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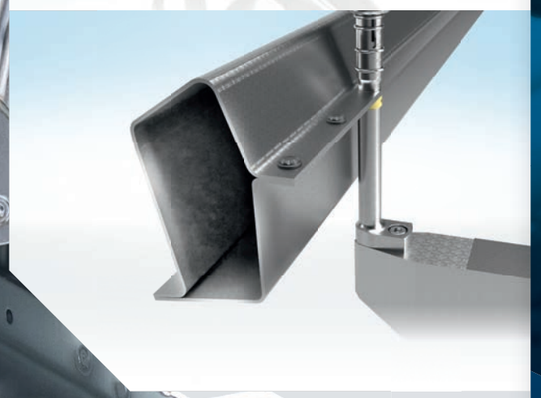
ARNOLD®
BlueFastening Systems



Flowweld®

Excellent fastening performance for difficult combinations of materials

- Innovative fastener design
- High-strength fastening in tensile shearing and cross tension
- No upstream processes
- Joining lightweight materials to high-strength metals
- Fully automated and reliable system technology

12 kN

Shearing strength

Fastenings made with elements consisting of with shearing strength of up to 12.0 kN and cross tension up to 8.0 kN.

Flowweld® withstands very high mechanical loads. When combined with structural adhesives performance is enhanced even further.

The Flowweld® effect

High shearing and cross tension strength

↘ Flowweld® creates a sufficiently large firmly bonded fastening area between the friction element and the base plate. A form-fit is produced between the head of the friction element and the covering material.

No upstream processes

↘ No predrilling or cleaning at the joint position. Flowweld® requires no preparatory work steps.

Joins lightweight materials to high-strength metals

↘ Friction element welding makes it possible to join new combinations of materials which cannot be joined using conventional methods.

Fully automated and reliable system technology

↘ User-friendly software controls the tool with its own feeder unit to join the friction element.

