Spectrum Metal Forming
Solutions for the metalworking industry
October 2016
Digitalization

New superlative in metal forming
03 Higher efficiency in manufacturing thanks to digital twins for products and production equipment

Servo-presses

Down with idle time!
06 The servo-tryout press from Fagor Arrasate enables the use of press tools of other manufacturers

Optimized pressing
08 Kurimoto uses Siemens drive technology for increased output and reduced energy consumption

Fast pendulum operation, smooth deep drawing
10 With a Simotion controller, deep-drawn parts for the automotive industry are manufactured by Tenneco on a servo-transfer press from Andritz Kaiser

Servo-press technology for Turkey
12 Higher process safety at Dirinler through the use of tried-and-tested standard components

Servo-press pioneer in Brazil
14 Prensa Jundiaí achieves higher flexibility and productivity with Siemens automation

Control cabinets from specialists
16 Individually customized control cabinets for metal forming from Chemnitz

Press handling

Low vibration at maximum stroke rates
18 The OAVIBX technology package for Simotion ensures the smooth running of press transfer systems at Dreher

Tailor-made double feeders
20 NSM Magnettechnik optimizes parts quality and productivity in hot metal forming with Simotion

The perfect combination for punching
22 Simotics servomotors and torque motors score highly in the punching of ball bearing retainers at Raster Technology

Servo-pumps

Precise profiling
24 Fill uses a needs-based variable-speed servomotor for efficient profile machining

Double the performance
26 The changeover to servo-pumps at Exner saves energy and increases performance

Spindle presses

Roll forming at its best
28 Using standardized drive technology, Dreistern offers ultraflexible solutions for roll forming

A custom-fit forging process
30 Vaccari uses an energy management system for pressing complex shapes and demanding materials

Cover picture: Siemens AG
New superlative in metal forming

**Digitalization:** The virtual world is increasingly becoming a "master" – and simulation a core competency for industrial manufacturing – as digital twins for products and production equipment lead to markedly increased cost-effectiveness.
Two trends currently define the development of industrial metal forming: companies are seeking to connect existing metal-forming equipment to form flexibly integrated production units, and at the same time they are looking to combine servo-presses and electronic transfer systems to offer new degrees of freedom. For both trends, motion characteristic curves can be freely defined across a wide range. The reciprocal coordination of these characteristic curves creates new scope for process optimization. For example, transfer systems can begin the parts transport process before the press is completely opened – and this starting point can be optimized using the press characteristic curve.

Using simulation to consistently exploit opportunities
Both the logistical and technical inter-connection of metal-forming equipment to form integrated production units and the optimized coordination of vertical ram and horizontal transfer movements require increased use of simulation techniques to evaluate and optimize the systems and processes. In the virtual world, optimization potential can be evaluated quickly, easily, and without risk before being implemented in actual production situations.

The ability to create digital twins for products, workpieces, tools, machines, and production-related infrastructure is therefore a new key skill in industrial metal forming. All phases of the lifecycle are affected, from product development and production planning, to machine and plant engineering and actual manufacturing, to maintenance and service. This process begins with the selection, use, and maintenance of the necessary systems and tools; affects the procurement and creation of the digital counterparts of all relevant resources; includes the actual simulation and optimization processes; and extends to the transfer of optimum manufacturing parameters defined through simulation to the real machine control system.

The virtual world is changing from a digital clone to a “master”
Experience with simulation systems thus far shows that the role of the virtual world is changing, or even reversing: the virtual side of manufacturing is evolving from a digital shadow used to test various options to an integrated master that directly parameterizes and controls machine and manufacturing processes by means of simulation-supported optimization. One example of this is the interactive Press Line Simulation (iPLS) system from Siemens, which transfers the parameters established and verified during simulation directly to the presses and the feeder and transfer systems. Production start-up for new products or workpieces, as well as retooling and start-up of the metal-forming line after a product or batch change, can be markedly accelerated. Experience with IMLS-powered press lines demonstrates that this considerably improves productive time, process security, throughput, and parts quality. Productivity can typically be increased by 10%.

Self-learning
Virtual and real worlds are converging
The consistent use of virtual manufacturing to control real production also involves merging knowledge and data from both worlds. This makes it possible to gather important or at least supplementary information relevant for preventive maintenance, as well as details on product improvements, in order to improve production efficiency and cost-effectiveness. Production equipment optimization measures can also be developed using this
information. The virtual side of manufacturing is thus becoming an additional driver in the continuous improvement process.

**Integrated system technology from a single source**
Along with a digital model of the machine mechanics and plant configuration, the behavior mapping of the control system and drive technology for all the machines involved is a key part of every production simulation. The more standardized the automation, the easier this is. It is also advantageous if the automation partner provides system-compatible virtual control systems that behave in exactly the same way as the real automation system.

Siemens is currently the only supplier that not only provides completely integrated and standardized automation solutions for all required production resources but also has all the necessary virtual systems in its portfolio: the CAD/CAM side for modeling digital twins, tried-and-tested simulation systems for metal-forming lines, complete production systems, simulation-based sizing tools, equipment condition monitoring systems, and cloud solutions for preventive maintenance.

From the creation of digital twins of machines, plants, products, and tools to transfer of the operating parameters established in the virtual world to the control systems, everything is state of the art and from a single source. This makes Siemens a valuable partner for integrating digital simulation and optimization techniques into the manufacturing process. With its experience, Siemens helps ensure at an early stage that manufacturers are on track for success in their projects.

🔗 [siemens.com/metalforming](https://siemens.com/metalforming)
✉️ alexandre.bonay@siemens.com
Integrating new tools into press lines is extremely time-consuming. This is why – with the aim of increasing throughput – more and more press line operators are using tryout presses, in which new tools can be set up alongside ongoing production. This speeds up the production start-up process for new parts. Unfortunately, some manufacturers do not support retrofitting of tryout presses for older press lines, and in some cases the manufacturers are no longer in business.

**Precisely reproduced characteristic curves for various target presses**
A situation like this at Volkswagen’s production site in Emden, Germany, prompted Spanish press manufacturer Fagor Arrasate to develop a tryout press matching the line presses’ core details – but using servo technology. The original presses’ motion and force characteristic curves play a key role here. Using precisely measured sets of data, Fagor’s ServoPressMotionGenerator generates electronic cam discs to control the servo-press. This results in an exact reproduction of the target press’s dynamic forming characteristics – a reproduction so precise that the tools introduced in this way can be used for series production without further adjustment.

Down with idle time!

