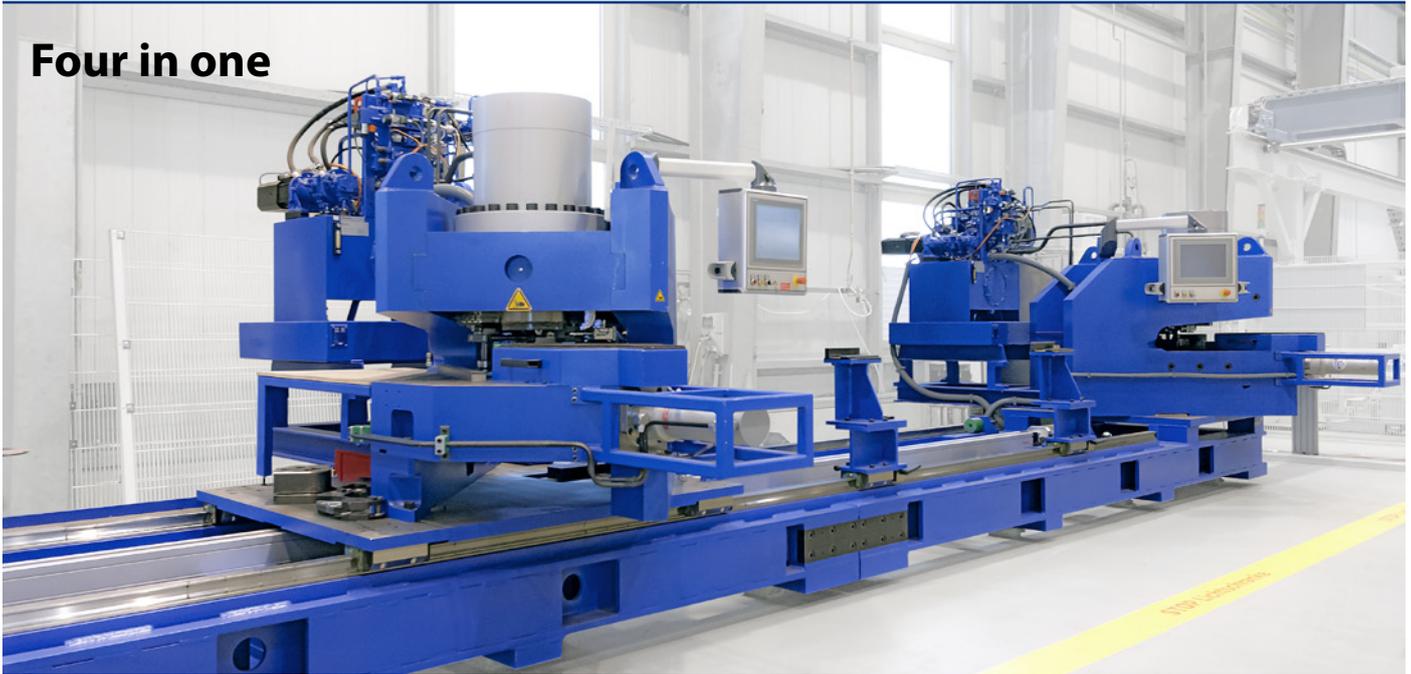




EHRT



Four in one

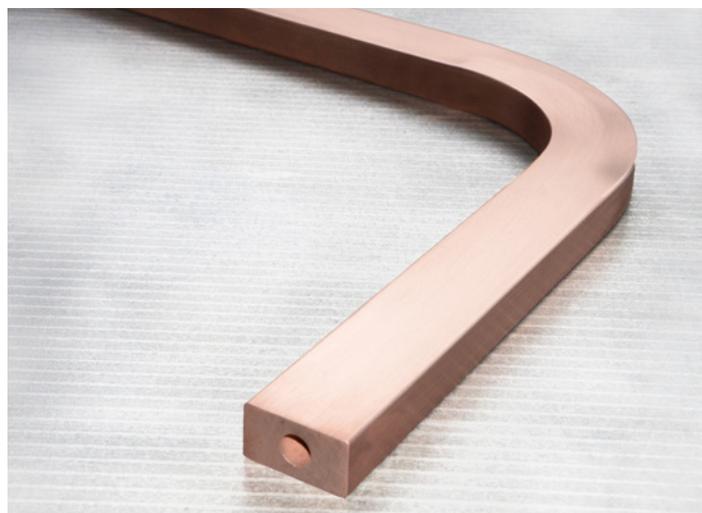


Bending machine with integrated press for copper conductors.

In January this year Siemens installed a new production line for generator rotor coils at their generator works in Mülheim. The main feature of this line is a double axial bending machine with integrated press, developed by EHRT GmbH in Rheinbreitbach. This machine is capable of bending and pressing copper profiles at both ends, improving both productivity and quality.

