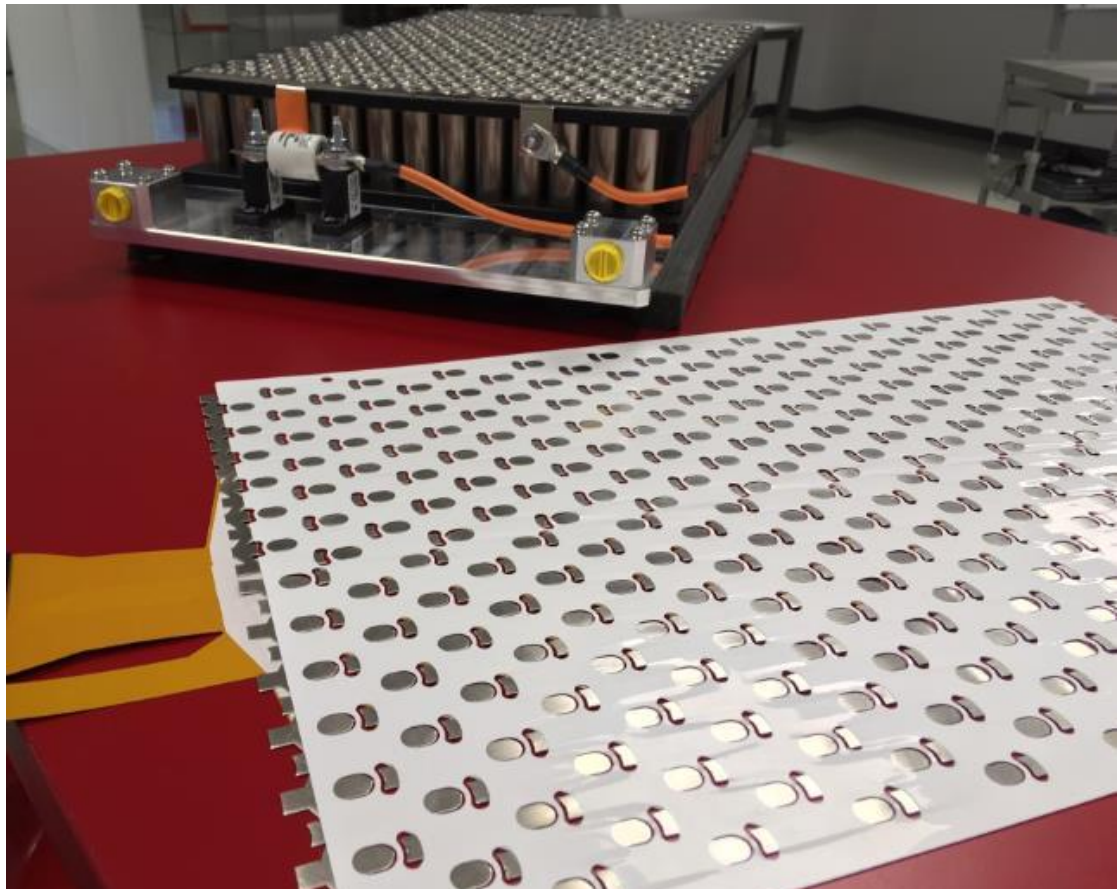
BATTERY BUSBARS & INFINI∞CELL

GENERAL PRESENTATION - 2021

Busbars – For customer presentation



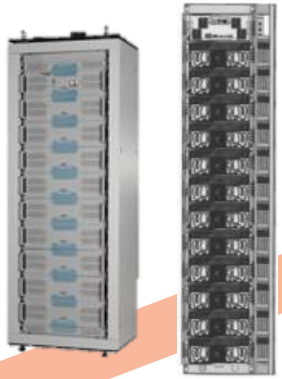


FROM CELLS TO BATTERY: HOW TO INTERCONNECT ?

