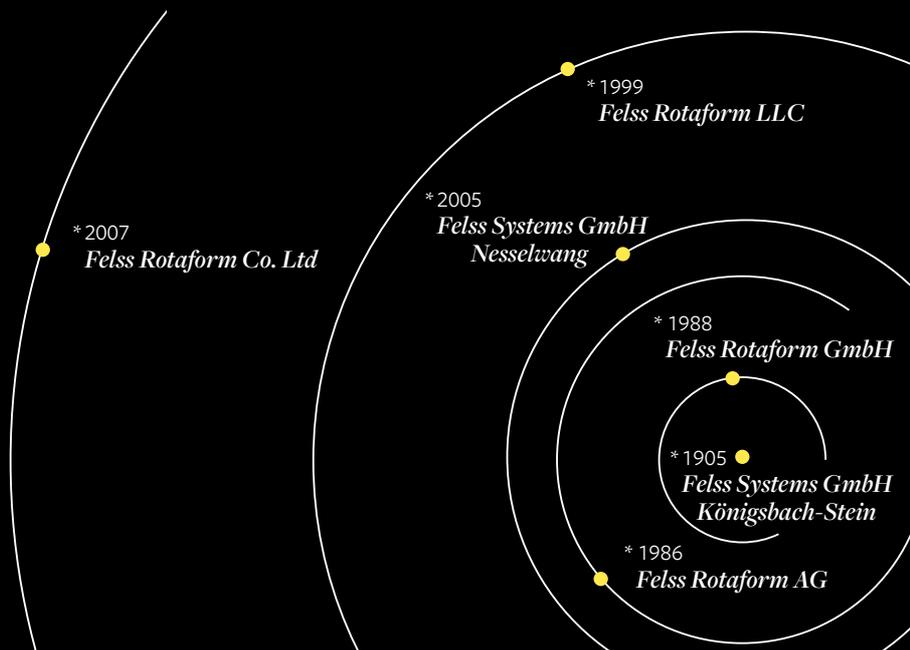


ABOUT THE FELSS GROUP

The Felss Group manufactures, under the brand name Felss Shortcut Technologies, metal processing machines and components for diverse sectors such as the automotive industry. The cold forming processes rotary swaging, axial forming, bending and tube end forming are central to the technology.

The Felss Group is a globally active group with headquarters in Königsbach-Stein. In addition to the other two German sites in Bretten-Gölshausen and Nesselwang, the company also has sites in Wujiang (China), New Berlin (USA) and Triengen (Switzerland). In 2012, the turnover was more than 100 million Euros. Felss employs more than 500 employees worldwide, of which 290 are based in Germany.

For more information please visit www.felss.com.



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OUR PROCESSES

Rotary swaging , axial forming , bending, end forming and autofrettage: Discover the versatile methods applied by Felss. We combine innovative technology with the best idea and thus create tangible benefits for users.

Rotary swaging

Hollow lightweight shafts due to intelligent material distribution

- Internal and external profiles in highest precision
 - Highest degrees of deformation in cold condition
 - Strength increase due to uninterrupted grain structure and work hardening
 - Ressource efficient, no chips due to forming instead of machining
 - Highest productivity and output due to short cycle
-

Axial forming

High precision internal and external splines by cold forming

Felss patented recursive axial forming for:

- Internal splines especially in blind holes
 - Very thin-walled components
 - Highest accuracy up to tolerance DIN class 5
 - Nearly perfect pitch and profile variation due to forming all teeth together by a one-piece tool
 - Involute profiles, serrations and other profiles like ball shapes
 - High output of up to five parts per minute
-

Biegen

Highest bending quality and repeatability

- Complex geometries bendable line with short straight between the arches
 - Rolling, draw bending , push roll- or collet bending, and bending both sides as well as the use of multiple bending levels in a tool possible
 - Design freedom and flexibility in shape
 - Great variety of different tube diameters in a tool
 - Integration into existing processes and expandability
 - Highest bending quality with maximum enclosure in the bending tool
 - Special tool geometry minimizes pipe incidence and terminal prints
 - Bending without mandrel
-

Autofrettage

Maximum pressure for extreme stability

After the autofrettage the tubes are much more resistant. Autofrettage is to increase the life at using operating pressures from 1,500 to more than 2,000 bar. By applying a single very high internal pressure (up to 12,000 bar) by controlled plasticization and residual stress build the fatigue strength is significantly improved. The process is very

flexible and can be integrated into existing production systems Autofrettage is the only way for curved pipes for drilling branches, cross section changes and complex geometries to be made stronger.

Fatigue strength that can not be achieved even with higher material quality or higher wall thicknesses can be achieved.

End forming

Perfect surfaces and maximum dimensional accuracy

- high accuracy
 - Very high surface quality in the sealing area
 - No "spangle" through joints in the tool
 - Free of coating
 - 100 % controlled
-

MAKE and BUY

MAKE

Felss Systems:

Developing machines, manufacturing equipment and the optimal process chains

Even while developing the component, Felss cooperates closely with the customer to ensure optimal design of the transfer systems and integration into the existing production process. Sole responsibility for value creation and for the control and optimization of processes then lies with the customer. But customers can count on the support of the Felss Service team at all times: They not only undertake maintenance and training, but also provide new tools and can further develop and expand the capabilities of the system on request.

BUY

Felss Rotaform:

Component manufacturing from a specialist – also in large-batch production

The special strength of the Felss Group lies in the fact that they not only have expertise in machine engineering & construction, but also in component manufacture. Felss Rotaform is backed by the entire know-how of the group and manufactures your components on systems specifically designed for the task. The company has long moved away from focusing solely on its core technologies, undertaking non-core work such as turning, grinding, polishing, and assembly on request. For customers, the 'Buy' option means that their capital is not tied up in production facilities, giving them greater liquidity. And as additional benefits, particularly in overseas markets: No systems have to be installed and no operators trained to run them.

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