Mechanical Joining by TUCKER

Punch riveting and clinching in one system

TUCKER®

Joining technologies in the material mix of modern vehicles

Aluminium-aluminium, aluminium-steel, aluminium-magnesium-steel, steel-steel ...

Whether the automobile industry, aerospace industry or machine construction: the trend is toward lightweight construction. The materials should weigh less and less, and yet they should be high-strength and stable. Lightweight construction is especially on the rise in the automobile industry. This is, however, not a goal in and of itself, but rather a pure economic and ecological necessity. Since more and more comfort and safety are installed in our cars, the additional weight must be saved in other locations.

Increasingly, light materials such as aluminium, magnesium and fibre-reinforced plastics (FRP) are replacing the classic steel material in automobile production. At the same time, composite construction is also increasing: more and more often, different materials such as aluminium, magnesium, plastic and high-strength steels are combined together in vehicle construction. Established joining processes such as welding or soldering are quickly approaching their limits here.

Connection of the "cold type"

Although spot welding will not disappear from the automobile construction process in the foreseeable future, alternative processes have become accepted in recent years. Mechanical joining processes in particular, such as punch riveting and clinching, have surpassed spot welding in a number of aspects. With this "cold" joining technology, the material is not thermally loaded. In addition, punch riveting connections not only show a comparable static strength to conventional spot welded connections, they also have twice the service life under dynamic loads. Lastly, there is a significant cost advantage in comparison to the laser welding that is used with aluminium connections.

Connection technologies for many materials

Whether thin sheet, high-strength steel sheet of different alloys, stainless steel sheet or aluminium, whether galvanised, coated or uncoated, whether 2 or more layers – the same or different materials up to a total thickness of approx. 9 mm can be automatically joined with the mechanical joining technology. In one work step, without pre-drilling!

Applications for mechanical joining

From the vehicle underbody to the engine bonnet and boot lid through to applications in visible areas, such as on the roof.

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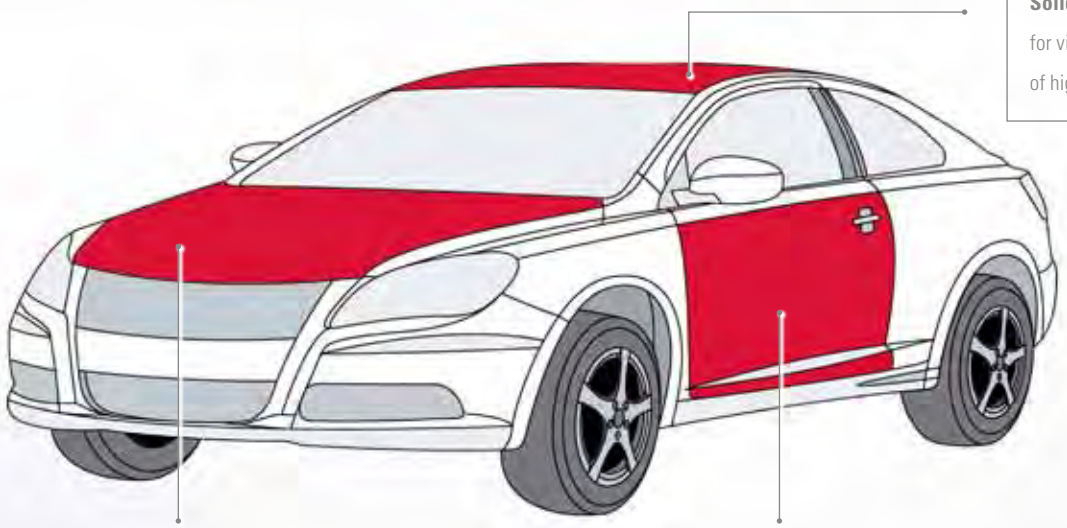
Joining without thermal loading

Punch riveting and clinching start where spot welding leaves off.

Technically perfect, economically optimised

Resilient connections from one source



Solid punch riveting
for visible areas and simultaneously of high strength.

Clinching as an economical application with no joining element in areas with low strength requirements.

Joints with a **semi-tubular punch rivet** with maximum strength for crash-relevant areas and components.