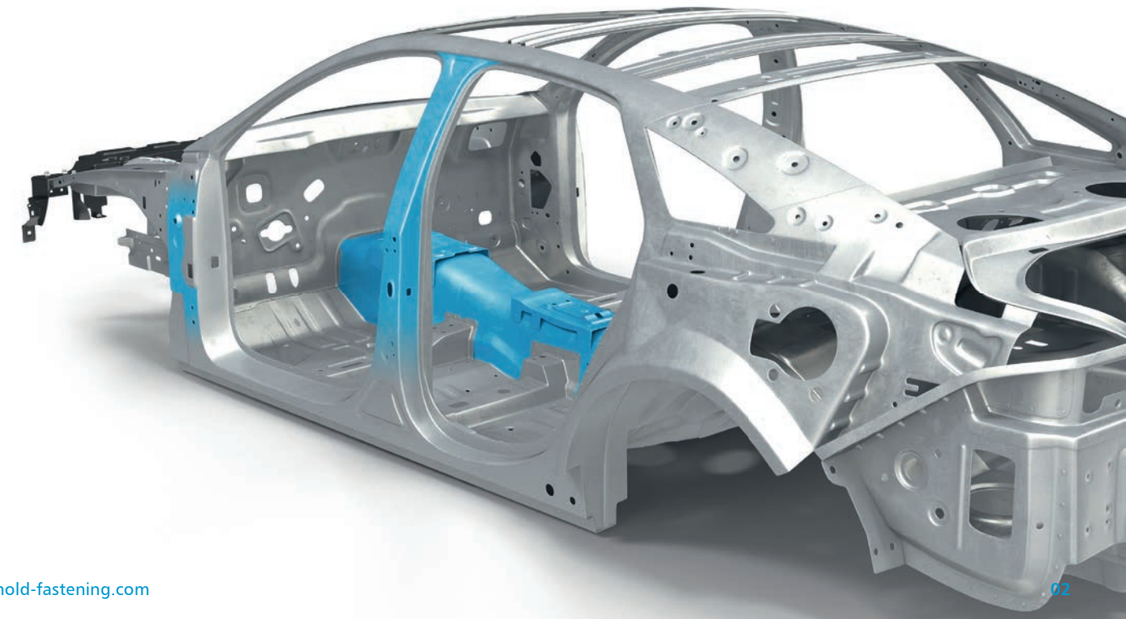
ARNOLD BlueFastening Systems

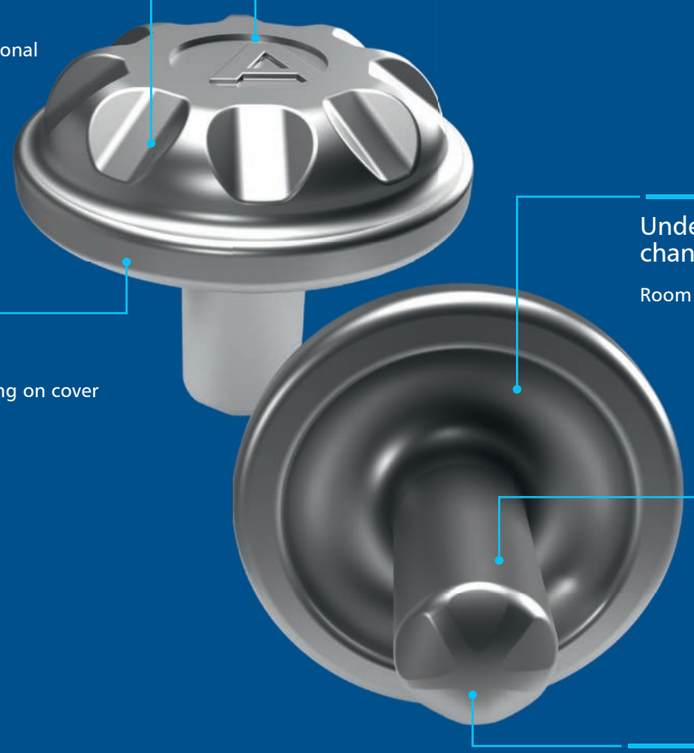
Flowweld®
joins lightweight metals to high-strength steel

Friction element welding supplies excellent fastening performance in difficult combinations of materials.

Friction element welding: The joining technique for extreme situations

Flowweld® – friction element welding from ARNOLD UMFORMTECHNIK starts where conventional joining processes used in the manufacture of vehicle bodies reach their limits. The joining process is distinctive for its fastening performance in difficult combinations of materials. The comprehensive system joins the fastening element securely and economically.





Intake surface

Securely positioning of the fastening element at the driving tool

Drive

Axial force and rotational speed transmission

Flange

Head setting on cover material

Underhead channelling

Room for raised material

Shaft

Material for friction welding process

Profiled tip geometry

Reliable penetration of cover material and friction on base plate

Technical data

Material	1.5525 20MnB4	**Coating**	Zink-Nickel
Strength class	10	**Weight**	2.2 g
Shaft diameter	3.5 mm	**Head height**	3.5 mm
Shaft length	5.0 mm / 7.0 mm	**Head diameter**	11.9 mm

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Technical benefits
and unique features of Flowweld®

Reliable, high-quality joining process

Flowweld®
Top Features

- Base plate thicknesses start at 0.8mm and strength classes up to 1900 MPa
- Cover material thicknesses available from 0.8 to 3.00mm with just two lengths of fastener element
- System technology designed especially for friction element welding
- Joining direction aluminum to steel
- Hybrid material combinations can be achieved with adhesive
- Achievable flange widths, min 17.0mm
- Shearing strengths up to 12.0 kN
- Cross tension strengths up to 8.0 kN

System technology designed especially for friction element welding

We developed our own system to bring the art of friction welding to perfection. The system is adapted to the geometry of the element to ensure a fast, reliable joint.