**Servo-presses:** A new servo-tryout press reproduces the characteristics of other manufacturers’ head and line presses – meaning that the tools set up here can be used for production in the line without any further adjustment. As an additional benefit, the 2,100-t machine is also suitable for manufacturing small series.
sufficient to set up the tools for all the stations in a line – including press lines from various manufacturers. This saves at least one tryout press, as well as all the resources involved. Fagor’s first servo–tryout press is a 2,100-t connecting rod straight-side press. The movement of the motion characteristic curve is handled by four Simotion-controlled water-cooled Simotics T-1FW3 Heavy Duty torque motors. The drive technology’s power electronics are also water-cooled for reasons of space and maintenance. An eight-point drawing cushion, also motion-controlled by Simotion, is available for complete simulation of the lead press in the line.

Small connected load, low standby consumption
Tryout presses are run in single-stroke operation. Thus, constantly running auxiliary units account for a large proportion of overall energy consumption. In Fagor’s tryout press, the auxiliary units are switched off or changed to energy-saving standby mode early on. This in itself considerably reduces the system’s energy consumption and noise level: a hydraulic press of this size clocks up a standby consumption of approximately 160 kW, while this servo-press uses just 50 kW.

The energy required during the working stroke is also not drawn directly from the supply network but rather buffered in the DC-link of the Sinamics S120 drive system. Two free-running Simotics M-1PH8-type motors with a shaft height of 355 serve as kinetic energy storage devices – including when recovering the deceleration energy from the ram. Only the process’s power loss and the forming energy are drawn from the supply network, for which the entire cycle time is available; peak loads in the process do not disrupt the network. As a result, the connected load of the press – which has an overall output of 2.5 MW – is just 380 kW. This keeps the rate charged by the electricity supplier low.

Focus on development of safety technology
In mechanical presses, safety is ensured by the service brake and/or connector. A servo–tryout press, however, generally has neither of these: the servodrive is rigidly coupled to the connecting rod mechanism. With this in mind, Fagor collaborated with Siemens and the German professional association for wood and metal trades to develop a safety system that was suitable for this press. The developers implemented a Safety Integrated solution with drive-based safety functions from the Sinamics S120 series of converters and precertified safety function blocks. Handheld controllers with enabling switches keep operation efficient. The safety system permits manual loading and unloading and set-up – with up to four active operators. All safety functions are active even when the press is fully switched off, with a safe uninterruptible power supply having been installed for this purpose. In the event of a power failure, the drive controls and programmable logic controllers are kept in operation using the energy stored in the kinetic buffers. This means that the press can always be shut down safely, even in this situation.

Flexible and cost-effective press line operation
The servo technology’s ability to precisely reproduce the forming behavior of various presses in just one tryout press provides operators of multiple press lines with considerable potential for streamlining, as the number of tryout presses can be reduced. The press’s suitability and certification for safe, manually set-up single-stroke operation means that tryout of tools for manually loaded small series production is also possible. Thus, in practice, servo–tryout presses display much greater capacity utilization and are considerably more cost-effective than traditional tryout presses – especially when combined with a comprehensive, cost-reducing energy management system.

Fagor’s first servo–tryout press has been in operation at VW Emden for two years now. Jens Leuchtenberger is responsible for electrical and plant technology and therefore also the tryout presses. He reports: “We also have mechanical and hydraulic tryout presses here, so we can make a direct comparison. The servo–tryout press offers us maximum flexibility, and this benefits the entire factory.”
Servo-presses: Japanese machinery manufacturer Kurimoto Ltd. is making use of the technological and economic benefits of servo technology. The benefits for end users include increased throughput, low energy consumption, and high process reliability.

Kurimoto Ltd. develops and manufactures machinery and plants for public and industrial infrastructure. The globally active company’s solutions cover a variety of industrial sectors and processes – including the metal-working sector, which Kurimoto supplies with forging and forming presses, among other products. The company’s main customers are in the automotive industry. Back in 2014, Kurimoto launched a process of innovation with the development of a servo–forging press. Initially, the company built two presses with servodrives. The machine manufacturer runs the first of these innovative forging presses itself to evaluate the feasibility of forming tasks and optimize industry customers’ machining processes. Kurimoto sold the second servo-press to a renowned manufacturing company in Osaka.

Gaining time with an individually optimized motion profile
When it came to designing the drive technology and press control, the company collaborated with Siemens – or, more precisely, Yaskawa Siemens Automation & Drives (YSAD). The two servo–forging presses have a force of 1,600 and 2,000 t, respectively. In mechanical terms they correspond to traditional connecting rod presses, whereby the eccentric mechanism is driven directly, without a flywheel. The drive used is Siemens’ most powerful torque motor, a water-cooled Simotics T-1FW4 Heavy Duty, with a peak output of 1.5 MW. This motor’s properties were one of the reasons that Kurimoto and Siemens collaborated on this project: a high rated output, high overload capacity, and high torque, even at low rotational speeds, are key prerequisites for applying the required force when forging.

The drive facilitates both extreme acceleration and controlled guidance of the ram and tool. The ram undergoes extreme acceleration at the start of a cycle, and the space between the open tool and workpiece is covered at maximum speed. Before it penetrates the workpiece, the ram is slowed back down so that the forming speed can be adjusted to suit the material’s flow properties. Throughout the metal-forming process, the powerful servo-drive is able to influence the force and motion profile and, therefore, the entire forming procedure. The ram is then returned to the upper dead center at maximum speed, leaving more time...
for part handling. This makes it possible to work at higher cycle rates without inhibiting the loading and unloading of the press. The servo technology achieves a higher cycle rate overall with the same or greater process reliability.

**Low energy consumption**
The servo-presses offer efficient energy management by switching between acceleration and deceleration within the cyclical process to prevent peak loads in the large servomotor from disrupting the supply network. The rotating mass of a free-running large asynchronous motor serves as a kinetic energy storage device connected via DC-link to the Sinamics S120 of the Sinamics S120 drive system. This DC-link also has six Sinamics capacitor modules installed as electrical energy storage devices.

Only the forming energy and the machine’s power loss are drawn from the mains, averaged over the cycle time. Despite its peak drive output of 1.5 MW, the press has a connected load of just 120 kW – and therefore requires an infeed designed only for this rating. The low peak load and active infeed with high efficiency and low harmonic content reduce energy costs.

**Comprehensive system software – efficient engineering**
The user software in Kurimoto’s servo-presses is based on Siemens’ SimoPress Servo system software. This software covers all the usual requirements in terms of press control, operation, maintenance, and diagnostics. A large part of the Kurimoto press’s user software was thus already available in quality-assured form with SimoPress Servo. This made further engineering efficient and more reliable, as the developers were able to concentrate fully on the machine and customer-specific functions.

**Driving improvements in technology and productivity**
Kurimoto has combined the benefits of a forging press with energy management, and the benefits of a servo-press with a user-definable ram motion. Despite the shortened cycle time, there is plenty of time for handling the workpiece, as the freely optimizable motion profiles save time when inserting and withdrawing workpieces. They also facilitate optimization of the actual forming process. Without sacrificing process reliability, servo technology provides greater productivity – in terms of both achievable quality and throughput.

