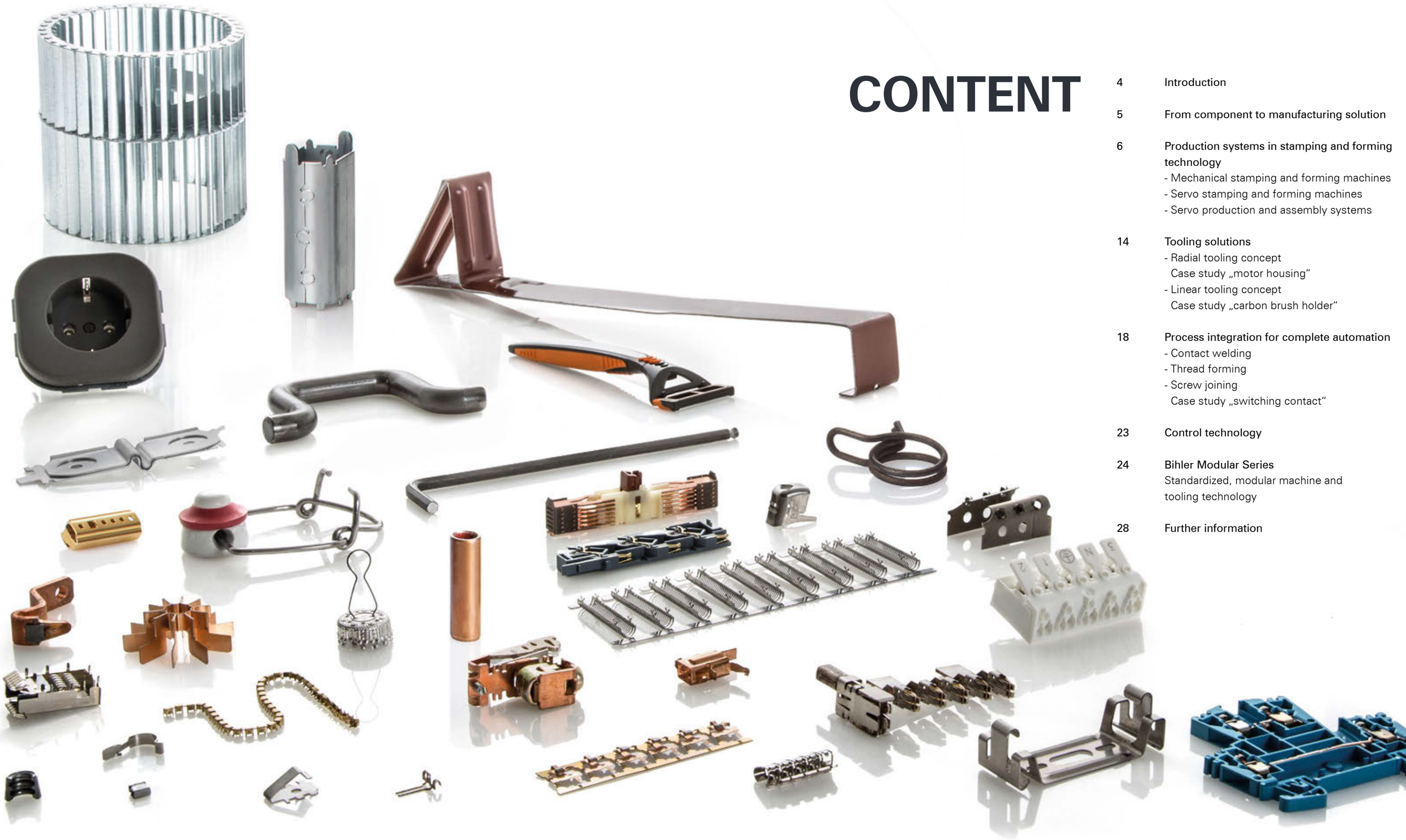
STAMPING AND FORMING TECHNOLOGY

Efficient production of stamped and formed parts and assemblies

BIHLER



CONTENT

INTRODUCTION

Stamping and forming technology is a fascinating technology. Beyond pure stamping and forming, it integrates many other process steps into efficient complete production. Whereas in the past it was mainly simple stamped and formed metal parts made of strip and wire that were manufactured in large quantities, today it is increasingly complex components and assemblies in ever smaller batch sizes and an ever greater variety of variants.

Stamping and forming technology is used in a wide range of industries, such as the automotive industry, electrical and electronics industry, communications technology and medical technology. Thanks to high added value, it contributes to the fact that manufacturing can also be carried out economically in high-wage countries such as Germany.

The white paper provides a practical insight into stamping and forming technology. It describes the basic manufacturing systems in stamping and forming technology, their components, the tooling concepts implemented on the machines, and additional processes that can be integrated. Successfully implemented case studies illustrate the possible applications of stamping and forming technology. And with the Bihler Modular Series, the white paper presents forward-looking perspectives for even greater efficiency in the production of stamped and formed parts and assemblies.

FROM COMPONENT TO MANUFACTURING SOLUTION

The term “stamping and forming technology” refers to a separating and forming manufacturing process. In this process, one or more semi-finished products, such as a metal strip or a metal wire, are processed into a finished product on a single production machine.

At the beginning of the journey from the component to the manufacturing solution, there is always the idea for a new product that is to be launched on the market at a certain point in time. The product usually consists of several components. In order to manufacture these components in series, a customized manufacturing system is required. The close cooperation with Bihler then usually begins at the component development and design stage. In order to be able to design the manufacturing solution in the best possible way, the Bihler experts check the component or part drawing with regard to geometry, material specifications and the desired production requirements. They then adapt it if necessary (e.g. reducing the material cross-section) and test in series of trials and using product samples whether the modified component meets the functional requirements. In this way, Bihler sometimes has a direct influence on component design.

