

RIVSET®

Self-pierce riveting for modern multi-material design

BÖLLHOFF



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RIVSET® Self-pierce riveting – Technology



No pre-drilling, no emissions, no noise. RIVSET® self-pierce riveting is a process used in joining technology that creates mechanically strong joints of similar or different types of material. Even joining with more than two layers is possible.

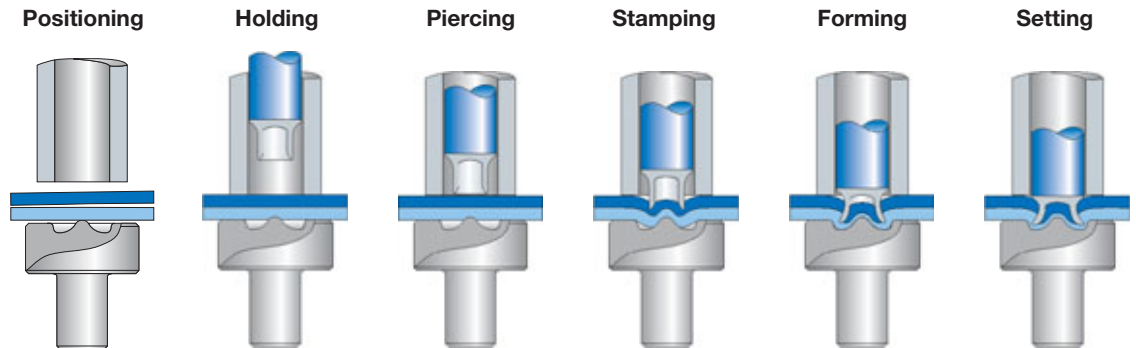
Method / principle

RIVSET® self-pierce riveting enables dynamically strong joints. There is no need for the material components to be pre-drilled or positioned exactly. In one step, the semi-tubular rivet pierces through the upper layer of the work piece and forms an undercut in the lower layer, making the characteristic locking head. This process offers high dynamic and quasi-static strengths, high reproducibility and can be easily automated.

Setting process



RIVSET® Setting process



RIVSET® Self-pierce riveting – Advantages

The technology

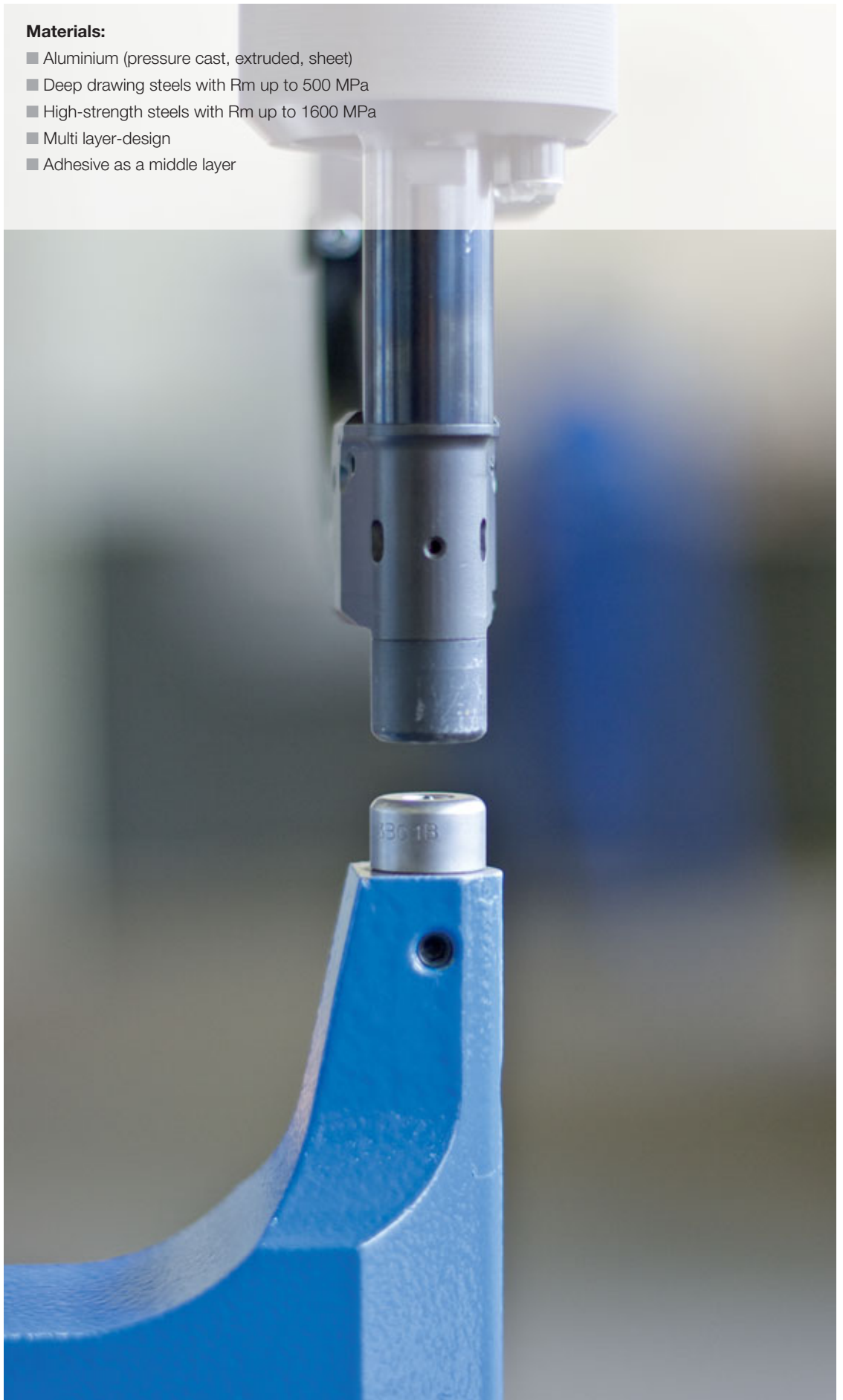
- High-strength joints
- Reproducible joining result
- No pre-drilling
- Watertight and airtight
- For various materials
- For various thicknesses and strengths of material
- Hybrid joints (in combination with adhesive) possible



For all applications

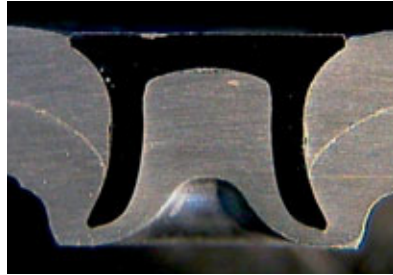
Materials:

- Aluminium (pressure cast, extruded, sheet)
- Deep drawing steels with Rm up to 500 MPa
- High-strength steels with Rm up to 1600 MPa
- Multi layer-design
- Adhesive as a middle layer





