



---

## Electric Vehicles

Smart solutions for the EV sector



« Fastening solutions for electric vehicle applications from A to Z. Bossard is your expert one-stop shop. »

## SMART SOLUTIONS FOR THE EV SECTOR

# Better connected

We are the experts for all fastening technologies in electric vehicle applications.

The EV sector is characterized by a rising demand for reliability, speed and punctuality. To make vehicles faster and more economical, lightweight materials are used increasingly. In addition, short throughput times in production and lean maintenance of the cars should be ensured. We understand these trends as well as the resulting challenges, and provide fasteners that meet the highest safety and quality standards, helping our customers increase their efficiency and productivity.



### One-stop shop

- Fasteners for electric vehicles construction
- Fasteners for mechanical purposes



### Engineered parts

- In-house engineering know-how
- International network of specialized partner companies



### Optimal delivery conditions

- We are present with more than 70 subsidiaries worldwide
- Short response and delivery times
- E-Shop for all catalog products



### Own testing laboratories

- ISO/IEC 17025-accredited test laboratories in 10 countries around the world.
- Comprehensive mechanical, optical, geometric and chemical test methods



### Assembly Technology Expert

- Comprehensive engineering services
- Customer trainings for fastening solutions



### Smart Factory Logistics

- B- and C-part management
- IoT ready
- Smart, lean and reliable

## SMART SOLUTIONS FOR THE EV SECTOR

# Applications

---

### Body in white (p. 13)



### Powertrain, Inverter (p. 7)



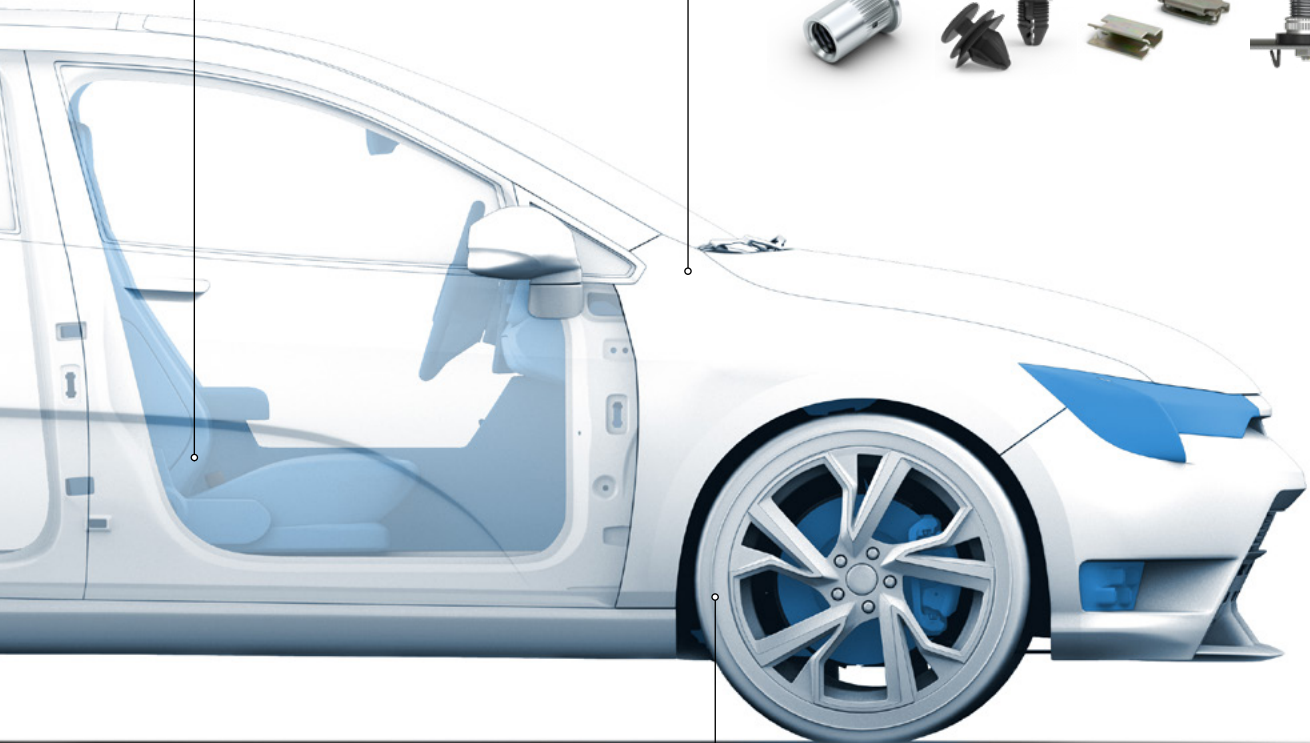
### Battery (p. 9)



Interior (p. 19)