Battery management System (BMS)
Electronic (Monitoring) system associated with battery pack

Cells
Cylindrical
Prismatic
Pouch

Battery module
Group of cells connected together



Battery pack/rack/string
Group of modules – Ready to use

ESS market

EV / HEV market

MERSEN

MERSEN: KEY EXPERTISE IN ELECTRIC VEHICLES

ELECTRICAL EXPERTISE

Electric vehicles

bus bars for batteries

EV dedicated fuse range (400-800V)

- **2 million EV fuses to be delivered in 2024**

Around 30 different customers in all geographies

- **Top 5 for fuse quotes:**
  > €30m over several years

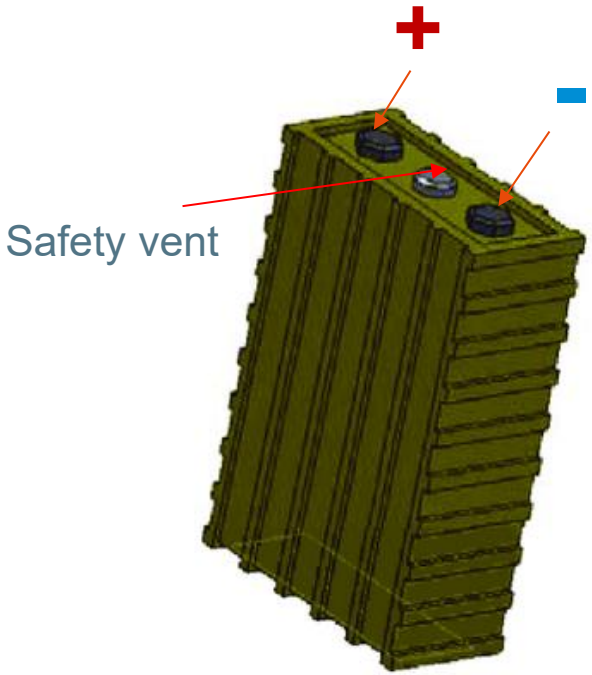
Ford F-150

Hyundai MX5

BMW iX

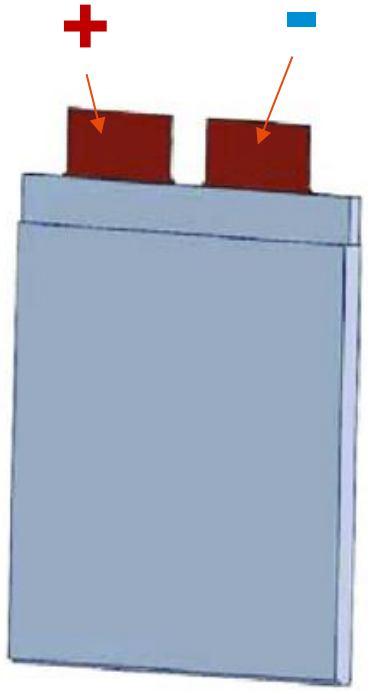
FROM CELLS TO BATTERY: HOW TO INTERCONNECT ?

Prismatic
(Hard casing)