Aluminium 1.2 mm
Steel 1.0 mm
Aluminium 1.2 mm



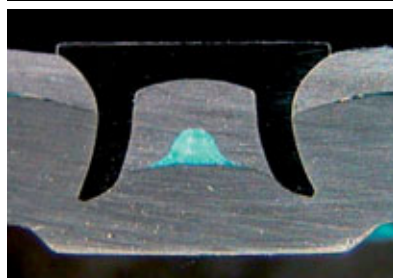
Aluminium 3.0 mm
Aluminium 3.0 mm



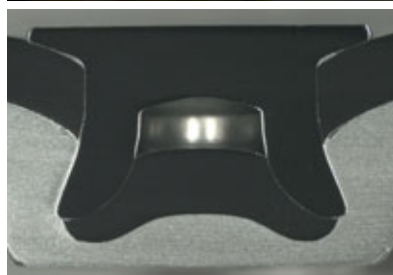
Aluminium 1.2 mm
Magnesium 1.5 mm



Plastic 3.0 mm
Aluminium 3.0 mm



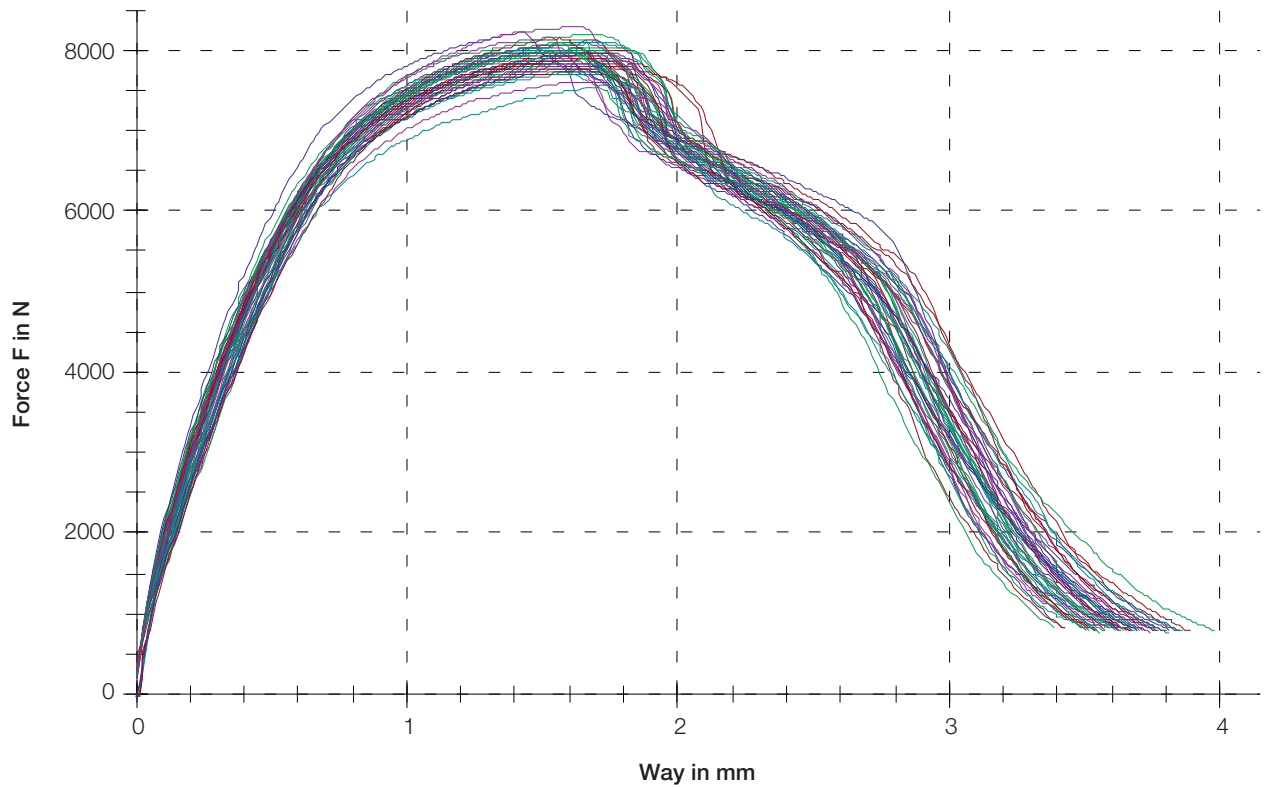
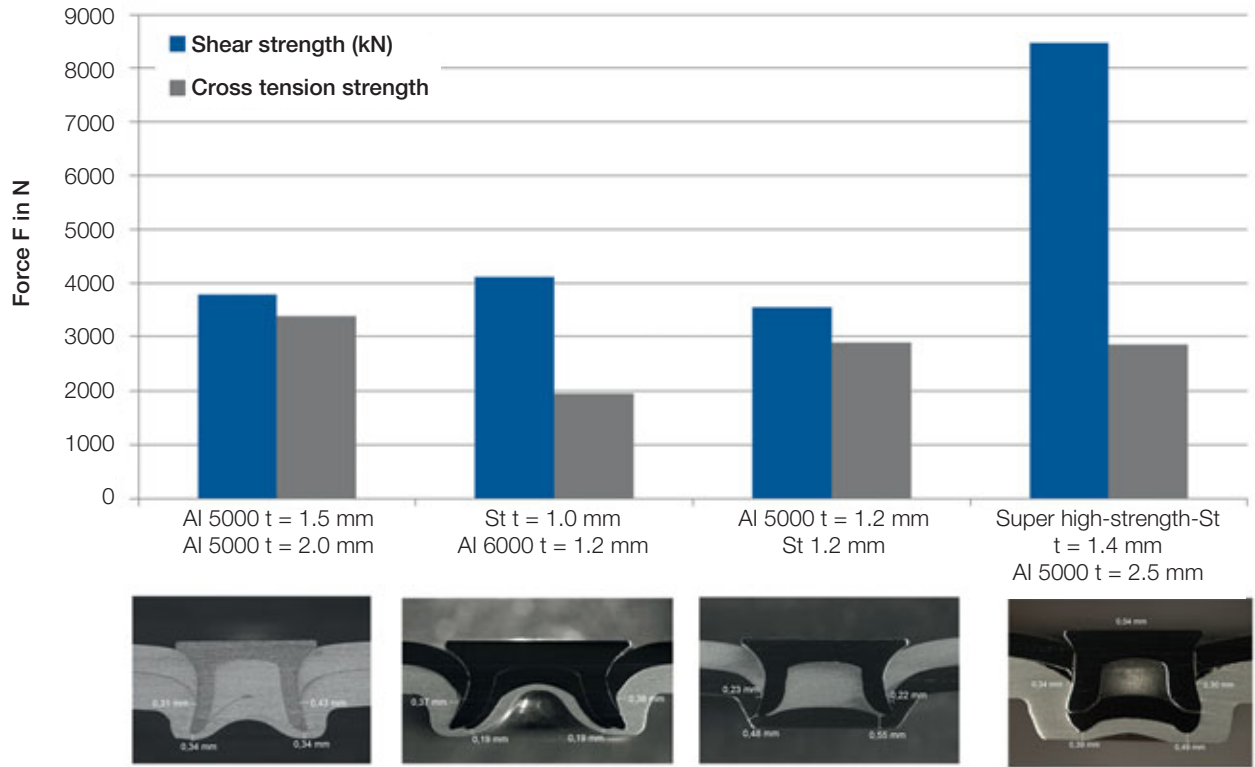
Aluminium 1.2 mm
Adhesive
Aluminium casting 2.0 mm



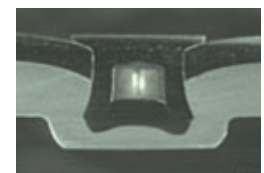
High-strength steel 1.5 mm
Aluminium 2.0 mm



Aluminium 1.2 mm
Super high-strength steel 1.4 mm
Aluminium 2.0 mm



n = 50	
Top layer	High-strength steel t = 1.7 mm
Basic layer	Aluminium casting t = 3.0 mm
Rivet	HD3 5.2 x 5.5 SK H4
Die	FM1002118
System	Automation H
Setting force	55 kN
Pre-clamping force	4 kN