More about the system technology on pages 15 and 16

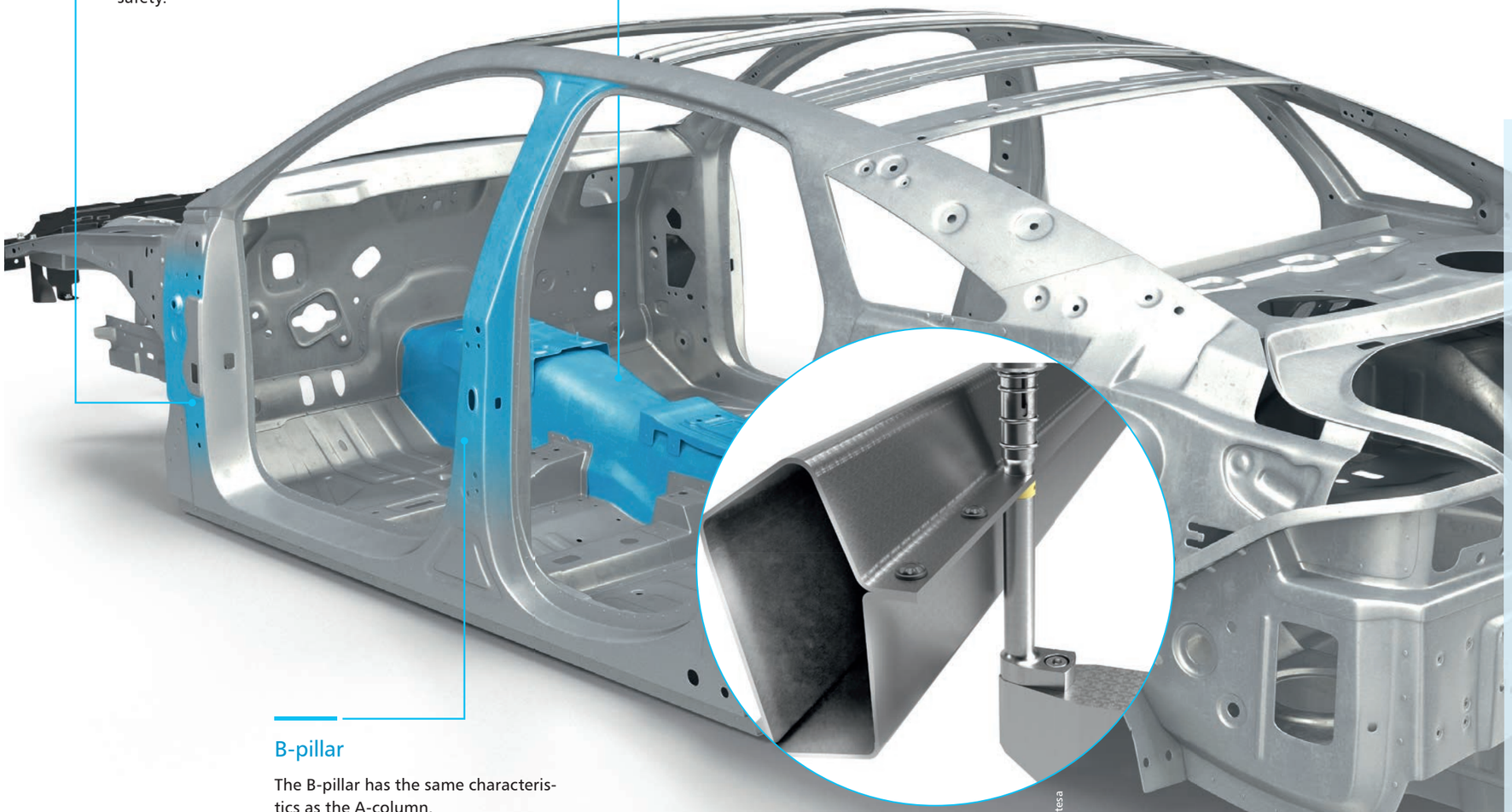
Body shop fasteners at limit ranges – fully secure with Flowweld®

A-pillar below

The aluminum outer skin is fastened to the A-pillar. The high-strength steel component remains rigid in a crash, so is important for passenger safety.

Middle tunnel

The middle tunnel connects the rear end to the front of the body. The combination of materials and the way it is shaped ensure that the underbody is rigid.



B-pillar

The B-pillar has the same characteristics as the A-column. The reduction in flange widths ensures a wide entry area.

The applications shown here are examples. In principle, the process can be used for any combination of aluminum and high-strength steel, with access from both sides.

Areas of application

The materials

- Lightweight materials for the cover material
- High strength steel for the base plate

Dimensions

Flowweld® can join minimal flange widths of 17.0 mm. Depending on the application the point-to-point distance can be selected individually.

Performance

The strength of the fastening depends on the material combination used.

For application guidelines see pages 11 and 12.

Flowweld® provides better passenger protection.

Flowweld®
How it works in four steps

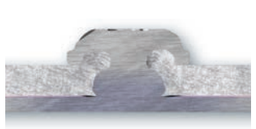
01

02

01 | Positioning
Press the components together, provide the fastening element

02 | Penetration
Penetrate and displace the cover material

03



04

03 | Friction
Remove base plate coating, warm the joint zone

04 | Compression
Compress the fastening element

Easy configuration for difficult fastenings.