High material efficiency, low unit costs

After the validation phase, the actual manufacturing process must be developed and implemented on a Bihler manufacturing system. The focus here is on minimum material consumption with maximum production quality, low unit costs, maximum process reliability and the efficient interaction of a wide range of production technologies on one machine in order to save unnecessary work steps on separate downstream machines. Modern Bihler production systems meet all the requirements for this. They can be used to manufacture a wide range of precision parts and assemblies. In addition to flat strips made of various materials such as high-performance copper, aluminum, carbon steels, high-strength chrome-nickel steels or bimetals, wires made of these materials can also be processed.

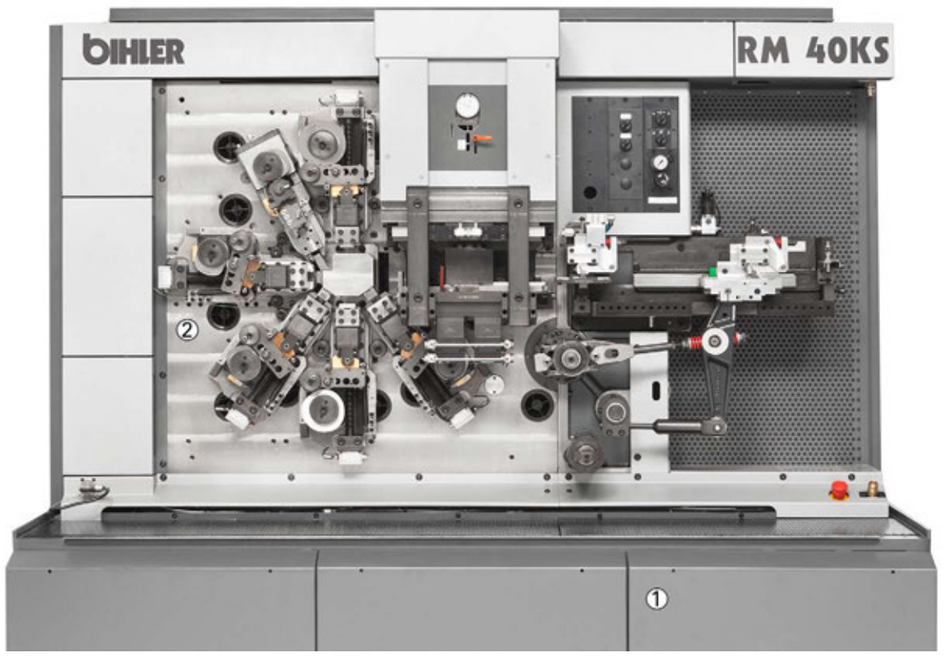
PRODUCTION SYSTEMS IN STAMPING AND FORMING TECHNOLOGY

Mechanical stamping and forming machines

Due to their very high dynamics and very high forces, mechanical stamping and forming machines with cam plate technology are mainly used in the mass production of stamped and formed parts and assemblies. In general, a distinction is made between two types: Stamping and forming machines with one vertical processing side (machine front side) and stamping and forming machines with two vertical processing sides (machine front side and rear side).

The single-sided stamping and forming machines are mainly used for the production of classic stamped and formed parts. In the case of two-sided automatic stamping and forming machines, the two machine sides can be used either independently of each other for the simultaneous production of two (also different) components or linked together for the production of more complex components. Many drive positions are available on both the front and rear sides of the machine to integrate movements into manufacturing concepts.

Key features of both types are the possibilities to integrate drive movements from below, from above and transverse to the work plate, to feed different materials from different directions (from above, from below, transverse to the work plate) and to combine different operations (stamping, forming and assembling) synchronously on one system. Both types of mechanical stamping and forming machines can be further subdivided into machines with different stamping and forming forces as well as different speeds.



Design of a stamping and forming machine

The stamping and forming machine used must provide the required stamping and forming forces and enable the desired production speed. The choice of stamping and forming machine is therefore based on the dimensions of the component, the material specifications and the desired production output. The figure on the left shows the structure of a stamping and forming machine. The base frame (1) and the work plate (2) standing vertically on it can be seen. The base frame houses the drive elements as well as the pneumatics, hydraulics and central lubrication. Inside the work plate runs the central gearwheel (3), which serves as the central drive element.

All units mounted on the front and rear of the machine are driven via the central gearwheel. The gearwheels of the units engage directly on the central gearwheel running behind them through the pickup holes (4) provided as drive positions on the work plate. Other mechanical components (e.g. material feed and press) are driven via intermediate gears (5). A center opening (6) is located in the center of the work plate. Through this opening, transverse movements can be integrated from the rear of the machine to the front of the machine and parts can be transported.

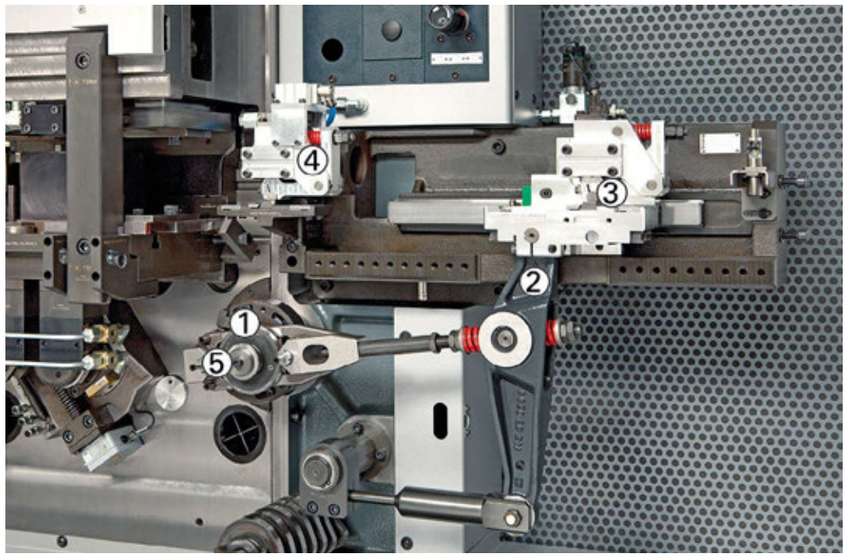
Material feed units and processing units

The functions of the material feed units and processing units used on a stamping and forming machine are explained in more detail below.