> siemens.com/metalforming
> bernd.dietz@siemens.com

---

1,600-t forging press with servodrive from Kurimoto Ltd.

Driven by Siemens’ most powerful torque motor, a water-cooled Simotics T-1FW4 Heavy Duty, with a peak power of

1.5 MW

A kinetic storage device and the DC-link capacity buffer the energy released during regenerative braking of the press for the next production cycle.
Fast pendulum operation, smooth deep drawing

**Servo-presses:** Automotive supplier Tenneco manufactures constantly changing sophisticated deep-drawn parts for exhaust gas systems on a servo-transfer press from Andritz Kaiser. A Simotion controller controls the press and drawing cushion and communicates with another Simotion controller for the transfer and conveyor system via Profinet IRT.

The 1,250-t press was tailor made for automotive supplier Tenneco’s constantly expanding range of parts. The company runs a central press shop for the entire Tenneco group in Edenkoben, Germany, meaning that the new machine has a key role to play. Malfunctions or failures could put production at other sites at risk. Reliability and availability are of utmost importance, which is why the company management opted for a press from Andritz Kaiser GmbH, with Siemens control system technology throughout.

A flexible press with high output
The servo-transfer press is used to manufacture a wide variety of components for car and truck exhaust systems in batches from 2,000 to 6,000 parts. The range includes more complex, large-volume components with a large drawing depth as well as simple, smaller parts that require a high level of force due to the sheet thickness. An additional challenge is the highly asymmetrical distribution of force when producing many parts, which can only be reliably managed over the long term with a reinforced, very rigid press structure.

The press is designed for a maximum of 35 strokes per minute. This ensures sufficient power reserves for the system to maintain high output over extended periods in both progressive and transfer operation. Due to the tools used, the current output is 20 to 25 parts per minute. The press has a fixed stroke of 500 mm, but smaller strokes can be achieved through pendulum operation. The semiauto-
mated tool-changing system facilitates a high degree of flexibility, which is essential when dealing with two or three production changes per shift. The new press system achieves almost double the output of the hydraulic press that it replaced, and the machine’s rigidity leads to a considerably better part quality. In addition, wastage is down by as much as 25% (depending on the component).

Integrated automation with Profinet IRT

The press is fed by a coil line from Dreher Automation, which can also be used to manufacture sandwich panels. The sheets fed in from the side are transported by a transfer system, also from Dreher, with a variable number of levels. Drawing cushion operation allows for up to 5 levels; not using a drawing cushion allows for up to 12. Highly dynamic transfer is ensured by Simotion’s internal vibration reduction, VIBX (vibration extinction).

The motion control for the servo-press, including the hydraulic drawing cushions, is coordinated by a Simotion D455-2 controller, which communicates with another Simotion D445-2 via Profinet IRT (isochronous real time) for the transfer system. “The integration eliminates interface problems and permits extra-short cycle times without data loss. This allows us to achieve the desired rapid, reliable operation,” explains Wolfgang Wiedenmann, deputy sales manager at Andritz Kaiser. A failsafe Simatic S7-300F controller acts as the higher-level press control system.

Optimizing use of tools

The press manufacturer has long been achieving rapid ram movements that are gentle on the press, tools, and components with the OACamGen curve generator tool for Simotion. Taking into account all the limit values for the press and drives, it calculates an optimized ram profile for each molded part. One inherent advantage of the servo-press is the fact that it allows acceleration and deceleration of the process at practically any point. Tenneco is already taking advantage of this ability to optimize use of existing tools. Additional steps, such as feed-in, joining, and welding of inserts, will be integrated into the pressing process in the future. And the new press is equipped to handle this, too.

Easy, energy-efficient operation

The handwheel is also very easy to operate when setting up new tool sets with very slow machine speeds. This is one of the main benefits of the three heavy-duty Simotics T-1FW3 torque motors, which drive the ram powerfully, dynamically, and precisely by means of two connecting rods.

In Andritz Kaiser presses with three torque motors, the energy generated when decelerating is always absorbed by the combination of a Simotics M-1PH8 flywheel motor and a capacitor buffer and fed back into the working stroke. As a result, the press is considerably more energy efficient than the hydraulic press it replaced or a comparable conventional mechanical press.

“Two Simatic IPC477D panel PCs with a 19-inch touch display also make monitoring, control, and machine diagnostics easier. It’s a comprehensive solution,” says Andreas Dahl, head of process engineering at Tenneco’s press shop.
Servo-press technology for Turkey

Servo-presses: The Dirinler Group delivers more than 350 presses to the four corners of the earth each year – around 50 of which have a force of between 100 and 1,000 t. And now the enterprising manufacturer of connecting rod and hydraulic presses, compressors, and special CNC machinery has added an innovative servo-press to its portfolio.

Dirinler’s new line of servo-presses is designed for forces of 100 to 1,000 t. The press shown here has a capacity of 150 t and 150 strokes per minute.

The first servo-press to be developed in Turkey comes from Dirinler and uses Simotion for motion control. The family-run firm, now in its third generation, is a market leader in quality press, CNC, and special machinery construction in Turkey; it is, for example, the only Turkish press manufacturer authorized to use the CE mark. The few components that Dirinler does purchase are always top-quality German products that are internationally accepted and that benefit from local service.

A perfectly honed energy efficiency strategy
The company from Izmir showcased its servo-press for the first time at the 2015 EMO trade fair. The 150-t servo-press, with Safety Integrated and convenient recipe management,
generates 150 strokes per minute at a connected load of just 40 kW. It draws energy for acceleration and work capacity from Sinamics capacitor modules. These are initially charged from the mains but then store kinetic energy released during deceleration. As a result, during processing the supply network is burdened only with the power loss and the energy required for operation. The conductor cross sections show how efficiently peak loads can be avoided in the supply network: cables as thick as a child’s arm between the converter and servomotor demonstrate the press’s power. The 40-kW mains connection looks thin by comparison – but is completely sufficient.

Flexible and with a high degree of repeat accuracy
Dirinler’s servo-press takes into account the growing demand for flexibility and cost-effectiveness in production, with batch sizes decreasing and the diversity of molds increasing. A servo-press’s electronic motion control can be used to quickly and easily modify the lift, stroke rate, and speed profile of the ram movement and, therefore, the development of force to suit the tool’s and material’s requirements – individually for each phase of the process. Because servo technology has a high degree of repeat accuracy, forming processes at the limits of the material’s flow properties enjoy optimum process reliability. Even parts that can be manufactured only with considerably lower throughput on connecting rod or hydraulic presses are handled with a high cycle rate, a low scrap rate, and high cost-efficiency by the servo-press.

