A German premium automobile manufacturer has for more than a year relied on three new servo-transfer presses from Andritz Kaiser GmbH (based in Bretten, Germany) for the efficient production of various structural parts. With a pressing force of 25,000 kN, two of these presses are among the largest of their kind, and a 12,500-kN press completes the trio. For strategic production reasons, the machines were engineered with more than twice the usual stiffness. In spite of the associated increase in mass in the machine frame, they achieve dynamics previously unknown in this class. The symmetrical drive allows not only a circulation mode with a fixed stroke of 750 mm and a maximum of 30 strokes (sine), but also a pendulum mode with a minimum 300-mm stroke and up to 35 strokes.

Siemens supplied the control and direct drive technology for all three systems. A decisive factor in the high pressing force, flexibility, and dynamics is the heavy-duty torque motors from the Simotics T-1FW3 series, with a peak performance of 550 kW and a peak torque of 11,400 Nm. The permanently magnetic water-cooled torque motors are designed mechanically in an especially robust style to withstand shock stresses of up to 10g and are destined for rigorous press use. On each of the two large presses, seven of these motors drive the 200-t press ram via pinion shafts, a transverse intermediate shaft, and a gear, ensuring a high working capacity of 1 MJ for a required force path of 6 mm before BDC. The motors are

**Seven at one stroke**

Seven coupled Simotics torque motors provide the flexible driving force behind the largest Andritz Kaiser servo-transfer presses to date, with a pressing force of 25,000 kN. Simotion provides for dynamic motion control in circulation and pendulum modes.

**Seven servos drive the ram**

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operated under load-balancing control, that is, one motor under position control and the other under speed control. The load balancing is achieved by adjusting the speed of the speed-controlled motors. Four Simotics M-1PH8 main motors act as energy storage devices, which can store electrical power comparable to that of the main drive and release it again within fractions of a second. This balances load peaks and reduces the connected load for the main press drive from a nominal value of 3,850 kW to 1,000 kW.

**Motion control at its best**

A Simotion D-455-2 ensures dynamic motion control with a high level of repeatability. The interaction of the seven motors in the main drive and the energy storage motors is coordinated via Profinet with IRT (isochronous real time). For this purpose, the press control system is integrated via Profinet into an assembly with another Simotion D445-2 for the automation, which was implemented by Dreher Automation. All in all, around 50 drive axes are coordinated with each other.

To calculate the optimal ram motion for the respective transfer tools or progressive dies, Andritz Kaiser relies on the curve generator tool for Simotion. This takes into consideration all the important exposure limits and calculates a ram travel profile online that is optimized in terms of energy and metal forming for every press part or tool. Here, the permissible ram speed limit and the handling times for transfer and automation units are also factored into the curve calculation, making it very complex. “With the most powerful drive-based Simotion, we can even implement stand-alone solutions without additional independent simulation tools,” says Wolfgang Wiedenmann, deputy sales manager at Andritz Kaiser.

**Integrated distributed safety**

An established practice on the presses from Bretten is the integrated control of process and safety functions within one controller. This principle has been retained, but it has been structured logically and distributed across three fail-safe Simatic S7-319F-3 PN/DP controllers for press, automation, and spray lubrication. The general safety-relevant functions are consolidated in certified modules in the optional Simatic Distributed Safety package. There is an additional library of safety modules especially for presses, for use with Distributed Safety. This means that functions such as two-handed operation, selection of operating mode, protecting door, enabling switches, and emergency stop can be implemented simply and flexibly using software. The press safety modules are certified under EN 61508 and EN 62061 (up to SIL 3) and EN ISO 13849 1 (up to PL e). Safety functions implemented in the control units in the Simotion/ Sinamics assembly eliminate the need for separate safety hardware and additional expense.

The first press has been working since June 2013 and is now running in three-shift operation under these specifications. The operator’s conclusion: “The new servo-presses from Andritz Kaiser are currently the most powerful in their class in the company's global pressing plant association.”