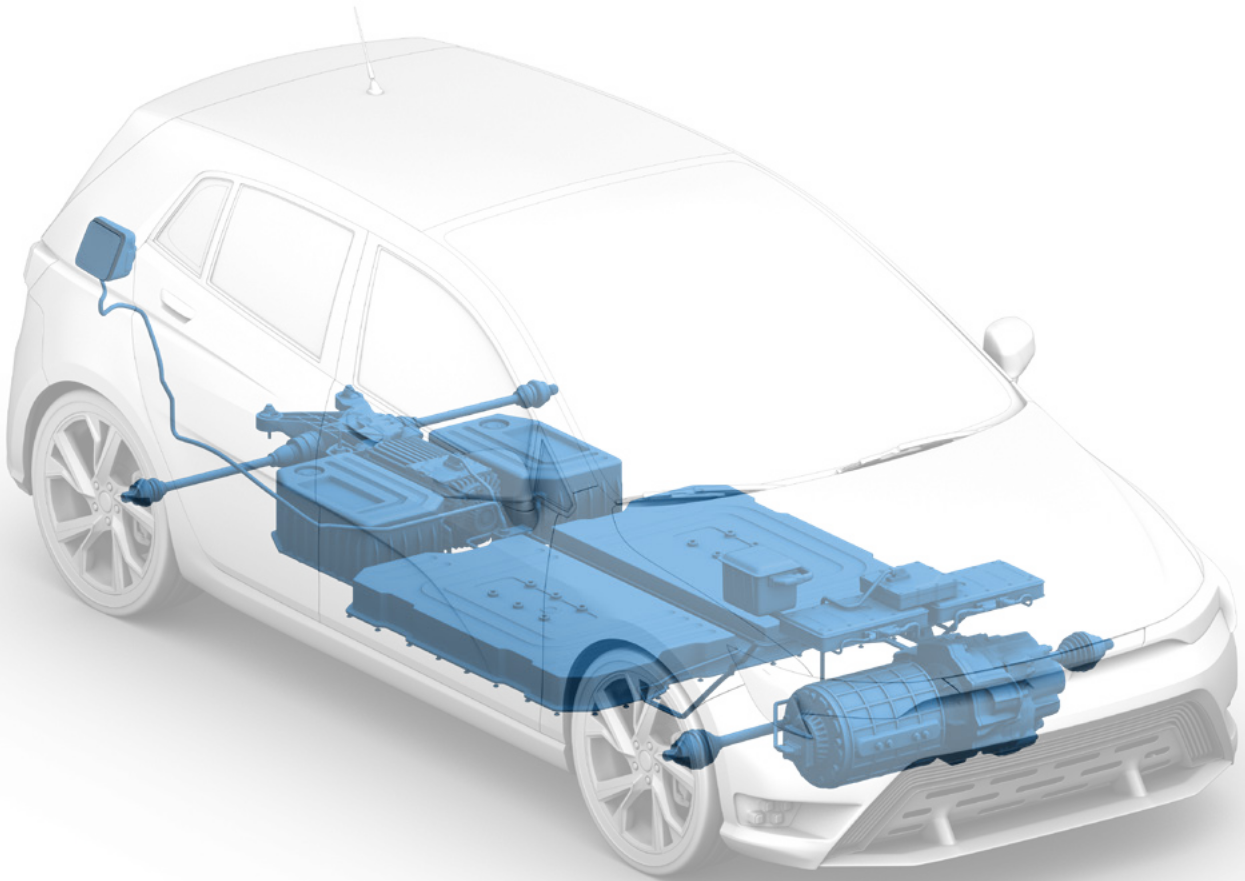


Exterior (p. 17)



Chassis (p. 15)





## STABILITY AND DURABILITY

### Power Management: Powertrain, inverter, battery

---

The range of an electric vehicle depends on the power management. Core components are powertrain, inverter and battery.

Fasteners should have the following characteristics:

- High durability
- Vibration-resistant
- Resistant to extreme temperatures

## POWERTRAIN, INVERTER

### CABLE GLANDS

Cable glands for safe mobility

- Superior performance on fire resistance
- Available as standard, low smoke or high temperature version depending on requirements
- Product range streamlining thanks to high sealing and clamping areas



### SEALING PLUGS

Highest level of perfection in seal technology

- Precise positioning
- Fast and easy installation
- Effective sealing of drilled holes
- Extremely durable



### CHECK VALVES

Precise flow control and minimal leakage

- No additional sealant or adhesive compounds
- Self-retained part, anchored safely in vibration environments
- Easy installation and removal procedure
- Forward-flow and reverse-flow types available



### FLOW RESTRICTORS

Cost-effective solution to restrict flow in fluid systems

- Ideal for deep hole locations
- Eliminates the need for thread machining – substantial process cost savings
- Orifice diameters customized to your flow requirements



---

## CIRCLIPS

Retaining rings for smooth shaft rotation

- Allow rotation but restrict lateral movement of shafts and dowel pins
- Solve problems such as clearance diameter, flexible and radial installation, tolerance take-up and also thrust load capacity
- Easy to install and remove by using circlip pliers



---

## SHIM WASHERS

Highly precise spacers

- Reduce tolerance requirement
- Available in minimum thickness to adjust even smallest gaps
- Particularly suited for plastic and metal parts



---

## THREAD-FORMING SCREWS

High clamp load and vibration resistance

- No thread-tapping tools needed
- Faster assembly
- Optimal material flow
- Suitable for feeding in automated assembly





## BATTERY

---

### EMBEDDING AND SURFACE BONDING FASTENERS

Reliable mounting in soft and composite materials

- Intelligent fasteners with high torque and tear out strength in soft materials
- Can be surface-mounted with adhesive or completely embedded
- Invisible integration into the application material



---

### THREADED INSERTS FOR THERMOPLASTIC HOUSINGS

Lightweight inserts with high pull-out strength

- Provide strong thread in thin materials
- Usable for thermoset and thermoplastic materials
- Various installation opportunities