Convenient operator control
Operators access the servo-press’s capabilities by means of Dirinler’s practical and convenient operator control, which is based on tried-and-tested standard functions from the Simotion application library. Parameter sets defined once for a tool/material combination are stored as a recipe and reactivated when the workpiece is used again. The servo technology’s high degree of repeat accuracy comes into play here as well: repeat parts are manufactured immediately with excellent process reliability and without further adjustment. This means that even small batches can be produced at a competitive cost.

Excellent connectivity boosts productivity
Dirinler prepares its machines for remote access as standard, facilitating rapid diagnostics and telemaintenance as well as operator coaching. Atilla C. Yilmazlar, head of marketing and sales at Dirinler Makina, explains: “With the Simotion motion control system, everything comes from a single source – it’s designed as a consistent system portfolio. This allows for a very streamlined system structure with integrated safety functionality as well as access to all data that are important for process quality and cost-effectiveness, even from the drive level and peripherals. At the same time, Profinet provides a good and transparent connection to the operator’s IT world and for line integration.”

Operators benefit from experience and customer orientation
Dirinler uses this good connectivity for its customer service. Based on the collected operating data, operators are given very concrete suggestions on how they can improve the throughput, quality, and cost-effectiveness of production. This means that they benefit from Dirinler’s decades of experience in metal forming even after buying the machine.

»All our new developments and improvements are focused on delivering concrete customer benefits and are robustly and reliably implemented using tried-and-tested methods and components.«

Nihan Dirin (left), Deputy General Manager, Dirinler Sanayi

siemens.com/metalforming
bernd.dietz@siemens.com
Servo-press pioneer in Brazil

**Servo-presses:** The combination of proven, rugged machine design and Siemens automation not only ensures the required performance and reliability of the presses at Prensa Jundiaí S.A., a leading South American machine manufacturer, but also offers the highest levels of flexibility and productivity.

The individualization of production is one of the key features of the fourth industrial revolution. The goal is to cover the widest possible range of products with a single machine, while at the same time producing them with high efficiency. Prensa Jundiaí, a machine manufacturer located in Brazil, identified this trend at an early stage and is expanding its portfolio to meet the challenge. Its current line of mechanical and hydraulic presses offers a wide range of press forces, from 50 t to over 1,000 t. In the future, the presses will be enhanced by high-performance servo-press technology from Siemens.

The collaboration between Prensa Jundiaí and Siemens has led to the development of a solution that offers significant advantages to machine operators, as they can adjust the highly flexible press movement to suit the component pro-
The partnership with Siemens has been crucial in enabling us to develop this high-quality, efficient machine.«

Lucas Rodrigues, CEO, Prensa Jundiaí S.A.
Modern electrotechnical, control, and drive systems make metal forming more efficient, more precise, and more flexible. Recent examples of this improved technology include servo- and spindle presses with kinetic or electrical energy storage devices and electronic transfer systems. However, as the scope of automation technology increases, so too do the demands placed on – and the complexity of – control cabinet manufacturing.

Machine manufacturers that cannot, or do not wish to, have this capability in-house need not miss out on the advantages, however. The Siemens System Engineering Plant in Chemnitz (“WKC” for short) has a comprehensive range of services, the latest technologies, and around 900 experienced employees at the ready for this purpose. These specialists based in the German state of Saxony can take on whatever task is required – from planning, to configuration and production, to testing ready-to-use control cabinets of any dimensions – in batches of one or for series-manufactured machinery.

Expertise rooted in experience
WKC is the European market leader in control cabinet manufacturing for machine tools and has also been manufacturing customized switchgear for production machinery for more than...
20 years. Up to 30,000 control cabinets a year, plus innumerable smaller control boxes and panels, make for experience and extensive industry expertise. The plant is also a competence center for switchgear cooling, has its own heat laboratory, and is a certified UL panel shop.

The plant’s range of services covers every aspect of control cabinet manufacturing, from customer specifications to ready-to-use electrical equipment: consulting and design, configuration, contract processing, materials logistics, mechanical production, assembly, wiring, testing, software installation, and precommissioning. Added to this are international shipping logistics, with just-in-time and ship-to-line delivery. The customer determines the extent of service provided or, alternatively, uses only individual services. The trend is moving more and more toward ready-to-install modules, which, in addition to the actual control cabinet, feature a control panel, energy chains equipped with pretested cables, and other – for example, fluidic – components.

Professional production on an industrial scale
As a partner to more than 200 well-known manufacturers of individual and series machines, WKC places great emphasis on professional organization and largely automated processes in production. Ideally, this begins with electronic data interchange with the customer through standardized interfaces in order to avoid unnecessary time losses and errors. Permanently assigned project managers then supervise each order from material procurement to change management.

Additional manufacturing engineering – which includes, among other things, a 3D design layout that permits examination of the scope available in thermal and EMC terms, as well as autorouting of connections – is key to achieving high productivity in manufacturing. In the case of control cabinets for presses with high drive power, configuration of the water cooling system is also involved. The NC programs for sheet metal working and the data for automated prefabrication of lines and cables are then derived from this “digital twin.”

Depending on the quantity and similarity, the cabinets are then set up and wired in a batch or assembly line production process. This is followed by an automated standard test, which includes the functioning of switching, operating, and signaling devices. If desired, the specialists can implement additional complex tests, right through to precommissioning in accordance with customer specifications. Additional services are also available. For example, WKC provides support with the interpretation of standards (particularly UL/NFPA); designs customized drive, control system, HMI, and safety solutions; implements joint design-to-cost analyses; and draws up electrical documentation. In addition, WKC develops cooling solutions for critical applications and tests them in its own heat laboratory. Consulting and measuring services are also offered on-site at the customer’s premises.

Unique control cabinets for presses
Many of these services are included in the manufacture of individually designed, one-off control cabinets for presses – if desired, with back-to-back set-up, with capacitor cabinets and booksize or chassis converters, and with or without water cooling. The largest cabinet for an individual press to be built so far included two infeeds of 630 kW each, as well as 18 motor modules of 800 kW each, and was approximately 20 m long.

Benefits at a glance
• Complete portfolio of services from a single source, which reduces procurement costs and capital commitment
• High level of flexibility
• Individualized support
• Expertise in standards and applications
• Documented quality
• Ready-to-use individual and series cabinets

WKC designs and produces individual control cabinets – including for the metal-forming industry

siemens.com/metalforming
ts.richter@siemens.com
matthias.neumann@siemens.com
Low vibration at maximum stroke rates

Press handling: Machine manufacturer Automatic-Systeme Dreher is considerably reducing vibration in press transfer systems with the OAVIBX technology package for Simotion. This ensures noticeably smoother operation, as well as making transfer processes more reliable than ever. The result? Uninterrupted operation at maximum stroke rates.

