



Article for Aircraft Magazine

Correcting and adjusting of sheet metal parts by shrinking and stretching

Summary

Shrinking and stretching are indispensable operations in aircraft manufacturing, mainly for correcting and adjusting of pressed parts of all sorts. The special machines and tooling of Eckold offer a highly efficient solution to assure precise fitting together of the individual parts.

When young Walter Eckold (1895-1963) joined Junkers Aircraft Co. in Dessau/Germany in 1917 as a toolmaker he soon got involved in Professor Junkers' project to build metal aircrafts instead of those made out of wood. The forming of corrugated metal sheet the hard way, the bending of profile sections, or the blind riveting from one side only, those were the challenges in the newly formed department for jigs and fixtures.

The shrinking of sheet metal turned out to be more complex to solve. How to remove too much material and to bring back the part into the desired shape, and all this by cold forming? The German patent no DRP 477 153 granted in 1924 is describing the first shrinking machine. The two-levers hand pliers followed soon after permitting shrinking operations inside the structural body of the aircraft. These hand pliers were widely used in the aircraft industry.

Walter Eckold left Junkers in 1936 and founded his own manufacturing company for jigs and fixtures for aircraft manufacturing. However, the metal forming and particularly the shrinking and stretching remained unsatisfactory as there was no universal equipment available yet. The break-through happened 1950 when Walter Eckold introduced the first universal cold forming machine type KF 400.

Today there is a full range of machines in different sizes called Kraftformer, having different throat depth and forming capacity. Maximum horizontal throat depth is 675 mm and a forming capacity of 6 mm thick steel, and 7 mm of aluminium, reached with the largest machine KF665. This machine offers a large working area and allows to produce larger pieces too.



Largest type of Eckold forming machine, KF665 with 675 mm horizontal space (Bilder: Eckold)

The large selection of tools allows to find a solution for numerous forming and correcting jobs. Besides shrinking and stretching, there are tools for flattening, doming, and planishing, straightening and finish forming, all of them available in different sizes with different maximum forming capacities.

Tool change is done in seconds which makes the use of the machine highly flexible. Machines and tools are designed to reach their maximum capacities without special effort and to do quick and efficient forming of profiles and other sorts of sheet metal.

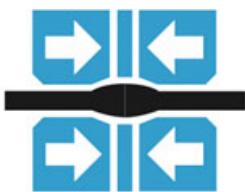


Large selection of tools for various forming operations

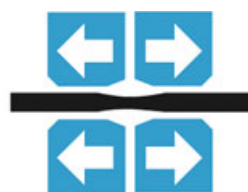
But, often more important in aeronautics, the system of tool and machine is designed to control the force applied extremely sensitively, which allows then to do very small and precise correcting and adjusting of pressed parts. For instance, the big machine KF 665 can operate with a maximum

force of 700 KN, but is also able to work in a very smooth way on small and thin parts with just little force. A special series for tools is available for the aeronautical industry, which do shrinking and stretching with a high tech synthetical surface. This allows to treat the surface of the work piece according to the high quality requirements in the aircraft industry, basically without marks and without making scratches on the surface. The principle of the

shrinking and stretching tools works in the way that the vertically applied force of the machine clamps the metal sheet in between the jaws of the tools. Additionally, part of the vertical force is transformed inside the tool to a horizontal one. In case of shrinking, the material is being upset, which results in increasing thickness of the material and a reduced (shrunk) surface of the piece. With stretching tools, the contrary happens, resulting in a thinner piece and an increased surface.



Principle of Shrinking



Principle of Stretching

Generations of aircrafts have been produced with the help of Eckold shrinking and stretching machines, in the civil sector as well as in the military field (examples: A400M, Eurofighter). As well in helicopter manufacturing (for example EUROCOPTER), space flight and space travel (for example HERMES space plane, or the European Ariane carrier rocket), aircraft maintenance and repair shops, shrinking and stretching is used. The main task of the Kraffformer machines is to do correcting and adjusting of pressed parts. This means to correct the shape and dimensions of the part, to remove buckles or dents. For instance, this is being used for manufacturing of all the types of Airbus aircrafts in the factories of EADS in Germany, France and Great Britain as well in numerous parts supplying companies to Airbus.



Airbus 319 (Copyright by Airbus S.A.S.)



Correcting Job with Eckold forming machine KF460 of a lower covering part of of the floor section for the Airbus A380



The operators work step by step, check the part in between with the template, and continue until the part fits perfectly to the template. Machine operators need some basic training with the machine and the different tools. Because they are usually very familiar with the behaviour of sheet metal, they become after a short time very efficient users of the machines and tools which then results in a significant increase of productivity in the workshop.



Correcting and adjusting of a pressed part of the fuselage section of an Airbus A340



Partial shrinking of wings for Dornier Do 228

Knowing that Eckold is the specialist for sheet metal forming, the German aircraft industry has approached them several times with some special problems to solve. For example Eckold created efficient special tools for correcting and adjusting of forward panels of the wings, which are being milled before from the solid.



Correction of forward panels with special RIG-016 tool

Another sophisticated solution was created for the production of the wings for the Do 228 of Dornier. The wings milled from the solid with pockets for weight reduction became distorted by the milling. Special hydraulic tools brought the wings back into a defined plain form, and formed afterwards the whole wings with partial shrinking into the cambered wing shape.

Eckold, a company with its roots in the aircraft manufacturing is providing effective and efficient solutions with their complete and large range of tools. Machines and tools have been used more than 50 years, and customers report a very high satisfaction with the performance, quality and very long life of the equipment.

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