



High-speed friction welding

The friction welding process:

01 Initial situation:

Both workpieces are firmly clamped into the machine; one workpiece is rotated.

02 Heating:

The two workpieces are pressed together with a defined force; the rotation and contact force generate friction which causes the weld surfaces to heat up.

03 Welding:

At a defined moment in time, the rotating workpiece is braked and the contact pressure is increased. This creates the friction-welded joint.





The friction welding machines from KUKA: even faster, even more precise, even more productive.

Almost 50 years ago, KUKA established friction welding as an industrial joining process. Numerous KUKA innovations, such as short-cycle welding, mixed-material combinations and defined-angle friction welding, have shaped this field ever since. A multitude of process and design innovations and superior control technology have resulted in process and performance perfection.

The machines set standards not only in terms of precision, dynamics and process control, but also with their high cost-saving potential for your production. No matter which markets you are active in, which customers you serve or which tasks you are faced with, this KUKA Systems product guarantees you supreme quality in the production of safety-relevant components and enables you to weld even unusual material combinations.



Turbine rotor



Aircraft engine turbine



Highly sophisticated aluminum shock absorber



Machine features:

Machine bed

Headstock, work slide and frame columns are supported on a shared, FEM-optimized machine bed. The extremely accessible working area has been generously enlarged. The workspace is equally suitable for manual and automatic component handling.

Main spindle

All machines have a main spindle with multiple bearings. The precision with which parts are joined, and thus the dimensional accuracy of each manufactured workpiece, remains permanently unaffected by the high forge forces. This is helped by the high-performance bearing combinations manufactured specially for this generation of machines.

Slide guideway

Preloaded play-free rolling-contact bearings in the slide guideway ensure maximum stiffness and precision. They also provide significant advantages with regard to maintenance, with extremely long servicing intervals.

High-speed drive

Highly dynamic drives with frequency control enable variable spindle speeds and efficient energy input. This ensures smoother operation and is instrumental in achieving a high weld quality.

Floating slide

A highly sensitive device for the automatic compensation of material elasticity, particularly in the case of long components. Tolerances in the case of manual loading are compensated automatically.

HNC process axis

NC hydraulic system for precise joining, as there is exact control of pressure and position of the drive slide at all times.

Human/machine/environment

The design and machine concept stand for collaboration between human and machine. Maximum user safety is an integral part of the concept. Up to the RS 45, the hydraulic system is completely integrated into the sound-proofed housing. As standard, all machines are designed to comply with the current noise protection regulations. All electrical components of the machines have been evaluated and chosen for their energy efficiency.

| | Machine type | Max. forge force (kN) | Calculated weld cross-section, structural steel, solid | |
|---------------|--------------|-----------------------------|---|-------------------------|
| | | | min. (mm ²) | max. (mm ²) |
| Small series | RS 2 | 20 | 20 | 170 |
| | RS 5 | 50 | 40 | 410 |
| Medium series | RS 12 | 120 | 120 | 1,000 |
| | RS 30 | 300 | 230 | 2,500 |
| | RS 45 | 450 | 400 | 3,750 |
| Large series | RS 80 | 800 | 900 | 6,700 |
| | RS 140 | 1,400 | 1,350 | 11,600 |
| | RS 300 | 3,000 | 1,200 | 25,000 |
| | RS 1000 | 10,000 | on request | |

Special sizes and designs (double-head machines and machines of vertical design) are available on request.

Exact monitoring and precise control with the KUKA Systems PCD.

High-end welding calls for a high-end system for process control and monitoring. The KUKA Systems PCD is a tried-and-tested solution, guaranteeing reproducible process sequences in real time. It enables control over the decisive process parameters.

Display as required

The welding parameters are automatically displayed after each welding cycle. Simultaneously with the process, the PCD system archives all the program and actual value data in an integrated database. An Ethernet interface is available for data exchange and connection to the network. Data are entered rapidly and in a user-friendly manner on a Panel-PC.

Interface for greater productivity

A further plus point is the graphics capability and thus user-friendliness of the PCD system with its Windows-based user interface. For example, it is possible to choose between a numerical and a graphical mode when entering the welding parameters.

Helpful navigator

Before a fault can become a problem, the integrated process and machine diagnosis software ProAgent kicks in. It helps the user to localize malfunctions quickly and easily and, in most cases, to eliminate them straight away.

Secure troubleshooting online

A secure data line allows you to make full use, within seconds, of our worldwide online product support – as if we were with you on site. The options range from remote diagnosis and process analysis through to software updates and preliminary information for service call-outs.

KUKA Systems PCD-Features:

- Swiveling Panel-PC
- Real-time operating system
- Ethernet interface
- Numerical or graphical editing of the welding parameters
- Ability to save graphics
- Operator-friendly user management

Process parameters monitored and documented:

- Spindle speed
- Friction pressure/travel/time
- Starting point
- Total shortening
- Forge pressure
- Braking time



From the machine to the system: technological leap as standard.

KUKA Systems friction welding is an integral part of KUKA's large spectrum of products and services. As a manufacturer of flexible systems for automated production, KUKA Systems has the experience and expertise to develop and implement cost-effective complete solutions with high process reliability. With its open, easily-accessible working area and the network capability of the controller, the new generation of machines offers ideal conditions. The integration of linear axes or robotic handling of the workpiece could not be easier.

There are three possible levels of automation:

- Partial automation with linear axes for workpiece infeed and/or removal
- Robotic automation for the handling of workpieces
- Fully-automated solution integrated into the specific workflow

Customized automation

Generally speaking, it is company-specific and production-specific factors that determine whether or not a friction welding machine is fitted with additional automation components. All KUKA machines are ready for integration into an automatic process, however. With its modular design, a friction welding machine can be optimized to meet the specific requirements of each individual user.

Retrofits made easy

Automation of a KUKA friction welding machine is also possible at a later stage without difficulty.

Thinking ahead

It may be useful to carry out a prior analysis before integrating a new machine into a work process – particularly in the case of robotic machine tending. 3D process simulations provide a realistic representation of the manufacturing cell. This makes it possible to optimize manufacturing processes, robot integration, human-machine interaction and ergonomic factors at an early stage.

The main advantages of KUKA friction welding machines

Cost reduction

01

The state-of-the-art friction welding processes make it possible to limit use of expensive material to those points that are relevant for the component.

Very high weld quality

02

Avoid unnecessary problems – opt for a production process in which every component is validated.

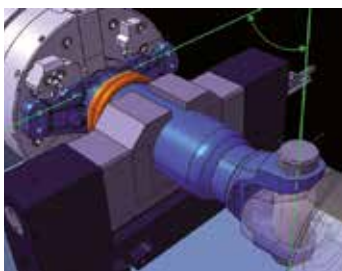
Component optimization

03

The automotive industry demands solutions that reduce weight – welding paves the way for the mobility of the future.

Ask us – we'll bring things together.

Options



Defined-angle positioning of the workpiece



Removal of friction welding flash



Short-cycle welding



KUKA Systems is the reliable specialist for innovative joining and forming processes for a wide range of materials as well as one of the world's leading suppliers of automated production and assembly solutions for sustainable industrial manufacturing.

The international system integrator stands out in systems, tools & dies and special-machine engineering thanks to customer focus, technological leadership and superior solutions. Around 4,000 employees across all market sectors are working on automation solutions for the products of tomorrow – from engineering, project management and systems implementation through to after-sales service.

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