---

### CLINCHING FASTENERS

Easy to install – superior performance

- Extremely stress-resistant even in very thin sheets
- Ideal also for coated surfaces
- No damage or bulging on the back of the component
- No recutting of threads

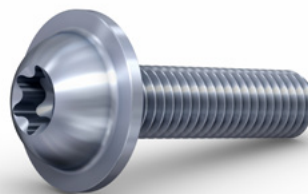


---

### MULTIFUNCTIONAL SCREW

Reliability and efficiency

- Fewer single parts for faster processing times
- Reliable and durable fastened joints
- Suitable for feeding in automated assembly

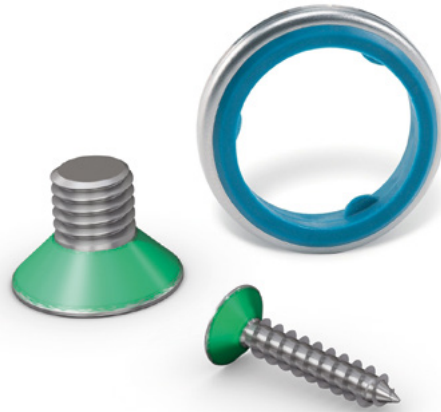


---

## SEALING

Additional corrosion protection

- Protects against corrosion, moisture and much more from entering battery components and assemblies
- Applied directly on the fastener, so fewer parts like O-rings, gasket seals and sealants are needed
- Sealing Gaskets can be used as a protective edge on sheet metal and ensures secure sealing of the enclosure



---

## NUT/WASHER ASSEMBLIES

Preassembled washer saves time and cost

- Retaining clamp load even with high temperature changes



---

## SEMS SCREWS

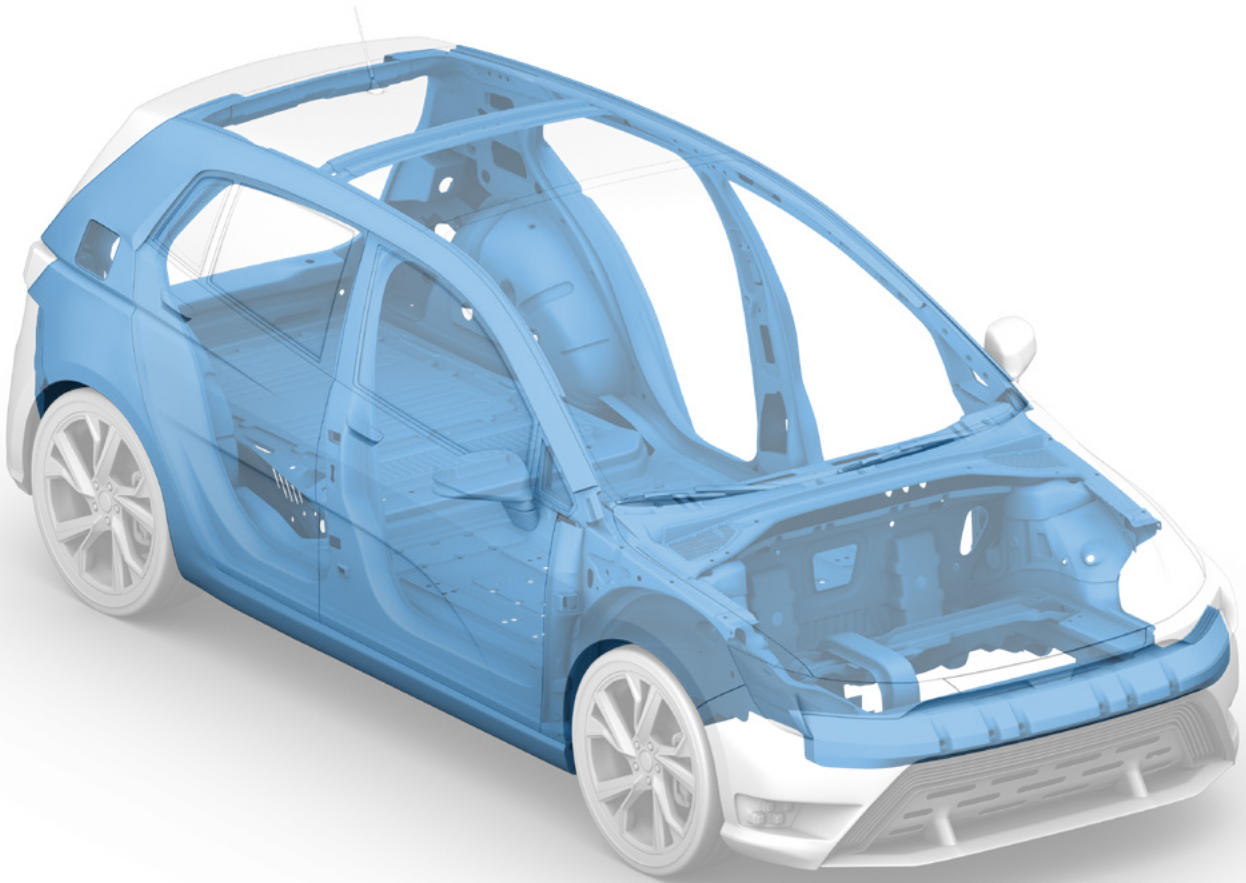
Screw-bolt/washer combinations for busbar assemblies

- Conical washers prevent loss of clamp load caused by temperature fluctuations that are common in high voltage joints
- Flat washers prevent embedment into soft materials like copper, which are often used in busbar assemblies





« Many leading manufacturers of electric vehicles trust in solutions and consulting from Bossard. »



## QUICK AND EASY INSTALLATION

### Body in white

---

In this central application, structural stability and reliability are essential to guarantee passenger safety.