Mechanical material feeder

The general task of a mechanical material feeder is to feed strip or wire material to be processed from a decoiler via a straightener and to feed it to the machine in a preset length and defined time in a precise position for processing. The figure shows the setup: The linear feed motion is generated by an adjustable eccentric (1) and a feed lever (2). Two adjustable limit stops (right and left) are used to precisely define the feed length and the time sequence.

The hydraulically actuated feed gripper (3) on the feed carriage and the hydraulically actuated material retainer (4) fix the strip or wire alternately and thus ensure slip-free transport. The mechanical material feeder offers the possibility of reducing the feed time. By using a special cam plate (5), a compensating movement is generated. By shortening the feed time, more time is available for the subsequent processing steps.



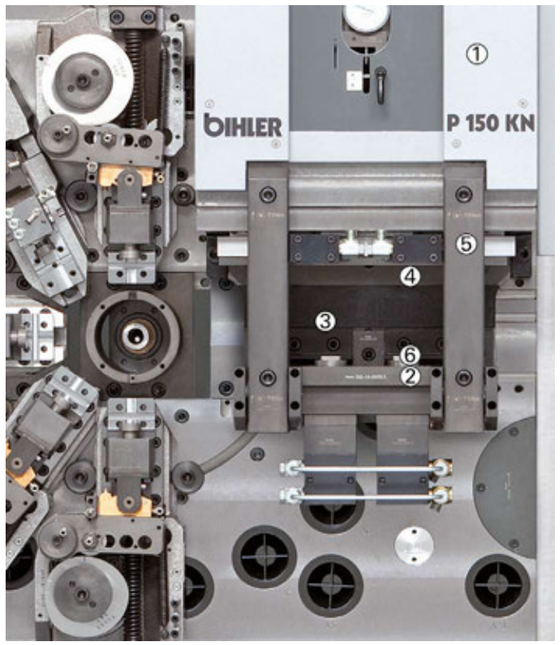
Servo-controlled material feeder

Servo-controlled material feeders can also be used on mechanical stamping and forming machines. In such feeders, a servo motor drives a special rotating belt on which feed grippers (1) with a pressure compensation system are mounted. These grippers are opened and closed by means of hydraulics, which can also be used to variably adjust the clamping pressure.

During the feed movement, the material is always clamped by three grippers. This method of operation results in a very high surface pressure, which guarantees safe and positionally accurate material feed. Compared to mechanical feeders, servo-controlled material feeders offer more time for subsequent machining operations because there is no return stroke. It can be operated in any running direction and position and offers the advantage of shorter setup times.

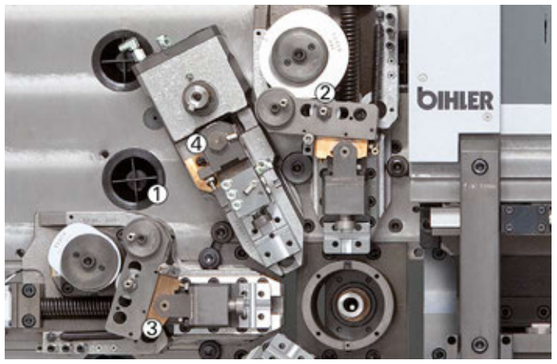
Press

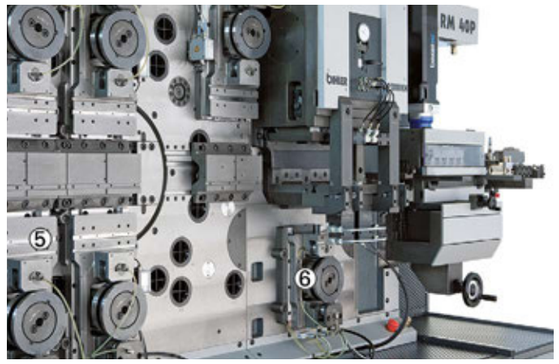
With the two-point eccentric press, the fed strip material is precisely stamped, coined or formed in the cutting tool. In the press upper section (1), the rotary motion of an intermediate wheel is converted into a vertical linear motion via the eccentric shaft and connecting rods. The press table (2) is used to support and fasten the cutting tool in the press mounting space (3). The upper part of the cutting tool is fastened to the press slide (4). Tie rods (5) prevent the press table from springing. Hydraulic clamping elements are integrated for fast tool changes (6).



