Press retrofit specialist Miebach Schaltanlagen und Montagen GmbH & Co. KG of Dortmund, Germany, recently modernized a complex press line for chassis parts. Ten conventionally controlled 500-t crank presses were brought back into conformance with the latest standards of automation and, in particular, safety technology. The results of this retrofit are 20% to 50% higher stroke rates, significantly faster production changeovers, and generally improved operability and diagnostics. Even more important is the integrated press safety, for which Miebach and Siemens took a new, software-based approach. The winners in terms of safety are the fail-safe Simatic S7-300F controls and the cam control safety software from the Siemens press safety library, evaluated in practice for the first time, in combination with a safe rotary encoder (absolute encoder).

As part of a retrofit, Miebach equipped 10 crank presses with fail-safe Simatic controls and realized press safety easily, efficiently, and cost-effectively by means of cam control safety software.

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Flexible software instead of rigid mechanics
Press safety can be achieved more easily, efficiently, and economically with the new cam control safety

A new set-up with a central role
A safe cam control plays a major role in the modernization of mechanical crank presses. It defines certain areas of the 360° press cycle as “safe,” making it possible to logically analyze when there is a risk of danger for the operator. During the closing motion, for example, the hazard is great, and the motion must be stopped immediately as soon as the operator releases one of the buttons for two-handed operation. During plunger retraction, in contrast, the danger is usually over, and the press control can take over the current lift, so that it stops automatically at the upper dead point (TDC, 360°). The safe cam control then provides the signal to release this so-called takeover. The procedure must meet increased safety requirements in accordance with the guidelines for operating crank presses (DIN EN 692). The same is true for the “Hold at TDC” signal: the mechanical connections between the press crankshafts and the cam control mechanism (shaft-break monitoring) are also monitored by querying the encoder movements.

In the past, mechanical cam controllers with special authorizations performed this task. However, these mechanisms are expensive and subject to a certain amount of wear, meaning they need to be inspected and maintained regularly. This takes up time, during which the presses cannot be in operation. What is more, adjusting the cams after modifications or a replacement of the switchgear is time-consuming, and the adjustment options are limited.

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software from the press safety library (Simatic S7-F/P) for fail-safe Simatic controllers and a safe rotary encoder. The relevant press safety modules for the use and monitoring of the safe cams, for the over-travel, and for shaft breaks / encoder connections (SW_CAM and ENC_MON) are integrated and interconnected in the safety program just like standard function blocks. For this project, the visualization was prepared in the new TIA Portal engineering framework (V11), and the control system was programmed using Step 7 V5.5. During operation, the F CPU communicates with the safe rotary encoder via Profinet and the Profisafe profile.

The control system monitors all cam signals from the beginning of the press cycle and stops the press quickly and safely if it exceeds safety limits (e.g., excessive overrun at TDC stop). Thanks to the absolute value encoder, even potential slips in the coupling or brakes or a shaft breakage is detected considerably faster than previously.

A dynamic approach to higher stroke rates

"A clear advantage of the cam control safety software is the option to take valve shaft or other run times into consideration when programming the control, and thus being able to design switching operations flexibly and dynamically, even in relation to the press speed. What’s more, the settings can be saved in formulas and called up at the push of a button," explains Jörg Weiss, the technician responsible for software and commissioning at Miebach. The entire press cycle can thus be adjusted more precisely, and the stroke rate (output) can be optimized and reliably verified for every tool.

The software approach also saves time thanks to the ability to easily adjust the position after a lift height adjustment or when replacing and readjusting a rotary encoder.

A new path for retrofits

Miebach is delighted with the new solution and its easy implementation and will take this approach again in future press retrofits.