We therefore recommend fasteners that fulfil the following prerequisites:

- Easy to assemble and disassemble
- Made of high-strength materials
- High corrosion resistance
- Compliance with high safety standards

## BODY IN WHITE

---

### WELDING STUDS

Stud welding allows metal fasteners such as weld studs, weld pins and threaded studs, to be welded onto another metal object using an arc at lightning speed.

- No holes required, hence no leaking or weakening of substrate material by drilling, punching, etc.
- Wide range of use from  $\varnothing$  2 mm up to  $\varnothing$  25 mm
- High level of automation possible
- Access to parts only required from one side



---

### LARGE DIAMETER CLINCHING

Hardened clinching fastener for increased thread strength

- High push-out and torque-out resistance
- No introduction of thermal stresses
- Reduced environmental concerns, cleaner work environment
- Clean assembly, no weld spatter



---

### SELF-PIERCING TECHNOLOGY, FLOW DRILL SCREWS

Combining drilling and thread forming

- Fast one-sided assembly
- Self-piercing rivets: no heat zone in material during installation
- Assembly time reduced to one minute
- Flow drill screws: High loosening torque and vibration resistance



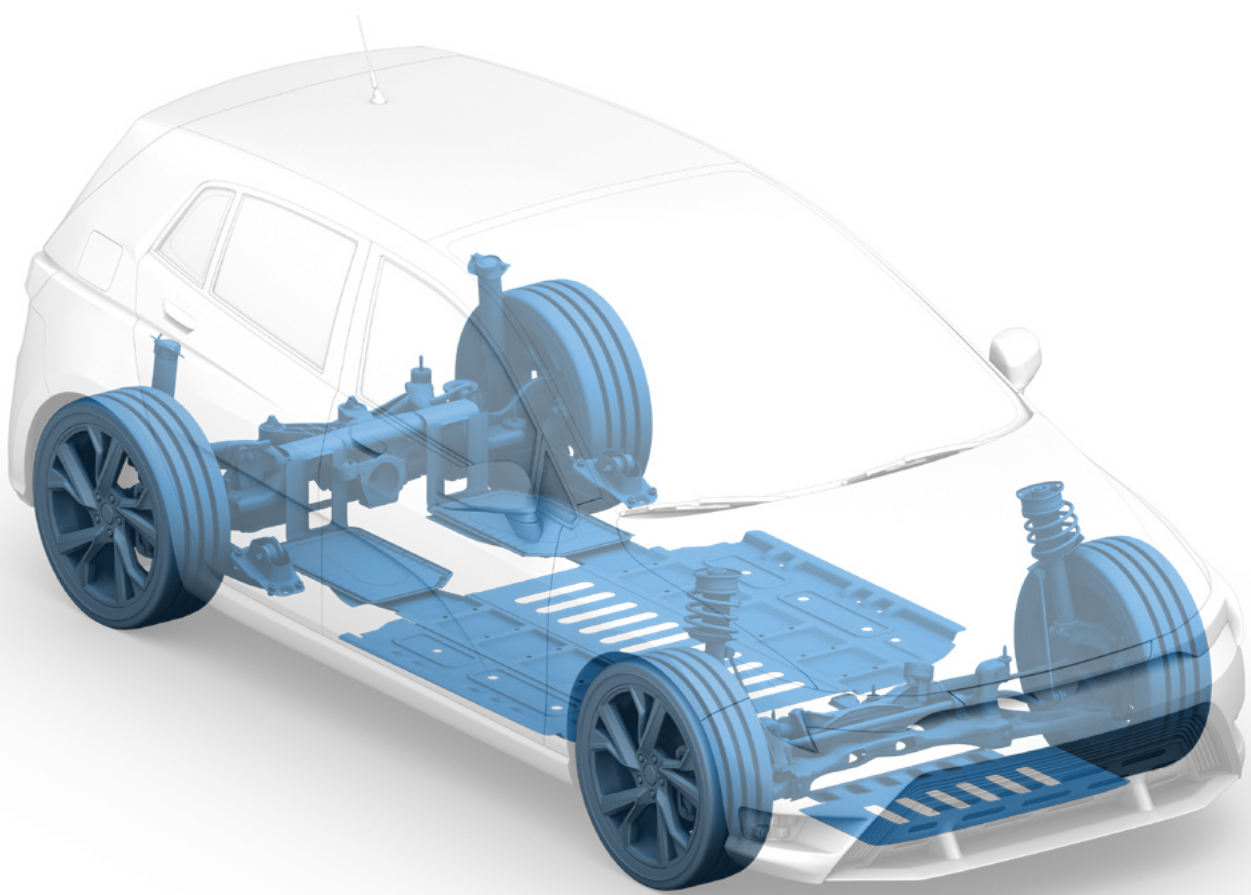
---

### STRUCTURAL BLIND RIVETS

Strong solution for structural assembly

- Perfect for high-tensile applications
- One fastener for up to four rivets
- One-sided access
- Big diameter rivet
- Durable and reliable fixation





## SAFETY CRITICAL FASTENING

### Chassis

---

The chassis plays a vital role in the vehicle. The main requirements on the chassis are operating reliability, maintainability and driving comfort through suspension and damping.