The trend toward higher press stroke rates – and therefore faster transfer movements – is bringing the issue of vibration to the fore. The faster the parts need to be picked up, transported, and put down, the more important it is for all movements to be optimized. Excessively abrupt acceleration and deceleration contributes to the generation of vibrations, which can cause parts to be picked up and passed on incorrectly, or even dropped, resulting in interruptions to operation or, in the worst cases, even in damage to components, tools, and presses. In order to prevent this, Automatic-Systeme Dreher GmbH is constantly working to make transfer systems – particularly large-scale transfer systems – more dynamic and at the same time less prone to vibration.

Vibration reduction with tried-and-tested technology

As a manufacturer of customized press automation systems, Dreher uses the Simotion D motion control system and the OAVIBX (Open Architecture ViBration eXtinction) technology package specially developed for it. Dreher has established an integrated, scalable automation solution for its transfer systems based on Simotion D, Sinamics S120 converters, and Simotics S servomotors. Thanks to the SimoTrans electronic transfer control system for Simotion, the machine manufacturer is able to optimize the interplay of the gripping, lifting, and feeding movements and adjust them to match the press strokes precisely. To do this, it uses all the system’s available features, such as electronic axis coupling in gearbox and curve synchronism on virtual and real axes, jerk control, and safety functions.

But press operators expect more and more. However, support lengths of over 5 m, traverse distances of 2 m, running speeds of up to 3.6 m/s, and acceleration levels of up to 20 m/s² mean that the machines are reaching critical limits in terms of vibration. This is why Dreher always looks carefully at vibration behavior in all large transfer systems, using OAVIBX for regulation where required. The technology package is essentially a setpoint filter, which can be used to simply but effectively suppress the dominant natural vibration (frequency \( f_d \)) of mechanical parts in motion. This filter’s task is to alter an axis’s setpoint in such a way that excitation of the dominant natural vibration of the mechanical parts (\( f_d \)) is avoided, and vibration-free positioning is achieved. The filter is parameterized through the frequency of the natural vibration to be filtered (\( f_d \)) and the damping. In practice, minimal damping (\( D = 3\% \)) is used so that the natural frequency of the damped system (\( f_d \)) approximates the resonance frequency (\( f_r \)).

Easy to implement – even as a retrofit

The technology package is installed in the Scout engineering system and provides the function for all Simotion platforms. The frequency (\( f_d \)) can be determined either using the integrated tracing or measuring function in the engineering system or using external measuring devices. The solution does not require structural changes or addi-
tional sensor technology or actuators, which simplifies retrofitting. It is also possible to use independent axis set-point filters on several axes of a control system simultaneously – and thus also in the case of electronic axis coupling and interpolatory movements.

Dreher calculates the frequency of the vibrations, which are often visible to the naked eye, using an accelerometer: once for each transfer rail and once for each movement (closing/lifting) at the required maximum speed and stroke rate.

The calculated vibration values then serve as the basis for the damping of all axes in a direction of motion. This has little impact on the drive control cycle time. What is more, it seldom takes longer than 30 minutes to achieve smooth running; even retrofitting existing Simotion systems requires no more than two hours, if adequate preparations have been made. The improvement in smoothness of operation also means that the transfer system is subject to less mechanical stress, which in turn has a positive impact on wear and service life. As damped systems are generally subject to lower mechanical stress, they can have a lighter-weight design.

**An increasingly important selling point**
Hasan Sarac, managing partner at Dreher, believes that OAVIBX is a real selling point for press operators: “The simple functional principle is not that easy to explain – but the difference and the benefits are clearly visible and quantifiable. We have already been able to achieve up to 20% higher stroke rates and can ensure maximum process reliability. The costs are manageable, and the investment pays off within a short time.”

---

**Benefits of vibration reduction with OAVIBX:**
- Shorter positioning times
- Higher stroke rates
- Operation with less mechanical stress
- No additional hardware requirements
- No structural changes
- Easy retrofitting

In almost 90% of Dreher’s larger transfer systems, the OAVIBX technology package for Simotion helps damp vibrations electronically.

[siemens.com/metalforming](http://siemens.com/metalforming)
[manfred.popp@siemens.com](mailto:manfred.popp@siemens.com)
Tailor-made double feeders

Press handling: Highly dynamic linear feeders made by NSM Magnettechnik optimize parts quality and productivity in hot metal forming. A Simotion control system ensures perfect synchronization with the press using the new “chasing” function module.

An American automotive supplier was looking for a replacement solution for inserting blanks and removing the finished parts by robot on hot metal-forming presses. The insertion time for blanks of up to 2.3 m by 2.3 m in size needed to be just as short as before in order to be able to press blanks heated to 950°C at optimum process temperature. However, insertion precision and the degree of repeat accuracy also needed to be improved to reduce the need for manual intervention. Another goal was to extend service intervals in order to minimize downtime.

Impressive patented feeder kinematics
The company approached NSM Magnettechnik GmbH, based in Olfen in Westfalia, Germany, with these requirements, and the latter developed a tailor-made double feeder application based on NSM’s patented high-speed feeder kinematics. The reduced mounting height of the telescope system permits a smaller press opening height, with the result that positioning movements can be started earlier and therefore executed more rapidly. Both feeders can be moved in three axes by means of servo-motors. In addition to the main axes x (insert/retract) and z (raise/lower), there is a y-axis for lateral movement.

Proven integrated automation
The sequence and safety functions are controlled by a fail-safe Simatic S7-300F controller, in part using standardized press safety components (for two-handed operation, light grid, load monitoring) that reduce the time required for engineering and approval. Further savings are achieved by the safety functions integrated into the Sinamics S120 drive system, such as Safely Limited Speed (SLS) and Safe Torque Off (STO).

Motion control – tailor made and efficient
A Simotion D445-2 DP/PN controller coordinates motion control for both feeders. In order to have the system ready for use more quickly, NSM uses ready-made, open applications from Siemens’ Metal Forming Solution Package. This contains Simotion example programs with SimoFeed and HMI operating screens for feeder applications that considerably reduce engineering requirements.
At the request of NSM, the drive specialists at Siemens developed a “chasing” function especially for this application that facilitates time-optimized, collision-free operation of two feeders within the tool space. This function makes it possible to determine the distance of the feeders from one another using the machine geometry and the positioning information in the x-axes, thereby ensuring that the inserting feeder – synchronized with the motion of the press – follows the removing feeder at the highest possible speed and the shortest possible safety distance. In material terms, this led to a 30% reduction in the insertion and removal time – time that can be used for metal forming under optimum conditions. In order to ensure the smoothest possible running during acceleration and braking, NSM implemented Simotion VIBX vibration extinction. This allows the dominant natural vibration of the moving mechanical elements to be easily and effectively suppressed without the need for structural changes or additional sensor technology. NSM took advantage of all the options afforded by the coordinated control system, motion control, and drive technology from Siemens to generate a cost-effective solution individually tailored to the application in question. Where necessary, when sizing more complex pressing/handling configurations, NSM also uses the Press Line Simulation (PLS) software.