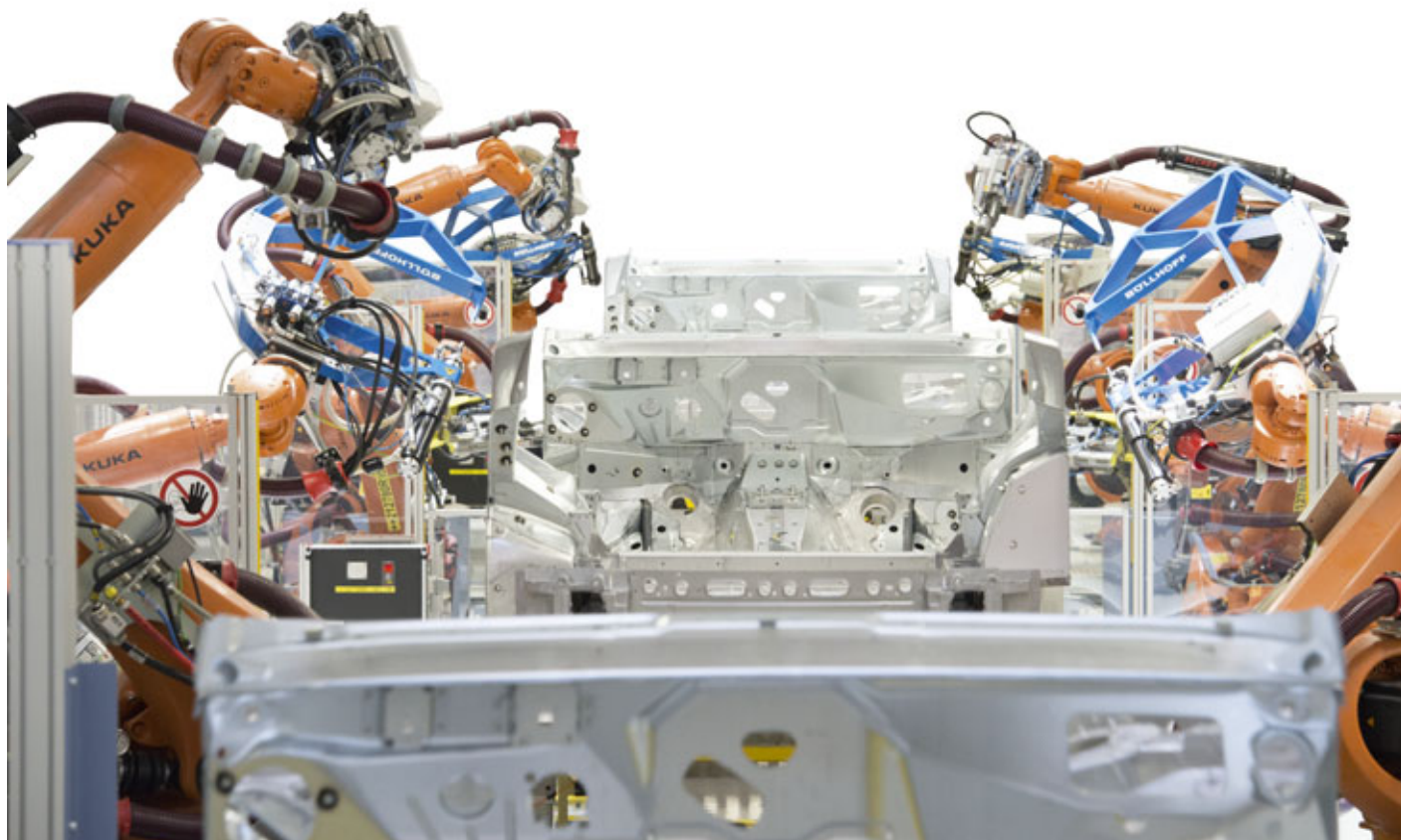
Material	Sheet thickness on punch side (mm)	Material die side	Sheet thickness on die side (mm)	Rivet size (ø)	Shear strength (kN)
DC01	0.75	DC01	0.75	3	2.29
DC01	1.00	DC01	1.00	3	3.10
DC01	1.00	DC01	1.00	5	3.75
DC01	1.20	DC01	1.20	3	3.89
DC01	1.20	DC01	1.20	5	4.45
DC01	1.50	DC01	1.50	3	4.37
DC01	1.50	DC01	1.50	5	5.99
H320LA+ZE	1.00	H320LA+ZE	1.00	3	3.72
AlMg3	0.80	AlMg3	0.80	3	1.70
AlMg3	1.00	AlMg3	1.00	3	2.19
AlMg3	1.20	AlMg3	1.20	3	2.48
AlMg3	1.20	AlMg3	1.20	5	3.17
AlMg3	1.50	AlMg3	1.50	5	4.38
AlMg3	2.00	AlMg3	2.00	5	4.94
DC04	2.00	DC04	2.00	5	7.60
AlMg4,5Mn0,4	2.50	AlMg4.5Mn0.4	1.25	5	5.20
AlMg0,4Si1,2	1.20	AlMg0.4Si1.2	1.20	3	3.00
AlMg0,4Si1,2	1.20	AlMg0.4Si1.2	1.20	5	3.40
AlMg4,5Mn	1.15	AC300	2.00	5	3.20



RIVSET® Self-pierce riveting technology in use

Automotive industry

Automated setting of self-pierce rivets for all body parts, aggregate construction, interior and exterior.



Self-pierce riveting technology of Böllhoff in modern body construction with robot-guided component using the example of Audi Q7 manufacture at Volkswagen in Bratislava.



Extract of the video "Böllhoff RIVSET® in the Audi Q7 production at Bratislava"
Source: Audi AG

Industry



Manual use of self-pierce rivet systems; shown here for door and gate assembly. The large photo shows a manually-operated tool with gyrosopic handling device.

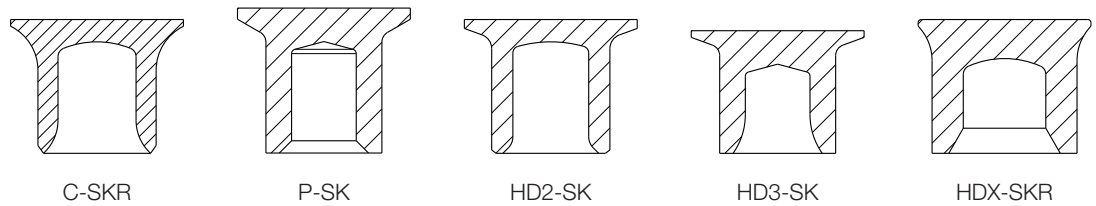
Production of air ducting segments with manually controlled components and integrated setting tool.



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RIVSET® Self-pierce rivets – Variants

The wide variety of possible applications of self-pierce rivets also explains the wide range of variants. RIVSET® self-pierce rivets differ in material, shape, hardness, surface, head shape, shaft length and diameter: your application determines the rivet type.



RIVSET® HDX – Self-pierce riveting technology for high-strength joints



This was the objective when developing the new RIVSET® HDX rivet. It meets the requirement of joining material mixes of ultra high-strength steels and more ductile materials with the known limits to setting force the setting device has.

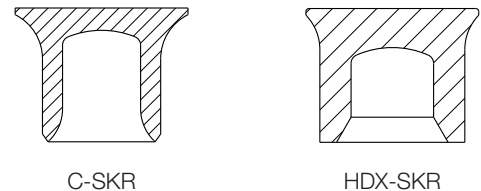
This is achieved by the combination of the optimal fastener geometry and the required hardness.

Böllhoff successfully realises joints using materials with a tensile strength of 1,600 MPa and a sheet thickness of 1.8 mm in the top layer.

The HDX rivet can be used for established flange widths employing the RIVSET® self-pierce riveting method.

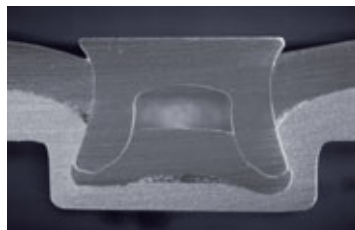
RIVSET® HDX – Compared to the RIVSET® C-SKR rivet

- Increased shank diameter (e.g. from 5 mm to 6 mm)
- Modification of the cutting edge geometry
- Application of force by means of a larger surface
- Increase of hardness to H6

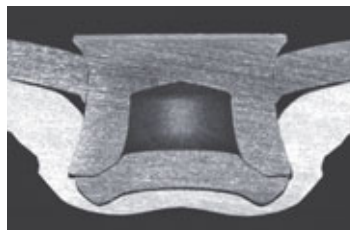


Materials:

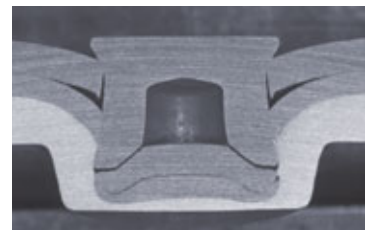
- Higher-strength steels with Rm to 1,600 MPa and approx. 1.8 mm in the top layer
- Aluminium (pressure casting, extruded profile, sheet)
- Adhesive as intermediate layer



Press-hardened steel 1.8 mm
Adhesive
Aluminium 2.0 mm



Press-hardened steel 1.8 mm
Aluminium 2.0 mm



Press-hardened steel 1.35 mm
Deep-drawing steel 1.0 mm
Aluminium 2.0 mm

RIVSET® Ring groove die



RIVSET® Self-pierce rivets – Special requirements

In addition to the combination of steel and aluminium sheets, aluminium cast and extruded aluminium are increasing in components within the modern vehicle body construction.

Due to their mechanical characteristics, cracking can occur in the material on the button side when joined with self-pierce riveting technology with semi-tubular rivets.

The new RIVSET® ring groove die, made by Böllhoff, minimises or eliminates cracking on the button side. Simultaneously, it increases the interlock and reduces the load of the rivet.

