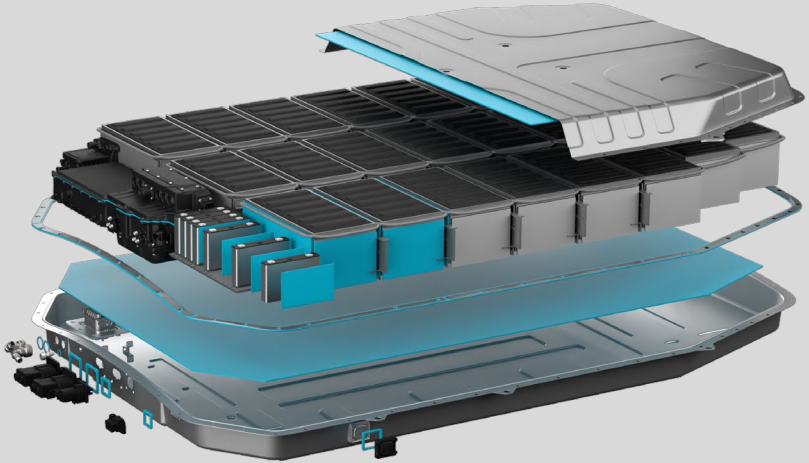


Sealing & Thermal Interface Materials Technology for Battery Systems

DATWYLER

Clear structure to increase market focus and strengthen our core competencies

Business Areas

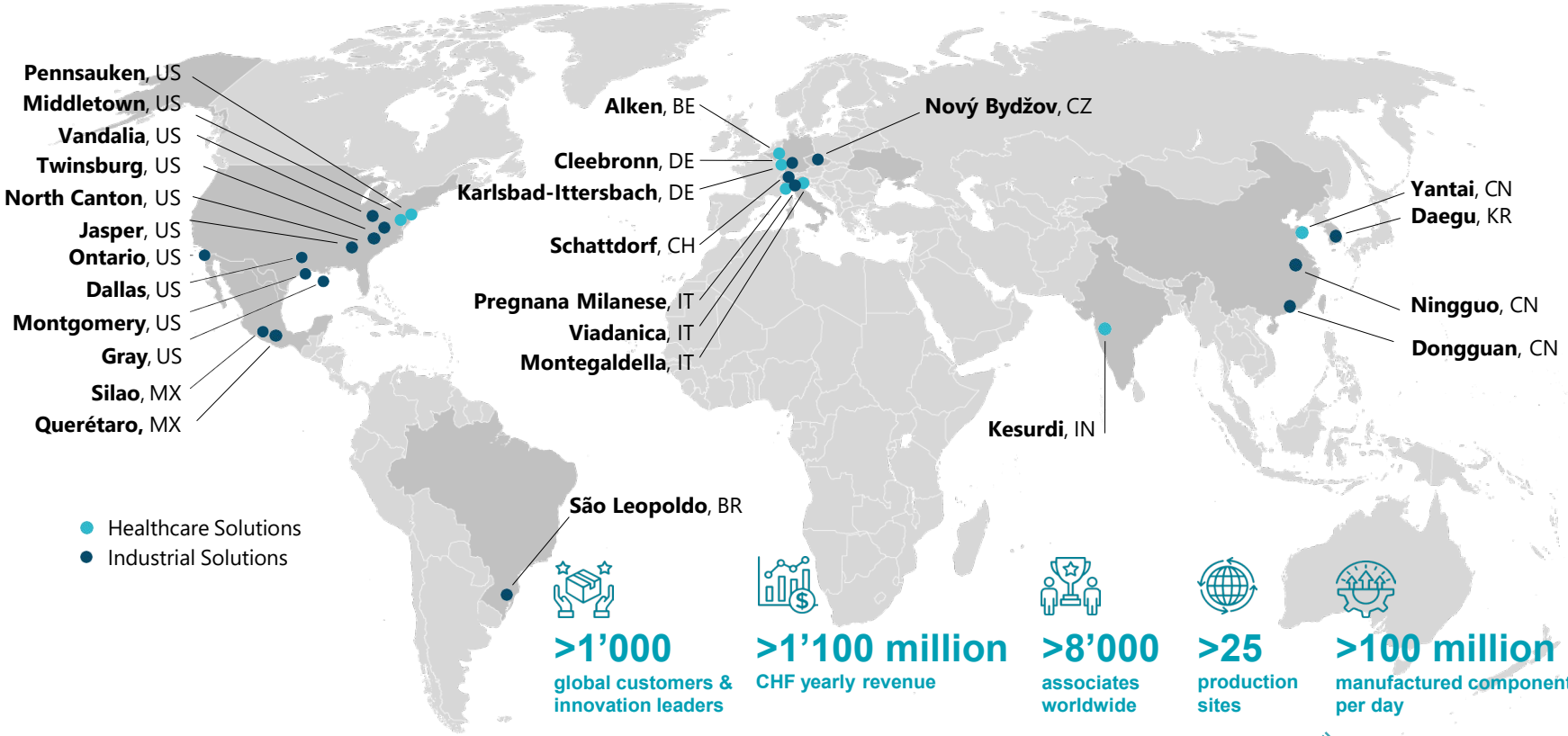
Technology & Innovation

Sustainability & Operational Excellence

Finance & Shared Services

Group Functions

Global presence and manufacturing footprint



>1'000
global customers & innovation leaders

>1'100 million
CHF yearly revenue

>8'000
associates worldwide

>25
production sites

>100 million