Parameters of Flowweld® process

Different settings are made for each of the four steps of the process.
First, control variables, necessary to make the joint, target variables to define the end status of each step, and monitoring variables to check the joining process.

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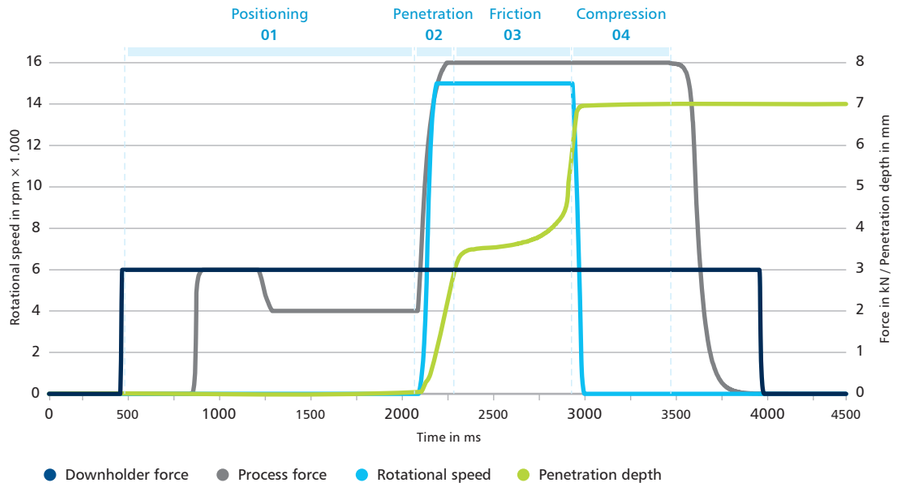
An overview of the process progression

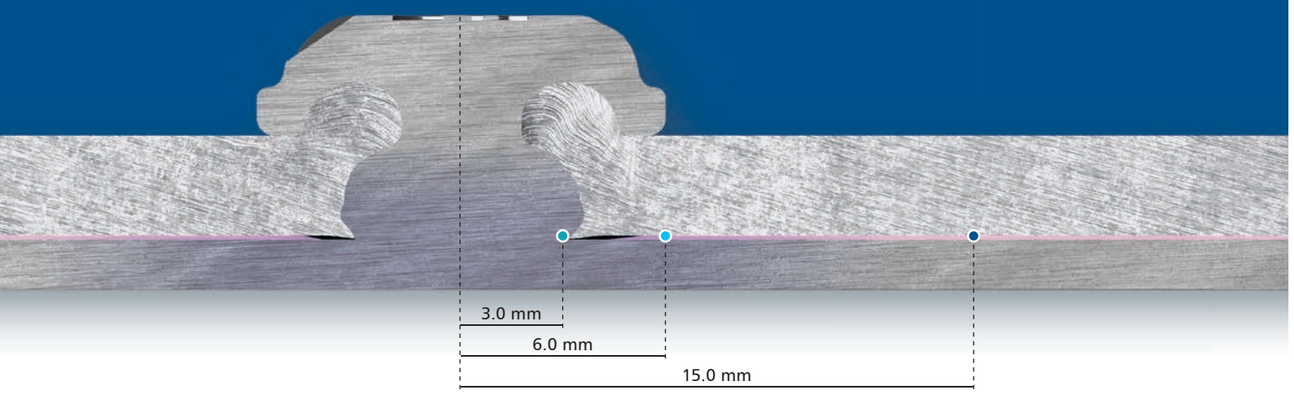


Settings for the Flowweld® process

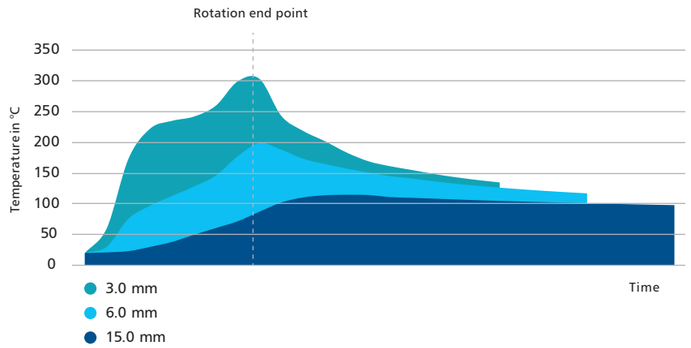
The control variables governing the downholder force, process force and rotational speed are configured for all four process steps.
The penetration depth of the fastening element can be adapted individually to the material, to act as the target and monitoring variables.