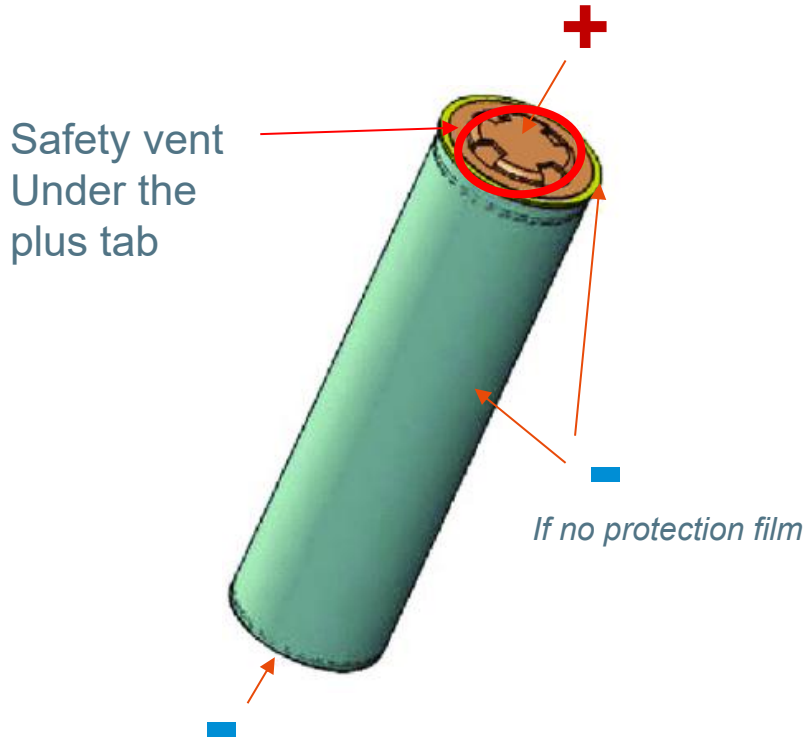
- No standard size
- Safety vent important for gas evacuation in case of overheating

Pouch
(Prismatic with soft casing)



- No standard size

Cylindrical



- Standard sizes (18500, 21700, …)
- More and more bigger

→ Most of the requests are about prismatic and cylindrical cells

CELLS PROPERTIES

Voltage : Depending of the chemistry. Between 3.2 and 3.7V
Capacity :

Prismatic

Up to 100 Ah

Cylindrical

Around 2 and 3 Ah

Low voltage and current

→ Need to interconnect cells together (series and/or parallel) to obtain the right properties for the module

Temperature limitation : Fire risk if cell's temperature over 80 / 90°C
→ Need of thermal control and monitoring

INTERCONNECTION METHODS

Standard interconnection method :

Cylindrical cells

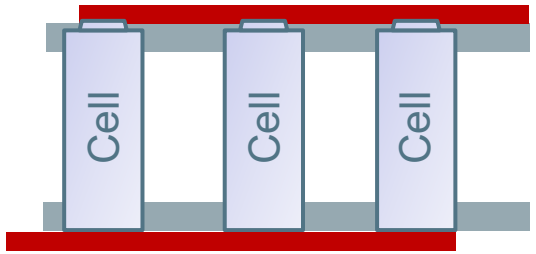
Bus bars fixed on plastic casing
+ Wire bonding between cells and bus bar