manufactured components per day

Recognized core competencies as central element for superior customer value

From an innovative idea…

…to a globally available serial product.

Advanced Development
Design & Prototyping
Serial Production
Continuous Improvement

Sustainability standards we comply with

UN Global Compact
Membership since 2009

Global Reporting Initiative (GRI)
Sustainability reporting since 2008

Carbon Disclosure Project (CDP)
Reporting since 2013

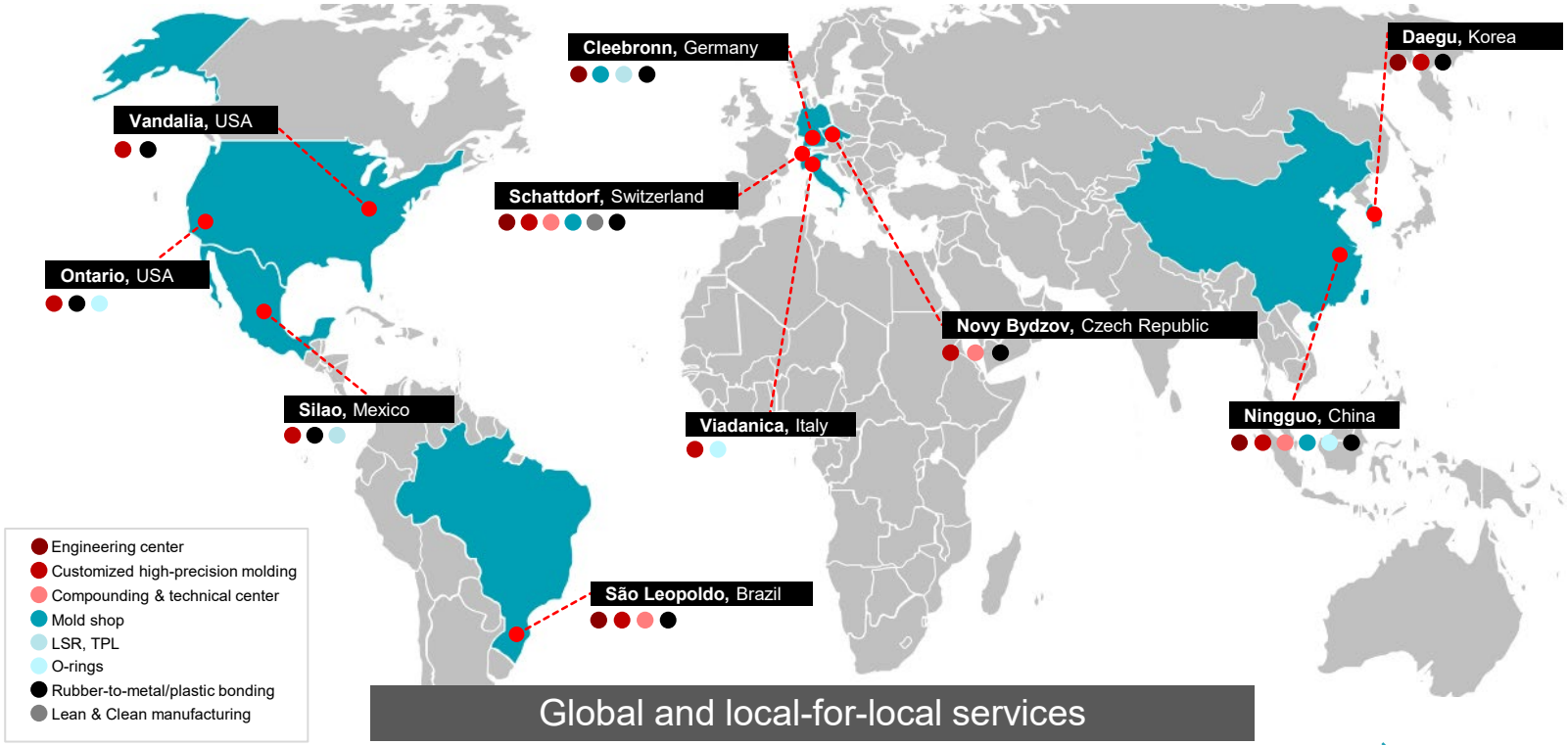
Specific ISO certifications
14001, 50001, OHSAS 18001

