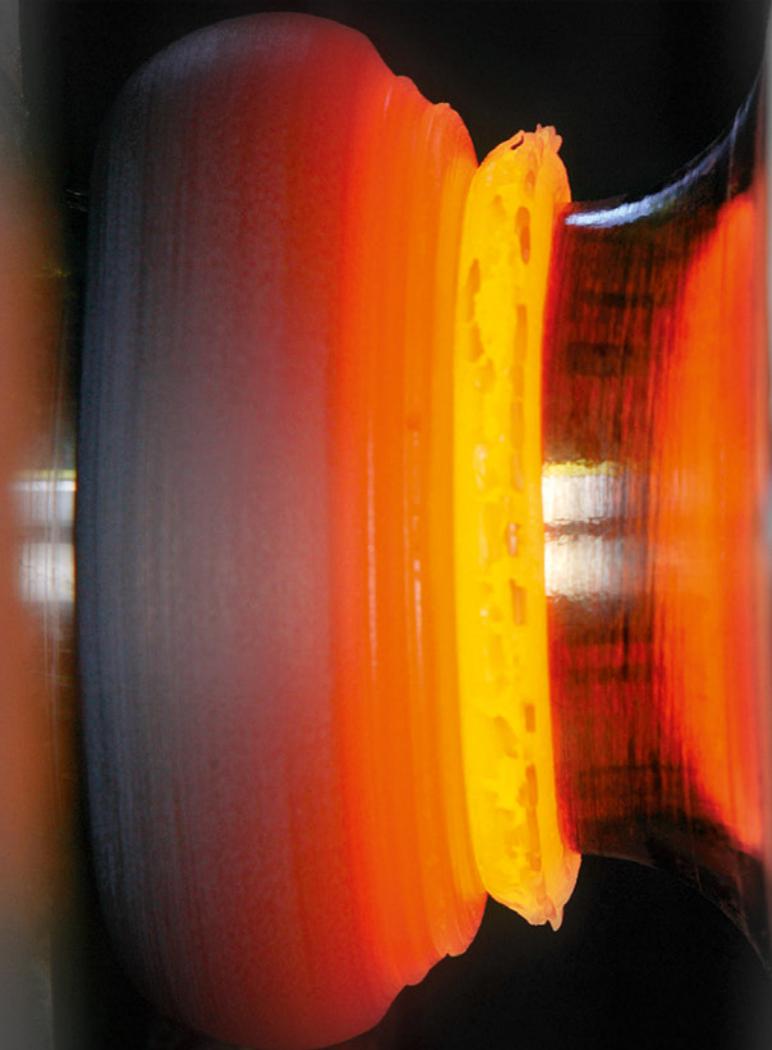


# KUKA



Technology\_Rotary friction welding

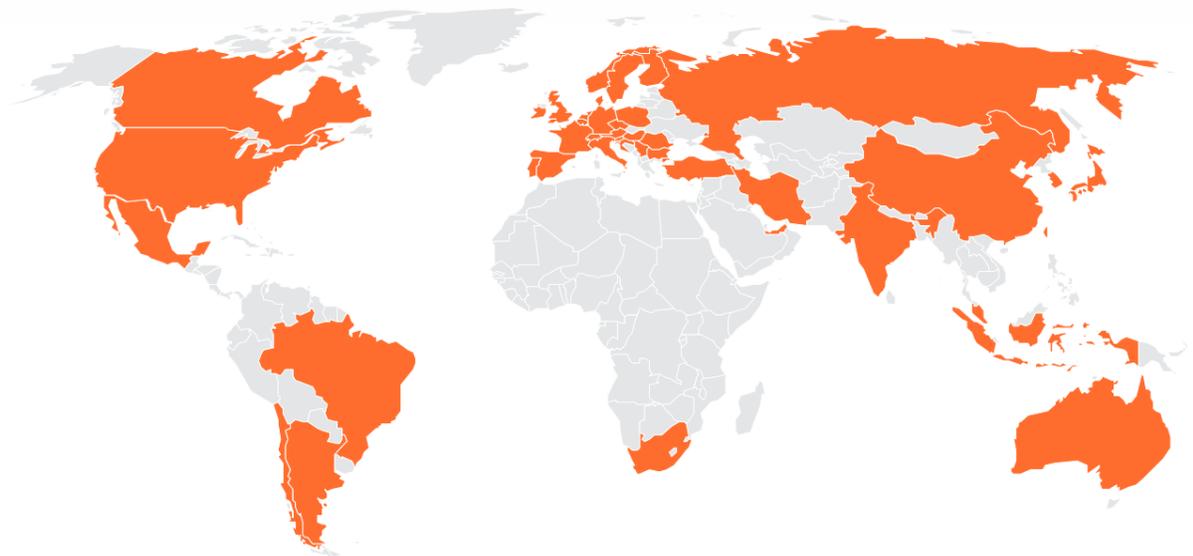




## 50 Years Experience

### A strong partner

We're one of the world's leading suppliers with more than 1,200 rotary friction welding machines installed in over 44 countries.



Over 50 years ago, KUKA established rotary friction welding (short 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.

With the takeover of the machine manufacturer Thompson Friction Welding (UK) in 1994, the product range was extended continuously to applications beyond the automotive industry. Since then KUKA has been one of the global leaders in this field. The machines set standards not only in terms of precision, dynamics and process control, but also with their 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 Industries product guarantees you supreme quality in the production of safety-relevant components and enables you to weld even unusual material combinations (e.g. aluminium-copper).

