

BLECH

2|2016

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THE TRADE JOURNAL
for sheet metal, pipe and profile
processing



KOHLER
COMPETENCE CENTER
LEVELLING



The wet sheets leave their marks in the levelling machine. Without regular cleaning, traces of corrosion would be seen on the sheet metal. This would be absolutely unacceptable in aircraft construction. Images: Albrecht

PEAK PERFORMER PG PART LEVELLING MACHINE IN THE AIRCRAFT INDUSTRY

From levelling

by **Volker Albrecht** Pilatus Aircraft Ltd in Switzerland builds all-metal aircraft using diverse aluminum alloys. In the process of forming these alloys, cut sheets are solution heat treated, quenched, levelled, put in cold storage and finally formed. Due to the short time frame, the metal sheets are wet at the levelling step. Accordingly, the part levelling machine from Kohler must be corrosion resistant and easy to clean.



Leveling to Liftoff

Behind the Swiss mountains in Stans near Lake Lucerne, Pilatus Aircraft Ltd develops and builds business and training aircraft. The company generated around 1.2 billion CHF in turnover in the past year, delivering 120 aircraft. Among them is the PC-12 business aircraft which has been built around 1300 times. Looking to the future, there is the PC-24 project in development, and two prototypes of the jet have already completed their maiden flights.

„We build all-metal aircraft and use diverse aluminum alloys,“ says Hans Haverkamp, Director of Sheet Metal Processing. Composite materials are not used for structural components, we do however use them for engine cowling and various interior panels. This is in contrast to large aircraft like the Airbus, for example.“

The use of age-hardenable aluminum alloys requires an elaborate manufacturing process because the material is not formable in its normal state.

The forming process therefore begins with a solution heat treatment followed by quenching. While still wet immediately after quenching, the distorted blanks are levelled by an electromechanical “Peak Performer PG” part levelling machine from Kohler Maschinenbau GmbH before they are put in cold storage and later formed on a fluid cell press.

„We produce the majority of our parts in batches of 10 to 20 pieces,“ says Hans Haverkamp. „In about 40,000 batches per year, that sums up to around 350,000 parts. For that we process about 27 tons of aluminum.“ At a thickness of 1 mm, that corresponds to around 10,000 square meters of aluminum sheet – about enough to cover two football fields.



**Hans Haverkamp,
Director, Sheet Metal Processing**

»In the evaluation of appropriate levelling machines, we took particular care to find one that has a corrosion-resistant levelling unit and is easy to clean.«



The machine is safe and shuts down when the operator gets too close to the levelling rollers.



The Peak Performer PG is easy to operate, and its Expert Calculation System also provides assistance.



After quenching, only a short time slot remains for levelling the still-wet sheets.



Hans Haverkamp (left), Director of Sheet Metal Processing, and Josef Blätter, Project Manager for Procurement at Pilatus.

Pilatus actually mostly uses sheet metal with thicknesses from 0.4 mm to 1.4 mm, only seldom are parts formed with thicknesses up to 2.5 mm.

Heat treatment and cold storage

The entire process takes place within a narrow time frame. For example, very little time remains after solution heat treatment and quenching in which the sheet metal can be easily formed at room temperature. After that, the material gradually hardens. „This hardening process is prolonged by cooling,“ says Haverkamp, „which is why the cut sheets must be cooled down to minus 20 degrees Celsius as quickly as possible.

That way we have a time frame of seven to eight days for forming them on the fluid cell press.

And after forming, the parts must be kept at room temperature for another 96 hours until they achieve their final hardness.“

Since the metal sheets that Pilatus uses are sometimes very thin, for example at 0.4 mm almost more like a film, these can be strongly warped after quenching. This warpage would also remain after forming the parts on the fluid cell press, at least in the flat surfaces that are only slightly affected by the forming process. „Therefore, we must level the material,“ says Hans Haverkamp. And because the levelling is logically performed directly after quenching while the sheet metal can still be formed well at room temperature, there only remains a time frame of approx. 20 minutes for the levelling process. That leaves little time for drying, so that the fluid has a short time to drip off, but otherwise sheet metal pieces are fed to the levelling machine while still wet.

-20°C

STORAGE TEMPERATURE

In addition to the high demands placed on the levelling results, corrosion resistance was also an important factor.

This is because the moisture from the sheet metal pieces gathers in the levelling unit, and thereby causes corrosion on the levelling and supporting rollers of unprotected levelling machines. These corroded rollers may then leave marks on the levelled pieces which is unacceptable in aircraft construction, because such damage cannot be corrected in the subsequent processing steps.