The development



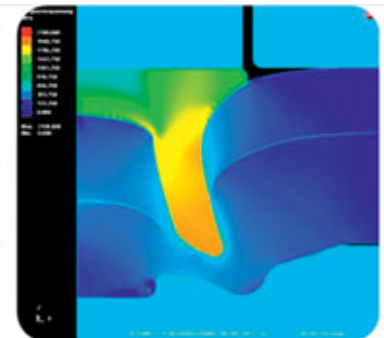
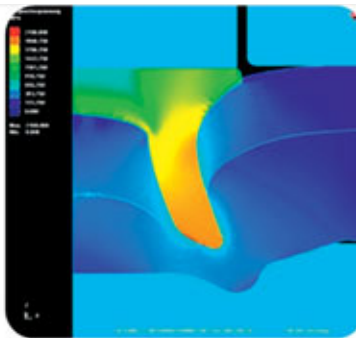
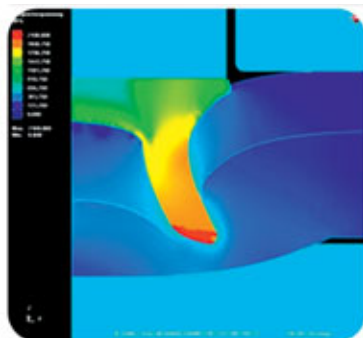
Standard



RIVSET® ring groove die with cup



The load on the rivet is reduced. It decreases in the illustration from left to right.



Your benefits at a glance

- Avoidance/minimisation of cracking on the button side
- Reduced rivet load due to an optional cup
- Increased interlock of the rivet

Fields of application

The RIVSET® ring groove die is made for modern mixed material design in the automotive industry. It can be used optimally for aluminium cast components, e.g. a suspension strut.





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RIVSET® Portable – Hand tools for self-pierce riveting

RIVSET® self-pierce riveting is a well-known process for high-strength mechanical joining of similar or dissimilar materials. Also several layers can be joined without problem. The technical issue of joining different materials concerns all manufacturing industries. Furthermore, the flexibility during the production plays an important role. The RIVSET® Portable hand tools enable flexible combination options while using the same basic unit. Self-pierce rivet heads can be easily replaced directly on site.

RIVSET® Portable is recommended for applications requiring approx. 10,000 setting cycles annually.

Flexible, mobile and reliable.



Characteristics

- Ergonomic two-component housing: secure grip, non-slip
- Combination possibilities: the riveting head/frame on site
- Basic units: setting forces 25–50 kN and 40–80 kN
- Lithium-ion battery: no memory effect, exchange of higher performance and capacity
- High-quality charger: extremely short charging times (15/22 minutes)

Well-known properties

- Processing tape-collated or loose RIVSET® self-pierce rivets
- Optimal accessibility to joint through small setting head
- Choice of mains or battery operation
- Wearing parts simple and fast to change
- Easy handling
- Adjustable setting forces
- For rivet types C and K with a diameter of 3 mm and 5 mm
- For HDX rivets
- Different C-frame shapes

Fields of application



- Site fabrication
- Prototype construction
- Refinishing solution
- Repairs




Flexible combination options with the same basic unit

Basic unit with setting force 25–50 kN
 Basic unit with setting force 40–80 kN

Combinations for 25 – 50 kN hand tools

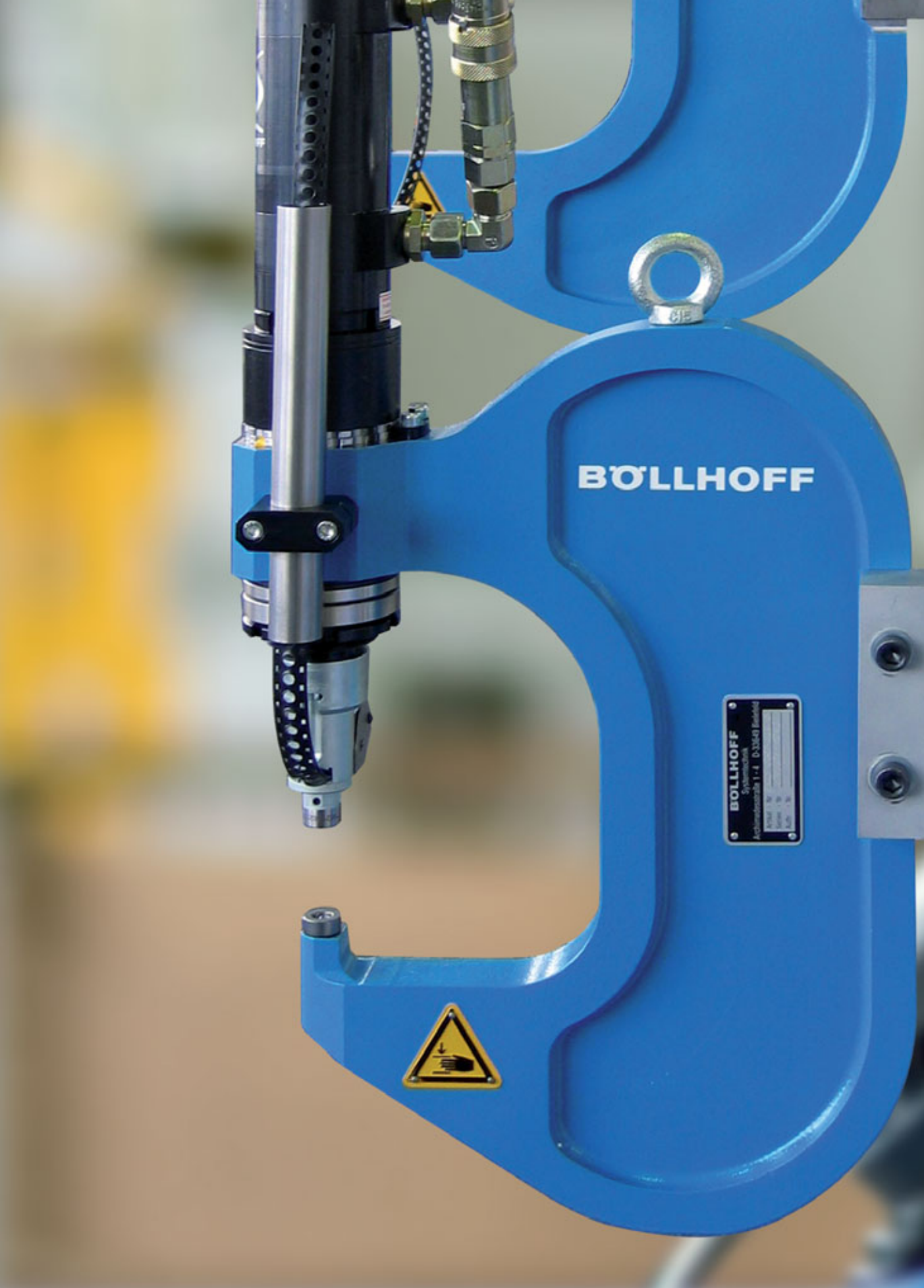
Self-pierce rivet head T 35 magnet	Self-pierce rivet head T 140 magnet	Self-pierce rivet head T 200 magnet	
		SNS3M SNS5M	
Self-pierce rivet head T 35 TF	Self-pierce rivet head T 80 TF	Self-pierce rivet head T 140 TF	Self-pierce rivet head T 200 TF
		TF3 TF5	

Combinations for 40–80 kN hand tools

Self-pierce rivet head T 80 magnet	Self-pierce rivet head T 150 magnet	Self-pierce rivet head T 200 magnet
		SNS5M

T = Throat depth, TF = Tape Feed, SNS3M = Punch with magnet for 3 mm C rivets,
 SNS5M = Punch with magnet for 5 mm C rivets and 6 mm C rivets (RIVSET® HDX)

RIVSET® Classic – Flexible self-pierce riveting system



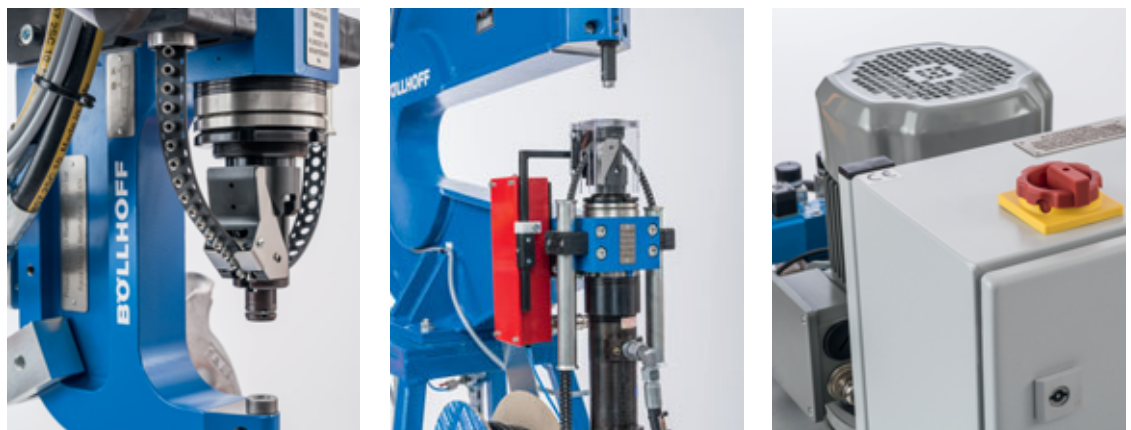
Properties

- A compact rivet guide and setting head for optimum access to the joint
- Processing of tape-collated self-pierce rivets and single self-pierce rivets with manual single feed
- Robust and resistant mechanical version for long-lasting service life of the used components at the setting head
- Easy handling
- Short rivet cycle times
- Low space requirement through compact construction