# The friction welding process

## Advantages of rotary friction welding

### Very high weld quality

- Fine-grained structure, no pores, minimal hardening
- No distortion of the component (uniform heat input)
- Maximum reproducibility
- Excellent traceability of the quality through documentation of the weld parameters

### High savings potential

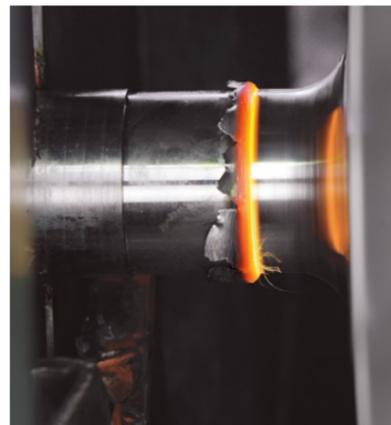
- No consumables materials required
- Unit cost advantage through short cycle times
- Material savings through component optimization
- Cost optimization through composite construction

### Additional process advantages

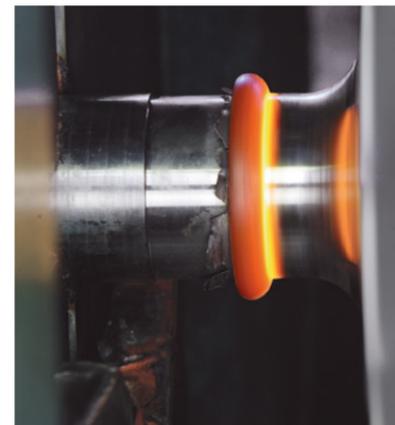
- No fumes, no dazzling
- No weld spatter
- Good process control and monitoring ensure highest process reliability