Leading global ESG rating agency MSCI awards Datwyler an "A" rating

With the gold rating, Datwyler is in the top 5% of all companies assessed by EcoVadis

Global footprint

Engineering, materials and manufacturing mobility experts

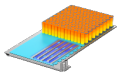


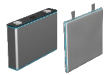
Component portfolio for advanced and traditional systems

Advanced mobility

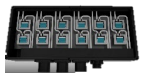
Battery


Battery Housing Seals


Thermal Interface Materials


Cell Electrode Seals

Vehicle Interior


EAP Control Unit


Haptic Feedback


EAP Stack

E-Powertrain


High Voltage Connector


E-motor Sealing


Power Electronics Housing


DC Converter

Hydrogen


Polymer Bi-polar Plate


O-Ring


Sealing Disc

ADAS

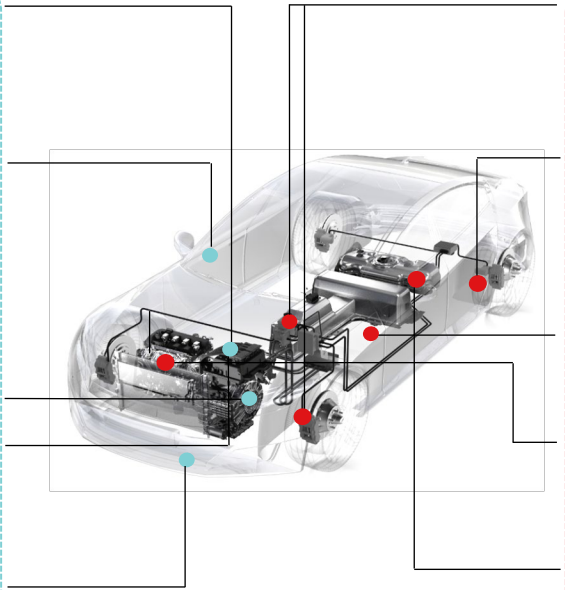

Camera Cap


Sensor Shell Seals


Air Pressure Sensor


Overhead Display Gasket

Customized solutions



Traditional mobility

Brakes


Brake Membrane


Damping Disc


Piston Seal


Dust Boot

Comfort


Dynamic Seal


Sealing Plunger


Slip Yoke Damper Assemblies

Emission Reduction


Equalizing Element


Membrane


