



Lightweight construction

Efficient joint solutions for lightweight construction

B'OLLHOFF

Böllhoff – your expert in lightweight construction



Lightweight construction ...



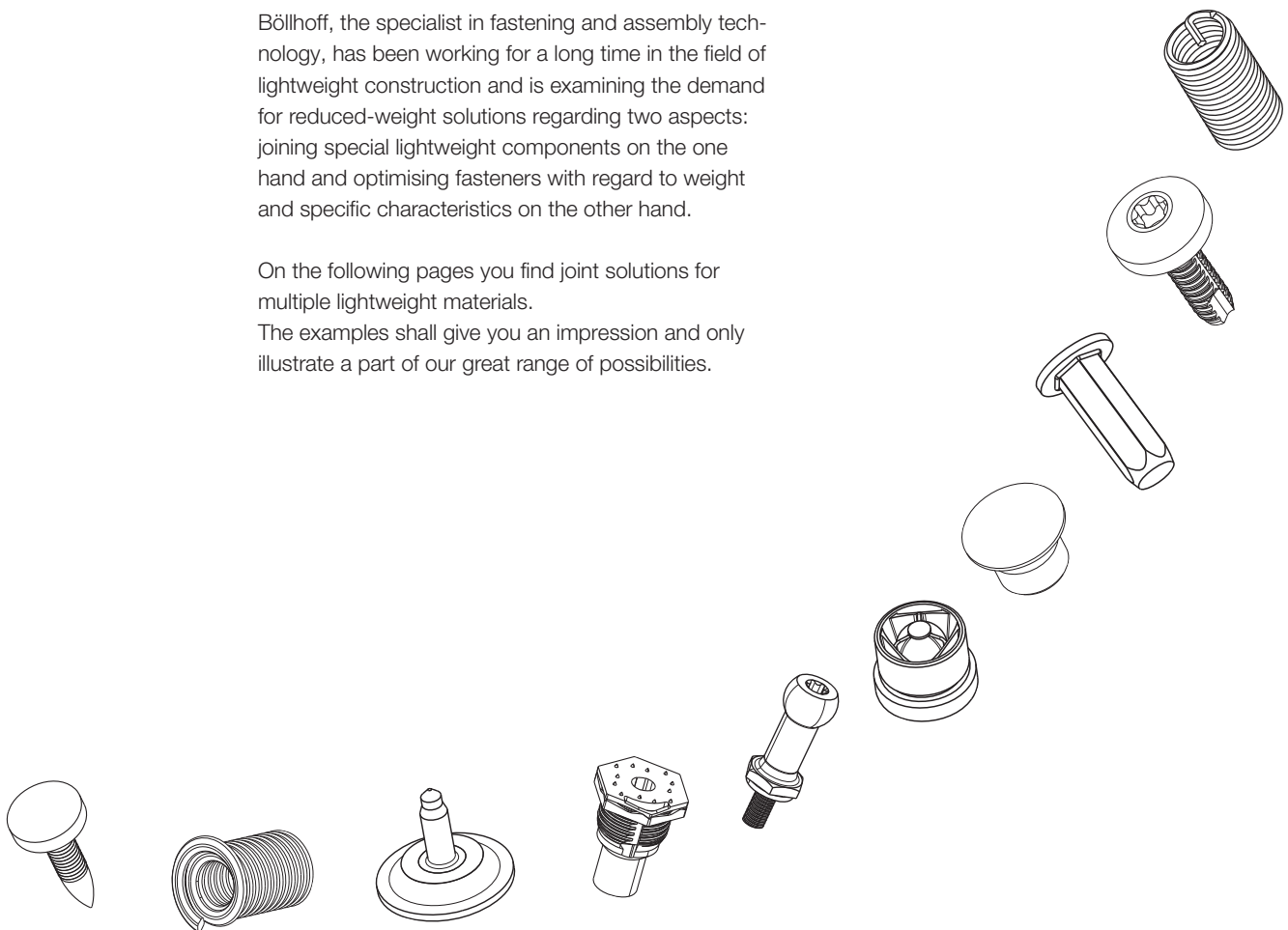
... lighter with innovative fasteners

Today's challenges such as source reduction, energy and material efficiency as well as CO₂ emissions reduction are directly intertwined with lightweight construction. Lightweight construction plays a key role with great potential for various branches of industry.

Böllhoff, the specialist in fastening and assembly technology, has been working for a long time in the field of lightweight construction and is examining the demand for reduced-weight solutions regarding two aspects: joining special lightweight components on the one hand and optimising fasteners with regard to weight and specific characteristics on the other hand.

On the following pages you find joint solutions for multiple lightweight materials.

The examples shall give you an impression and only illustrate a part of our great range of possibilities.



Your business and for lightweight



Strong thread?

HELICOIL® Thread inserts for thread reinforcement in lightweight materials.



Thin-walled components?

RIVKLE® The solution for fastening a high-strength nut or stud thread to a thin-walled component.



Threads in plastics?

AMTEC® Metal inserts for thread reinforcement of plastic parts.



Easy compensation of tolerances?

FLEXITOL® Systems for compensation of production tolerances.