**01 Initial phase**  
Both workpieces are firmly clamped into the machine; one workpiece is rotated.



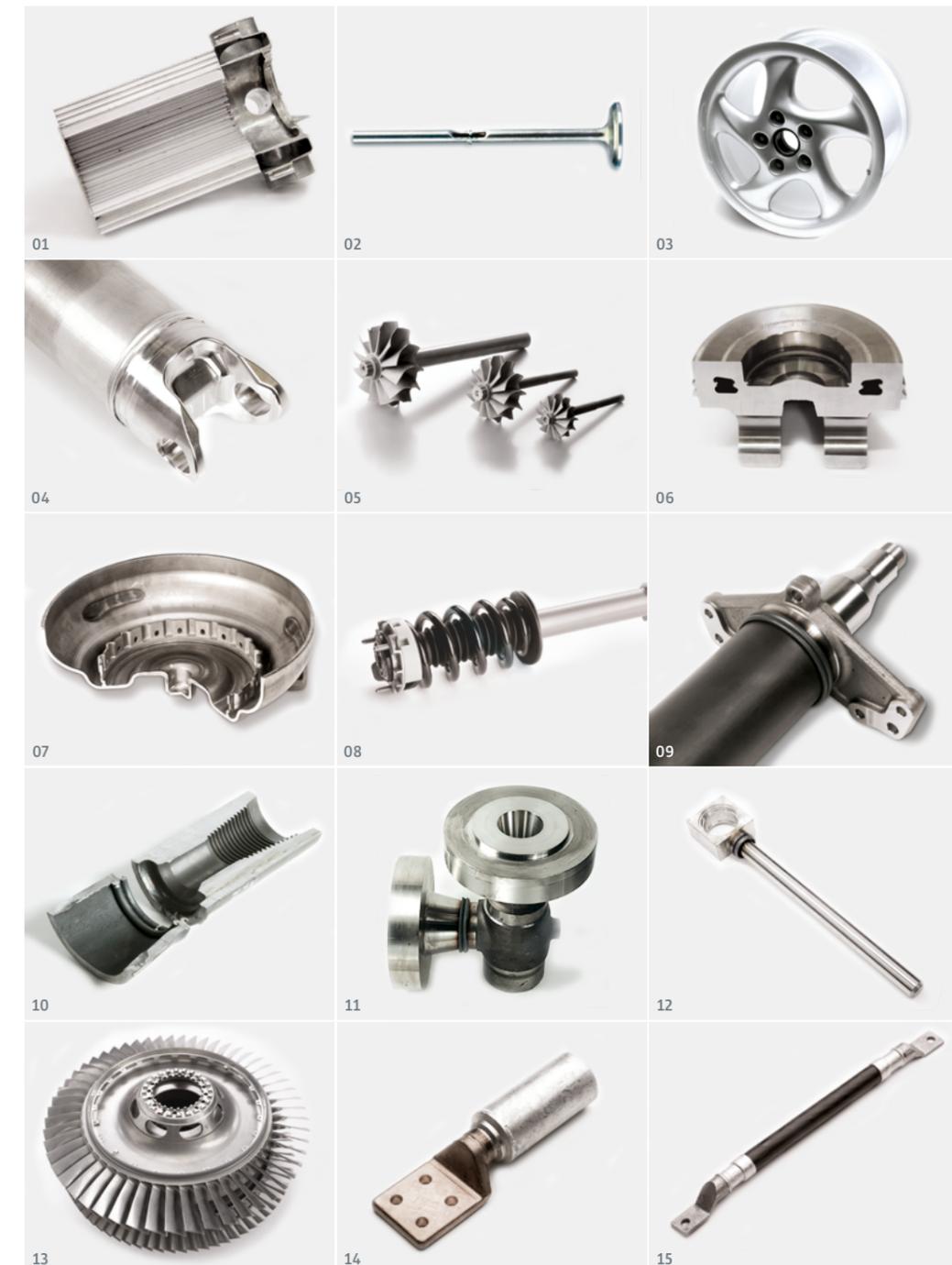
**02 Heating**  
The two workpieces are pressed together with a defined force; the rotation and contact force generate friction which causes the weld surfaces to heat up.



