

Precision manufacture of individual cold-formed parts for multi-functional use



Most traditional fasteners are cold-formed. But for complex multi-functional components, cold-forming is an alternative to machining processes such as turning, which often are more costly. From the early design stage through to building the prototype, design engineers and developers benefit from efficient processes and get their product ready for series production much faster.

Under the brand name Conform, Arnold Umformtechnik GmbH & Co. KG develops complex cold-formed parts for multi-functional applications. Such parts are in fact solutions worked out individually with each customer to meet their particular requirements. Very often they are parts developed for the electric vehicle market, or for light-weight construction.

„Ever-increasing tolerance requirements are being placed on components. So it is important that we work alongside the customer as early as the design and development stage. That derives the greatest benefit for the customer,” said Marius Fallmann. Fallmann has worked at the company since September 2018 and as soon as he had completed his degree in industrial engineering he took



„Ever-increasing tolerance requirements are being placed on components. So it is important that we work alongside the customer as early as the design and development stage. That derives the greatest benefit for the customer,“

Marius Fallmann, Conform Team leader at
ARNOLD UMFORMTECHNIK

up his job in the Functional Components project management department, responsible for Conform.

So the design of the component must be chosen to ensure that it can be produced using cold-form technology. In certain cases, the component may need to undergo some post-production machining, for example when hollow parts are manufactured with an internal thread. When choosing the production technology and looking at the costs involved, it is important - right at the start of the development process - to consider capacity.

Functional samples, produced by Arnold during the design and development stage, support the process. In other words, the final design of the cold-formed parts is ready for the initial production or the start of series production, with no further changes needed.

There is a demand for aluminium and copper parts, and these harbour challenges

AUT has been manufacturing Conform parts for several years now. In the past few years, the range of manufactured products has changed. “Weight reduction and conductivity in aluminium parts have become increasingly important. And there is also a demand for copper parts because of their good conductivity,” affirmed Fallmann, who, at the start of this year, was appointed team leader of the Conform department. Nowadays, one enquiry in three is for aluminium or copper parts. But aluminium and copper need to undergo a different forming process than steel because these materials are softer. Impact points can occur and this makes it difficult to maintain the requirements for an even surface. This has to be borne in mind during production and when handling the parts. That is why, concerning the quality requirements, Arnold offers the option also to handle a proportion of the aluminium and copper parts individually, rather than in bulk, as is normally the case when producing cold-formed parts. Moreover, aluminium and copper parts need to undergo a specific cleaning process, and an appropriate surface coating needs to be applied. During the project stage, copper parts in particular often require changes and adjustments to surface treatment and coating thickness. So, together with the customer

and supplier, Arnold Umformtechnik develops an appropriate treatment during the design stage.

The options, limits, and expansion of production

As a rule, Conform products are produced on presses that have between five and seven stages. Depending on the geometry requirements they may require post-production rolling or some machine finishing. Of course, the biggest cost benefit occurs when cold-forming alone meets all the requirements and the part can be produced without a finishing process. Conform products in steel can be produced to a maximum diameter of around 30 mm, starting with a maximum wire diameter of 20 mm. External diameters of more than 30 mm are possible in softer materials such as aluminium and copper, depending on the geometry of the component. The length of the part always depends on its required diameter. Lengths of approximately 100 mm can be achieved.

Another advantage of the Conform process is that Arnold Umformtechnik has its own tool-making department. The majority of the tooling is produced in-house. “This provides us with the opportunity to react quickly, and in individual cases, we can generate a rapid throughput for a new part,” said Marius Fallmann.



Picture 2: Chip-free manufacture of complex precision components for series applications with cold-forming. (Source: ARNOLD UMFORMTECHNIK)

Most importantly, the company has invested in new cleaning technology with a – basket washing system – for aluminium and copper parts. Slightly softer parts are simply panned inside baskets. This is a gentle treatment that avoids points of impact. Moreover, there are many different cleaning routines to suit the component in question. The company has a new department called Conform Next to expand the range of products and services concerning materials and component dimensions, and Arnold's developers are currently working on this. The new department focuses mainly on forming larger-sized aluminium and copper parts with complex geometries. The manufacturing capacity for this department is located at the new production site in Rauhbusch. The engineers are currently developing the machinery for the new Conform Next department. As a result, it will be possible to manufacture parts in copper and aluminium with a diameter up to 50 mm and up to 120 mm in length.

Applications and component design possibilities are almost unlimited

The main focus for Conform is currently the mobility and lightweight structure sectors. But new industrial projects regularly arrive in the inbox. And applications from other fields are always a possibility.

In general, Conform can manufacture a huge range of cost-optimised multi-functional parts. With the individual process, the areas of application and the design possibilities are almost unlimited. Examples of ideal applications are precision parts, toothed parts, hollow parts and nuts and bushes.