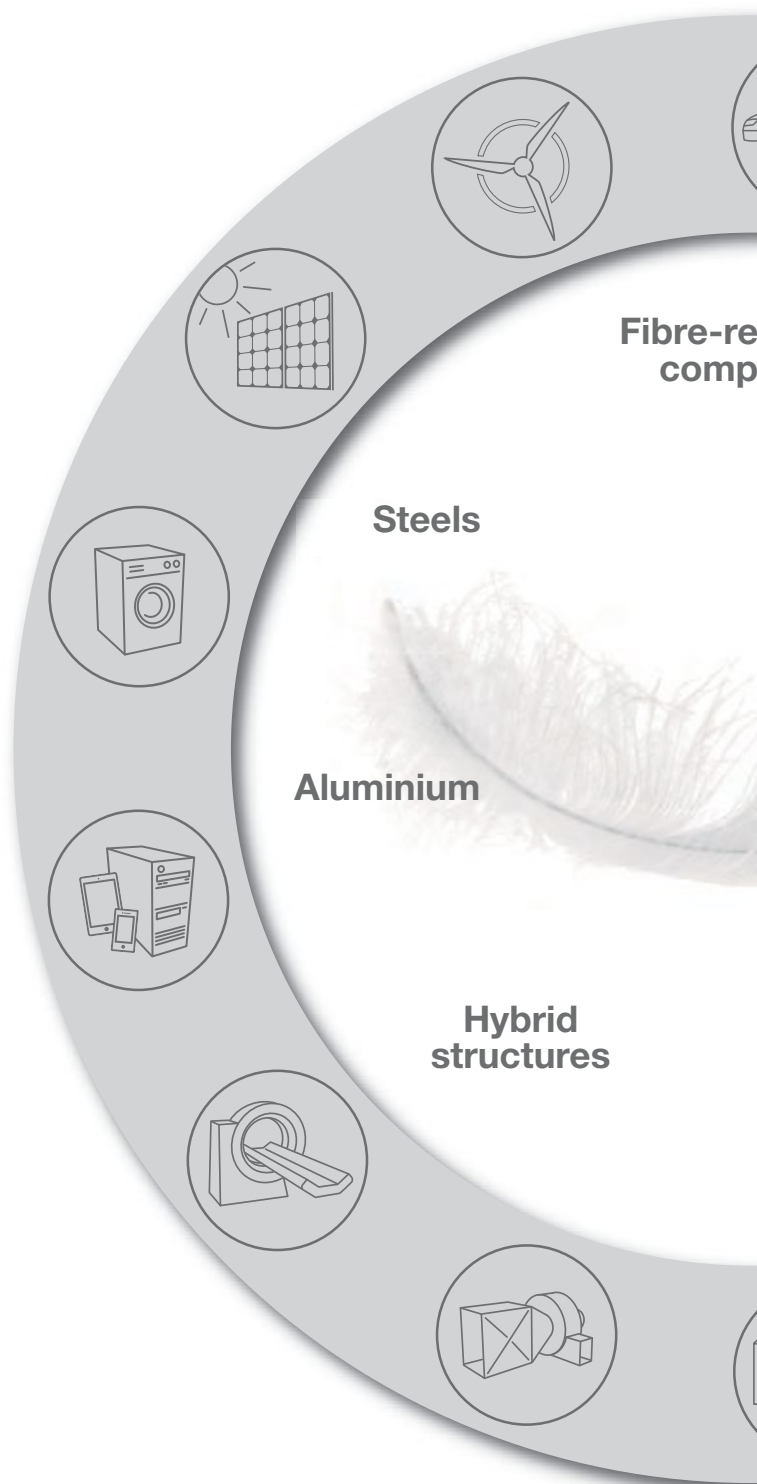
Snapping and decoupling?

SNAPLOC® Vibration- and noise-decoupling fastening system.