SCR Fork


Flutter Valve

Powertrain


Connection


Spark Plug Boot

Fuel


O-Ring


CNG Injector


Sealing Disc

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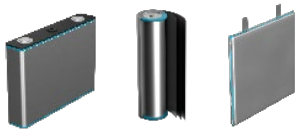
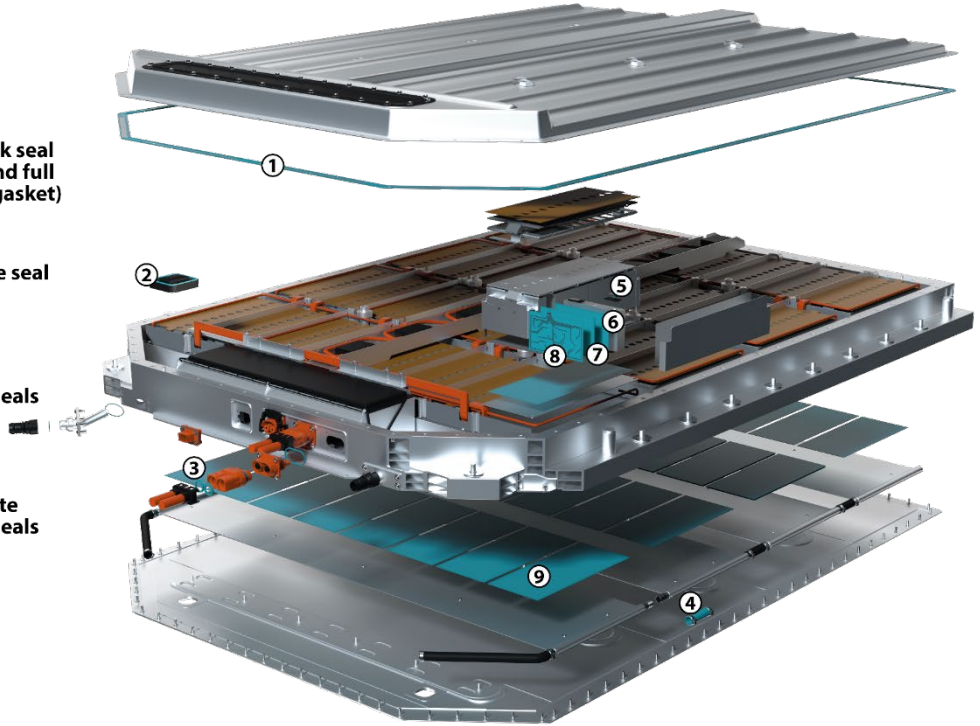
Applications in battery system

O-ring, gasket seals for cell

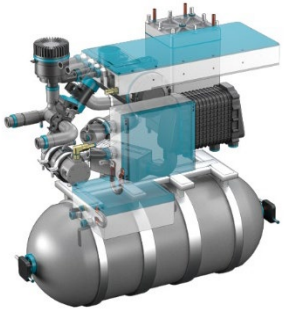




Fuel cell and hydrogen seals

Addressing specific requirements for hydrogen-based technologies

Hydrogen applications

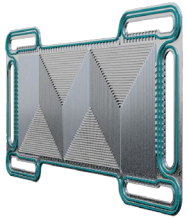


O-Ring

Sealing disc

- Elastomer parts with low permeability, good chemical resistance, high precision and cleanliness
- Long life-time and durability of auxiliary system and fuel cell stack

Fuel Cell Stack



Polymer Bi-polar plate

Gaskets for Bi-polar plate

- Development partner in material & process engineering for polymer-based Bi-polar plates
- Industrialization partner for gaskets and sealings for Bi-polar plates

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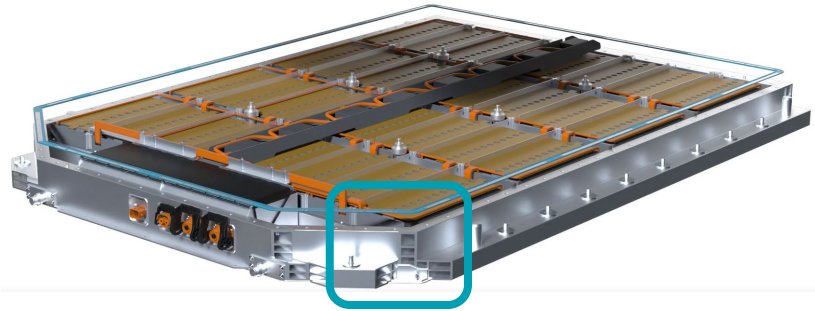
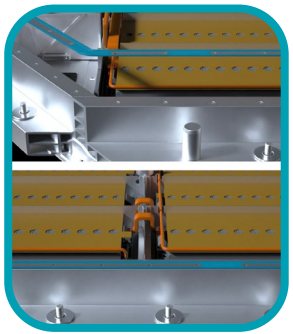
Battery pack sealings