Application areas

- Manual operation
- Optional operation of the component or the setting tool

RIVSET® Classic



Robust and flexible self-pierce riveting system

- Manual and easy handling of the setting tool
- Manually adjustable setting forces
- Optional as execution road sign production

RIVSET® Classic C



Compact and flexible self-pierce riveting system

- Manual and easy handling of the setting tool
- Compact design inclusive framework on rolls
- Operation by mobile manual control
- Final window indication per joining point (load/deflection values)
- Programmable joining parameters
- Manually adjustable pre-clamping pressure
- Higher joining quality due to pre-clamping forces up to 7 kN

RIVSET® self-pierce riveting technology for modern body construction

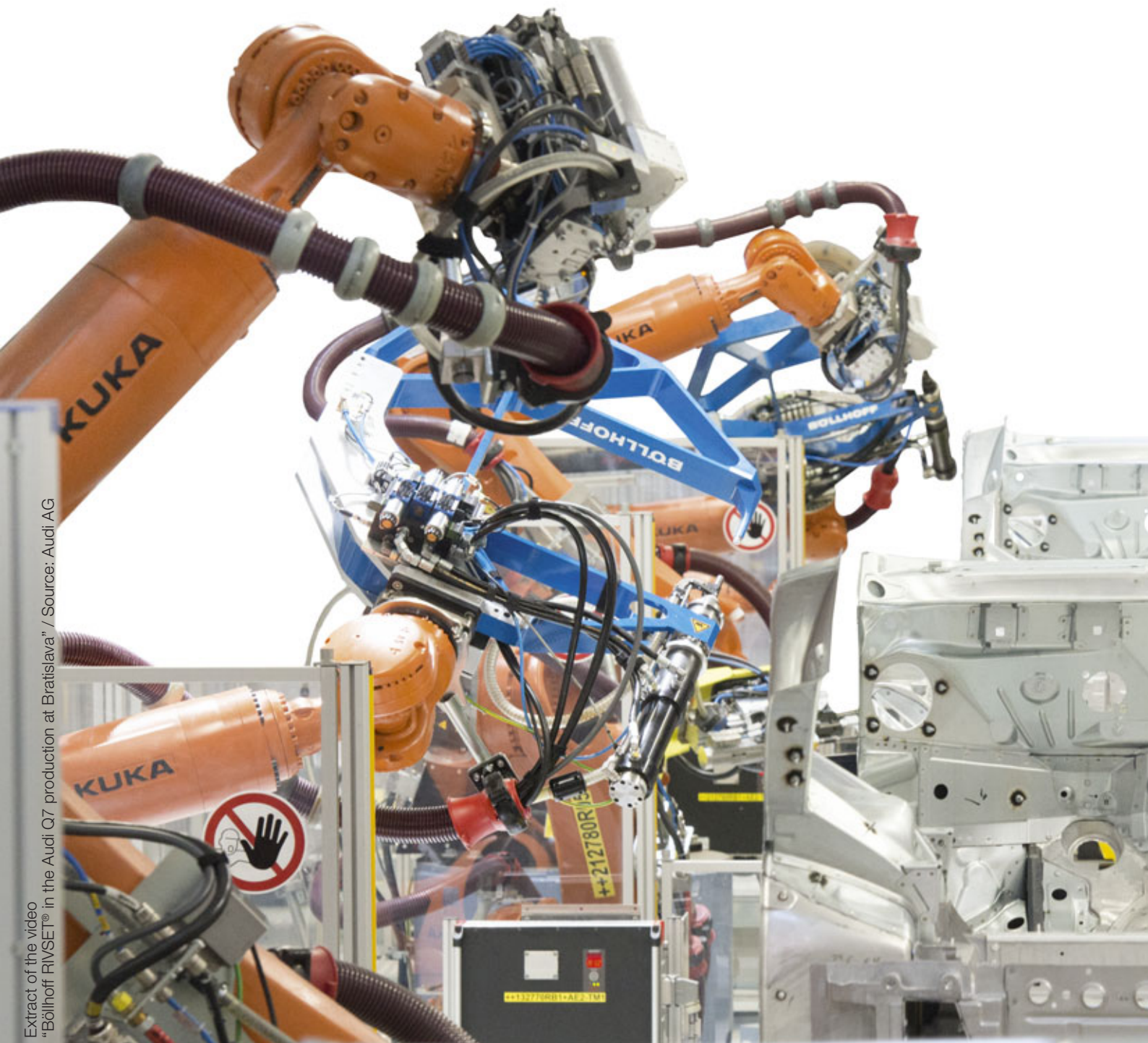
Modern lightweight concepts: the automotive industry in particular cannot work without them. They not only considerably improve vehicle dynamics, they also help to reduce emissions. Lightweight design continues to be a key technology for future cars and is also important for e-mobility.

The green innovation capacity counts on the know-how in the battery and lightweight technology.

While chasing ever greater reach, lightweight design is particularly essential to further promote e-mobility.

Efficient lightweight design also sets high standards thus requiring innovative fastening technology.

These developments have given a new impulse to the RIVSET® self-pierce riveting technology. It's time to shape the future.



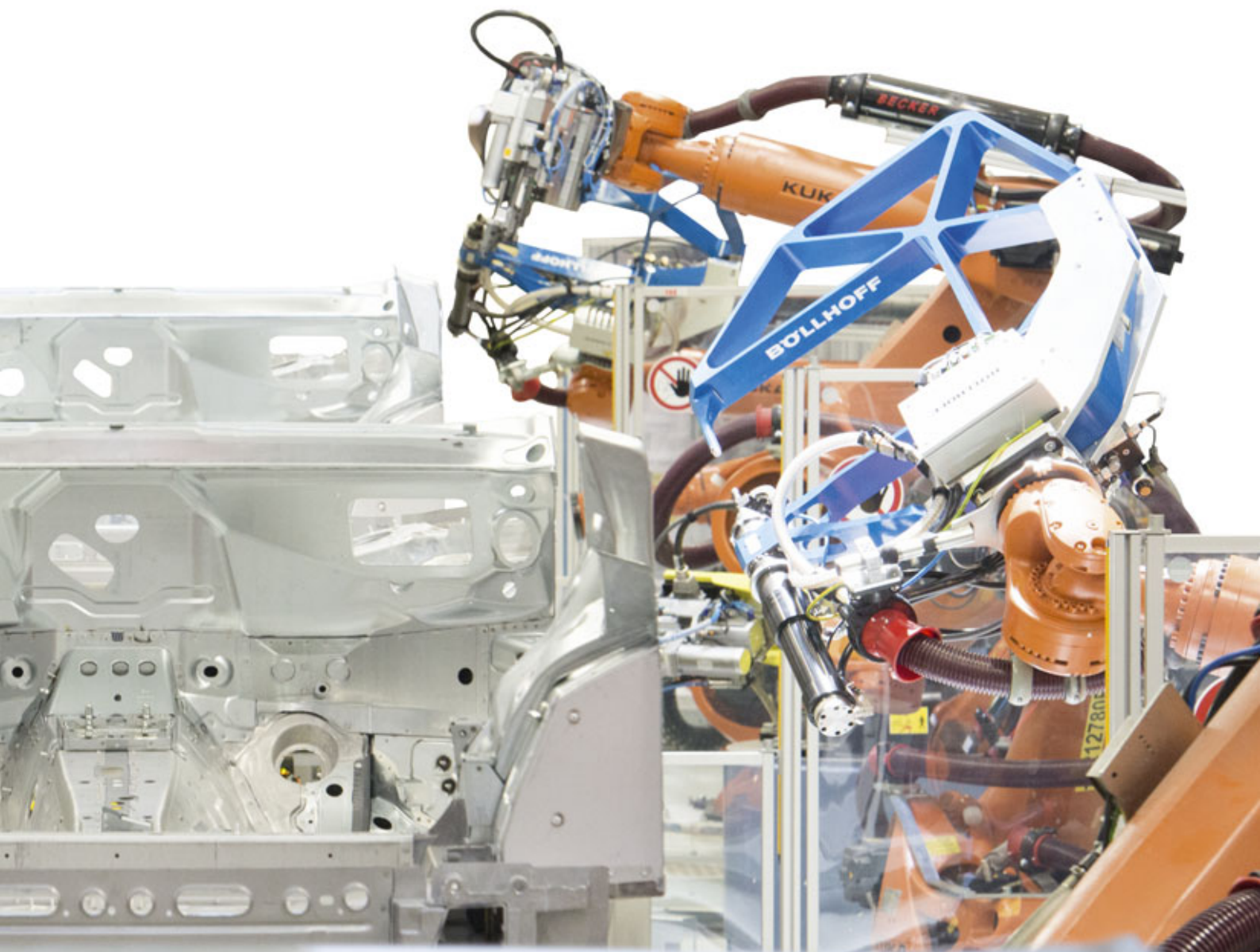
Modular, flexible, efficient!