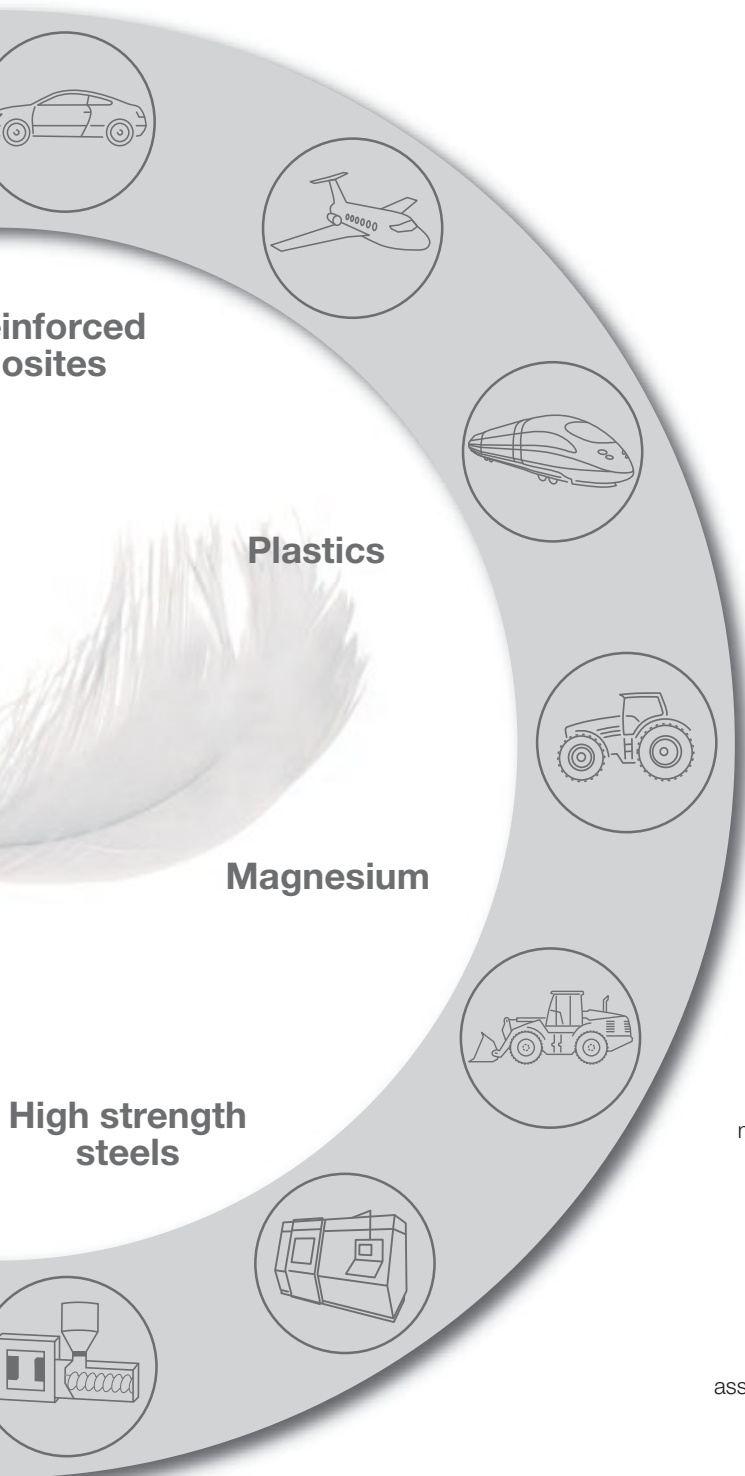


Easy inmoulding?

IMTEC® Moulded thread inserts for plastics.



our joint solutions constructions



Just in case?

TEPRO® High-precision technical moulded parts and components.



Direct screw-fitting?

TEPRO® K' in K' (plastic in plastic)
Screws and screw driving systems as a plastic fastening solution.



High-speed joining?

RIVTAC® The innovative joining process for mixed, multiple-layer and hybrid joints.



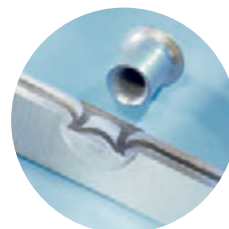
Easy bonding?

Quick and process-reliable bonding of fastening elements with light-curing adhesives.



Joining for all purposes?

RIVSET® High-strength joining of steels, aluminium and plastics without loss of performance.



Assembly of fasteners?

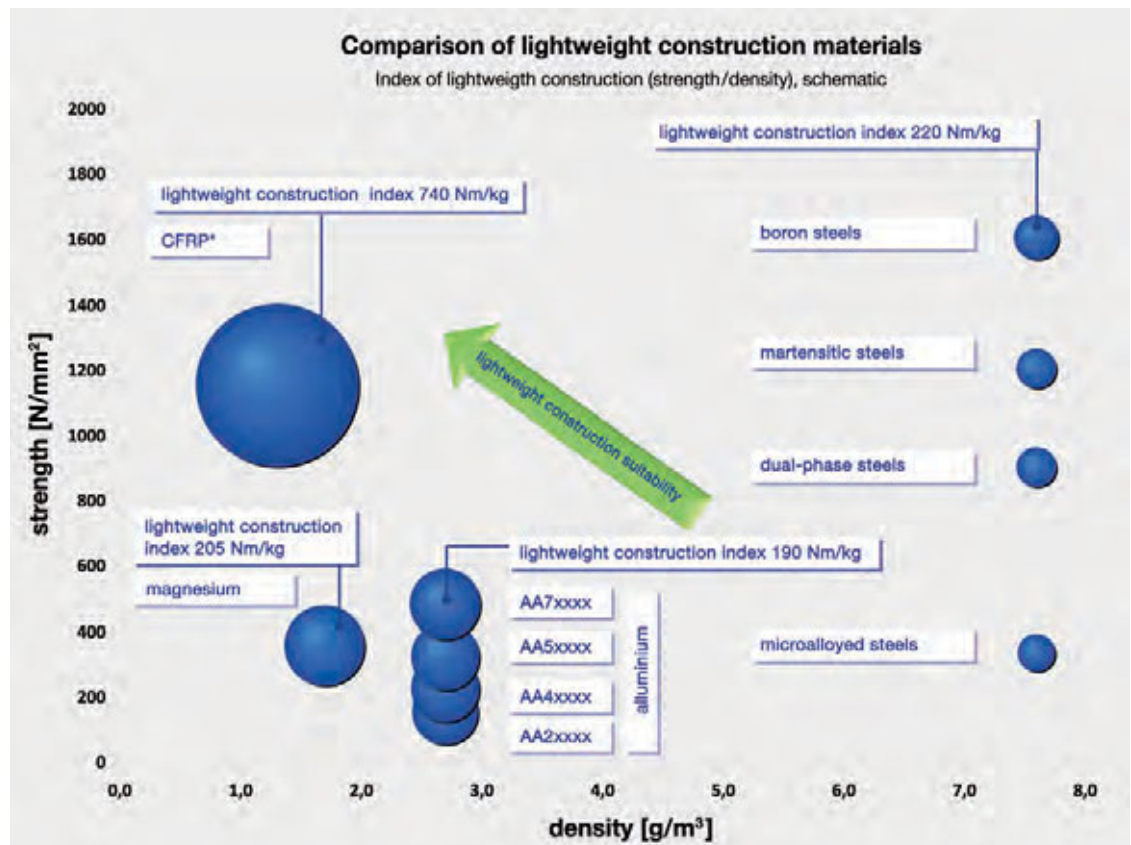
As the leading system supplier in fastening and assembly technology, we also supply the matching assembly solutions for the fasteners.



Over the past years, the relevance of lightweight structures in modern industry has considerably increased. Apart from classic lightweight materials such as higher-strength and super high-strength steel, titanium, aluminium, magnesium and ceramics, a broad and constantly growing range of continuous fibre-reinforced and textile reinforced composite materials with polymeric, metallic or ceramic matrix has emerged in the meantime.

Those lightweight materials in multi-material, hybrid or homogeneous construction are more and more being shifted to the focus of the automotive industry, aerospace industry, rail vehicle technology, etc. The growth potential for future-oriented materials is thus correspondingly high.

The following figure illustrates the lightweight potential of different materials indicating their strength, density, relative material costs and lightweight index.



Legend: ■ *CFRP strength in tensile direction ■ Circle sizes: relative material costs

For a successful employ of new materials and innovative construction principles, all possibilities for optimisation have to be exploited. From a holistic point of view, lightweight concepts are best possible compromises between function requirements, economic general conditions and production-related possibilities.

