



Anniversary at KUKA: 50 years of friction welding

Background report on the topic of “friction welding”

“Friction welding – a process with a future” – KUKA already advertised with this slogan back in 1966 and has long since been proven right. Fast, safe and economical: characteristics that distinguish this process and have made it indispensable down to the present day. In particular, the combination of different materials is a major argument for this technology. KUKA was very quick to recognize the advantages of friction welding and has continued to develop the process over the years. Today, the Augsburg-based company can look back on a 50-year success story.

Friction welding 4.0: anything but outmoded

“Friction welding sometimes comes across as outmoded,” says Walter Weh, Division Head Advanced Welding Solutions at KUKA Industries. “However, the technology is anything but.” For five decades, KUKA experts have been developing and improving the process. From the first doubled-head machine for universal shafts for Daimler in the 1970s to the modular KUKA Genius friction welding machine. “We are guided by market requirements, move with the times and are able to find the perfect solution for every customer thanks to our many years of experience and expertise in friction welding,” says Weh. Automation specialist KUKA Industries has been quick to take Industrie 4.0 into consideration in friction welding machines in order to offer its customers solutions for long-term increases in productivity. Complete integration of the friction welding machine into the production network makes it possible to achieve greater productivity. Thanks to these digitally networked processes, it is becoming possible to manufacture products with a greater degree of flexibility, energy efficiency and customization and a reduced impact on resources. All process data from the KUKA PCD (Process Control and Documentation) controller are numerically monitored and electronically archived. These data are thus available for further analysis (e.g. in Cloud systems). This is the basis for the implementation of Industrie 4.0 and ensures traceable quality and data transparency. With this in mind, the ability to process large volumes of data safely plays a fundamental role, as do uniform standards at the system interfaces. Implementation of this principle is not limited to new products and solutions. It is also possible for robots, cells and systems that are already in operation to be networked in this way.

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1966: KUKA establishes friction welding – a historical review

Our Stone-Age ancestors were already aware of the fact that heat can be generated by means of friction. Friction welding technology is based on the same principle. One component is fixed in place while the other workpiece is rotated and approaches the firmly clamped part with a relative motion. The contact surfaces touch and the material is plasticized. The two parts are pressed together under high pressure and ultimately joined.

The first patents for heating and welding were already issued at the end of the 19th century. The first functioning machine was developed and built in the Soviet Union in 1958. KUKA market-launched the first machine in 1966. Numerous KUKA innovations have shaped this field ever since: in 1970, a friction welding machine with hybrid drive, a combination of continuous external drive and inertia friction welding, was launched. “Due to the very high-quality spindle bearings and precise external braking systems, KUKA was the sole manufacturer for a long time and thus free to specify braking and forge times,” recalls Gerhard Hauswurz, Global Sales Manager at KUKA Industries. The product portfolio was extended still further with the takeover of British competitor Thompson. Today, customers can choose from a broad spectrum of machines with different contact pressures ranging from two to 1,000 tonnes. In 2015, the automation specialist presented the latest friction welding generation – the KUKA Genius. The compact and modular machine is flexible, energy-efficient and powerful. Moreover, the attractive design of the machine has also attracted accolades: it is the dual winner of the Red Dot Design Award 2015 and the German Design Award 2016.

((Info box 1))

Facts about KUKA friction welding

KUKA has installed over 1,000 systems in 44 countries.

- The glow plug for diesel engines is the smallest welded component with a diameter of 3 millimeters.
- A pressure cylinder weighing 700 kilograms is the heaviest welded component.
- More than 25 years ago, as part of his thesis, Rainer Simanowski, the current Head of Technology Services at KUKA Industries, developed a table-top friction welding machine that could be taken to customers for demonstration purposes.
- The table-top friction welding machine was the size of three shoe boxes and was presented to millions of TV viewers in a science program on the ZDF channel called the “Knoff-Hoff-Show”.

((Info box 2))

Contract manufacturing with the KUKA machine pool

- KUKA has been carrying out contract manufacturing for renowned companies since 1970 – almost 50 years now.
- Alongside friction welding technology, other processes, such as Magnetarc or laser welding, can also be carried out in the KUKA machine pool.
- The KUKA machine pool has a production area of 2,000 square meters:
 - Ten machines of various performance classes for rotational friction welding with cross-sections up to 31,400 square millimeters and a forge force from 1 to 300 tonnes



- Two machines for Magnetarc welding with cross-sections from 60 to 4,000 square millimeters and a forge force from 1 to 35 tonnes
- Four flexible robot cells for laser processing with up to eight kilowatts of laser power and various processing optics for thin sheet and thick plate welding
- From process validation to prototype manufacture, customers benefit from KUKA's many years of expertise.