Prismatic cells

Bus bars in plastic casing
+ Manual bolting

#1 - Standard solution with wire bonding

#2 - Standard solution with laser welding but bus bars on each cell side



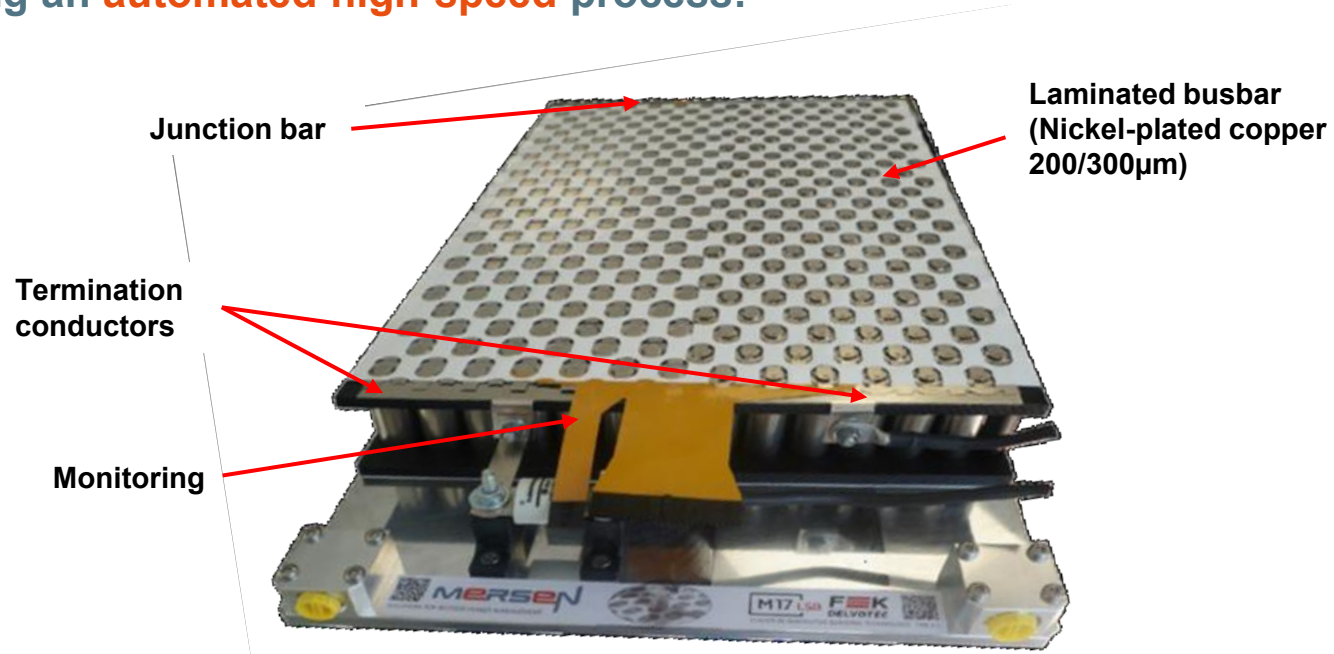
☹ High bus bar thickness
☹ Difficult assembly
☹ Lot of components to assemble – Safety risks

Drawbacks :

- **Costs** (Plastic casing, Manual bolting, Wire bonding…)
- High **thickness**
- **Low** (or no) **monitoring integration** (wire harness)

INFINI∞CELL: A NEW CONCEPT FOR BATTERY CELL CONNECTION

In the frame of a collaboration with laser-welding equipment manufacturer F&K Delvotec (GE) we have developed a single-layer interleaved laminated busbar, connecting cells (from 18650 to 4680) and using an automated high-speed process:



A module demonstrator including:

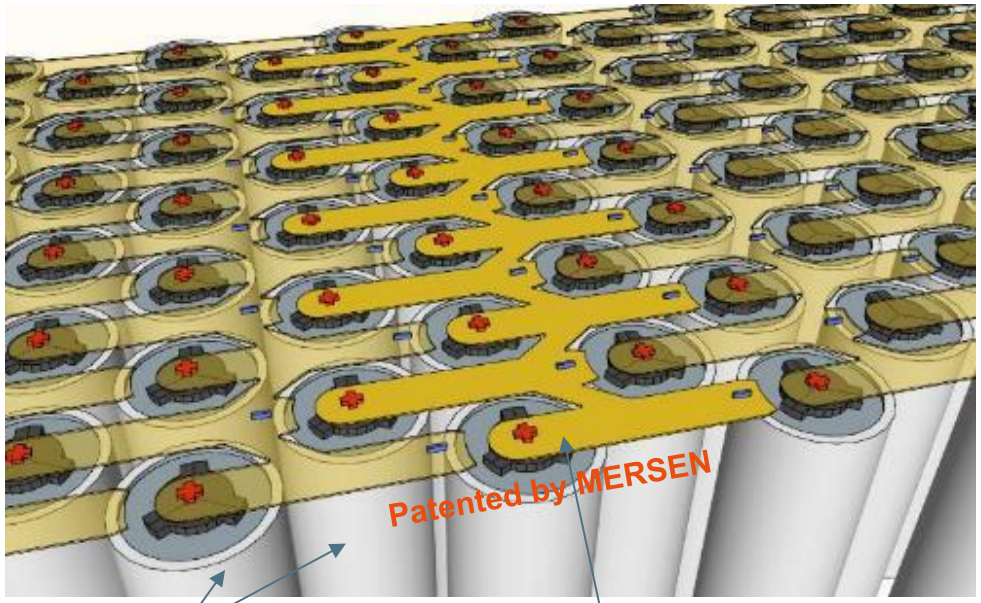
- A laminated busbar (with monitoring)
- Cooling plate
- Mersen fuse
- Laser welding by F&K DELVOTEC