Joining operations between similar and dissimilar materials are of great importance here.

With this in view, we want to contribute our know-how in the fastening and assembly technology.

Modern materials – Steels ...



Steel, still the basis material in many modern industries, is currently changing. There is a trend toward higher- and high-strength steels corresponding to the generally growing requirements. Strengths of boron-manganese steels, for example, are increasing to 1,400 MPa and more.

Compared to conventional alloys, new steels with high strengths allow reduced-weight, secure and more thin-walled constructions.

There is much more potential for lightweight construction in steel and new alloys yet to be discovered.

... with an example of our joint solutions:

RIVSET® High-strength joints without loss of performance

The joining parts are joined with a semitubular rivet in one step: without pre-punching in a low-noise, low-emission process. The result is a form- and force-closed joint. The rivet punches through the top material layers and is spread out in a die in the bottom layer. Since the bottom layer is not punched through, a gas- and liquid-tight, punctual joint is formed.

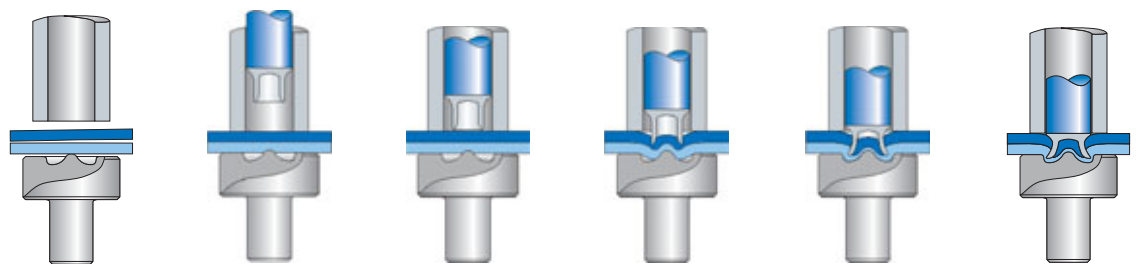
The advantages are most obvious: The joint is high-strength, can be visually inspected and reproduced. RIVSET® self-pierce rivets are exclusively manufactured

at Böllhoff production plants. They are subject to most stringent quality checks in every single production step. This is the only way for Böllhoff to satisfy the high customer requirements.

The product range of RIVSET® self-pierce riveting systems comprises different manual systems as well as systems for automated production designed for diverse fields of application and adaptable to the specific production environment.

Your advantages – an overview:

- Modular
- Application-oriented
- Integration into production lines



RIVSET® self-pierce riveting

General application examples of **RIVSET®**



Automotive industrie
Vehicle structure, components



Sheet metal processing



White goods



From 1990 to 2012, the average share of aluminium in cars, for example, has almost tripled from 50 to 140 kg. Apart from low weight, high specific stiffness and strength, corrosion resistance and conductivity, very good processability characteristics have a main part in this development. Moreover, aluminium is available in a very broad product range. It is perfectly suitable to be

rolled into sheets or thin foil, pulled into filigree wires or pressed into complex profiles. Aluminium is also particularly well suited for casting. Aluminium alloys are and will continue to be important materials for lightweight construction.

... with an example of our joint solutions:



RIVKLE® Threads in thin-walled components

RIVKLE® blind rivet nuts and studs are the most versatile solution for fastening high-strength threads to components when tapped threads are not possible due to small wall thicknesses. Blind rivet nuts are usually installed “blindly”, that is without counter pressure, and can therefore also be set at points of one-sided accessibility such as hollow sections. Blind rivet fasteners can be used for all metallic materials, plastics and fibre composites.

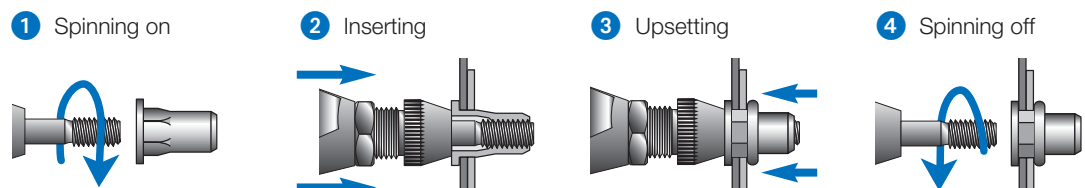
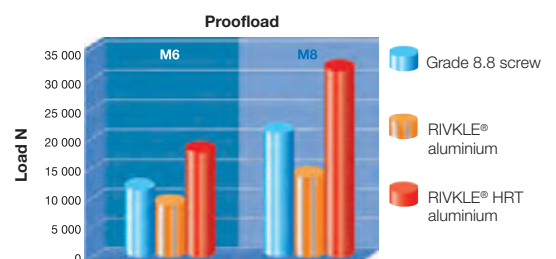
High-strength aluminium blind rivet nuts

The HRT process (High-Resistance Thread) resulted from the further development of the RIVKLE® technology.

With respect to lightweight construction, this also produced high-strength aluminium blind rivet nuts. The aluminium designs comply with the strength requirements for class 8.8 screws (ISO 898-1) and are employed in applications requiring high-strength aluminium blind fastening elements. The mechanical properties comply with property class 8 (ISO 898-2).

Your advantages – an overview:

- Low weight
- High corrosion resistance / no contact corrosion
- Unrestricted recycling in aluminium components (homogeneous use)



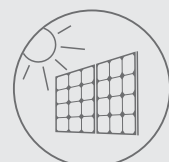
General application examples of RIVKLE®



Automotive industry
Body structure, fastening of frontend,
fastening of door ...