The values shown are by way of example.
The actual values required must be investigated on the original component.
The System Testing Centre offers support here. A joint investigation and series production examination will define the settings.

Temperature and heat affected zones



The image shows an example of the temperature progression during the joining process using EN AW-5754 3.00 mm cover material and a 1.5 mm 22MnB5 base plate.



Flowweld® temperature progression

The temperature in the joint zone rises sharply as the rotation to pierce the cover material begins. After a stop point, the temperature is at its maximum, as the element becomes shorter through friction. At that point rotation stops. The cooling phase then follows.

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Friction element welding compared with other mixed construction techniques

Flowweld®

Benefits

- Can be used on very high-strength steels
- No preparation required
- No base plate separation
- Joins thick base plates
- Easy to apply sealant for corrosion protection
- Uniform tool technology for various thicknesses of material combinations
- Testing concept in line with production techniques
- High tolerance against component thickness variations

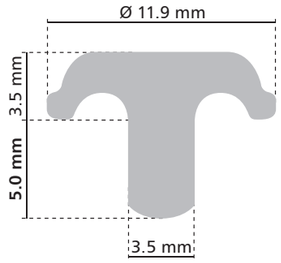
Comparison with self-piercing rivets

Unlike self-piercing rivets, Flowweld® can also create good quality mixed material fastenings with cast aluminum materials that are susceptible to cracking. As for steels, these can be thick high-strength steels. Moreover, the fastenings will be stronger. Finally, the process is very economical with adhesive because very little becomes displaced during the joining process.

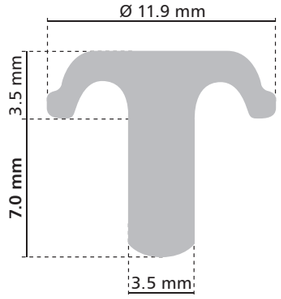
Combinability with adhesives

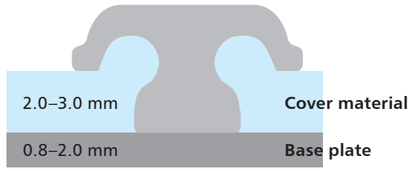
Friction element variants
A matter of size

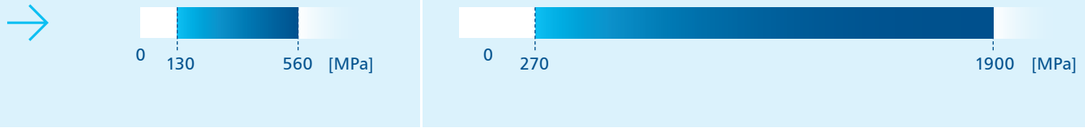
Shaft length 5.0 mm



Shaft length 7.0 mm







The right element for each application

To achieve a good friction welding fastening it is crucial to choose the right element. That choice will depend on the thickness of the cover material. To ensure that the head setting is secure, the volume of underhead channelling on the fastening elements is adapted to the material displaced.

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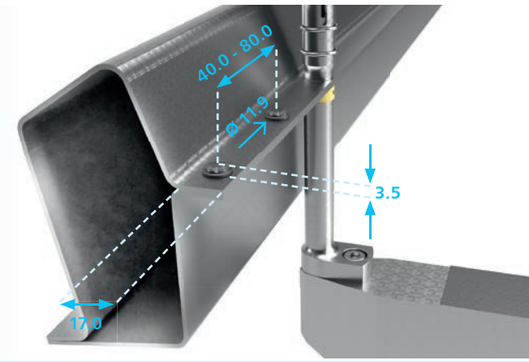
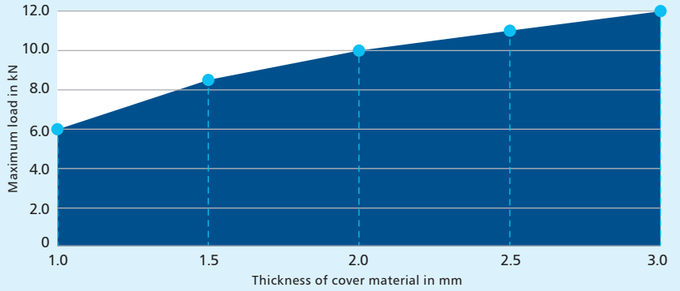
Dimension and performance of fastening

Geometry of the application

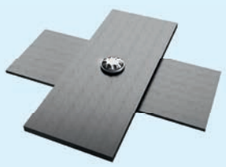
The geometry of the element head remains as the interference contour on the plate. The friction elements can be joined on flange widths from 17.00 mm. Use 40.0 to 80.0 mm as a guideline for joining point distance.
This is defined by whether adhesive is to be used, as well as the component's required fastening strength.