- **High design flexibility**
- **Ability to optimize the manufacturing assembly integration**
- **Suitable with copper or aluminum (cost reduction)**
- **Compatible with many integration processes (from wire bonding to laser welding)**

INFINI∞CELL CONCEPT: A FULLY FLEXIBLE PROCESS

Design should allow + and – connection on the same side:

Pattern connecting cells by 2 columns (2C design) :

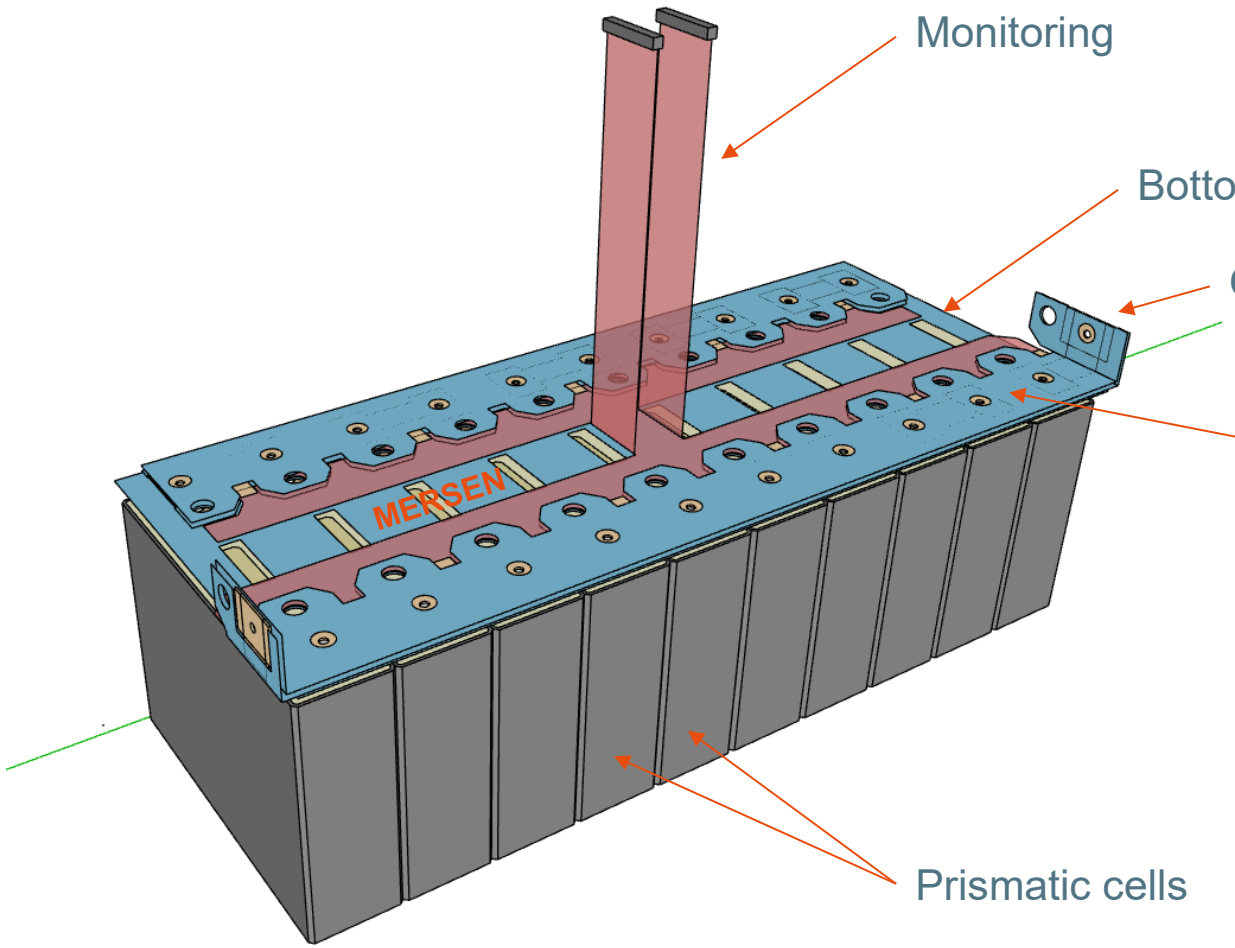


<u>A custom concept</u> : To fit all type of cylindrical cells

Thanks to an easy resizing, concept is compatible with all cell's size, including most common 18650, 21700 or new 4680

PRISMATIC CONCEPT

For prismatic interconnection, more options depending of the customer configuration