Slide unit

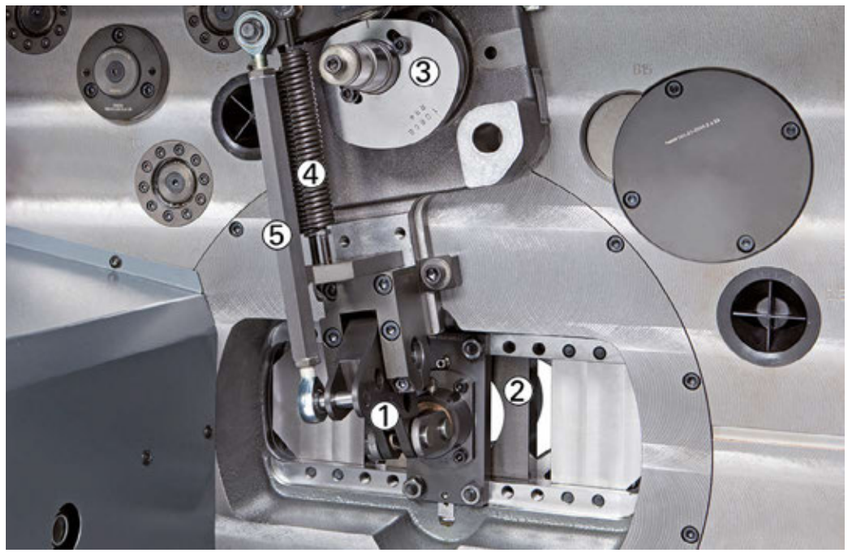
Slide units accommodate the forming tools and control their motion sequences. Depending on the production task, they are arranged either radially around the forming center or vertically above and below the main working plane. The slide units are positioned at the drive bores (1). Defined linear movements are made via cam plates (2). The geometries of the cam plates determine the occurring speeds and accelerations of the tools and thus the inertia forces. Depending on the production task and the forming forces required, as well as the space available on the work plate, normal (3), narrow (4), wide (5) or double slide units are used. For movements from below into the press, drive positions for wide slide units are available below the press (6).





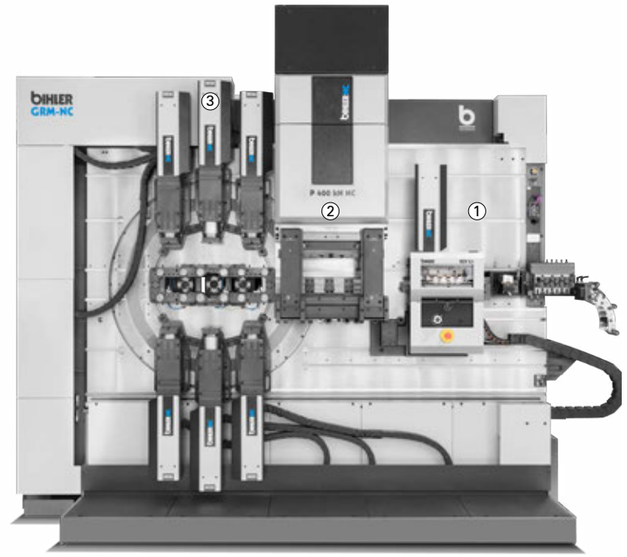
Central mandrel

The central mandrel (1) controls movements from the rear of the machine into tooling solutions on the front of the machine through the center opening (2) in the work plate. The feed and return stroke movements are controlled by the cam plate (3). The stroke length is determined by the cam plate, and the stroke position can be changed via an adjusting spindle (4) on the push rod (5). Depending on the production task, the central mandrel fulfills the following functions: Displacement of the core piece in the forming center, deformation of the workpiece in the forming center, ejection of the finished workpiece. Several central mandrels can be arranged next to each other.



Servo stamping and forming machines

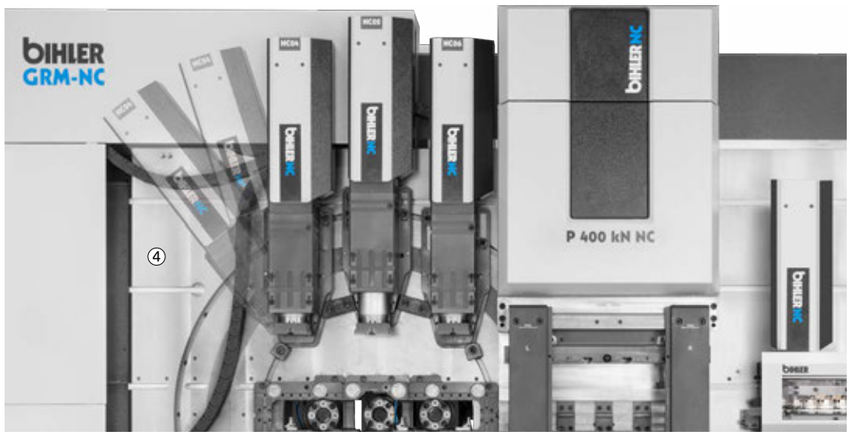
Due to their flexibility and dynamics, servo-controlled stamping and forming machines are used primarily in the production of classic stamped and formed parts in small and medium batch sizes and with a high number of variants. They allow a particularly fast and demand-oriented response to customer requirements. Servo stamping and forming machines intelligently combine the strengths of different production processes and can be individually expanded with additional technologies according to the modular principle.



Reproduced set-up

Servo stamping and forming machines have the same structure as single-sided mechanical stamping and forming machines. The infeed module (1), the press module (2) and the forming module (3) have a standardized design here. Alignment of the NC slide units and adjustment of the forming tool movements are performed fully automatically and in a very short time via the control system. For this purpose, the servo machines are equipped with a slide positioning unit (4). This is integrated in the machine plate in a circle around the forming center.