**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.

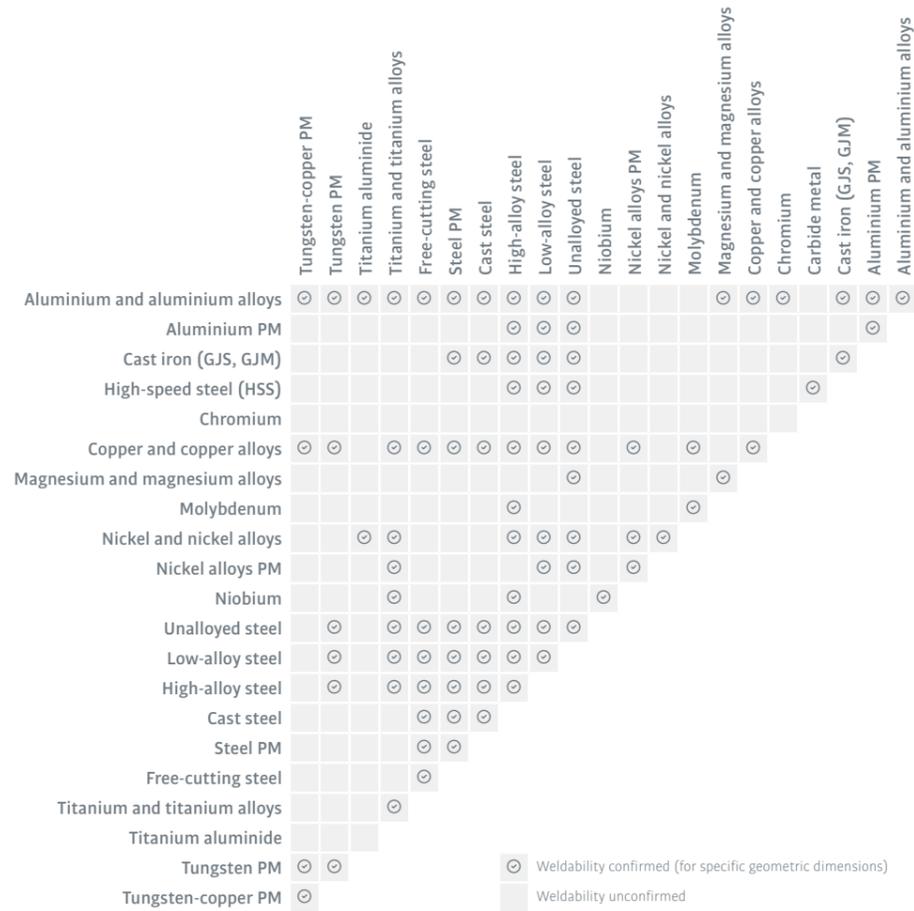
# Vast range of applications

Thanks to the KUKA Industries range of friction welding machines, a wide variety of components can be joined for many different industries. These include sectors such as aerospace, automotive, construction machine, electrical, general mechanical engineering, oil and gas exploration. Technology trends such as E-mobility and lightweight design make high demands on the mastery of the welding process which allows industrial joining of different material combinations at low cost.



01 Heat exchanger (Al) 02 Hollow valve 03 Passenger car wheel rim (Al) 04 Cardan shaft (Al) 05 Turbo loader (Inconel/Steel)  
06 Motor hollow piston 07 Converter for passenger car automatic gear 08 Shock absorber (Al) 09 Truck axle 10 Drill pipe  
11 Valve housing 12 Piston rod 13 Turbine for aircraft engine 14 Cable lug (Cu/Al) 15 Vehicle cable (brass/Al)

# Various material combinations



## KUKA Industries supplies the machine perfectly tailored to your requirements

With its vast portfolio of 1 to 10,000 kN upsetting force, KUKA Industries can friction weld even the most difficult customer components. Whether you decide on our new universally applicable compact Genius series or whether you look for special machines for special parts. The machine range with its two different construction designs is tailored exactly to your requirements. Special sizes and designs (double-head machines and machines of vertical design) are available on request.



## The main advantages of KUKA friction welding machines

### Maximum cost reduction

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.

### Maximum availability

As a result of the use of high-quality components maintenance expenses are low and the machine availability is very high.