Fasteners must above all be:

- Vibration-proof
- Corrosion resistant
- Resistant to extreme temperature changes
- Able to maintain clamp force of assembly

## CHASSIS

---

### STRUCTURAL FASTENERS

Strong solution for structural assembly

- High shear and tensile strengths ensure longer service life of the connection
- Secure fastening even under extreme vibration
- Assembled surface without damage or distortion
- Reduced fastener inventory and simplified stock control



---

### WEDGE-LOCKING FASTENERS

Self-locking through tension

- Quick and easy installation and dismantling
- Superior performance in maintaining clamp load
- High vibration and corrosion resistance
- Maximum safety against loosening



---

### WHEEL NUTS & LUG NUTS

Lower risk of wheel runoff crashes

- Ease of assembly and disassembly
- More security through taper on wheel nuts
- Coatings protect against corrosion



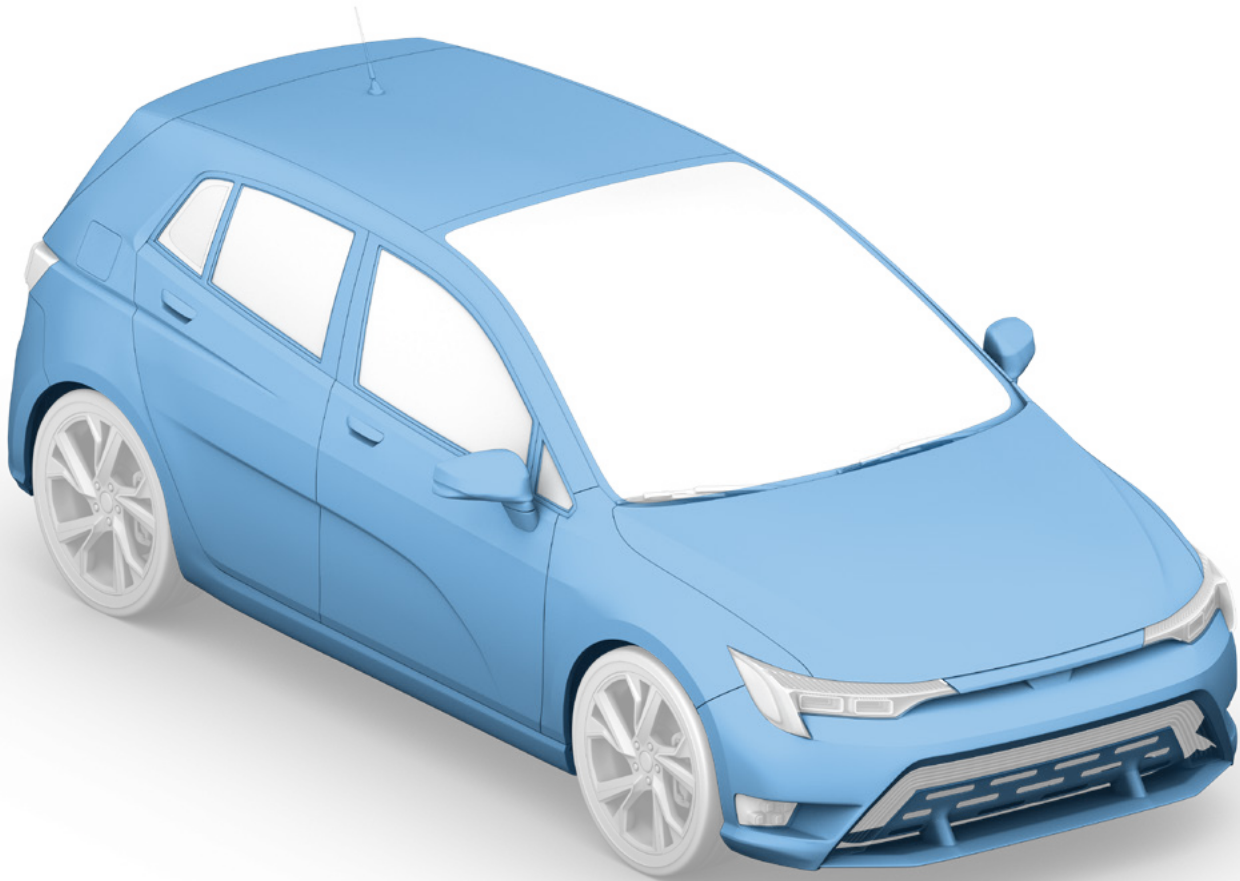
---

### CAM BOLTS, NUTS, WASHERS

Alignment fasteners to ensure correct setup for maximum wear and tear

- Washer offset can be designed to maximize performance
- Exterior coating for maximum corrosion performance





## QUICK AND EASY INSTALLATION

### Exterior

---

In this application, the design as well as a fast accessibility for maintenance and inspection of the equipment are paramount.