Faster, safer, and more precise – in record time
Thanks to good preparation and collaboration, NSM was able to complete commissioning on-site in only three weeks. The two NSM feeders have been “chasing” each other back and forth dynamically, collision-free, and with high precision ever since. Thanks to increased rigidity and higher positioning and repeat accuracy, NSM was also able to reduce the defect rate from 20 to only 1 or 2 per 1,000 cycles, resulting in a considerably increased output rate. Because the permanent load on mechanical and electrical components is relatively low thanks to the patented design, the machine manufacturer also expects service intervals to be significantly longer. NSM has no doubt that the robustness of the automation technology from Siemens will contribute to this.

siemens.com/metalforming
stefan.loesing@siemens.com
Press handling: Raster Technology uses individual and direct electronic drives in fully automated parts feeding to achieve minimal retooling times and double the output in the production of ball bearing retainers.

Raster’s highly efficient solution is tailor-made for punching 80 different versions of ball bearing retainers for drive shafts in small to medium batches, making it ideal for frequent changes. The system’s core components are a Raster RST 1000 automatic punching machine and a new, fully automated parts feeder that feeds from two sides. A combination of Simotics servo- and torque motors makes it possible to change formats at the touch of a button, as well as facilitating high-precision positioning and indexing of the retainers at two processing stations. The entire system is controlled by a failsafe Simatic S7-300F controller and a Simatic industrial PC. All settings and changes can be executed quickly and easily on a 19-inch touchscreen or a portable Simatic MP177 PN mobile panel. Functional safety is integrated into the drive system, thus reducing operator workload.

Highly dynamic and precise
The backbone of the parts feeder is a reversible loading device, which is moved precisely and dynamically by
two servomotors and three torque motors. Two feeds, which can be adjusted using servomotors, supply blanks to the loading device from two sides. This means that two retainers – even of different sizes – can be inserted and punched side by side simultaneously. In addition, preliminary and final punching can be executed in two consecutive steps at two stations without reclamping, making it possible to achieve particularly high surface quality and dimensional precision. Upon changeover, the reversible loading device picks up another blank immediately and places it in the first station. The direction of feed and ejection is freely selectable in both steps.

In order to ensure reliable transportation of parts and short retooling times, the two feeds can be set to the entire range of blanks independently of one another. This is done via a servomotor at the touch of a button. For new parts, the system calculates almost all the setting parameters automatically. To ensure that the asymmetrical blanks reach the press in the right position, they are measured during feeding, turned automatically if required, and then received by the relevant loading device/indexer, hydraulically clamped, and inserted. These steps are also performed using a servomotor, with the torque being determined when the blanks are placed in the dies in order to avoid damage to tools. The torque motors turn both parts further after each stroke, meaning that all conceivable positions are, in theory, possible. The servo-axes allow the bar height and width to be adjusted easily. Another servomotor ensures controlled conditions upon discharge. Thanks to individually driven indexing units, the torque can be monitored separately during further cycles of both units, and action can be taken immediately in the event that limits are exceeded. The compact torque motors keep the moving loads small for improved dynamics, while special hollow-shaft encoders facilitate excellent positioning accuracy.

Optimum interaction
The interplay between the 18 drive axes and six servo-gripper axes coordinates the press control, along with an electronic cam control mechanism and a positioning module for ram adjustment. The function modules relieve the CPU, which communicates via Profinet with four IM151-3 PN interface modules in the central control cabinet and in the lower-level control cabinets. The Simotics motors are connected to the four CU320-2 control units of the drive system via the Drive-Cliq digital system bus, which allows both sides of the feed to be operated and serviced separately.

Dramatic increase in flexibility and output
The servomotor-driven setting and changing of parts feeding reduces the machine’s retooling time from two man-days to less than 30 minutes in some cases. Parts can now be fed considerably faster and with greater process reliability, achieving up to 300 strokes per minute. The cycle time for manufacturing four-recess retainers is four seconds, while six-recess retainers take six seconds. This represents an almost twofold increase in output, to up to 6,000 parts per shift – with no compromises on quality or process reliability. Operators are now able to respond to and meet customer needs much more flexibly and rapidly than ever before.

siemens.com/metalforming
andreas.gaupp@siemens.com

Simotics T torque motors are key to maximum dynamics and highest precision in turning the reversible loading device and indexing the parts.
Austria-based Fill Gesellschaft m.b.H. creates individual system solutions for complete profile machining, primarily for automotive suppliers. The core components are most often linked hydraulic presses for metal-forming and punching tasks. To continue satisfying customer requirements in a cost-effective manner, Fill has updated its presses’ hydraulic system. Instead of an asynchronous motor, the hydraulic pump for the main current is now driven by a variable-speed Simotics M synchronous servomotor. It is regulated by the Sinamics S120 drive system and the customized standard DCC servo-pump software application.

**Servo performance flexibly (pre)planned**

DCC stands for “Drive Control Chart.” The software contains drive applications for Sinamics S120, comprising ready-made, standardized modules. These modules carry out various control tasks, as well as arithmetic or logical operations, and are easy to combine into a customized drive application. DCC servo-pump includes all functions relevant for efficient operation of Simotics servomotors on hydraulic pumps. This means that Fill is able to implement press ram positioning or ventilation with ease and can adapt the process flexibly – all with considerably greater control precision than before. At the same time, tool protection is increased, as more

---

**Precise profiling**

**Servo-pumps:** Fill is making profile machining more precise, more energy efficient, and faster than ever before with a needs-based variable-speed servomotor and an open-standard servo application in the drive.

Various versions of aluminum cross-arm systems for bumpers are manufactured on the press line.
precise procedures prevent wedging of tool parts and, therefore, damage to tools and components, even at higher stroke rates.

A considerable reduction in effort and energy consumption
The servo-pump drive eliminates the need for conventional valve technology, which simplifies mounting, maintenance, and spare parts stocking. The pumps only run when they are required, which means they consume at least 30% less energy. As a result, the oil requires considerably less cooling – and in some cases none at all. The drive’s intelligence also reduces the cost of the hydraulic system. A further positive effect is the noticeably reduced noise emissions.