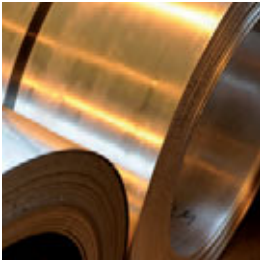


Rail technology
Air-conditioning systems,
covers ...



Solar technology
Fastening of photovoltaic,
solar heating

Modern materials – Magnesium ...



With a density of 1.74 g/cm³, magnesium is only two thirds the weight of aluminium. It is thus the most lightweight metal used in series production in the automotive industry. As another plus, the availability of magnesium is practically unlimited. It can be processed as sheet, extruded into strands or be easily cast from melt.

Magnesium alloy components are still today used particularly in cases where every gram counts but concessions with respect to strength can hardly be made — as is the case in the aerospace industry.

... with an example of our joint solutions:



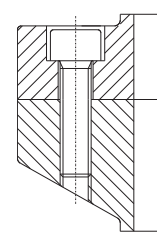
HELICOIL® Thread inserts for high-strength fastenings

HELICOIL® Plus thread inserts leave the engineer a relatively free choice of materials and material thicknesses. With a maximum strength thanks to thread reinforcement, HELICOIL® Plus meets the current trend toward lightweight construction using magnesium requiring only minimum space. Due to a reduced number of joints, reduced screw dimensions, less material, reduced installation space and weight at equal or higher requirements, HELICOIL® Plus also contributes to cost reduction.

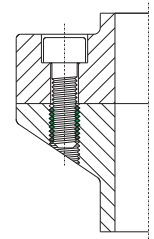
If materials are used, which are particularly susceptible to corrosion, such as magnesium, HELICOIL® Plus is employed as a special stainless steel version with special coatings, hard-coated high-strength aluminium or bronze. Contact corrosion is therefore impossible.

Your advantages – an overview:

- Corrosion- and heat-resistant
- Wear-free
- Rejects recovery



without HELICOIL®



with HELICOIL®

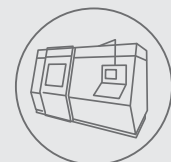
General application examples of HELICOIL®



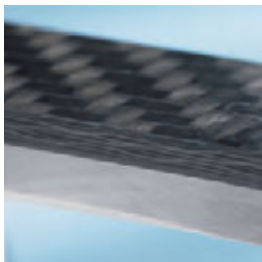
Automotive industry
Gear housing,
engine and aggregates ...



Aerospace
Satellite technology,
aero engines ...



Mechanical and plant engineering
Printing machines ...



The metal/plastics composite technology is also referred to hybrid technology. The positive characteristics of plastics and steel are specifically combined in hybrid components. Steel has a high elastic modulus and strength. Plastics are mainly used due to their low weight.

Hybrid structures have a higher lightweight potential and energy consumption capacity than sheet components.

... with an example of our joint solutions:



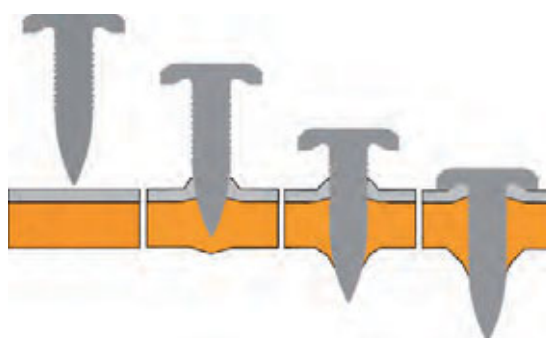
RIVTAC® Tack setting

New materials and material combinations ask for correspondingly innovative fastening technologies. Böllhoff has added a future-oriented joining technology to its product range: RIVTAC® tack setting.

In this mechanical joining process, a nail-like auxiliary joining part is accelerated to high speed and driven into the not pre-punched joining parts. The ogival point of the tack displaces the material without forming punchings. For this method, the joining parts must in any case be sufficiently stiff. The required systems for automated tack setting in robot-controlled systems have already been developed and first uses in series have been realised in the automotive industry. High-strength parts and profiles with a strength above 1,000 MPa as well as multiple-layer joints can also be joined without loss of performance — still providing the usual particularly good strength characteristics.

Procedure

1. Positioning
2. Entering
3. Penetration
4. Bracing



Your advantages – an overview:

- Joining without pre-punching in case of one-sided accessibility
- Reduction of joining and cycle times to a minimum
- Flexible application for mixed joints, multiple-layer joints and hybrid joints



RIVTAC® for joining aluminium, steel and fiber-reinforced composites also in composite construction without pre-punching.

Source: EDAG Fulda

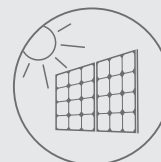
General application examples of RIVTAC®



Automotive industry
Joints of aluminium, steel and fibre-reinforced composites – multiple-layer ...



Wind industry



Solar technology
Corner joints of solar collectors ...

Modern materials – Fibre composites ...



Fibre composites usually consist of two components: an embedding matrix and reinforcing fibres. The advantage is, thanks to the mutual interaction of both components, that the material can have superior properties than the individual components. Practical use shows, compared to similar steel or aluminium solutions, particularly by employing CFRP fibre com-

posite constructions, that weight reductions from 30 to 60 % can be achieved. Due to requirements such as low weight and mechanical strength, it makes sense to use glass-fibre and carbon fibre reinforced plastics in technical fields where lightweight requirements apply.

... with an example of our joint solutions:

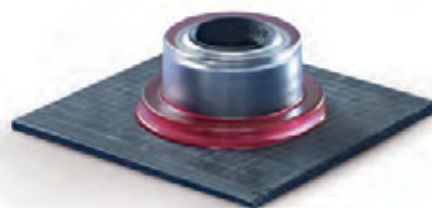
ONSERT® Quick and process-reliable bonding

Fastening elements made of transparent/translucent plastics with or without metallic thread reinforcements can be fixed using light-curing adhesive. For applications where flat connections are required, adhesive domes can be produced in different variations such as with internal thread, stud thread, ball stud or as snap connections. It can be employed whenever welding is technically impossible, the high heat input causes problems, holes or openings in the components are not possible or, as is the case with CFRP components, problematic or highest optical requirements are to be fulfilled.