(approx. 5,900 characters including title and info boxes)

Suggested illustrations



Image S0778_001: The new KUKA Genius: flexible, energy-efficient and powerful, and yet compact and modular. It is the dual winner of the Red Dot Design Award 2015 and the German Design Award 2016.

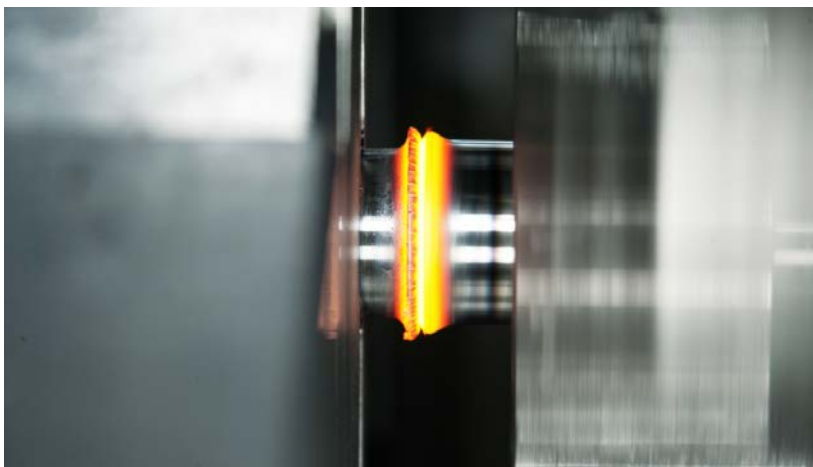


Image friction welding : Friction welding makes use of the heat generated by friction. The parts are rotated and moved towards one another so that their contact surfaces touch. Once the material



has been heated to the point where it becomes plastic, the parts are positioned and pressed against one another with high pressure.



Image S0778-011: All process data from the KUKA PCD (Process Control and Documentation) controller are numerically monitored and electronically archived. These data are thus available for further analysis (e.g. in Cloud systems).

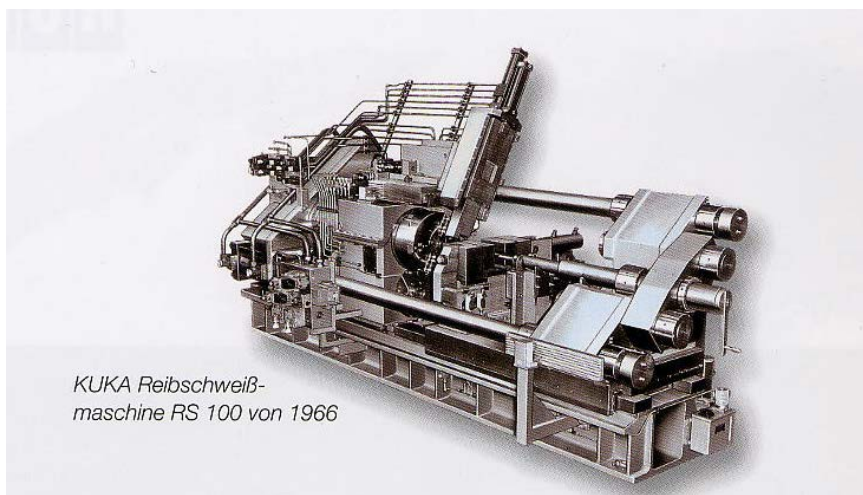


Image RS100 1966: KUKA market-launched the first machine in 1966. Due to the very high-quality spindle bearings and precise external braking systems, KUKA was the sole manufacturer for a long time and thus free to specify braking and forge times.



Image KUKA flexFELLOW: Remarkable loading and unloading. Create flexible production solutions of tomorrow with the KUKA flexFELLOW.

KUKA Industries GmbH

KUKA Industries is your reliable partner for intelligent, process and customer-oriented cells and solutions. Experienced employees adopt a visionary approach to developing and integrating automation ideas for the efficient and sustainable production of tomorrow. From the initial idea right the way through to production support, customers receive all products and solutions from a single source. With its comprehensive automation competence and in-depth process expertise, KUKA Industries provides its customers with a decisive competitive edge in the market.

From its locations around the world, KUKA Industries offers its customers in the Automotive, Consumer Goods, Energy & Storage and Electronics sectors, and in many other fields, innovative joining and machining technologies, laser welding and special welding processes, as well as all process steps for the foundry sector and for photovoltaic and battery production.