Automation standard for presses
With help from Siemens, Fill has developed a kind of standard automation package for its presses. The core components of each press are a Simatic S7-300 PLC and the modular Sinamics S120 drive assembly. Added to this is a Simotics M-1PH8 servomotor on the main pump, which is customized to suit the unit’s force. Other standard asynchronous motors from Siemens are used for ancillary circuits. Simatic HMI devices for set-up, as well as monitoring and control during operation, complete the package. A failsafe Simatic S7-300F controller coordinates the safety-relevant functions of a line via Profinet and Profisafe.

The hydraulic cylinders’ actual levels of pressure are recorded in analog mode and passed on to the digital Drive-Cliq system bus and the CU320-2 Sinamics control unit via TM31 terminal modules. A glass scale is connected directly to the control unit to record the ram’s position. This creates a more closed, rigid, and precise control circuit. At ±0.5 mm, the positioning accuracy is considerably greater than before.

Simple, supported commissioning and changeover
“Siemens created a simple Excel tool for us for motor design. This enables us to determine the required motor torque and speed with just a few inputs,” explains electrical engineer Julian Gast. The operator enters these parameters into the Sizer configuration tool and is quickly taken to the corresponding motor. Siemens supervised the changeover and commissioning of the first few presses, but because the standard application is very well documented and easy to use, the press manufacturer is now able to do everything independently, including creating its own DCC modules. Siemens in Linz, Austria, provides application support.

Proven in practice
Fill has since used the Siemens automation package to create both individual presses and linked production lines, the latter very recently for a well-known automotive supplier. Using a four-stage press line, this supplier produces constantly changing versions of aluminum cross-arm profiles for bumper systems at a cycle time of well under 20 seconds.

siemens.com/metalforming
reinhold.steinberger@siemens.com

DCC servo-pump components
- Machine operation via Simatic HMI
- Machine control and safety technology provided by a failsafe Simatic S7-300F controller
- Sinamics S120 drive system
- Simotics M-1PH8 servomotor on the main pump
- Standard asynchronous motors for ancillary circuits

Fill creates individual system solutions for sophisticated profile machining on its hydraulic presses – including for the automotive industry.
In innovative servo-pump systems, pressure and flow rate are no longer controlled by the choking effect of valves, but rather by a servomotor’s torque and speed. This means that energy is supplied only when it is actually needed at the hydraulic cylinder. The result? A considerable increase in energy efficiency – as is confirmed by the real-world example presented here.

More than 50 years of experience
Exner Pressentechnologie GmbH was founded in Witten-Herdecke, Germany, by Ludwig Exner more than 50 years ago. A manufacturer of hydraulic presses with forces of between 200 and 30,000 kN, the company is active in both national and international markets. “Our business is focused on Germany and neighboring European countries, however,” says technical manager Michael Lange. Well-known firms from the automotive, electronics, medical technology, household appliance, minting, jewelry, eyewear, and watch industries are among the Westphalia-based firm’s customers. Exner was acquired by the present-day Schubert Group in Ennepetal around seven years ago, and business operations were shifted to this site. The Schubert Group now has a total of 90 employees – 35 of whom work for Exner. Describing the Exner presses, Lange says that they are “extremely robust and durable, with a wide product range, and highly customizable.”

Failsafe automation
Exner uses only Siemens products when designing press control systems – the two firms work closely together. The favored control system is the Simatic S7-300 PLC series. A Simatic S7-315F controller is being used in a new hydraulic press. This choice enables the design of a failsafe automation system for plants with increased safety requirements. The integrated interface can also be used to connect fail-safe I/O devices. The entire system meets safety requirements up to SIL 3, in accordance with IEC 61508, and PLe, in accordance with ISO 13849.1.

High energy efficiency
The backbone of the press automation set-up is a Siemens application for servo-pumps, which offers a solution for energy-saving hydraulic applications. Unlike with a conventional hydraulic solution, and thanks to dynamic direct pressure and volume regulation by means of a variable-speed servomotor, complicated control systems are not required, thus reducing energy consumption by more than half. “The oil pressure in the plant is regulated directly via the connected Sinamics S120 drive system,” explains Bernhard Kreutzer from Siemens in Essen, who looks after Exner. Using the Siemens solution has considerably reduced the energy consumption of the press. The transfer of heat into the structure has also been reduced, meaning that less heat needs to be dissipated, once again saving energy.

A custom-fit solution
The flexibility of the system means that it can be configured to meet customer requirements. Kreutzer confirms: “If we know the key details for the press, we can offer a solution that perfectly meets the customer’s needs.” In terms of control, the solution was implemented in such a way that the positioning of the ram is left to Exner’s control system, and a speed interface with the servo-pump is created from there. The main control system, and not a proportional valve, now controls the servo-pump’s set-point value for speed. “That was the best way to integrate the servo-pump,” says Kreutzer, as it allowed Exner’s standardized control system to...
be maintained. “Once Siemens had delivered the servo-pump we did the rest – organizing the entire control cabinet, building the HMI, and performing the overall integration. Commissioning was done in three days,” says Lange.

A considerable increase in performance

The servo-pump application brings the company other benefits in addition to significant energy savings. For example, control accuracy has improved considerably. “Compared with our standard presses, which had an overshoot of 10% to 15% during adjustment, we are at around 1% with the new solution – all within a very acceptable period of time,” emphasizes Lange. Above all, however, it is the machine’s increase in performance that Exner is particularly happy with: the press used to achieve 20 strokes per minute, and now it achieves 40. That is an unexpected 100% increase. One thing is very clear: the engineers involved have been very pleasantly surprised.

Benefits

of the servo-pump application:

50% energy savings

Compared with standard presses, which had an overshoot of 10% to 15% during adjustment, we are at around 1% with the new solution.

Increase in performance:

from 20 strokes per minute to 40

siemens.com/metalforming
christian.gehrhardt@siemens.com
Dreistern GmbH, based in Schopfheim, Germany, focuses on the flexibility of individual and multimotor drives, consistent standardization, and process-oriented modularization of hardware and software. The core components the company uses are the Simotion D motion control system, Sinamics S120 and Sinamics DCM converters, and Simotics motors. The latter are available in both AC and DC versions and can be controlled using the same motion control software by means of technology objects. This was a prerequisite for a standardized drive design with motors of different types and outputs for individual machines. So when it comes to the motion controller, it makes no difference whether AC or DC technology is used. This is important because, for reasons of space, drive power of about 80 kW or more on the main feed can often only be achieved using compact DC motors.

Roll forming systems: Technological leader Dreistern has completely overhauled, simplified, and standardized the drive design for its roll forming systems, offering modular, ultraflexible solutions for efficient roll forming.