"Fortunately we have already been involved for many years in a wide variety of development projects with major OEMs. Original annual requirements forecast has been raised hugely. For this reason, mobility is an opportunity for us to provide our expertise in the field," Fallmann continued.

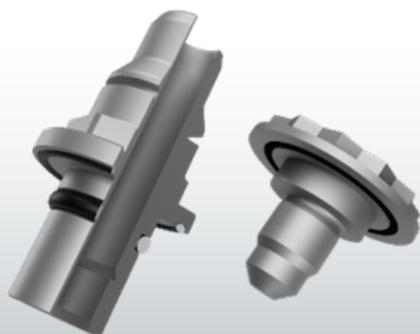
Due to this development in the mobility sector Fallmann states that the enquiry process has also undergone a decisive change. „In the past enquiries were frequently for existing, trusted, and known items. And for surface coatings, there were for example de-

fined standards with zinc or zinc-nickel coatings. Now, with the move to electrification, the products have completely new requirements," he said. For example, we need to assess conductivity, strength requirements for copper and aluminium - which are rather soft - and also the surface voltages. As an alternative to the typical pure copper, Arnold offers CuCrZr1 (copper chromium-zirconium). Mixing chromium and zirconium greatly increases the strength but does reduce conductivity slightly. Moreover, coating systems such as silver and tin are coming into focus. How these products are handled also needs to be adapted. When it comes to the battery, of particular importance is the seal of the fastening solution as well as how the appropriate seal concept is drawn up.

Regular discussions between customer, supplier, and fastening solution manufacturer, i.e. Arnold Umformtechnik, form the basis of technically well-founded implementation of the solution the customer is looking for.



Picture 3: A multi-functional fastener manufactured by cold-forming.
(Source: ARNOLD UMFORMTECHNIK)



Picture 4: When it comes to the battery, what is especially important is the seal of the fastening solution and how the appropriate seal concept is drawn up.
(Source: ARNOLD UMFORMTECHNIK)

The best way to process a project

„It is important to be at the customer’s side if possible right from the start, in other words during the development stage. For us it is equally important to have a direct line to the customer’s technical people,“ said Fallmann, explaining the best way to process a project. Before we start to assess a project we need clarification of the following issues: Is it an application destined for the interior or exterior of the vehicle? What form of corrosion protection or what surface coatings are required? Are there cleanliness requirements? Is it possible to change the geometry? Is it possible to make changes to the material with regard to cold-forming? Are there sealed surfaces and if so, which? Together with the quotation, customers receive a proposal drawing for cost-optimised implementation, as well as a manufacturing feasibility assessment. As an option, customers can also commission a carbon calculation as early as the development stage. Using its own CO₂ calculator - developed in-house - Arnold can determine the Product Carbon Footprint for the part the customer is enquiring about, and can then work with the customer to improve it.



Picture 5: Arnold Umformtechnik has up-to-date plant and machinery to deal with Conform orders mit vielfältigen The options.
(Source: ARNOLD UMFORMTECHNIK)

Technical and commercial benefits for customers

Arnold Umformtechnik has up-to-date plant and machinery to deal with Conform orders. Presses with up to seven forming stages are available. At the last stage, a rolling station can potentially be incorporated to roll a knurl, for example, on the machinery. Added to these, Arnold also has perfectly adapted cleaning and coating technology. With Conform parts Arnold's customers are not only obtaining weight savings in their multi-functional fasteners. They are also able to generate many benefits. Customer-specific geometries can

be handled, as can individual material selections, along with an early check of the series run. As well as the technical benefits, Arnold also asserts that cost-savings of up to 80 per cent can be made, the number of parts and handling can be reduced, assembly time can be shortened and development time cut with Fastener Express.

Copy: Annedore Bose-Munde

ARNOLD UMFORMTECHNIK GmbH & Co. KG

Carl-Arnold-Straße 25
D-74670 Forchtenberg-Ernsbach, Germany
Phone: +49 7947 821-0
Fax: +49 7947 821-195
info@arnold-fastening.com
www.arnold-fastening.com

Magdalini Wanke
PR · Marketing & Communication
Phone: +49 7947 821-2833
Mobile: +49 151 176 086 08
magdalini.wanke@arnold-fastening.com

The ARNOLD GROUP — BlueFastening Systems

ARNOLD — internationally the name stands for innovative fastening technology at the highest level. With a foundation of many years of expertise in the production of intelligent fastening systems and very complex extruded parts, over a number of years the ARNOLD GROUP has developed into a comprehensive supplier and development partner for complex fastening systems. With our new positioning of "BlueFastening Systems" this development will now continue under a unified and harmonized structure. Engineering, fasteners and functional parts, along with feeder systems and processing technology, all from a single source, form a unique combination of experience and expertise — efficient, sustained and international. Since 1994 ARNOLD has been part of the Würth Group.