Suitable light sources have been developed for the processing concept. The specially developed curing lamps on LED basis can be integrated into hand-held battery devices as well as into fully automatic systems with robot connection so that we can offer you a tailor-made processing means according to your specific requirements.

Your advantages – an overview:

- No notches or openings (customer component)
- Short curing times (< 5 seconds)
- No delamination
- No corrosion
- Strong joint immediately after exposure (no post-crosslinking)



General application examples of ONSERT®



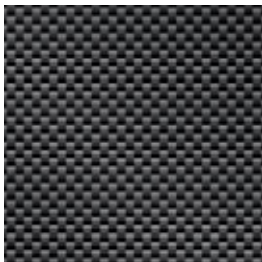
Automotive industry
Panels, covers, vehicle structures ...



Aerospace
Panels, covers ...



White goods
Panels, covers ...



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... with an example of our joint solutions:

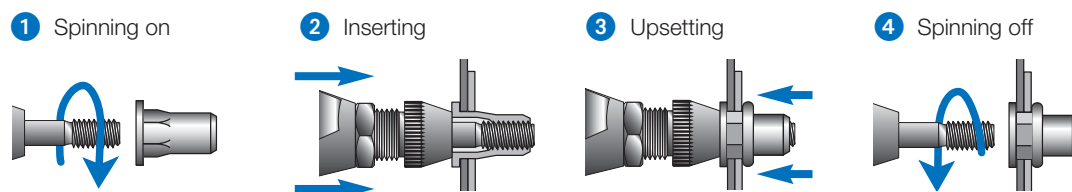
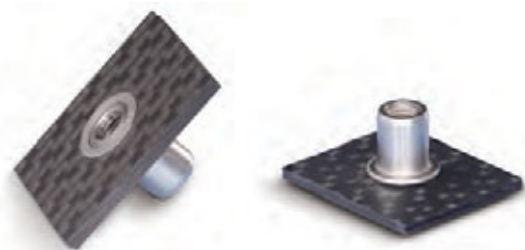
RIVKLE® Aero Two fasteners in one

Surely you know this situation: When under certain or extreme load, screwings tend to loosen. Load can be e.g. vibration, alternating load or general kinetic energy to be absorbed. In many applications, such as for the structure connection of the windscreen and door hinges in helicopters, precautions must be taken to prevent accidental loosening. As a specialist in fastening and assembly technology, we offer you RIVKLE® aero blind rivet nuts for those applications. An efficient combination of two fasteners — to be on the safe side. RIVKLE® aero is a combination of a high-strength stain-

less steel blind rivet nut and a HELICOIL® Screwlock. These two perfectly matching fasteners provide you with considerable benefits for screwed connections on thin-walled components with high mechanical requirements. Due to the polygonal-shaped thread of the HELICOIL® Screwlock thread insert, the screw is locked. These threads have a locking effect on the flanks of the screw or bolt to be screwed in. As a result, there is a highly elastically resilient frictional locking so that the screw is locked to prevent self-unscrewing.

Your advantages – an overview:

- Efficient and permanent screw locking
- High corrosion resistance
- High resistance against temperature change



General application examples of RIVKLE®



Aerospace
Structure connecting windscreen,
door hinges of helicopter ...



Automotive industry



Rail technology

Modern materials – Plastics ...



The modern world of lightweight construction is not complete without them: plastics. They are conquering more and more fields of use. Due to the high flexibility for processing and component design, metallic materials are increasingly replaced with plastics. Apart from conventional plastics such as polyamide, it is mainly fibre-reinforced plastics showing great lightweight potential.

It was not only the consistent further development of plastics which contributed to this success, but also the improving possibility to predict the behaviour of a plastic component under load by means of computer calculation.

In this field we are also looking forward to exciting developments in the lightweight construction sector.

... with an example of our joint solutions:

FLEXITOL® Systems for tolerance compensation

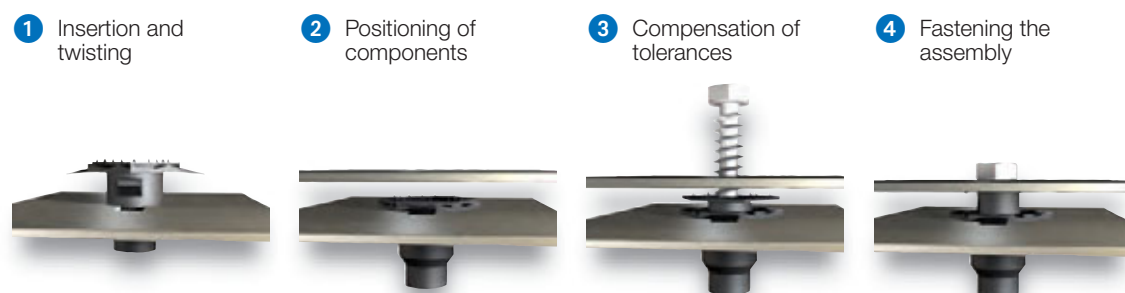
Production processes based on modular construction are increasingly employed. Individual components are supplied to the producer of the end product where they only have to be assembled. To ensure flawless series production certain tolerances are assumed. The automatic tolerance compensation system FLEXITOL® provides a technically and economically optimised solution. The FLEXITOL® plastic variant consists of a plastic adjustment element and a plastic fastening element

and is supplied as a pre-assembled subassembly. The subassembly is self-tapping and is to be screwed into a mounting hole in the plastic receiving part. The fastening screw can be a self-tapping (ideal) or metric metal screw. A good example for a fastener which is suitable for lightweight construction under two aspects: the use with plastic components on the one hand and the optimisation of the dead weight on the other.

