

APF - Automated Peen Forming

KSA's core product is the development and implementation of **APF - Automated Peen Forming** solutions for customers in the aerospace and transport industries. After development of an automated solution at our plant in Aachen, we either carry out **APF - Automated Peen Forming as a contract service** on our own peen forming facilities or arrange for the installation of **a customized peen forming facility as an integrated, automated solution at the customer's site.**



APF - Automated Peen Forming is a **repeatable, fully-automated** peen forming process carried out by **computer-controlled robots** in a **controlled** environment. Our **customized APF software** steers and controls the movement of the peening nozzle across the component while simultaneously performing **online data acquisition**. The information acquired is constantly **visualized, recorded** and **evaluated** within the **"closed loop" system** so that the peening parameters are adjusted automatically where necessary in order to form the component into the required shape. **Documentation** of the complete process provides proof of unvarying processing as well as a record of all the energies which have been applied to the component - an essential requirement for parts in the aerospace industry.



Development of an APF - Automated Peen Forming Solution

Rather than peen forming the component on a manual trial and error basis in production, as it is still the common approach worldwide today, we at KSA always implement an **extensive pre-production development programme** as a prerequisite to a fully-automated peen forming solution. We begin with a **feasibility study (phase 1)** in order to establish the exact peening parameters and tooling needed to obtain the required target shape. 1-5 original parts are peen formed during this phase, by the end of which we have programmed our APF computer software and established a frozen APF process, i.e. we have produced a customized first flight article. All the APF framework requirements as well as the necessary machine design and toolings are also established by the end of this phase.



The next stage consists of **pre-series production on our facilities (phase 2)** in order to stabilise and optimize the newly-developed APF process. After an additional 1-5 original parts have been peen formed (learning curve), the technology is ready for series production at our plant in Aachen or, alternatively, for transfer to the customer's site. In the latter case, we arrange for the **on-site installation of a customized peening machine (phase 3)** constructed according to our specifications and equipped with our APF software and tooling. This is followed by **series production at the customer's site (phase 4)**. **Post-installation back-up and support as well as training for machine operators and a new component service (phase 5)** are an integral part of our APF package.



All our automation solutions are equipped with our integral **ISIC® - System** for measuring and controlling shot velocity and distribution at the nozzle outlet. This unique device guarantees the transferability of our peening technology to any production site worldwide.

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The following examples illustrate some applications of APF:

Automated Peen Forming as a Contract Service

Production of Ariane 5 structural segments on a contract basis

We peen form tank bulkhead segments for the Ariane 5 rocket on a contract basis for MT Aerospace AG, Augsburg, Germany. Five tank bulkheads consisting of eight segments are required for each rocket. We also produce twenty-four cone panel segments for each Ariane 5 rocket for EADS Astrium N.V., Netherlands. In all, KSA peen forms 64 segments ranging from 0.8 m² to 3.2 m² in size for each rocket, resulting in a total of 300 - 500 segments annually. To date, we have successfully used APF to peen form more than 3000 segments on a fully-automated basis for Ariane 5.

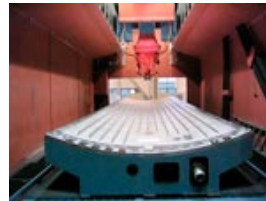


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Automated Peen Forming as an On-site Automation Solution

Re-shaping of laser-beam-welded fuselage shells for Airbus

We are responsible for re-shaping laser-beam-welded fuselage shells for a range of Airbus aircraft (A380, A340, A318 ff.) at the Airbus plant in Nordenham. This application entails the re-shaping of different types of shell ranging from 6 m² to 34 m² for various aircraft using automated peen forming and the integration of the APF process into the customer's production chain. To date, more than 1000 components have been peen formed successfully on-site for Airbus with our APF technology.



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Automated Peen Forming for Wings (APF4WINGS) and Other Applications

The production of wing skins represents a particular challenge as the component parts are frequently characterised by complicating features such as kinks, dihedral curvatures, stiffness stringers and multiple variations in thickness. Furthermore, wing skin production often involves a step-by-step combination of pre-stressing, saturation peening, peen forming, sanding and surface finishing. We are currently developing the automation of this technology with our Canadian partner Aerosphere Inc.



While APF4WINGS is primarily conceived as a process for wing skins, the technology can also be used to peen form parts such as interior and exterior train claddings and other large-scale complex components. For example, we have peen formed more than 300 components on a fully-automated basis for the Dutch diesel train DM'90 for Bombardier Transportation on our flexible, robot-operated facilities in Aachen.

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