With our self-pierce riveting technology with semi-tubular rivets, RIVSET® Automation H and RIVSET® Automation EH, you can join mixed materials as well as high-strength steels at very short process times.

Due to the modular design, this technology is made for applications in large-scale productions with maximum flexibility during production planning. The new drive provides a long life at maximum availability and minimum maintenance.

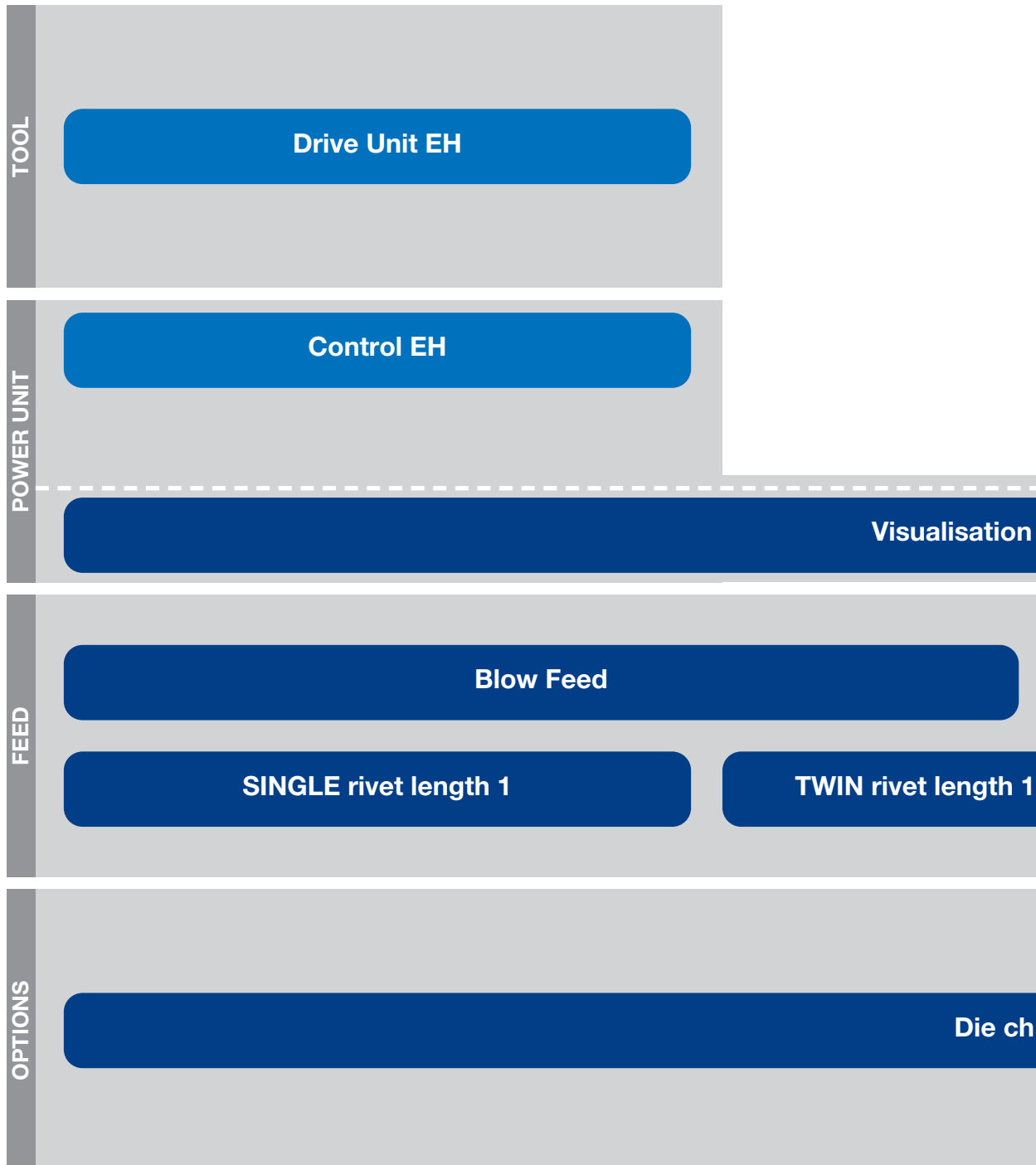
Characteristics

- Modular and extensive machine designs
- Machine configuration via Plug & Play
- Process cycle of ≤ 1.5 seconds / rivet (depending on the setting tool)
- Consistent machine availability
- Open interface to various robot interfaces (ProfiNet, Ethernet/IP etc.)



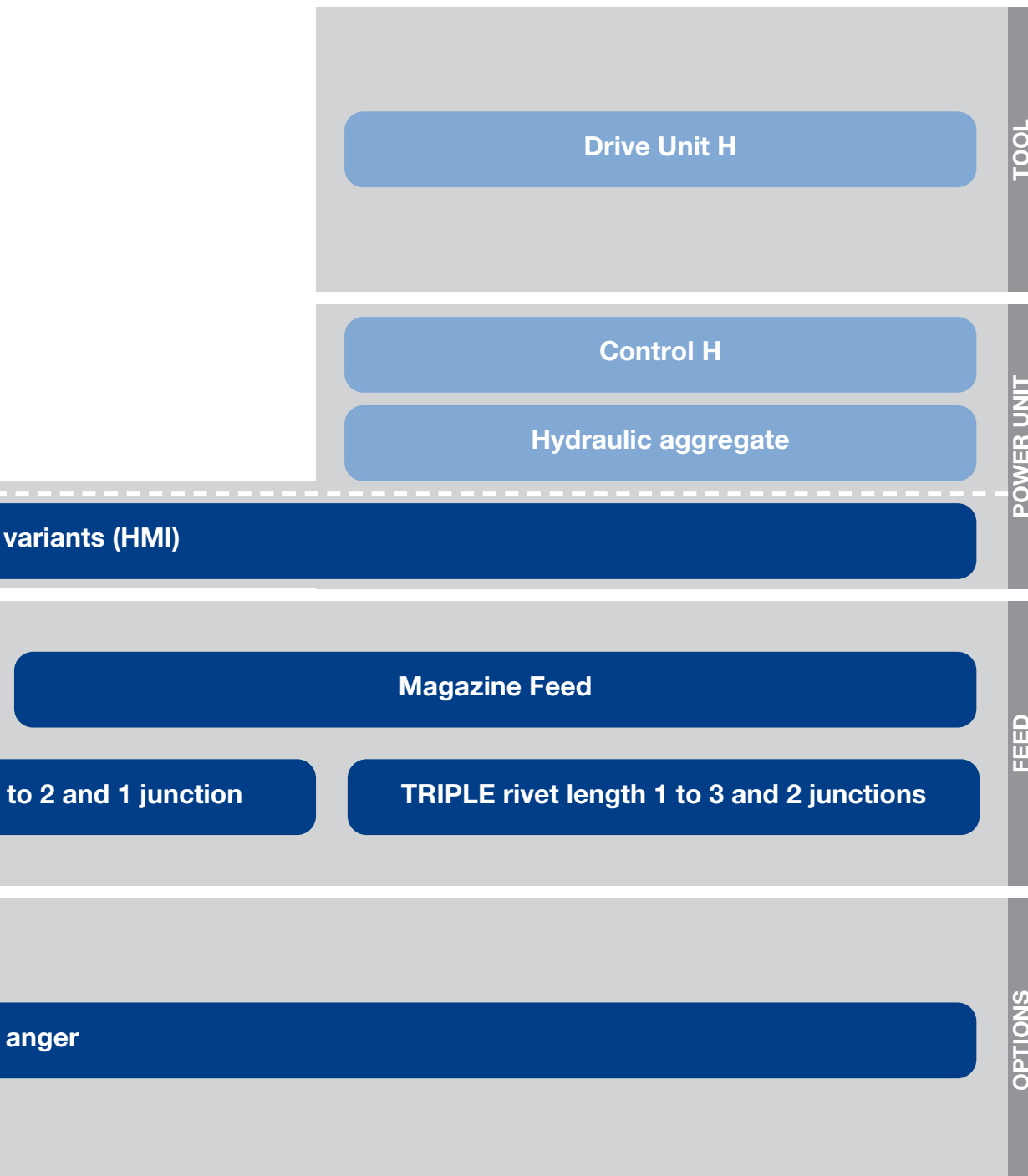
RIVSET® Automation EH

- Setting tool with electrical drive for setting forces 60 kN and 78 kN
- Compensation of impact forces (for high-strength steel applications with tensile strength up to 1,600 MPa)
- Cost-effective: long life cycle at maximum availability and minimum maintenance
- 100% electrical installation on robots - no hydraulic hose coupling necessary
- 7th axis function included in control