For all cases
Semi-tubular punch rivets for doors, body, underbody.
Solid punch riveting for the visible area.
Clinching for the engine bonnet and boot lid.

Daily large series application

TUCKER annually delivers several hundred punch riveting systems for manufacturing all aluminium vehicles in the automobile industry. The technology is used daily in large series applications for vehicles that use combined materials.

At all of its locations, our customers receive system operating support locally from technical experts.

Three technologies in one system

Semi-tubular punch riveting – Solid punch riveting – Clinching

System components for mechanical joining

Gripper (C-clamp with spindle), feed unit and control unit

Tucker's device system for mechanical joining has a modular design consisting of control unit, setting tool, tool carrier ("C frame") and punch rivet guide, as needed. Such a system can be set up as a robot, hand-guided or stationary system. The electric motor system and the installation-space-optimised ERC compact control box offer a full range of capabilities in a minimum amount of space.

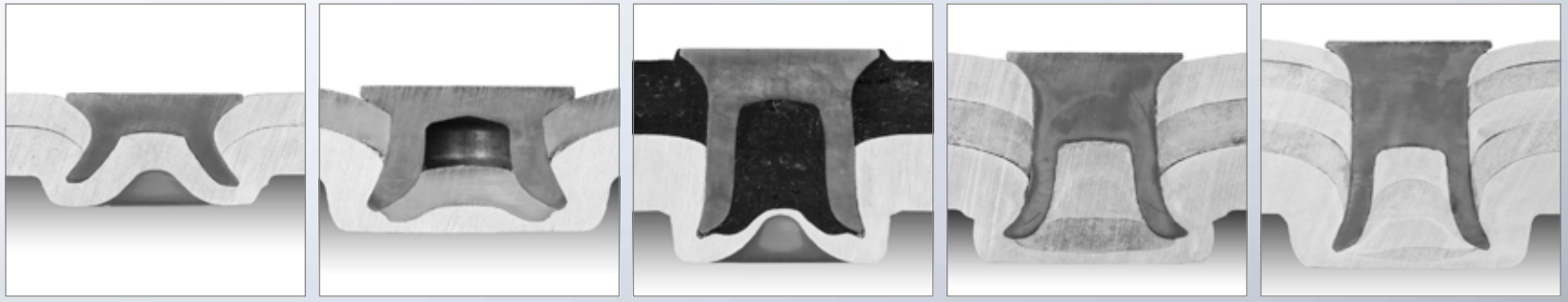
With this modular concept it is also possible to install a punch riveting system or a clinch system or vice versa with limited changeover costs. If both processes are used in one project, spare parts inventory and training expenses are greatly reduced. The programmer interface is designed the same for punch riveting as it is for clinching.

The best connection, guaranteed

The result of material sampling is the appropriate procedure. The selection of the right die plate guarantees the best connection.

The right solution even for extreme applications

Joining thick into thin, ultra-high strength material, total sheet thickness of 9 mm



Punch riveting with a semi-tubular rivet

Punch riveting, like clinching, has been common in the automobile industry for years. As with conventional riveting, the work pieces are also connected with an auxiliary joining part. The pre-boring that is required with conventional riveting is replaced with the rivet-cut process: here a die is used to press the rivet through the work pieces to be joined.

A die plate on the back side has a special die cavity to ensure the optimal formation of the joining element. The lower sheet layer is not penetrated in the process. Due to the shaping of the rivet, a interlocking connection is created.

In the automated application, the punch rivet is separated out from a bin and conveyed to the setting tool through a feed tube by means of compressed air.

A magazine can also be used for the feeding process. An application that uses a magazine provides a greater degree of freedom of access and also reduces compressed air consumption, thereby significantly reducing operating costs.

Both feed variants have been well proven in the bodywork shell where they are valued for their robust construction and highest availability.

Punch riveting with a solid rivet

Punch riveting with a solid rivet provides a level of quality that cannot be achieved with common welded connections.

Due to the fact that the solid rivet does not completely punch through the components, they undergo less deformation. That means that for critical components such as door side parts or also roof frames less effort is required in fastening the component than is the case in semi-tubular punch riveting applications. An additional advantage of the solid rivet is its "invisibility" after the finish. This is especially significant in locations where rivets are needed in a visible area.