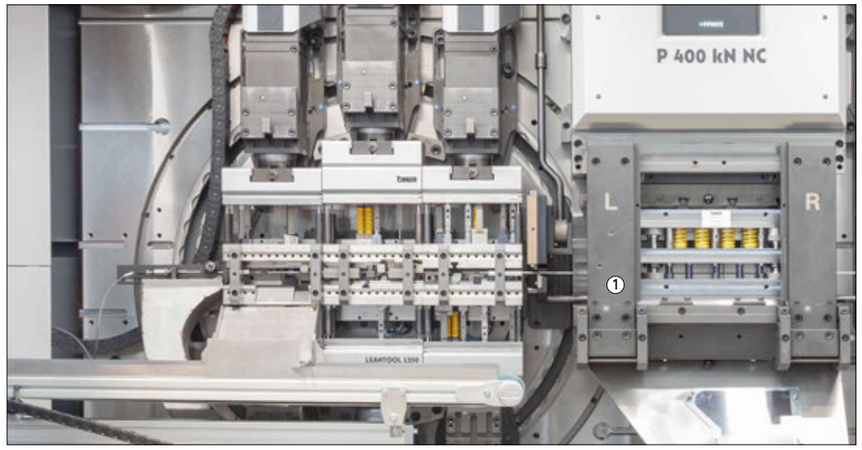
With the slide positioning unit, the positions of the NC slide units can be aligned in radial and linear direction simply by pressing a button. The slide positions are stored in the tool program after the initial setup. When they are called up again or after a tool change, they can be restored with absolute reproducibility. Hydraulic quick tool clamping systems contribute to a further reduction in setup times.



Highly standardized tool technology

Servo-controlled stamping and forming machines are equipped with highly standardized radial or linear tool technology, which handles the material to be processed very gently and carefully thanks to freely programmable travel profiles. Individually designed servo drives ensure that processing takes place at optimum speed at each station. This increases the quality of the products and significantly extends the service life of the tools.

Standardized Meusburger stamping and forming frames (tunnel cut and spring-loaded guide plate) (1) are used in the servo press. Existing radial and linear stamping and forming tools of mechanical stamping and forming machines can also be transferred to servo stamping and forming machines and optimized. One servo machine then often replaces several older mechanical machines and enables the user to achieve higher output figures and much faster response times to individual customer requirements.



Intelligent production systems

The intelligence of the servo stamping and forming machines stems from modern VariControl VC 1 control technology. The machine and process control guarantees the simple integration and combination of different processes on one system, their fast and easy reproducibility, very fast set-up and changeover times, and the continuous safeguarding of these processes.

Machine systems equipped in this way detect even if form deviations occur on the stamping strip or on the component and correct them automatically during the production process without stopping production. However, they also detect and report when they reach their limits or require maintenance - all with the aim of optimizing the service life of the system and thus productivity.

Servo production and assembly systems

Assembly production on servo production and assembly systems from Bihler offers decisive advantages in economic terms. On a single servo-controlled system, a very large number of different operations and processes can run in parallel or one after the other in one manufacturing process. This results in continuous, end-to-end manufacturing processes from the raw material to the end product.

Modular and standardized

The servo-controlled BIMERIC Modular production and assembly system has the same standardized structure as servo stamping and forming machines, i.e. on it the processes of feeding-in (1), stamping (2) and forming (3) are each modularized on one console. In addition, the BIMERIC Modular has PLUS stations and plenty of machining space on the adjacent, individually expandable work platform (4). Here, further servo process modules for welding, tapping and screw joining etc. as well as customized units for individual customer processes - especially for assembly operations - can be integrated. The individual modules can be used flexibly as required, depending on the task in hand. If the processes are expanded at a later date, the scalable machine can be retrofitted with low investment.

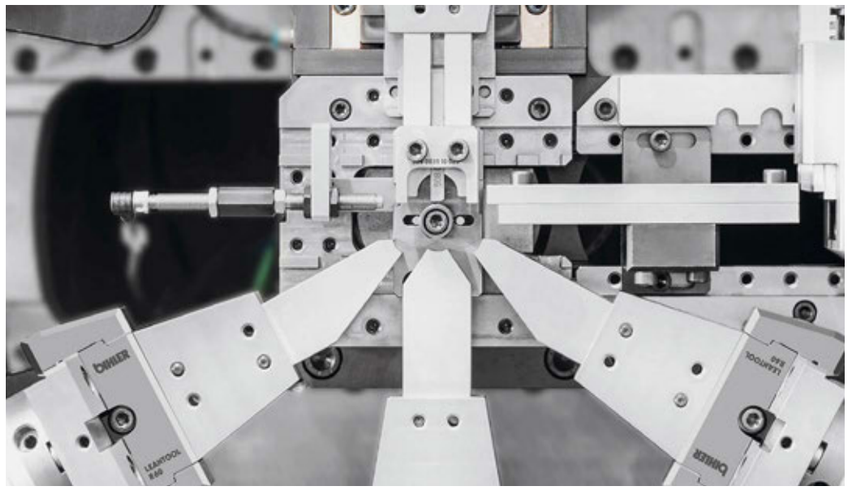
Fast tool change

For manufacturers with a wide range of assemblies or their variants and the resulting frequent changeover processes, set-up times become the decisive criterion for economical production. The BIMERIC Modular convinces here with particularly fast tool change times. During a product change, usually only the active tool parts or tool modules on the units used are changed. It is then sufficient to call up the production parameters programmed in the VariControl VC 1 central control system and the production of a new assembly or variant starts with one hundred percent reproduction.

TOOLING SOLUTIONS

Radial tooling concept

Depending on the production task, radial or linear tooling concepts can be implemented on stamping and forming machines. In a radial forming tooling solution, the multiple-action (NC) slide units with the separately adjustable forming tools are positioned in a circle around the forming center on the front of the machine.