Monitoring

Bottom layer insulation, to protect busbar from cells

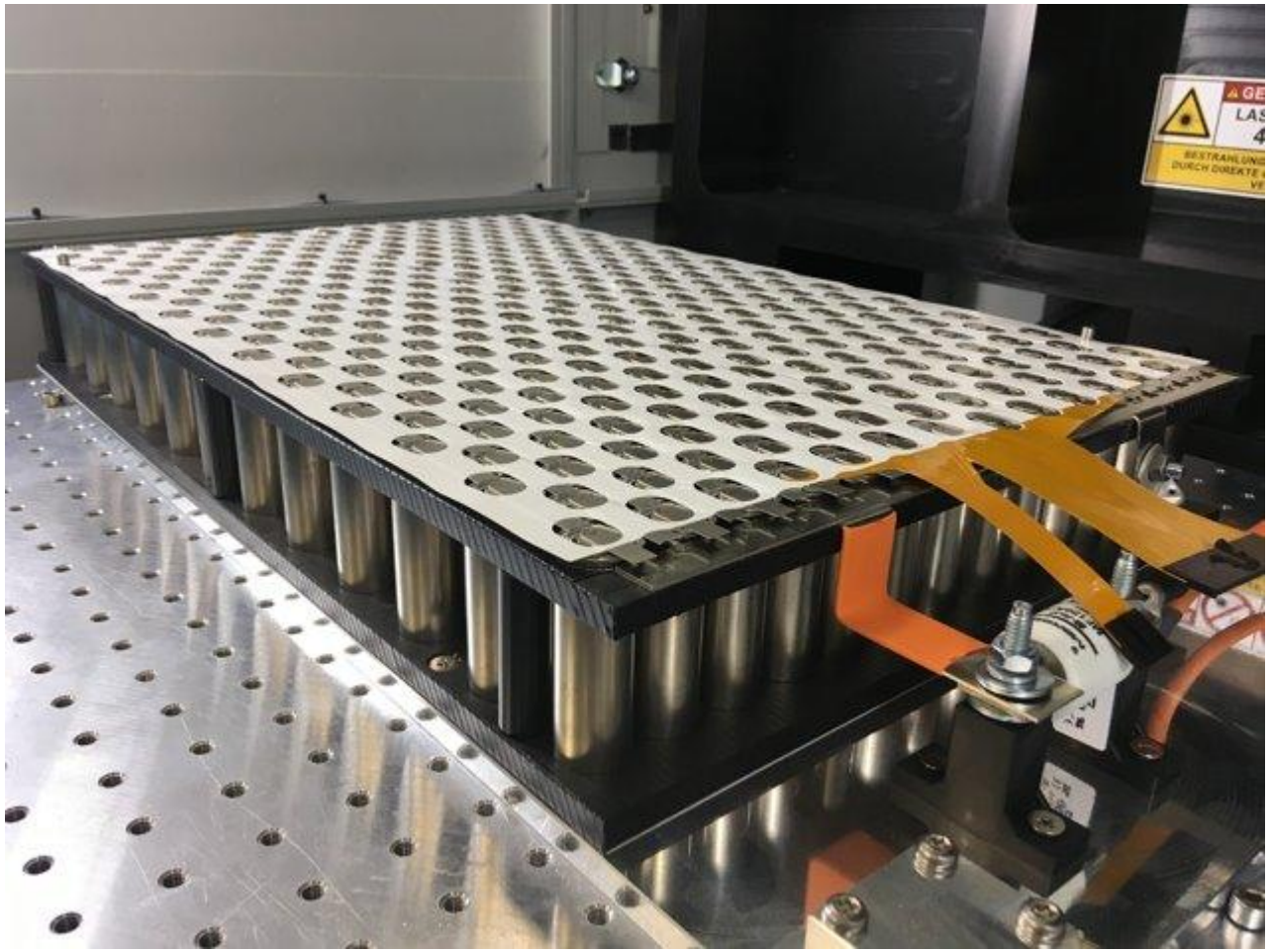
Output connection

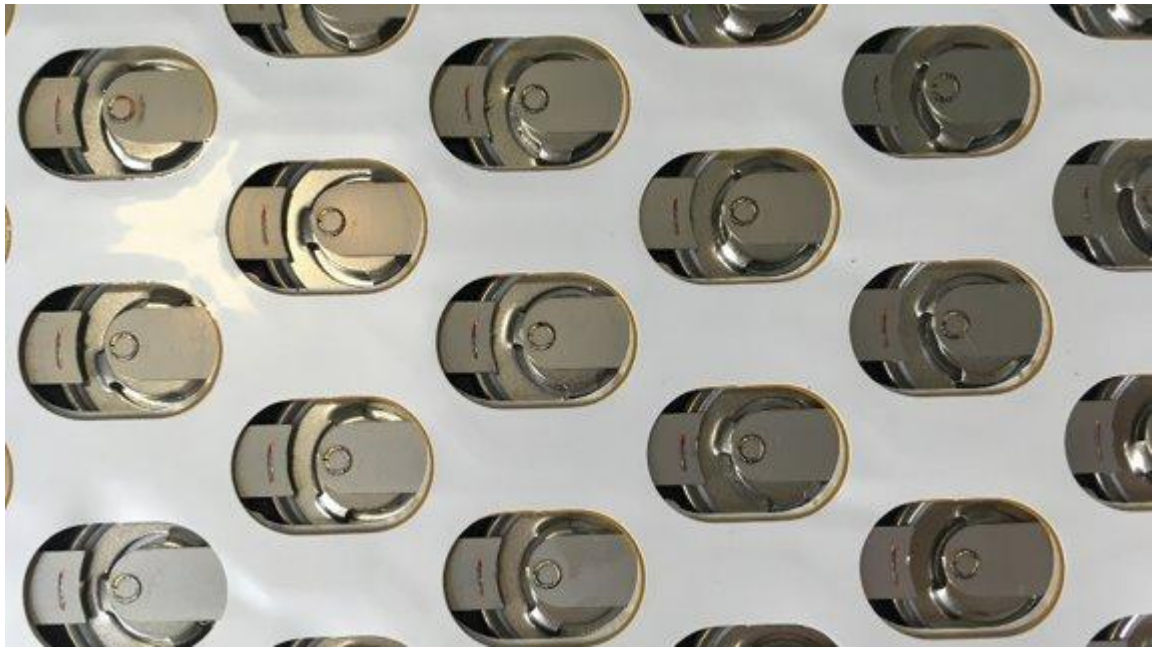
Top insulation layer, with
holes for screwing or welding

Prismatic cells

→ Low cost solution
→ High volumes allowed
→ Fully integrated

INFINI∞CELL: LASER WELDING





+ and – contacts are simultaneously soldered on the top of the battery cell. One on the center, one on the gasket)