The connecting elements must above all be:

- Quickly replaceable
- Captive
- Reusable for assembly and disassembly
- Suitable for easy and safe mounting



## EXTERIOR

---

### BLIND RIVET NUTS

Sustainable solution based on controlled deformation

- Blind installation: Very efficient setting with single sided access only
- Easy assembling to poorly prepared or oversized holes
- No deformation of the workpiece
- No surface preparation required
- Special blind rivet nuts are suitable for lightweight honeycomb panels, plastics and many other hard-to-access types of structures
- Low installation cost: no expensive tools or equipment required



---

### PLASTIC TRIM CLIPS AND PUSH FASTENERS

Rapidly fix panels and trims

- No screwing, drilling, or welding required
- Can be easily removed for maintenance
- Accommodation of most panel orientations and sizes

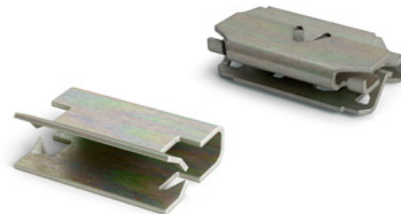


---

### METAL TRIM CLIPS AND U-NUTS

For stable yet flexible mounting

- No screwing, drilling, or welding required
- Suitable for high temperature applications
- Several surface treatments available to suit different mounting environments



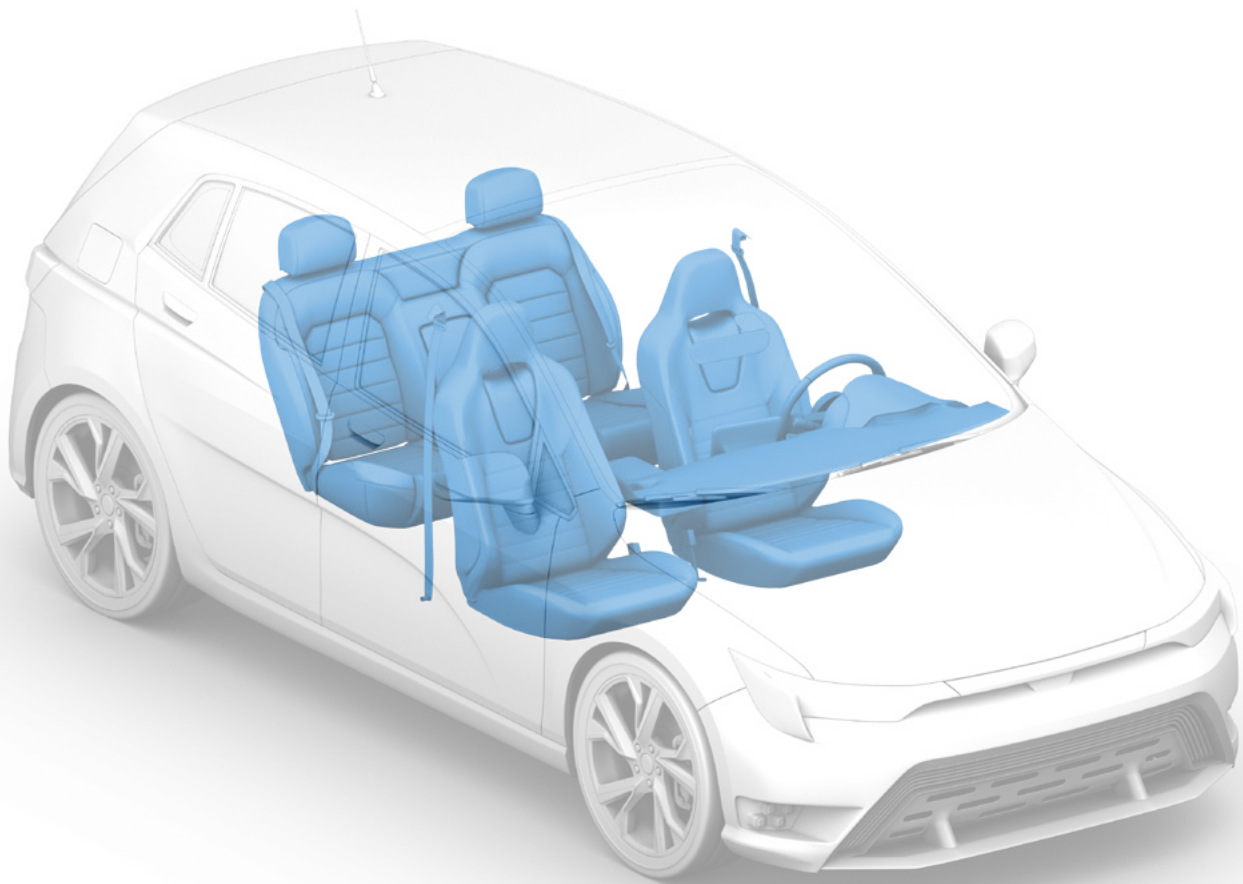
---

### TOLERANCE COMPENSATING FASTENERS

Precise and fast assembly

- Enables force-fitted connections
- Particularly suited for hard-to-access assembly locations
- Compensation of high manufacturing tolerances





## FUNCTIONALITY AND DESIGN

### Interior

---

Inside the vehicle, the emphasis is on driving comfort and safety for the passenger. Seats, dashboard and infotainment withstand daily stress.