The parts stamped or not stamped in the press are separated from the stamping strip in the machine center and brought into the final shape in several steps with the forming tool modules. The radial forming tooling solution is particularly suitable for round body parts and rotationally symmetrical parts, as well as for parts whose width matches that of the material strip. Because the carrier strip can be omitted, material waste is minimized (strip width = part width). The design of the forming tool is determined by the material thickness, the shape and dimensions of the workpiece and the required production quality.

LEANTOOL Radial

The LEANTOOL Radial is an intelligent optimization of the Bihler radial principle. In combination with the features of servo-controlled manufacturing systems, the number of parts in a LEANTOOL Radial tool can be reduced to a minimum. These tool parts also consist of up to 70 percent standard parts that do not need to be reworked, or only slightly.

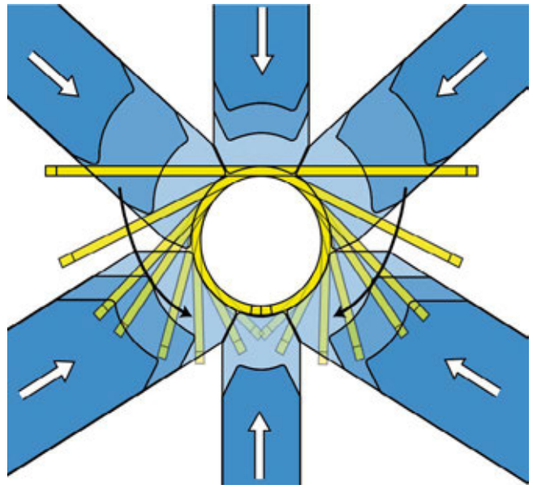
Advantages:
- Up to 70 % tool standard regardless of the task
- Up to 70 % reduced manufacturing costs compared with conventional radial tools
- Significant material savings due to part width equal to strip width
- Consistently high part quality due to forming in ideal rolling direction
- Optimum forming angle continuously adjustable

Case study

Radial production of an electric motor housing

The housing is used as an outer casing for electric motors. Such motors are used in various products of different industries. Typical applications are window regulators and seat adjusters for automobiles.

The servo-controlled material feeder feeds the steel strip to the GRM 80P stamping and forming machine from a coiler via a straightening unit. The geometry of the part is cut out in the cutting tool. In the forming tool, six forming punches finish forming the housing around a bending core. In the penultimate production step, a ring tool calibrates the housing. The finished housing is then ejected. The production speed is 150 parts per minute.



Efficient variant production

With this radial tooling concept, various round body parts and their variants can be produced on stamping and forming machines. The individually controllable forming movements guarantee a forming process that is very gentle on the material. Since only the active tool parts have to be changed when changing types or variants, this results in low tool, maintenance and repair costs as well as very short set-up times. Compared to conventional manufacturing processes based on deep drawing or progressive die technology, the stamping and forming process is significantly more material-efficient.

Linear tooling concept

In a linear forming tooling solution, the (NC) slide units are positioned linearly, i.e. vertically, above and below the main working plane on the machine plate.

The main working plane is understood to be the pass-through plane of the stamping strip. Compared to the radial forming tooling solution, the linear solution usually has a larger number of forming stations. These lead one after the other through to the finished component. Each bend can be set individually. In addition, other components such as plastic parts can be easily assembled. Linear manufacturing solutions are ideal for complicated parts, applications with many forming operations, and parts that require additional work steps such as thread forming, screw joining, welding, feeding, assembling, etc.

LEANTOOL Linear

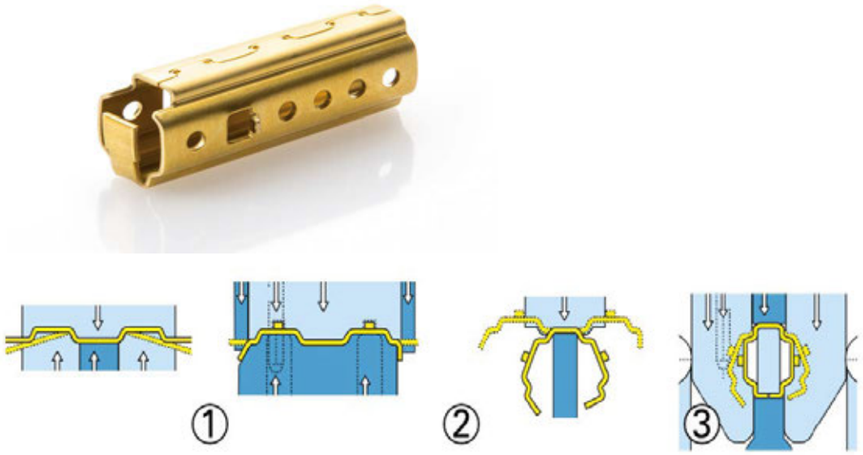
The LEANTOOL Linear combines the strengths of classic linear tool technology with those of Bihler machine technology. On the tool side, this means a large number of standardized tool parts from standard components and blanks. On the machine side, individually controllable movements from above, below and from the side can be implemented as standard. All this reduces the overall effort and complexity in the tooling. The GRM-NC servo stamping and forming machine, the two LM 2000-KT and LM 2000-NC linear machines, and the BIMERIC Modular servo production and assembly system form the customized machine platforms for LEANTOOL linear forming tools.

- Up to 70 % tool standard independent of the task
- Up to 50 % reduced manufacturing costs compared to conventional progressive dies
- Simpler tooling technology, as tool movements are standard through the machine from three sides
- No strip lifting in the tooling (usually only one carrier strip required)
- Less material waste compared to conventional progressive die solution

Case study

Linear production of a carbon brush holder

Carbon brushes provide electrical contact between the rotating and static motor components in electric motors. They are held by carbon brush holders.