Siemens in Mülheim produces high-efficiency generators at the upper end of the scale, from 165 MVA upwards. The raw material for these generator rotor coils is either solid drawn copper, or hollow profile copper bars, which are installed in sets, meaning tight bending tolerances are necessary.

EHRT GmbH in Rheinbreitbach is the market leader in the manufacture of bending and punching machines for copper busbar production. By working closely with Siemens, the Rheinbreitbach company were able to develop a double axial special purpose bending machine based on these specifications.



Material distortion on the inside edge close to the bending point during production of parts posed a particular problem

In the past this has had to be dealt with before production could continue. This was done in another work step on a second machine by pressing both sides of the conductor. Depending on the material composition, bending angle and bending radius, this could result in an error of up to 20.

The dimensions of these are impressive: Axial length up to 11,000mm, bar width up to 52mm and thickness up to 27mm with bending angles of up to 90°.

Over a leg length of 1000mm, for example, this could equate to an axial difference of about 30mm.

Siemens therefore decided to invest in a totally new bending technique to give them enhanced efficiency and quality. Their goal was to reduce the work steps from two on two machines to one on one machine, and thus to greatly improve productivity, accuracy repeatability and to gain greater flexibility by reducing tool changeover times.

The double axial bending machine developed by EHRT unites clamping, bending and pressing in one bending press machine.

Two mirror-image bending press units are available, to enable machining of both ends of the conductor at the same time. One unit is fixed, and one can be moved. An integrated length measurement system guarantees the accurate positioning of the moveable unit. When the hollow profile material is inserted, it is positioned and clamped. The bending process then takes place at both ends. EHRT's own patented spring-back compensation system takes care of any spring-back.

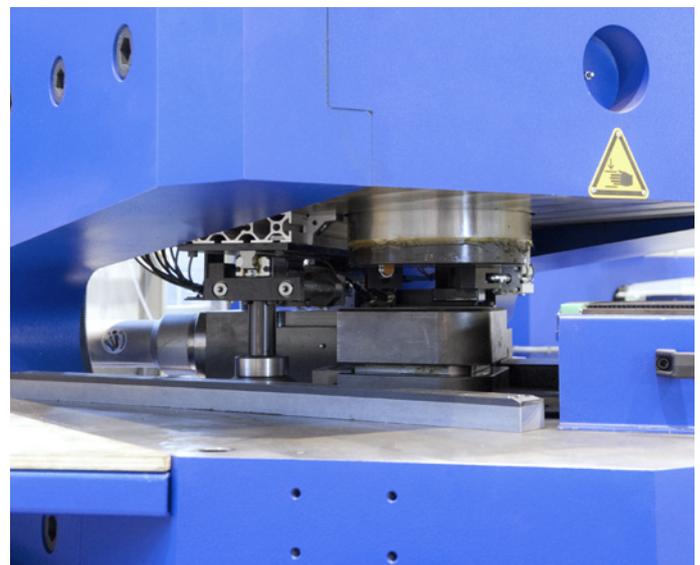
The material distortion is straightened out at both ends simultaneously by the press unit, and the bent angle is checked again. The accuracy of the bent angle obtained by this method is $\pm 0.15^\circ$, the material distortion after pressing is only a maximum of 0.04mm. The whole process time for a conductor is well under a minute. The complete production process is automated.

The engineers at EHRT were successful in condensing the two-step machining process, formerly using two machines, into one process on one machine. This rationalisation also reduced the inaccuracies by about a factor of 10, because the conductor is firmly clamped in place during the whole procedure. The operator no longer has to waste time positioning the piece for every bending and punching step, which led to inaccuracies. Tool-changing times have been radically reduced by EHRT's special system.

From the data currently available, the use of the new double axial bending machine has saved over 90 working hours just in the production of the rotor coil conductors for one generator.

The whole project was completed in just a few months, with EHRT working in close co-operation with Siemens. Richard Neuhoff, sales director responsible for the project, commented: "We are specialists in copper machining and we know what we are doing. We are no strangers to special purpose machines, built to our customers' specifications. However, the double axial machine did mean we were exploring new avenues.

EHRT is very strong on innovation, and is prepared to see it through, and having weighed up the risks and what was required of us, we took the job on, and succeeded."



According to Philipp Büttner, the project manager at Siemens, "we were not sure that any manufacturer could meet our requirements, especially as there was no equivalent standard machine in the market place. It was great to discover that EHRT GmbH was the appropriate partner for us, and was happy to take on this ambitious project with us. There was a great deal to sort out at the beginning, and we were in touch the whole time. The geographical proximity and EHRT's full and frank communication policy were very important factors, leading to a very successful outcome for this project. EHRT have developed and provided us with a powerful machine that meets all our expectations in full." ■