### Very high weld quality

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

### Maximum flexibility

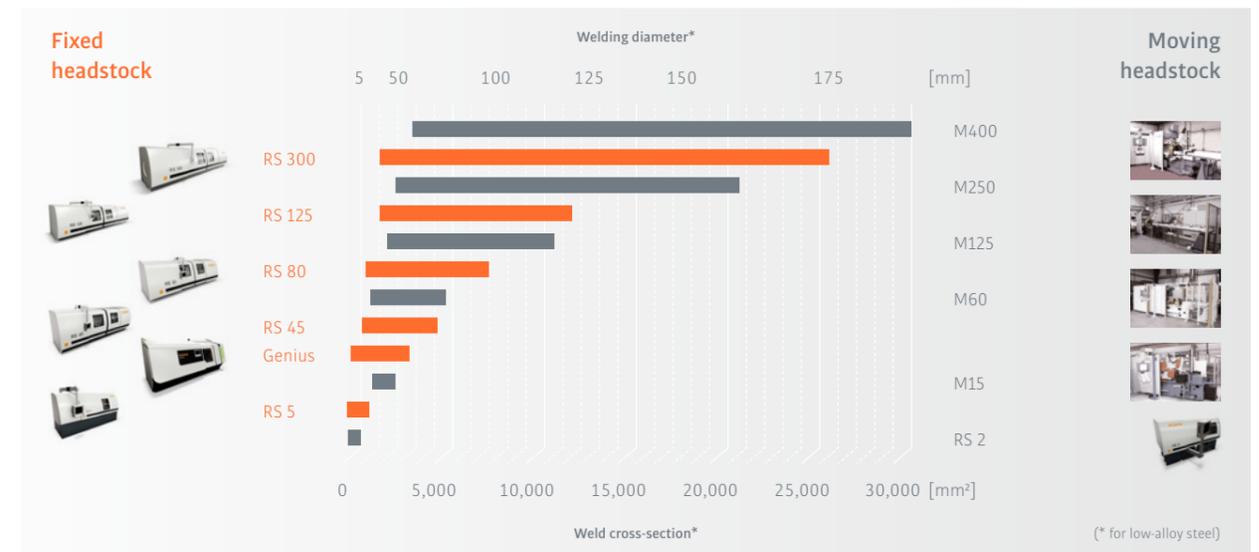
Every technology has its advantages, whether double headstock, fixed or moving headstock. We offer the ideal solution for every component.

### Component optimization

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

### Highest ergonomics

The use of intuitive touchscreen operation and the ergonomically-designed workspace make work faster and more effective.



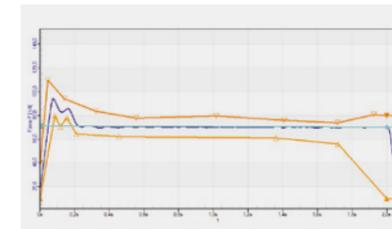
Machine portfolio KUKA friction welding machines



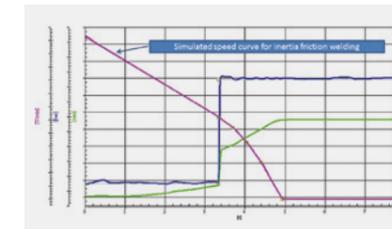
# Revolutionary control and process monitoring made by KUKA

## VIPER-Drive offers new opportunities

The combination of high-dynamic drive and revolutionary process control in the millisecond range (VIPER Drive = Virtual Infinitely Programmable with Extreme Response) allows the welding process to be accurately defined and controlled specifically for the part to be welded. This opens the possibility for new applications and further increases the productivity and versatility of KUKA friction welding machines.



Graphic parameter monitoring by means of envelope curves



Virtual inertia friction welding without flywheel

## KUKA technology pays off Technology highlights

Nowadays, high-tech machinery must meet the customer requirements for ever shorter cycle times, higher quality requirements, welding of new component combinations and complete traceability.