With punch riveting using solid rivets, the die plate has a ring-shaped contour that presses into the bottom sheet layer in order to create the undercut necessary for the connection strength. The punching waste that is created with the through punch removed automatically.

Clinching

is a process for connecting materials without using an auxiliary joining part. Here the sheets to be connected are pressed into a die plate by a die and plastically deformed. Thus, the sheets are connected in an interlocking and non-positive manner.

It is also true with clinching that the static and dynamic strength are higher than with common spot welded connections. Unlike with punch rivet connections, cutbacks must be made here. The reason for this lies with the absence of the auxiliary joining part that affects the cross tension strengths in particular.

Clinching is thus used in the automobile industry primarily in non-crash-relevant areas. Additional areas of application for this process include fastening parts or when the specified joining direction is from thick to thin.

Advantages and characteristics of the TUCKER system

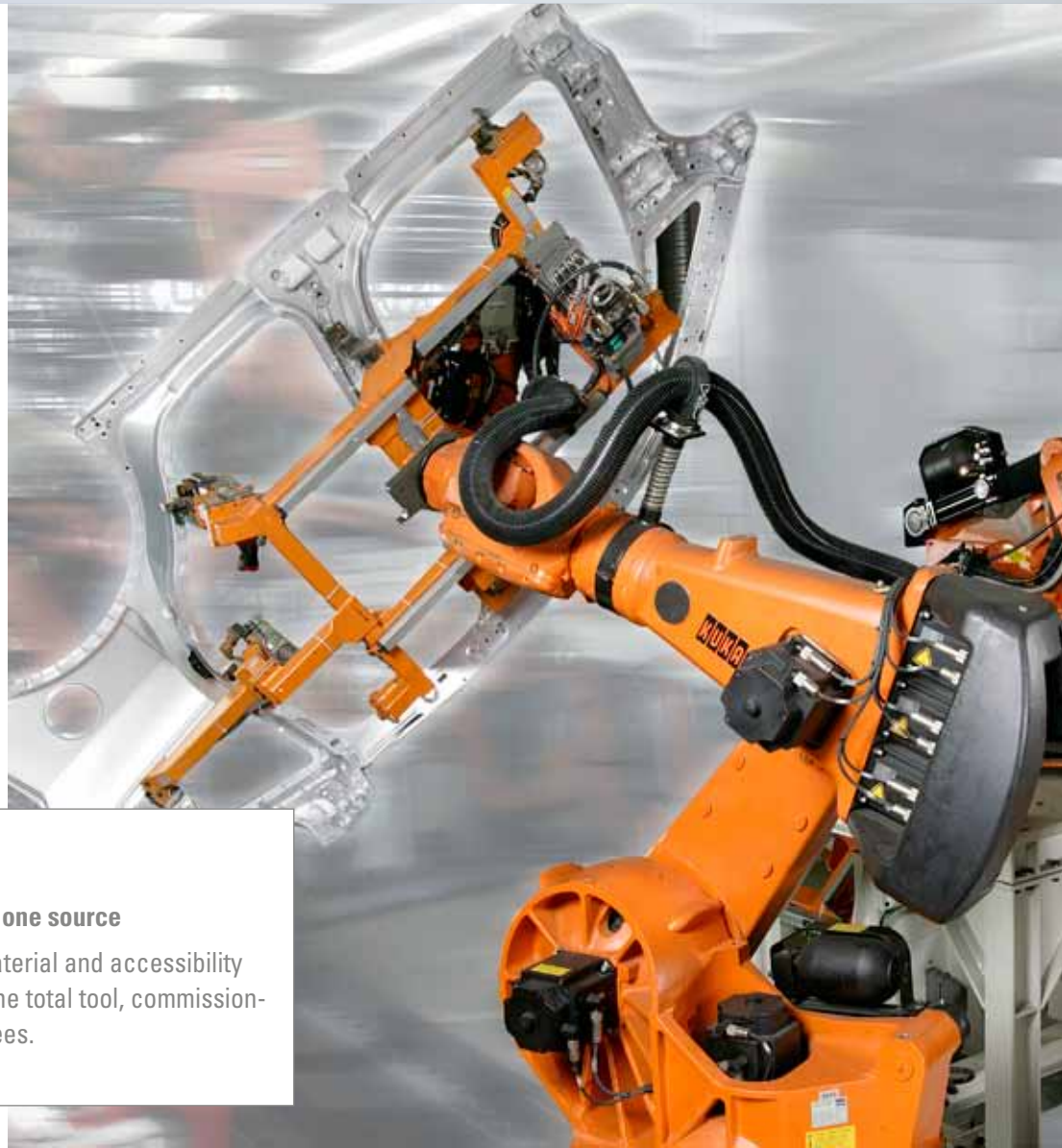
Tried and true in series production

Economical, process-secure, emissions-free

With "cold" joining technology, the material is not thermally loaded; unlike with welding, emissions are not created. In addition, it is significantly less expensive than the laser welding required with aluminium connections. The process is also significantly more secure since all process data can be checked in real time. With this integrated digital quality monitoring system, the number of components that have to undergo destructive testing is substantially reduced. This provides additional cost savings.

A punch rivet system proven in series production

The advantages of the series-tested total system consist, on the one hand, of its high speed: a rivet is set every 2.5 seconds – with unchanging, precisely repeated accuracy. Since the forces of up to 80 kN required for punch riveting with the Tucker system are created with an electric motor system and not hydraulically, maintenance costs are minimal. Leaks cannot occur and hydraulic fluid does not have to be exchanged or disposed of. Thus, punch riveting fulfils the guidelines of the Workplaces Ordinance to a large degree, since no production engineering consumables such as coolant, gasses or soldering materials are required.