The manufacturing process for carbon brush holders is as follows: Straightened and oiled brass strip is fed to the LM 2000-KT stamping and forming machine. In the cutting tool (standardized Meusburger cutting frame), the contour holes, the connection to the one-sided stamping strip and the clinching are cut out and the lettering is coined. In the three LEANTOOL forming tool modules, the part is formed in several stations (1). Then the clinch is closed (2). This is followed by an inspection station for dimensional control. As the last steps, the parts are separated, the bottom is caulked (3) and the finished parts are ejected.

Free accessibility

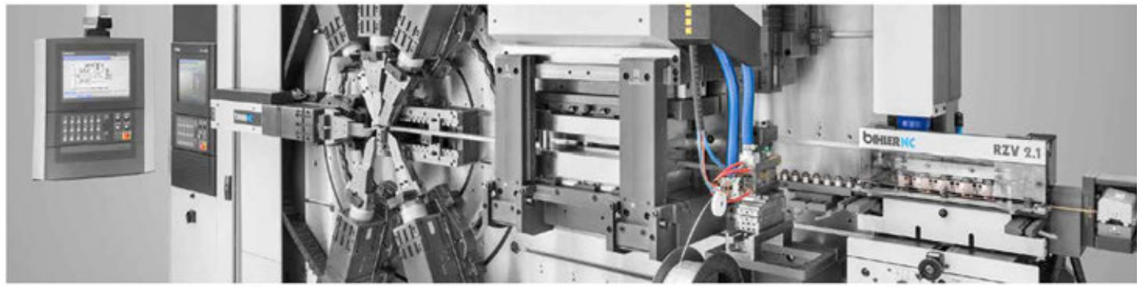
In this manufacturing solution, many movements are implemented on a compact LM 2000-KT stamping and forming machine. The individual processing steps are clearly divided, allowing each process and each bend to be set individually. The modular tool modules guarantee free accessibility. The production speed is 250 parts per minute.

PROCESS INTEGRATION FOR COMPLETE AUTOMATION

Material feeding, stamping, forming, thread forming, screw joining, contact welding, assembly, etc. The great advantage of Bihler technology is the interaction of many processes on one machine – and this via a central VariControl VC 1 control platform. Standardized, high-performance servo process modules and peripherals, as well as modules from partner companies, can be integrated into production concepts on Bihler production systems in a modular fashion for this purpose.

Contact welding

The integration of welding processes in complete solutions on Bihler production systems plays a central role in stamping and forming technology. Contact welding in particular is of great importance here.

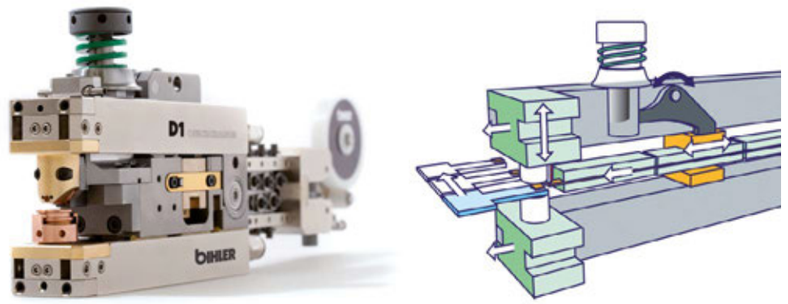


Components with welded-on contacts for industrial switching technology can be produced efficiently using stamping and forming technology - at very high speed and consistently high quality. These contact components are used in many industries: from information technology and control engineering to low-voltage, medium-voltage and high-voltage technology.

A contact welding unit is used as a process module for welding on contacts. This is a complete system with a modular design that carries out all processing steps from feeding the contact material to transporting the material, cutting and positioning, and finally welding the contact piece onto the carrier material. Different contact welding devices cover the entire application spectrum with regard to the semi-finished products and contact sizes to be processed. A distinction is made between welding units in various designs and a special contact welding device for welding on silver-graphite contact materials (AgC).

Welding unit

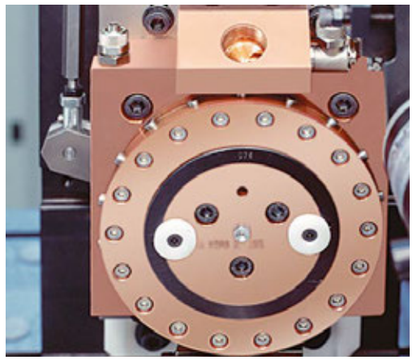
A welding unit can be used to join contact material made of weldable contact material alloys as semi-finished products in the profile forms round wire, profile strip, rectangular strip and platelets to a suitable metal substrate in a resistance welding process. The most important alloy components are precious metals such as gold (Au), silver (Ag), platinum (Pt) and palladium (Pd). Other uses for welding units include resistance brazing applications.

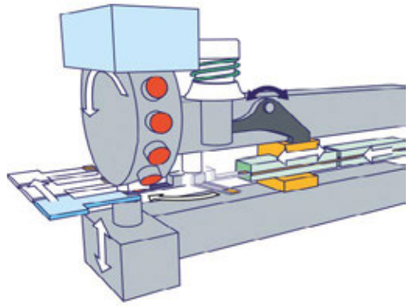


Welding units are controlled either mechanically or via an NC drive. In the mechanical variant, the welding unit is driven via a cam plate. In this case, the process sequence is synchronized with the movement of the main system, and the closing speed of the electrodes can be adjusted. With NC control, asynchronous movements of the welding units can be realized. This means that the contact welding unit can be operated independently and autonomously.