Your advantages – an overview:

- Cost reduction upon component production
- High performance reliability
- Easy integration into customer component

Method of installation illustrated by the bayonet-type



General application examples of FLEXITOL®



Automotive industry
Fastening of frontend,
front- and rear light fastening ...



Mechanical and plant engineering
Tension-free assembly of complex machine housings ...



Construction machine
Align of cabin panelling ...



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... with an example of our joint solutions:

SNAPLOC® Decoupling plug-in connection

SNAPLOC® is a two-piece system consisting of a ball stud and a coupling. The coupling can be pushed into the provided frame at the bottom of a component and held there form-closedly, for example. The ball stud can be screwed in. Joining by snapping on and removing by pulling ensure an ideal fit.

SNAPLOC® is based on the simple principle of a snap connection. Inside the coupling there is a ball socket which the ball stud as the counterpart can snap into. The joint can be repeatedly opened and closed. What is

special about SNAPLOC®? The joint ensures tolerance compensation as well as decoupling of vibrations and noise. There are diverse ways to fasten the coupling or stud. The SNAPLOC® ball stud can be supplied as TEPRO® K' in K' version, for example. Due to the self-tapping plastic thread, those ball studs can be directly screwed into plastic components. A joint solution with great potential to save weight and achieve short assembly times.

Your advantages – an overview:

- Easy installation and dismantling
- Vibration and noise decoupling
- Easy integration into customer part

Cross section of the coupling:



Detached connector



Attached connector



General application examples of SNAPLOC®



Automotive industry
Engine cover, fastening of air filter,
fastening of front- and rearlights ...



Mechanical and plant engineering
Covering soot filter ...



Medical technology
Maintenance flaps at
dialysis machine ...

Modern materials – Plastics ...



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... with an example of our joint solutions:



TEPRO® K' in K' Plastic screwing solutions for plastics

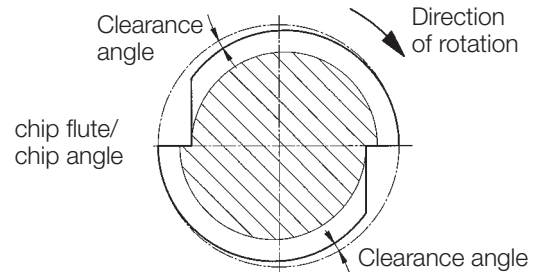


A further variant to support diverse lightweight concepts are our plastic screwing solutions for plastics. With specially developed thread profiles, they allow specially tailored solutions for force- and form-closed fastenings which are self-locking, self-forming, adjustable and tolerance-compensating. For K' in K' plastic screwings, thread geometry is of decisive importance since K' in K' threads have to self-form or self-tap a "holding thread" into the pre-fabricated tolerated cylindrical drill holes. For optimal tapping and forming without obstructing the thread flanks, there is a continuous longitudinal chip flute. During

screwing, the resulting chip angle and adjacent clearance angle allow the penetration of the base material with a minimum driving torque. The geometry achieves a small driving torque during screw-fastening and prevents the screw joint from loosening in case of dynamic load. Contrary to the classic thread locking for metallic screwings through elongation and surface pressure, with the TEPRO® K' in K' screw joint principle the thread is locked because the plastic base part relaxes in radial stress direction toward the centre around the screw profile.

Your advantages – an overview:

- High reverse-lock
- Self-forming
- All-plastic fastening solution reduces component weight
- Balancing of tolerances by adjustability



K' in K' is a registered trademark of the Böllhoff Company.

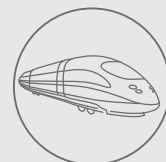
General application examples of TEPRO® K' in K'



Automotive industry
Fastening of instrument panel, screw joint of dash board, fastening of lighting ...



Electrical industry
Switch control boxes ...



Rail technology



Our dialogue with you is the thread of our working process. Thanks to smart innovation management and intensively working on the realisation of your wishes we develop tailor-made solutions for lightweight construction. From A to Z are we the partner for your projects — from the first concept to production.

Get to know us personally and find out all about the difference cooperation with us can make!

Quality

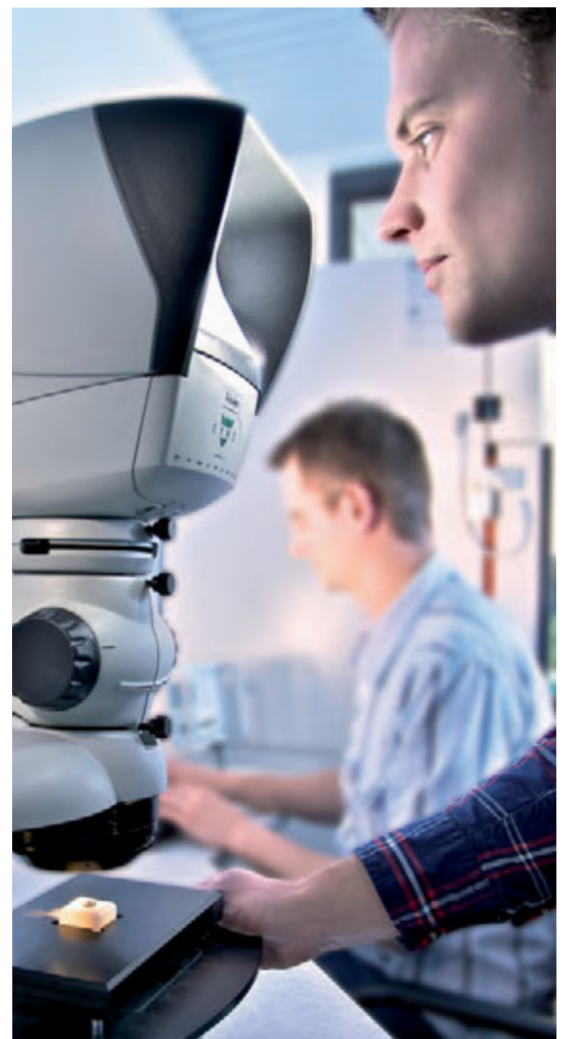
Our focus is always on sophisticated production processes and modern measurement and monitoring technology. Good quality is no coincidence, but the result of systematic planning and implementation.