The perfect connection from one source

Application consulting for material and accessibility inspection, specification of the total tool, commissioning, training for your employees.

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Automobile manufacturers worldwide
rely on
TUCKER's mechanical joining technology.

Process security

In practice, all process data such as force-path development, sheet thickness and rivet length are displayed on the control unit screen as an envelope or as a process value. Furthermore, an error display warns if specified tolerances are undershot and allows for quick correction. If the sheet thickness or rivet length are outside of tolerances, the system stops before riveting starts, delivers an error message and prevents expensive rejects.

With the integrated digital quality monitoring system, the number of components that have to undergo destructive testing is substantially reduced. This provides substantial cost savings.

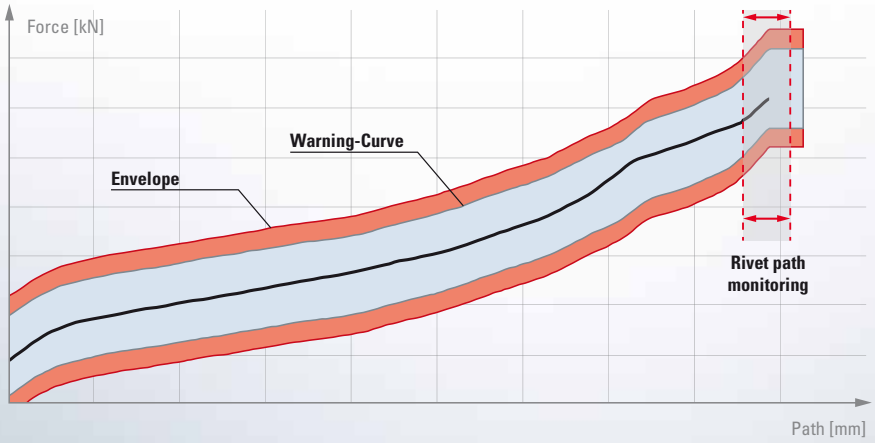
The joining process occurs with a setting spindle driven by an electric motor system. A path measurement system is used to ensure both the exact press-in depth of the rivet and the residual base thickness during joining. The feeding system can hold and feed up to 20,000 rivets.

A tool carrier called the "C-frame", which is specially constructed according to customer requirement, then provides for the positioning of the setting device. In particular, accessibility and rigidity are taken into consideration with the design.

Flexible use in series production

In separating mode, systems can be used at full capacity; rivets of the same diameter but of different length can be processed with one gripper. An application that uses a magazine provides a greater degree of freedom of access and significantly reduces compressed air consumption.

Quality assurance via process monitoring



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