Benefits of Datwyler's battery back sealings
Effective control of tolerance Integrated design of metal insert and rubber sealing
Reliable installation Precise positing and mounting design
Reopenable for battery pack maintenance Easy and efficient for inspection and maintenance
Good endurance Reliable sealing and high bonding strength between metal insert and rubber
UL94 V0 In-house rubber material development
Electric conductivity and EMI shielding Grounding of housing and shielding against electromagnetic interference
Customizable design Co-engineering, design, and simulation



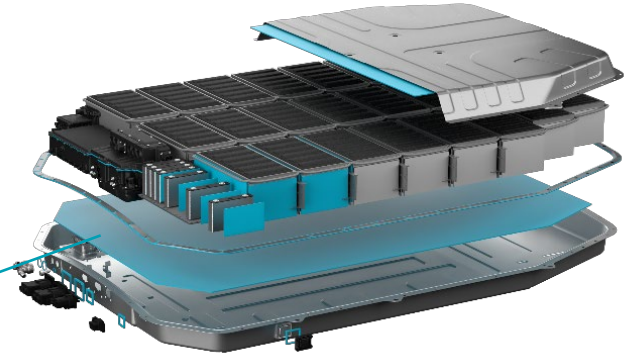


IP6x, endurance, reliable installation. electric conductivity, reopenable for inspection, etc.

Thermal Interface Materials (TIM) for battery system

Various Thermal Interface Material solutions

- Conventional “solid” rubber compounds for pads
- Foams for so-called “gap fillers”
- Resins
- Adhesives



These materials can be processed

- Cure-in-Place glue spot & glue coating, thermal Form-in-Place
- Mold-pressed or rolled independent thermal conductive mat, thermal conductive gaskets, etc.

Thermal Interface Materials (TIMs) are designed to provide adequate thermal conductivity that helps to evacuate heat thus preventing battery thermal runaway

New lightweighting Thermal Interface Materials (TIM)

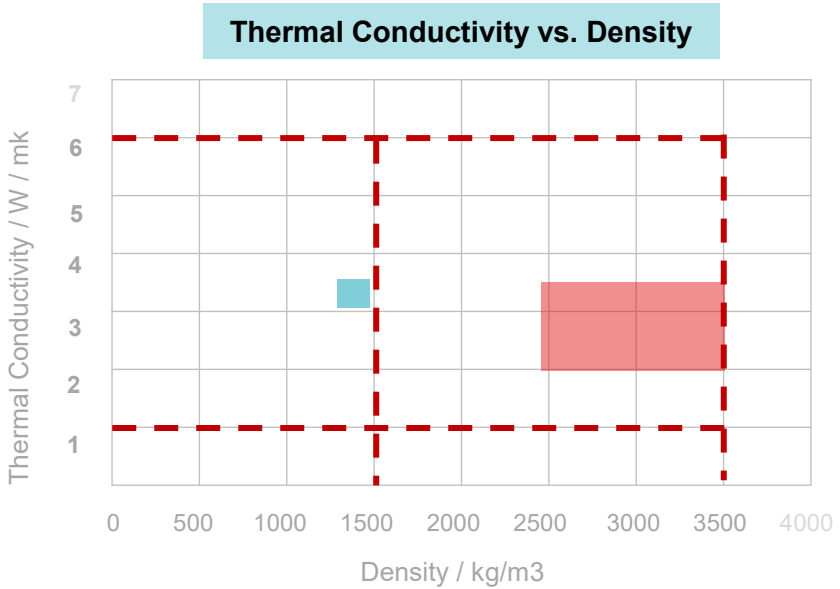
The benchmark study:

State of the art TIM performance today:
3.5 W/(mK) & 2500 kg/m3

Datwyler's TIM technology:
3.4 W/(mK) & 1400 kg/m3

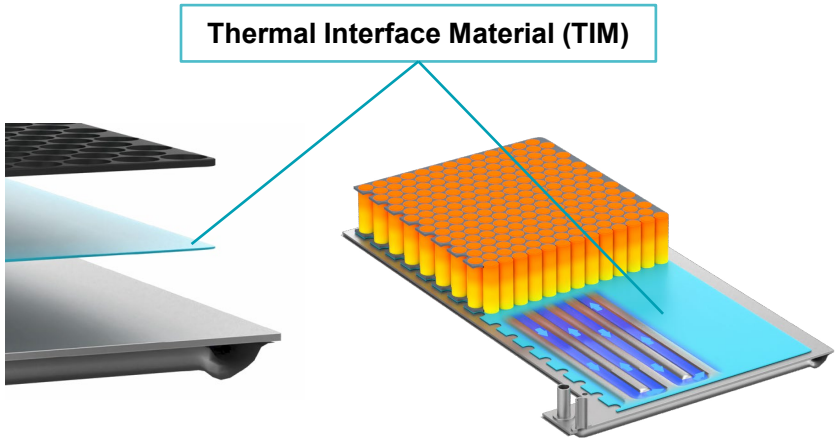
Lightweight

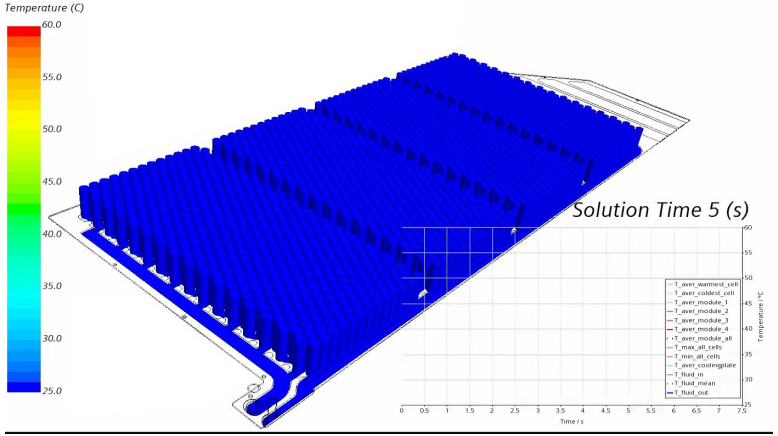
44% reduced weight



Datwyler offers state-of-the art TIM performance with a lower density meaning 44% reduced weight and also with the advantage of cost efficiency

Datwyler’s stand alone TIM technology properties





Properties:

- Thin layer and low materials density supporting the lightweight aspect
- High thermal conductivity
- Electrical insulation
- Damping properties to absorb vibrations and protect the battery cell-module-pack

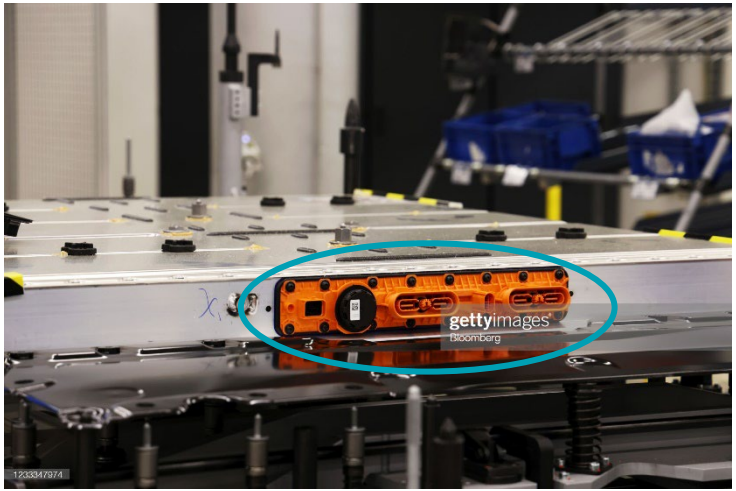
- Supports the heat transfer from battery cells to the cooling systems to:
  - Keep the optimal operating temperature
  - Increase lifetime of the battery
  - Prevent thermal runaway event