Corrosion resistant and easy to clean

„In the evaluation of appropriate levelling machines, we took particular care to find one that has a corrosion-resistant levelling unit and is easy to clean,“ says Haverkamp, referring to the previous machine that „could only be cleaned in a time-consuming process requiring the use of tools.“ Naturally, they had first checked with providers that had references from the European aircraft industry and found hydraulic levelling machines for which the levelling gap control was the primary emphasis. „Then we discovered Kohler on the Internet. We were particularly impressed by the design with intermediate rollers and the fact that on this machine, the complete roller frame can slide out on a motorized guide plate. That is a great advantage when it comes to cleaning.“ In the course of their research, the aircraft manufacturers also realized that for their thin sheets, neither levelling gap control nor special overload protection were really necessary.

The levelling machine is positioned directly beside the quenching bath. After briefly dripping off, the metal sheets are fed to the levelling machine.



Operator Thomas Stadelmann at the controls.

Kept at -20°C in the freezer cabinet, the parts remain formable for about 7 to 8 days.





The first prototypes of the new PC-24 business aircraft – here at their rollout in 2014 – completed their maiden flights in 2015.

Images: Pilatus



Focusing on the essentials

The Peak Performer PG model series from Kohler meets these requirements. In the version with the „aircraft“ option, these electromechanical machines are equipped with chrome-plated levelling rollers and all other parts that come into direct or indirect contact with the material being levelled are made of corrosion-resistant material or are protected against corrosion. In addition, the modular design makes it possible to select only those modules that the user needs. For just because something is technically possible does not mean it is necessary, in particular when it comes to thin sheet metal.

Thus for Pilatus, a Peak Performer PG was configured with motorized roller adjustment, a rigid roller frame and a numerical control unit including the Expert Calculation System. Electromechanical levelling gap control and additional overload protection were not incorporated. The Expert Calculation System is a module for determining the roller settings which utilizes a large database containing values collected from practical experience. With its help, even inexperienced operators can relatively quickly determine the correct levelling machine settings for a concrete application.

All controls can easily be operated via touch panel and provide absolutely precise repeatability. In this configuration, up to 200 different material and tool values can be stored and retrieved. Thanks to the control system, flexible speeds from 3–15 m/min. are possible.

In practical operation

After only a few months working with the Peak Performer PG, the tasks involved become noticeably streamlined. „The machine is safer,“ says Thomas Stadelmann, who works directly with the Peak Performer PG. „There is no danger of the fingers being pulled in. If you even only get too close to the rollers, the safety system shuts the machine down.“ He finds the machine easy to operate and he mastered the controls within a very short time.

Around 1600 parts a day are processed with the Peak Performer PG. „We clean the machine at least once a day and sometimes more,“ says Stadelmann. This task is completed within minutes thanks to the motorized quick-change device.

Swiss aircraft manufacturer

Founded in 1939, Pilatus Aircraft Ltd is the only Swiss company that develops, builds and then sells aircraft to customers on all continents: from the legendary Pilatus Porter PC-6 to the PC-12, one of the best-selling single-engine turboprop aircraft, and the PC-21, the training system of the future. Pilatus is currently developing the PC-24 – the world’s first business jet that can operate from short, unpaved runways. Headquartered in Stans, the company is certified according to ISO 14001 in recognition of its efforts for the environment.

The Pilatus Group includes two independent subsidiaries located in Broomfield, Colorado, USA, and Adelaide, Australia, as well as a joint venture company in Chongqing, China. With over 1800 employees at its headquarters, Pilatus is one of the largest employers in Central Switzerland. Pilatus provides training for over 100 apprentices in eleven different professions – job training for young people has always been a very high priority at Pilatus.

www.pilatus-aircraft.com

For this, the upper and lower levelling rollers and the supporting rollers are slid out on their motorized guide plate and are then easy to clean without having to dismount the rollers. Normally, cleaning the levelling unit takes about a quarter of an hour. For a more thorough cleaning, only a few steps are necessary to dismount the levelling rollers, also providing better access to the supporting rollers.

The machine, which is also designed to process larger and longer pieces of sheet metal, will soon be raised by placing it on an additional platform. This will improve the ergonomics even more, and then everything will be perfect for Thomas Stadelmann as operator. And Kohler can add Pilatus to its list of references as a customer in the European aircraft industry.

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