RIVSET® Automation H

- Optimised setting tool dimension at minimised weight - joining of components with limited access possible
- Optimal position of gravity centre for the use on the robot
- Compensation of impact forces (for high-strength steel applications with tensile strength up to 1,600 MPa)
- Mechanical joining for setting forces 50 kN, 60 kN and 78 kN





TOOL

Setting tool EH

- Setting tools with 100 % electrical installation for setting forces 60 kN and 78 kN
- Pre-clamping force adjusted with pressure springs
- Various mounting points on the setting tool for perfect position on the robot
- C-frame throat depths up to 1,000 mm
- Modular die post (with/without die lock)
- Interface to tool changing systems possible

EH clamping device:
Built-in mechanical assembly



POWER UNIT

Control unit

- "Embedded PC"-based control incl. servo controller
- Decentralised hardware configuration with centralised control of the individual modules via BUS system
- Open interface for different robot interfaces (ProfiNet, EtherNet/IP, etc.)

Manual control unit

- To visualise the process curves for commissioning (Plug & Play) and maintenance



Visualisation variants



TOOL

Setting tool H

- Setting force levels 50 kN, 60 kN and 78 kN
- C-frame throat depths up to 1,000 mm
- Exchangeable die post (with/without die lock)
- Programmable pre-clamping forces
- Media docking option
- Universal hydraulic aggregate from 50 kN to 78 kN



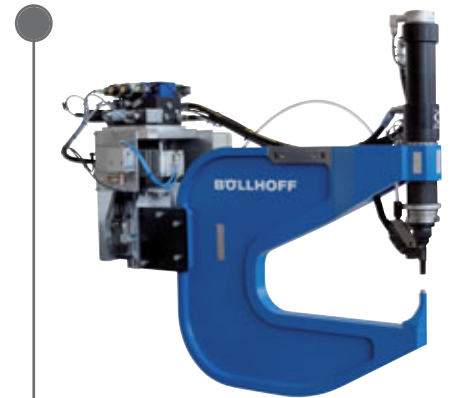
Multi-visualisation*

- For up to 5 control units
- With a hard and software upgrade multi-visualisation* can be used as a control centre

POWER UNIT

Control unit

- "Embedded PC"-based control
- Decentralised hardware configuration with centralised control of the individual modules via BUS system
- Open interface for different robot interfaces (ProfiNet, EtherNet/IP, etc.)



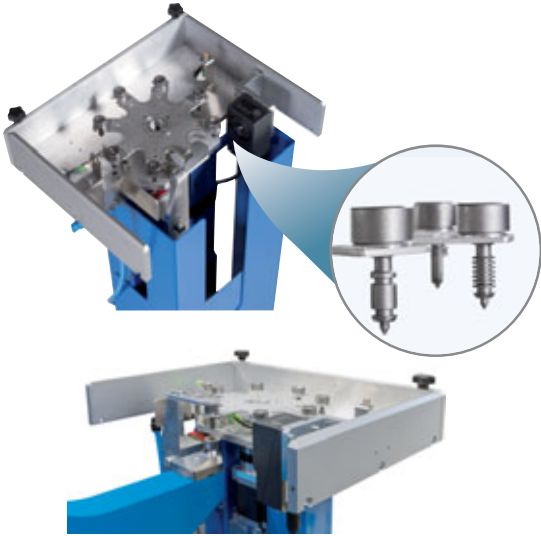
FEED

Rivet feeder

- Minimum maintenance at maximum availability
- Feeds approx. 45 rivets/minute
- Stockage of approx. 4,000 rivets (optionally expandable)
- Optional rivet length measurement precise to $\pm 0,25$ mm

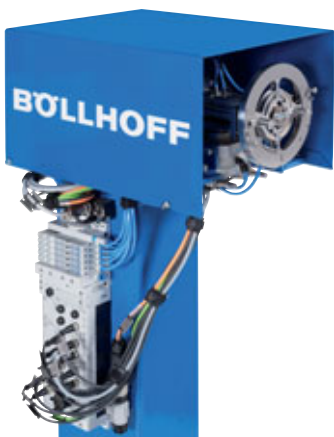
RIVSET® Automation – Options

Options for configurations of RIVSET® Automation EH and H



For prototyping, small series or series production and spare parts management – RIVSET® Die changers

- Takes up to eight dies
- Die change in approx. 6.0 s
- Die identification at removal position and assignment of die ID for each joining point
- Die locking in the die post of the setting tool
- Camera sensor for automatic die identification through die shank coding



Alternative rivet feed – RIVSET® Magazine feed

- Consists of loading station and magazine holder on the setting tool
- Up to eight rivet lengths can be processed in a magazine
- Up to 49 rivets per magazine
- Quick magazine change in approx. 4.0 s

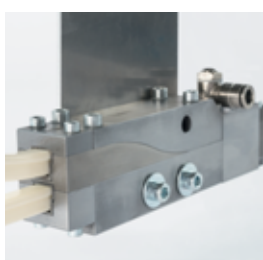
NEW! Modularity in perfection

Different configurations for the production planning of tomorrow.

Rivet feeder, base frames and rivet junction in an extension kit.

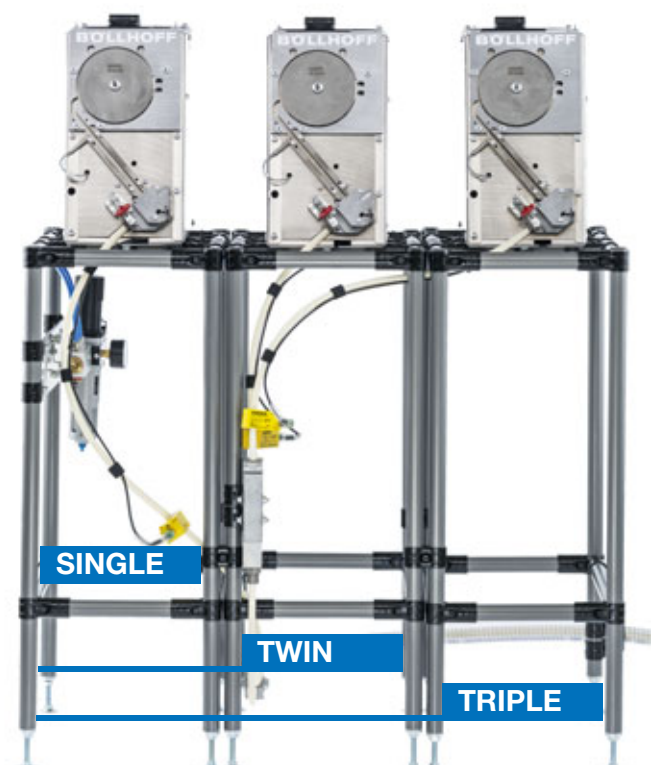
- Single** – One rivet diameter and one rivet length
- Twin** – One rivet diameter and two rivet lengths
- Triple** – One rivet diameter and three rivet lengths