Datwyler TIM products

Properties	Unit	EPDM Reference	TIM1	TIM2	TIM3	TIM4
Density	g/cm^3	1.04	1.62	1.43	1.40	1.44
Hardness	ShA	63	75	76	80	78
Microhardness	° IRHD	63	77	79	83	80
Tensile Strength	N/mm^2	15.9	9.3	6.1	6.0	3.8
Elongation break	%	364	344	284	294	342
Compression set 24 h / 130 ° C	%	12.9	24.9	20.5	40.7	38.4
DSC	° C	-53	-53	-53	-54	-55
Resistivity	Ωcm	1.35E+07	2.14E+07	4.76E+07	6.74E+07	1.39E+08
Impedance	Ω	2.03E+06	3.23E+06	7.17E+06	1.02E+07	2.10E+07
Thermal Conductivity – At 23° C	**W/mK**	**0.30**	**0.62**	**0.74**	**3.4**	**5.5**
Specific Heat Capacity, Cp	KJ / kg.K	1.333	1.202	1.271	0.889	1.036

Successful case – HV connector battery socket seal

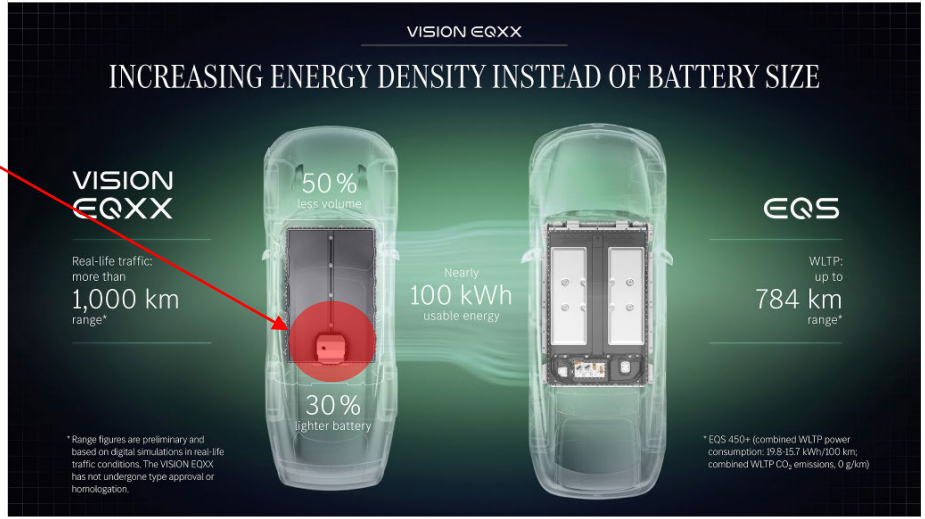
Successful case	HV connector Battery socket seal
Dimension	~500X80 mm
Requirement	– LSR – High voltage – Electric insulation – UL94 V0
Datwyler strength	✓ Co-engineering ✓ Simulation expert ✓ Reliable production ✓ Global footprint



Picture source: Gettyimages

Successful case – BCU box seals

Successful case	BCU (battery control unit) box seal
Dimension	~100X100 mm
Requirement	– Integrated design – 3C (plastic-elastomer-plastic) – High voltage – Electric insulation – UL94 V0
Datwyler strength	✓ Design co-engineering ✓ Simulation expert ✓ Reliable production ✓ Global footprint



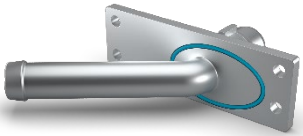
Picture source: https://group-media.mercedes-benz.com/

Other sealing solutions of battery systems

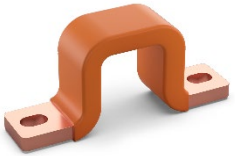
- Seals for Pressure Relief Safety Valve

- Seals for Safety Valve of Battery Cells

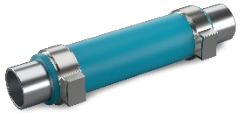
- Seals for Cooling Pipeline Joints



- Busbar Electric Insulation Protection



- Liquid Cooling Plate Connection Seals



Thank You!

DATWYLER