We offer fasteners which:

- Can be used in various materials
- Meet high design and functionality requirements
- Are available in different color variations
- Meet the requirements for light construction

## INTERIOR

---

### MM-WELDING®

Smart fastening solution platform for light-weight materials

- Fast and reliable processes – cycle time often below 1 second
- High mechanical strength in lightweight materials or hybrid material combinations
- No limitation to rotational symmetric parts, shape diversity
- Pre-drilling often not required, no gluing
- Integration in functional part possible
- Ideal solution for many different composites and fabric materials



### CLIPS AND GROMMETS

Designed for quick and safe installations

- No screwing, drilling, or welding required
- Grommets prevent wire abrasion from sharp edges
- Reduced hoop stress, resulting in a high strip out torque and pull-out force
- Well nut: vibration resistant, electricly insulated, provide sealing effect



### WIRE, TUBE AND CABLE ROUTING

For cable mounting and protection

- Special cable ties with extra high holding force and vibration resistance
- Multifunctional fastening elements for efficient assembly and high holding forces
- Cable protection specially developed for electric vehicles offer excellent mechanical protection and prevent additional rattling noises even better



## SUCCESS STORY

# Green Driving with nearly 50% rationalized fasteners

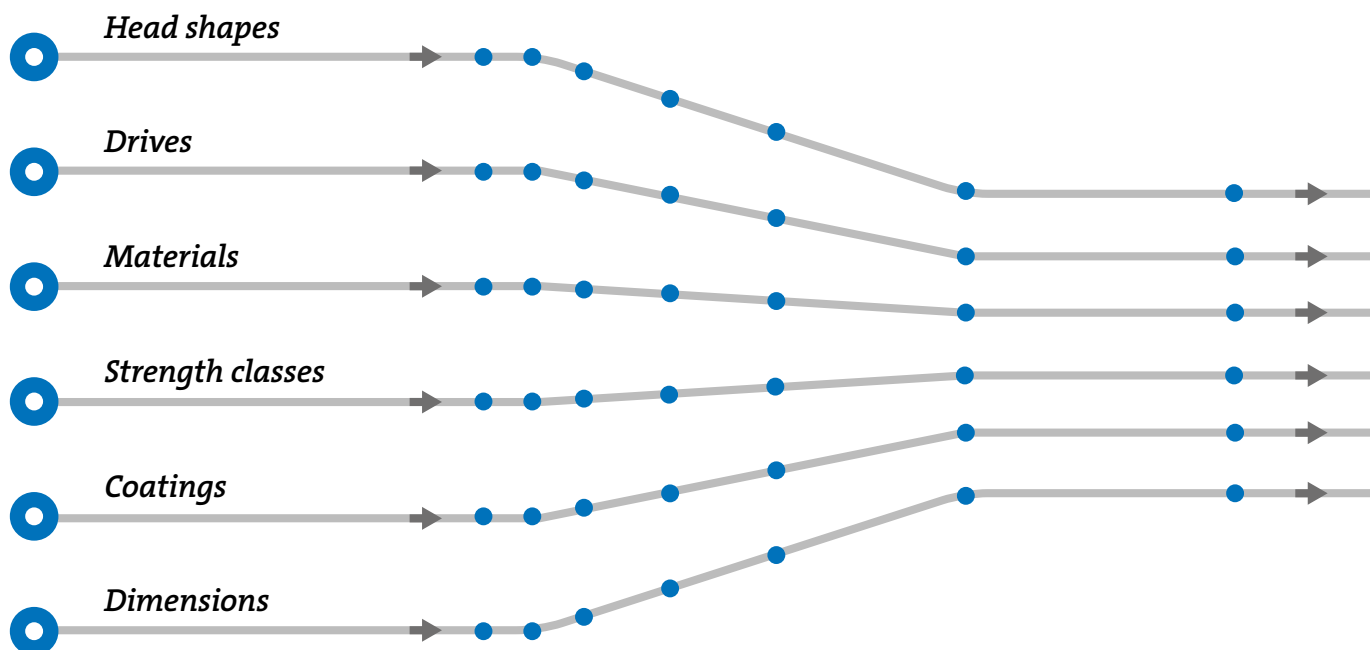
### Customer

One of our valued customers is China's number one national automobile brand. Aware of its responsibility towards the environment, the vehicle producer is working to align its strategy more and more with the principles of sustainability. The mission is to meet the rising demands for mobility in the most efficient and environmentally friendly way possible. Therefore, the company is dedicated to the development of new energy technology including the realization of electrified vehicles.

### Challenge

In 2016, the car manufacturer started to transfer one of its electric vehicle projects from Europe to China. In addition to local production, another main target was to improve the design of the lightweight car with zero-emission capability. But when it came to fastening technology, the local EV R&D center soon reached its limits. The Chinese development team needed a company to support them with engineering services. This is where our experts from Bossard with their comprehensive know-how came in.

### What is the Expert Assortment Analysis?



## Solution

With Expert Assortment Analysis – one of six Bossard Assembly Technology Expert services – our engineers took a detailed look at the vehicle to clarify the auto joint structure and localization. They carried out a systematic analysis focusing on all fastening elements used in the car. This also includes investigating the assembly technology, the assembly processes and tooling. Everything with the aim to reduce the total cost of ownership.

In this way, the Bossard engineering team was able to consolidate the original bill of materials (BOM) from 167 to 86 items – which corresponds to a reduce rate of 48.5%! Rationalizing fasteners and streamlining the BOM therefore resulted in a high cost savings for the customer.

The remaining 86 Bossard fasteners are embedded in all core components of the vehicle, 50 of these are flange parts used in the chassis. 25 items like rivets, self-clinching fasteners and welding nuts are part of the body in white. The exterior and interior of the vehicle contains another 6 items consisting of self-tapping screws and plastic clips, while the remaining 5 items of screws and washers are integrated in the electronics.

The project was finished with a technical agreement including detailed design description and documentation. In addition, our Chinese engineers re-created CAD drawings for the 86 items approved by the customer. All of this helps the R&D team during the implementation phase.