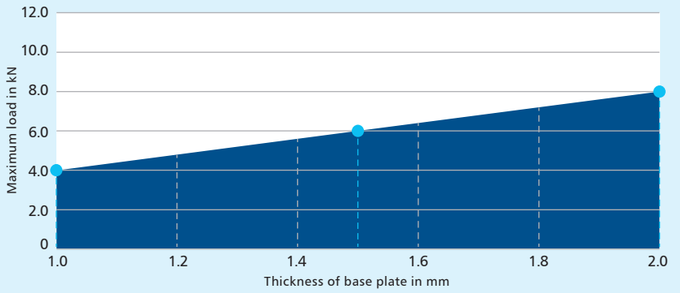


Shearing strength load
DIN EN ISO 14273



Cross-tension load
DIN EN ISO 14272





The Flowweld® System offers new opportunities for vehicle body design.

Lightweight structures are the future and Flowweld® is what connects them

40 %

That is the **proportion that the body adds to the overall weight** of a car. The car body plays a key role in moving vehicle production towards lightweight engineering.

If the joining point is accessible any lightweight material can be joined to steel.

Flowweld® joins lightweight metal components to high strength steel components. There are no limits to the steel component's strength classification. All that is needed is that the steel material can be welded. The limiting variable on the procedure is accessibility of the joining point.

If it is accessible, then any lightweight metal to steel fastenings can be made. Due to its higher specific tensile strength the use of high-strength steel is desirable.
Using less material the material combination achieves the same or even better mechanical properties.

High energy efficiency by reducing weight

For the automotive sector, energy efficiency is of extreme importance. Efficiency increases as drive technology, traction resistance and overall weight are optimised. The car body represents a major proportion of the overall weight. So saving weight is very important here. By reducing weight, combustion engine vehicles require less energy and this results in lower CO_2 emissions. And electric cars see an improvement in range per battery charge.

- Lightweight increases energy efficiency
- High strength hot-formed sheets
- Material pairings: any light metal-to-steel fastening can be made.
- Hybrid joins possible
- Outstanding mechanical properties using less material

Flowweld® the system technology

Joining tool

High parameter variations

The joining unit joins the fastener element. The hold-downholder force to press the components together, along with the rotational speed and process force for the joining process are produced by rotary and translatory drives. Different counterholder lengths can be selected to ensure accessibility depending on the application. The C-frame is designed to be very rigid to prevent bending.

Max down-holder force 4.0 kN

Max rotati-onal speed 25,000 rpm

Max process force 10.0 kN

XPegasus assembly program

User-friendly configuration

The control system is developed and manufactured by Harms & Wende, specialists in welding control systems, based in Hamburg. Their XPegasus operating software is tailored especially to what Flowweld® needs. Harms & Wende has decades of experience of networked welding control and friction welding. The Genius welding control system that is widely used in the automotive sector is the basis on which the modular Flowweld® System is built. All the parameters for the processes, elements, and monitor-ing variables are configured in the software.

Robot-assisted application

Ready-to-fit control cabinet technology

The control cabinet contains the communication system be-tween the system technology and the robot. Various interfaces can be selected for data exchange.

You can select a different hose length to minimise feed times.

Fastener element feeder

Feed unit protects the parts

The feeder has a hopper to supply the fastener elements.
The fastener elements are sorted into layers on a catch plate inside the drum and once separated are fed the joining unit by compressed air.

The ARNOLD GROUP

www.arnold-fastening.com

Wherever customers need us.

ARNOLD – this name is internationally renowned for efficient and sustainable fastening systems at the highest level.

With a foundation of many years of expertise in the production of intelligent fastening systems and very complex extruded parts, the ARNOLD GROUP has developed over a number of years into a comprehensive supplier and development partner for complex fastening systems. With our positioning of "BlueFastening Systems", this development process will continue under a united and harmonised structure. Engineering, services, fasteners and functional parts, together with feeding and processing systems, all from a single source – efficient, sustainable and international.

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