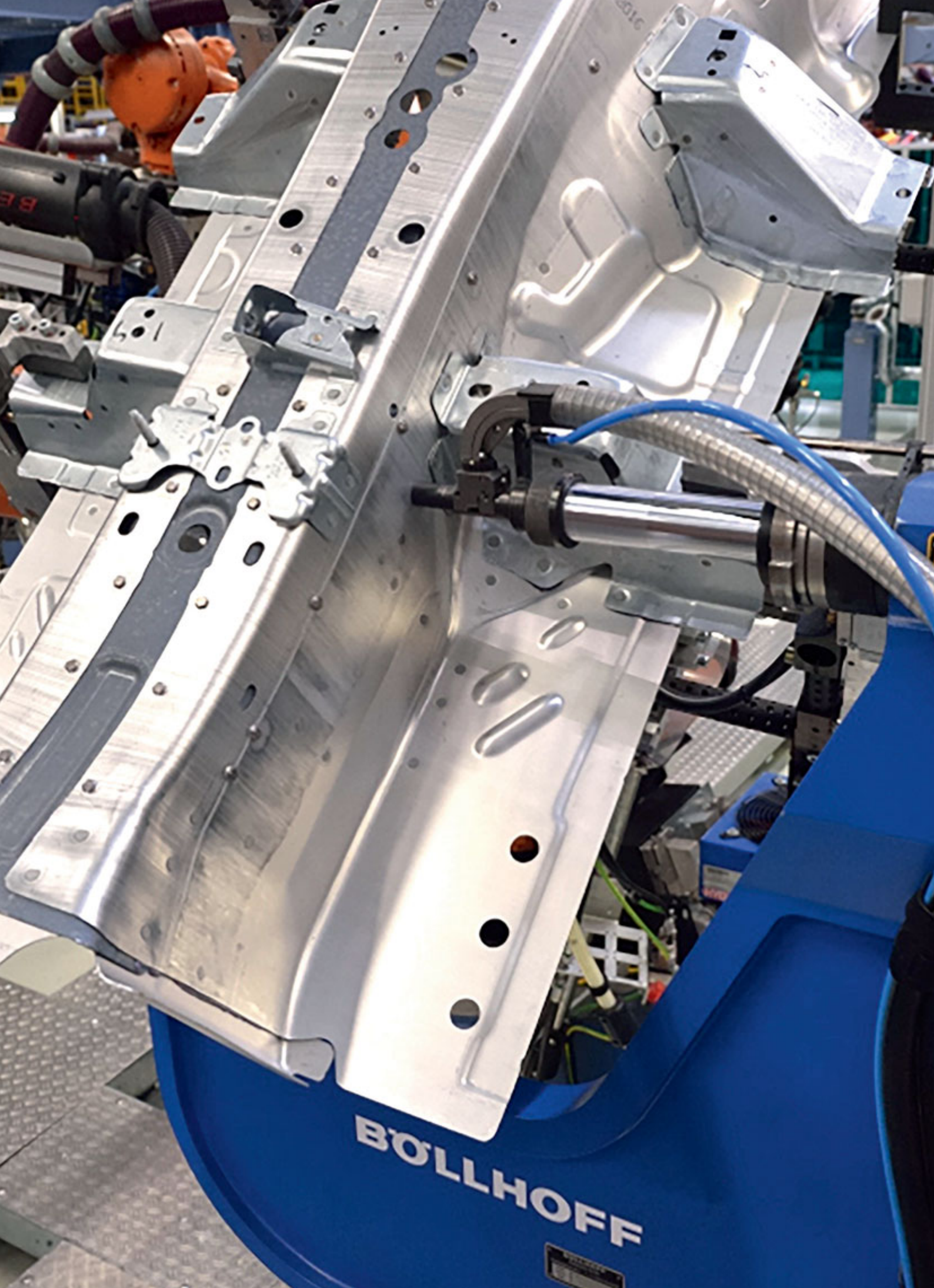
You can configure our new modular base frames for the rivet feeder and the rivet junction on site.



Rivet junction – the highlight

- 100 % mechanical rivet junction for rivet feed – no sensors
- Flexible positioning





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Sales

Innovative ability and technical potential are becoming increasingly important for a company's success.

Every customer has a special contact person who will be glad to discuss all wishes and requirements so you save precious time.

Our expertise and experience reflect in a worldwide distribution network. The headquarters of this family business, which has now been in the family for four generations, is located in Bielefeld, Germany. Böllhoff also has sales and production facilities in 24 countries. Outside these 24 countries, Böllhoff cooperates in close partnerships with representatives and merchants to serve international customers in further important industry markets.

Product and project management

We are satisfied whenever we can exceed your expectations.

The foundation of our competence is an efficient concept of counselling, development and support. The joint aim is to realise the technically optimal and economically most attractive solution. That is also the standard of our product and project management; they support you with management and product-specific expertise.

Our product and project management stands for interdisciplinary coordination of complex activities. Our employees call on many years of experience in the application engineering of joining and automation solutions and realise tailor-made solutions according to your requirements.

We think in terms of systems: optimising processes, reducing costs, strengthening competitive positions. Our product and project management stands for interdisciplinary coordination of complex activities. That means planning, controlling and monitoring in all project phases.

We provide product and project management on three continents:

- Europe
- North America
- Asia



Design and development

The development of fasteners depends on the material trends of our customers. For the respective assembly systems, we focus on functionality, flexibility and design.

The main requirements for such systems are reproducible processes, industrial-quality availability and short process times.

The earlier we can contribute our competence, the greater the potential.

FEM simulation reduces the amount of iteration loops and therefore the time-to-market.

To make ideas reality, we employ modern CAD systems complying with today's requirements in the automotive sector. Data transfer is agreed with each customer individually.

Production

RIVSET® self-pierce rivets are exclusively manufactured at Böllhoff production facilities. They are subject to stringent quality checks in every single production step. This is the only way we can meet the high customer requirements for every product. For every self-pierce rivet.

After extending our production facilities at the Sonnewalde location from about 4,900 to 8,900 m², we were able to double the production capacity for RIVSET® self-pierce rivets. We are well-prepared for the future and the market requirements.

Another of our core competencies is the installation and functional testing of processing systems. All final assemblies and commissioning activities are in-house operations that are not subcontracted.



Our competencies – one by one

Joining laboratory and quality

Our focus is always on sophisticated production processes as well as modern measurement and monitoring technology. Good quality is no coincidence, but the result of systematic planning and implementation.

You define all the technical requirements – by request in cooperation with our qualified team – which are then tested for practicability. You also benefit from process reliability and the avoidance of unnecessary costs.

Our certified laboratory, which fulfils the requirements of DIN EN ISO/IEC 17025, is also there to support you.

We evaluate the joint quality in mechanical joining, support you by applying numerical modeling procedures and also assess technical feasibility.

The Böllhoff in-house trainings

Are you looking for hands-on machine presentations and trainings in a modern training centre?

Our training concept has a strong practical focus and obtained knowledge can easily be transferred to your work environment.

That is how we stand out. Our trainers are renowned and experienced experts who are happy to introduce you to the up-to-date practice of our modern joining systems.

This is what you can expect:

- Machine presentations on real RIVSET® systems
- Training on a robot cell
- Theory and practice in an informative and inspiring combination
- A relaxed and at the same time intense training atmosphere with small groups and plenty of time to answer individual questions and talk about specific aspects

At our training centre, you find ideal conditions for maximum learning success.

We offer specialised trainings for equipment manufacturers, service personnel and experts.



After Sales Service

Our full-service in detail:

- Start-up of the systems
- External repairs of systems
- On-site system maintenance → spare parts supply
- Production support for machine parameter adjustments
- Support with initial joint evaluation and checking the system parameters in cooperation with your quality assurance department
- Testing of the joint parameter at real parts on site “Joint-Commissioning”
- Assistance with preparing maintenance concepts and TPM schedules
- Repair and compliants management
- Start-up schedule testing
- Remote servicing on request
- Spare parts management
- Tele-service
- 24/7 hotline

Repair centre

In the unlikely event that our tools do need repair, you can resort to our Repair Centre for:

- Evaluation of defective/damaged products
- Cost estimates
- Scheduling and coordination of repair
- Provision of replacement and exchange equipment
- Repair with subsequent function test
- Repair reports
- Assembly and commissioning of repaired equipment
- Generation of repair and maintenance packages







Böllhoff International with companies in:

Argentina
Austria
Brazil
Canada
China
Czechia
France
Germany
Hungary
India
Italy
Japan
Mexico
Poland
Romania
Russia
Slovakia
South Korea
Spain
Switzerland
Thailand
Turkey
United Kingdom
USA

Apart from these 24 countries, Böllhoff supports its international customers in other important industrial markets in close partnership with agents and dealers.

Böllhoff Group
Please find your local contact on www.boellhoff.com
or contact us under fasteningtechnology@boellhoff.com