A modular standard for the widest range of applications
The defined system and functional standard covers more than 80% of all roll forming applications, allowing requirements of all levels of complexity to be met rapidly, easily, and cost-effectively. A Simatic S7-1500 controller with a failsafe S7-1516F CPU functions as the main control system. The heart of the drive system is a modular Simotion D435-2 motion controller, which can be finely adjusted to suit any desired axis configuration within the scope of the standard by means of additional modules. "Despite fixed address and space assignments, this controller and the up to 32 possible axes on the specified base unit provide the flexibility required to set up individual machine configurations, normally with around 20 axes," says Josef Zeinhofer, head of the electrical design department at Dreistern. The Simotion controller coordinates the
interplay between these axes by means of a virtual master axis to which all feed axes can be synchronized, for instance. This ensures a constant feed rate of up to 200 m/min in all system components. Dreistern was able to easily adjust units for flying machining to suit roll forming using the “flying saw” application example for Simotion.

**Engineering and service simplified**

Once set up with all the necessary modules, the standard architecture developed by Zeinhofer considerably simplifies the engineering, as nothing else needs to be programmed or developed. This allows commissioning time to be considerably shortened, as the first few projects have shown. Another advantage of the standardized, ready-made software is that during future projects it will be possible at a very early stage to test and optimize functions on the machine that have already been programmed. This enables the various teams to work on a project simultaneously. In addition, a standardized, globally managed system for all machines makes service easier. New functions can now be developed at the technical center, adopted into the standard, and expanded on with ease, which ensures a high level of investment security.

**Modular mechanics follows electronics**

Dreistern has now developed the first autarkical machine modules (work modules), which are easy to retrofit and can be swapped between lines of the same type. A Simotion D410-2 DP/PN control unit serves as the control technology for each module. This expandable single-axis controller is ideal for integrating additional units or functions into existing systems. For example, it allows the axes for flying machining linked to the feed axis to be set up without great effort, with the fixed IP address assignment in the basic configuration preventing address conflicts. Users can connect up to three mobile units by means of the standard infeed. In addition to various roll forming and punching tools, the machine manufacturer sells mobile sawing and cutting units. Operators are also able to integrate their own units or obtain them from Dreistern as a general contractor and therefore from a single source.

**Pushing ahead with innovation and integration**

Dreistern achieved the expected time savings in engineering and commissioning during the design of the first two lines. Heinrich Weber, head of the sales division, says: “In the future we’ll be able to significantly shorten delivery times – ideally by as much as half.” One of these applications was also a pilot project for adoption of the TIA Portal engineering framework. The Dreistern team believes that the degree of consistency achieved, as well as the integration of the control system, HMI, motion control, and drive technology, will further simplify and streamline engineering, making it possible to meet the constantly increasing requirements of the market even more quickly, flexibly, and efficiently.

The Siemens AG corporate website is available at [siemens.com/metalforming](http://siemens.com/metalforming)

Email us at bernhard.ibig@siemens.com
A custom-fit forging process

Spindle presses: Vaccari uses an energy management system for pressing complex shapes and demanding materials. This stabilizes the process and reduces energy costs.

»We implement individual customer requirements with the help of the Siemens standard Drive Control Chart (DCC) software, which can be adapted extremely easily.«

Matteo Noardo, Head of Electronics Department, Vaccari
The forging of safety-relevant parts

The primary application area of the AMP series of machines is the forging of safety-relevant parts important to the quality of the material and parts are within the intended value ranges. High repeat accuracy is also required when forging alloys that must be formed within a narrow process window to achieve the desired quality of material and parts.

AMP series machines have a direct-driven, motion-controlled servo-spindle for demanding metal-forming tasks such as user-definable speed and force profiles, and acceleration and braking ramps for the ram. The metal-forming operation can thus be precisely adapted to the properties of the tools and the material to be processed. In short: the motion control of a servo-spindle press opens up additional scope for increasing productivity and product quality.

The primary application area of the AMP series of machines is the forging of ferrous and nonferrous metals into components made of steel, aluminum, copper, titanium, and their alloys. The forging of safety-relevant parts in particular requires a production process with a high degree of repeat accuracy so that all process parameters important to the quality of the material and parts are within the intended value ranges. High repeat accuracy is also required when forging alloys that must be formed within a narrow process window to achieve the desired quality of material and parts.

A high degree of repeat accuracy

In cooperation with Siemens, Vaccari has now developed a control and drive system that is specifically oriented toward the demand for minimum process tolerance and high repeat accuracy. The project started with the construction of a 2,100-t hot forging press for manufacturing safety-relevant truck chassis parts weighing 180 kg. “We use only standard Siemens components. This is important to our end customers, as they like to be independent of the machine manufacturer when it comes to spare parts procurement,” says Matteo Noardo, head of the electronics department at Vaccari. “We implement individual customer requirements with the help of the Siemens standard Drive Control Chart (DCC) software, which can be adapted extremely easily.” This allows Vaccari to offer end customer–specific applications that synergistically combine Vaccari’s experience in machine manufacture with the specific process expertise of the user. Integrated communication within the control and drive systems from Siemens offers easy access to all process-relevant drive parameters in real time and allows simple integration of, for example, force measurement systems via Profinet, thus resulting in high-performance control structures with a high degree of repeat accuracy.

Buffering released energy

For an energy-intensive process like forging to operate in one cycle with a high degree of repeat accuracy, the full amount of required energy must be guaranteed at exactly the right moment. This requires that power supply to the drives be independent of the current status of the supply system. Only in this way can the process be protected against negative effects from voltage fluctuations that cannot be corrected by the infeed, or against reactive power fed into the system from other machines. For this reason, the energy required for the next stroke (in the case of the Vaccari servo-spindle press) is collected in a bank of 12 powerful capacitor modules in the DC-link of the Sinamics S120 drive system. These capacitors are recharged from the supply network between the strokes. In addition, they buffer the electrical energy released during the active braking of the ram for the next cycle.

With this solution, only the energy required for the metal-forming operation and the power loss of electrical and mechanical components are drawn from the supply network. In addition, the power drawn from the supply network takes the form not of pulses but of the comparatively low and largely constant capacitive charging current of the capacitor bank. The consequence: despite the high rated output of the drive, the press’s connected load is low. The operator’s power costs, which are dependent to a large degree on the connected load, are therefore lower. In contrast to kinetic energy buffering, the capacitor modules have the advantage that their power loss is lower than that of flywheel motors, for which additional converters are required. If the waiting time between two strokes is comparatively long, as is the case with heavy workpieces with long loading and unloading operations, capacitive buffering is therefore clearly more efficient.

Energy management is worthwhile

The solution developed by Vaccari and Siemens enables maximum repeat accuracy and also reduces energy costs. With this solution, the motion curve and energy input to the workpiece can be controlled extremely accurately, resulting in a precisely defined metal-forming process executed with an extremely low scrap rate.

Matteo Noardo, head of the electronics department at Vaccari.
Subject to changes and errors. The information given in this document contains only general descriptions and/or performance features, which may not always specifically reflect those described or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.