***With Bossard's Expert Assortment Analysis, you can reduce your product range of fasteners and establish clear rules for the types of screws, materials and drives you prefer.***



## Your benefits at a glance:



### Elimination of unnecessary elements

Identify commonalities and reduce unnecessary components



### Reduction of complexity in procurement, storage and assembly

Define your product range to choose from.



### Greater productivity

Using Bossard's Expert Assortment Analysis has a significant impact on your overall productivity.

## Outcome

Through one and a half years of close collaboration with the EV R&D center and great internal teamwork, Bossard China has solidified 86 fastener items in the customer's automobile plants. The electric vehicle enters mass production in 2021 and brings the customer closer to his goal to become a leader in new energy technology.

Furthermore, the cooperation between the customer and our engineering team will continue beyond this project. The car manufacturer is so satisfied with our Assembly Technology Expert services, that an ATE contract with Bossard China was signed.

Would you also like to benefit from Bossard's Expert Assortment Analysis service? By effectively optimizing your assortment, our experts can help reduce your total cost of ownership. Eliminating redundant elements and operations improves your company's productivity and is a valuable contribution to sustainability. Visit our website and learn more: [www.bossard.com](http://www.bossard.com)

## OUR SERVICE MODEL

# Six Expert-Services

Assembly Technology Expert works with six differentiated services. Each part contributes to improving your productivity step by step.



### Expert Walk

We take an in-depth look at your production facility. We examine all workstations and assembly lines. Our engineering experts study fasteners and tools you are using and determine how to proceed leaner and smarter.



### Expert Assortment Analysis

To reduce your total cost of ownership, we streamline your bill of materials by identifying opportunities for fastener rationalization. We work with proven analytical processes, application audits and state-of-the-art methodologies and techniques.



### Expert Education

We empower you to become an expert in the full range of assembly technologies. In our seminars and e-learning, you learn about the essentials and secrets of fastening, from novice level to mastery.



### Expert Teardown

We disassemble your product and examine every inch of it. Focusing on the fasteners, their design, their functionality and their assembly procedure, we identify the best fastening solution and the cost-saving potential for you.



### Expert Design

Having the right fastener at the right time at the right place is crucial for your success. We provide you with technical solutions and access to big data to find the most practical part for you.

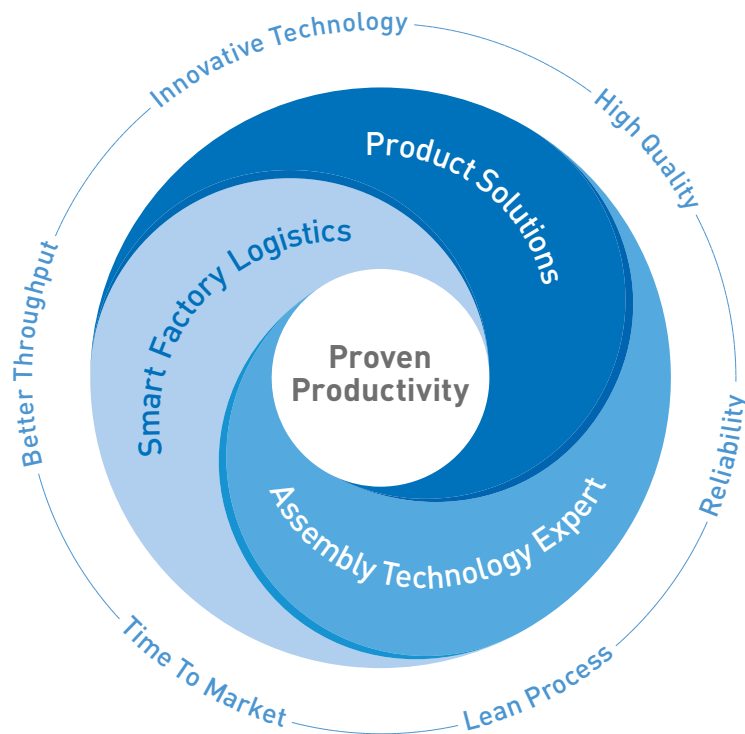


### Expert Test Services

Bossard's test laboratories in Europe, America and Asia have cutting-edge measuring and testing equipment at their disposal. They guarantee that your manufacturing reliably meets quality requirements and that your production procedures are flawless.

## PROVEN PRODUCTIVITY – A PROMISE TO OUR CUSTOMERS

# The strategy for success



From years of cooperation with our customers we know what achieves proven and sustainable impact. We have identified what it takes to strengthen the competitiveness of our customers. Therefore we support our customers in three strategic core areas.

Firstly, when finding optimal **Product Solutions**, that is in the evaluation and use of the best fastening part for the particular function intended in our customers' products.

Second, our **Assembly Technology Expert** services deliver the smartest solutions for all possible fastening challenges. Our services cover from the moment our customers developing a new product, to

assembly process optimization as well as fastening technology education for our customers' employees.

And thirdly, optimising our clients' productions in a smart and lean way with **Smart Factory Logistics**, our methodology, with intelligent logistics systems and tailor-made solutions.

Understood as a promise to our customers, "Proven Productivity" contains two elements: Firstly, that it demonstrably works. And secondly, that it sustainably and measurably improves the productivity and competitiveness of our customers.

And this for us is a philosophy which motivates us every day to always be one step ahead.

---

[www.bossard.com](http://www.bossard.com)