You can count on the support through our certified laboratory. We employ modern equipment and competent testing experts to realise mechanical-technological, physical, chemical and metallographic tests.

For more than 137 years, the flexibility and speed of an independent family business have been among the main characteristics of the Böllhoff Group. This independence will also set the pace for the future development of the company and its products especially for the lightweight construction. Experience creates confidence. Values create connections – joining together.

Your advantages – an overview:

- Certified quality management system according to ISO/TS 16949
- Certified environmental management according to ISO 14001
- Accredited in-house test laboratory according to DIN EN ISO/IEC 17025
- Everything from a single source: products, systems and logistics



Wherever you need us



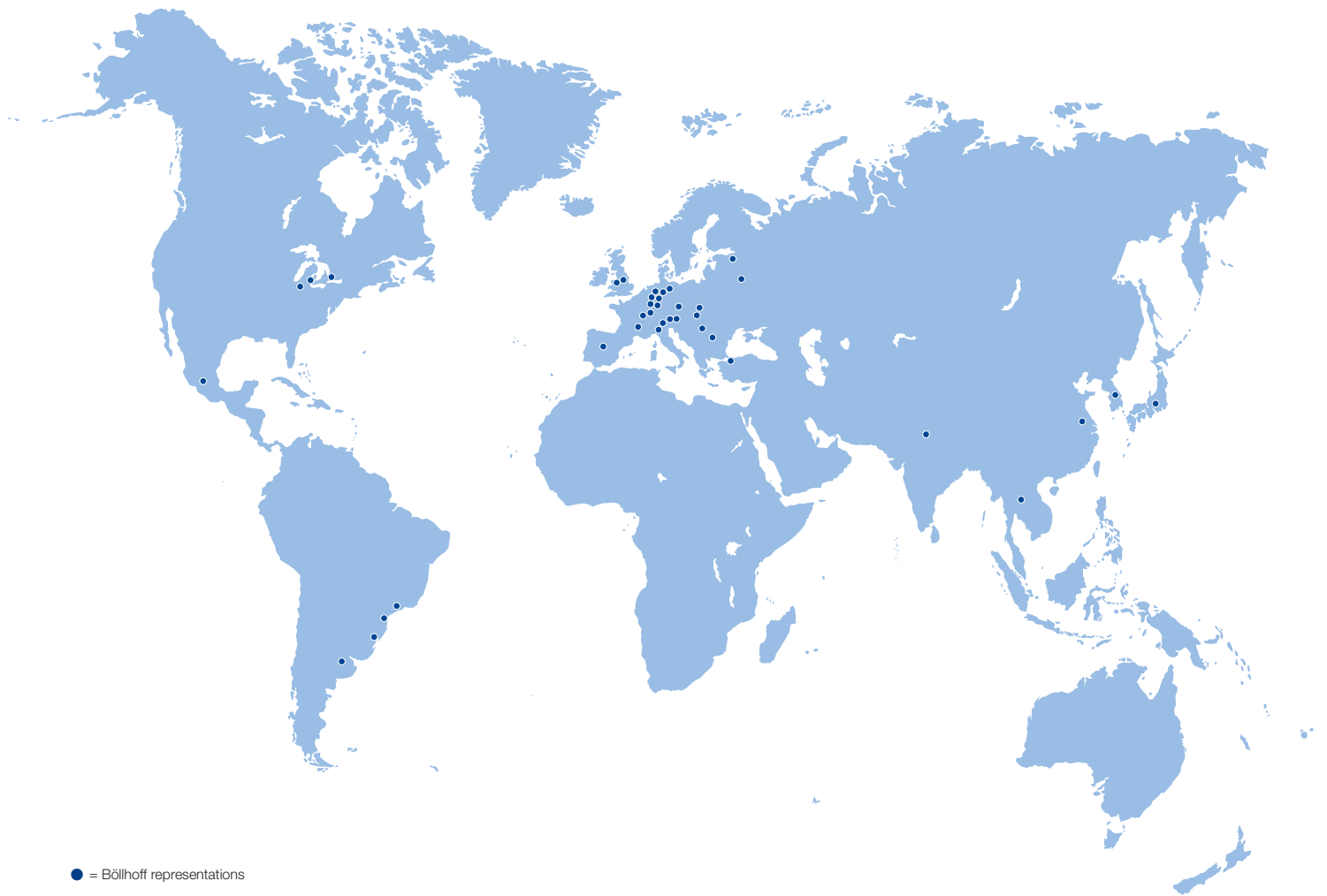
Innovative ability and technical potential are becoming increasingly important as the basis for chances of success.

You have a personal contact person who will be glad to discuss your wishes and requirements. So you save precious time.

Our expertise and experience reflect in a worldwide distribution network. The headquarters of this family business, with four generations of history, is located in Bielefeld, Germany. Apart from that, Böllhoff 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 other important industry markets.

Passion for successful joining! This company credo is the motivation for our everyday work at Böllhoff. On the one hand, there is our product range – the whole world of fastening technology. On the other hand, "Passion for successful joining!" puts the focus on us as persons. Persons who, with their personal internal and external connections, create the basis for today's and tomorrow's success. Courage, fairness and loyalty are the cornerstones of our corporate culture.

Your
Michael W. Böllhoff and Wilhelm A. Böllhoff



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**