### Mechanical engineering

- Optimized flow of forces and FEM-optimized machine components
- Highest dimensional accuracy due to main spindle with multiple bearing
- Big maintenance advantages due to long-term lubricated bearings
- Cycle time reduction due to automatic compensation of insertion inaccuracies due to floating slide
- High-precision joining due to HNC controlled process axis

### Design / Ergonomics / Energy efficiency

- Ergonomic workspace
- Optimized design for highest sound insulation
- Highest energy efficiency due to self-regulating hydraulic system
- Simple and intuitive touchscreen operation

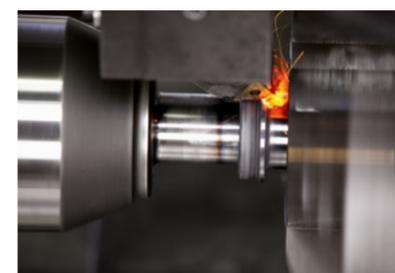
### Options

- Turning and facing devices
- Flash cut-off device
- Chip conveyor
- Automation solutions

Rotary friction welding



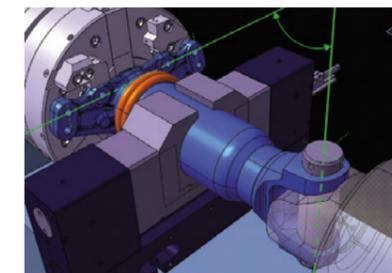
Touchscreen operation



Removal of friction welding flash



Short-cycle welding for demanding material combinations



Defined-angle positioning of the workpiece



Reduction of the welding flash with optimized parameters (from left to right)

### Active Travel Control (ATC)

With the active travel control (ATC), variations in the individual parts can be compensated so that the finished part always reaches its exact component length with consistently high weld quality.

### Traceability newly defined

All process data is documented numerically and graphically by the KUKA PCD (Process Control and Documentation) and archived electronically. Thus, claims will be a thing of the past.



## From the machine to the system

### KUKA Industries is prepared for Industry 4.0

Even higher productivity can be reached by complete integration of the friction welding machines in your production network. This will require open interfaces and an intelligent control. As a manufacturer of flexible, automated production systems, KUKA Industries has the experience and competence to develop and realize process-safe and economically successful turnkey solutions. With their optimally accessible work space and the network capability of their control, the machines offer ideal conditions for the new age of Industry 4.0.

#### We offer

- Full or partial automation with linear axes for infeed and outfeed of parts
- Robot automation for handling components
- Completely integrated solution in the specific production workflow using state-of-the-art 3D process simulation



Full automation with linear axis



## KUKA Industries – Your global partner from engineering to service

Long before the first workpiece passes through your application, we support you with our know-how.

Consultation, planning, engineering, implementation all the way through to complete customer service – all around the globe. We know what you need and have the right solution ready for you. One of the ways we ensure this is through our unique KUKA TechCenter. Our engineers carry out feasibility studies and test the practicability of innovative concepts.

Of course, the best kind of service is the kind you don't need to waste any words about because everything functions perfectly. KUKA Industries offers you exactly this kind of service – and it doesn't just start with maintenance and end with spare parts: from process and system training to comprehensive concepts for supplying and stocking spare and wearing parts, not forgetting maintenance, servicing, telediagnosics and hotline support.

We can also take care of the complete manufacturing operation for you – from process validation to prototype construction and small-batch production at our sites in Augsburg (Germany) and Halesowen (UK).

**We can be found locally all over the world:**

Argentina	Malaysia
Australia	Mexico
Austria	New Zealand
Belgium	Norway
Brazil	Poland
Canada	Portugal
Chile	Russia
China	Sweden
Czech Republic	Switzerland
Germany	Singapore
Hungary	Slovakia
France	Spain
Great Britain	South Africa
India	Taiwan, China
Italy	Thailand
Japan	Turkey
Korea	USA

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