Silver-graphite contact welding unit

Welding on silver-graphite contact materials (AgC) poses major problems in terms of electrode life. For this reason, there is a specially designed contact welding unit that is specially designed for welding on contacts made of silver-graphite materials from the profile strip or in the form of platelets. It consists of a feeding unit, a clocked turret wheel with the electrodes and an integrated cleaning station for the electrode contact surfaces. This contact welding unit achieves high electrode life and avoids undefined conditions in the welding process. As a result, the welding process is absolutely reproducible.

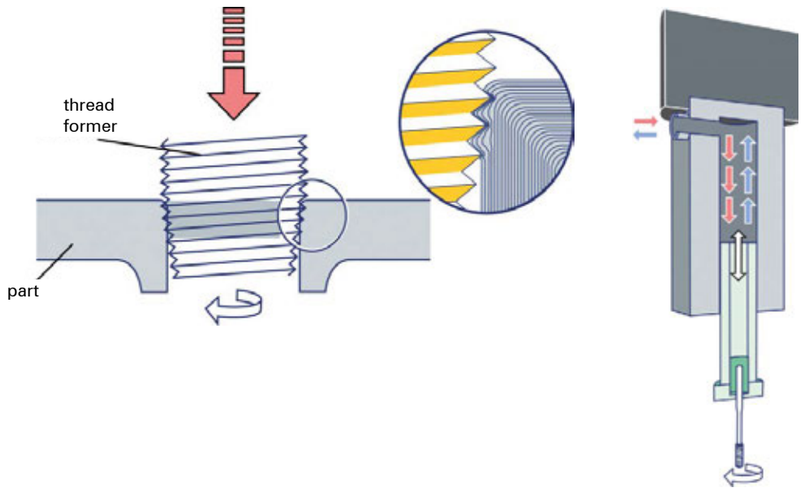




Thread forming

The integration of thread forming processes into fully automated manufacturing solutions on Bihler production systems offers users the possibility of joining complex components by means of screws.

In this process, the thread is created by chipless forming of the material to be processed. The material is pressed to the side in the prefabricated punched hole by the edges of the thread former and raised to form a burr. After several revolutions of the tap, the burr takes the shape of the grooves. The thread forming process is particularly suitable for materials with good formability and low tensile strength. With more stable tools, formed threads can be produced very accurately with a smooth surface, high strength and high load capacity because the material fiber is not broken.



Tapping unit

Two types of tapping units are used on Bihler production systems:

- Tapping units in flat design for use with low tool installation heights and in presses
- Tapping units in narrow design for use where space is limited in linearly arranged tools

These tapping units can be integrated into production solutions in both horizontal and vertical positions. Their compact design allows several units to be mounted side by side. Tapping units are designed for multi-spindle heads for simultaneous multiple thread forming or tapping in the same machine cycle. They have quick-change systems for changing the spindle together with the tap or for changing the tap only.

Tapping units can be used to both form and cut internal threads. The speed control of the NC drive motor makes it possible to freely program the cutting speed, including different forward and return stroke movements, adapted to the material to be machined.

Screw joining

Screws are used as fasteners in subassembly and in complex stamped and formed components. To enable secure screw connections on thin sheets, the number of threads can be increased by drawing a collar.

Multi-screw inserting unit

The NC screw inserting unit used on Bihler production systems is designed for mass production with high cycle rates. Together with tapping units, complete solutions can thus be implemented on stamping and forming machines.

The screw inserting unit performs all process-relevant steps such as feeding, separating, positioning and screwing in, followed by tightening to a precisely specified torque. The compact design allows several units to be set up next to each other in a vertical or horizontal position. The free programming of process-relevant parameters such as the pitch, the angle of rotation and the screw-in depth allows the process module to be used for different types of screws and threads.

Case study

Switching contact in 25 variants

Bihler projected the complete production of all 25 component variants of the switching contact onto a single BIMERIC BM 4500 servo production and assembly system.

All process steps from strip transport, stamping 1, soldering, welding, stamping 2, thread forming, feeding, screw joining to cutting are perfectly coordinated and can be reliably operated via the central VariControl VC 1 machine and process control system. The space requirement of the compact complete line is 10 x 5 meters.

Soldering and welding

In order to optimally integrate the resistance soldering and welding of precious metal contacts into the sequence of the system, the B 20K high-performance welding controller takes over the movement profiles of the servo axes required for this. Using two D3 QK soldering units, power contacts for connections and bridges are applied to the carrier strip in any desired position. The contacts welded on with two Quickchange contact welders vary in their position relative to the tape and in their shape (profile or round contact). In each case, the servo drives guarantee perfectly adapted movements of the welding tool for optimum welding results.

Tapping and screw joining

Two GSE KS servo tapping units and two MSE multi-screw units are used for the threading and screwing-in processes. The screws with washers are fed in from the rear of the machine. In the final work step, the finished switching contacts are separated from the carrier strip and ejected.

CONTROL TECHNOLOGY

The VariControl VC 1 (Stand 2.0) serves fully as a machine and process controller on mechanical and servo-controlled Bihler manufacturing systems. It controls, regulates and monitors all machine and process functions. Freely programmable digital and analog I/O bus modules are integrated on the machine side for operating, monitoring and safeguarding the tooling and process technology.

Operation and visualization

The control interface is simple, structured and easy to operate. Customized menu interfaces for the machine, process and tooling areas, clearly displayed machine states, functional areas (e.g. process module, infeed or tool clamping), production overview are integrated here. In combination with the 24'' touch control panel, this results in a very high level of operating comfort for the machine operator.

OPC UA

With the OPC UA interface integrated as standard, machine states can be transmitted to higher-level MES or ERP systems or to the Bihler Analysis Tool. OPC UA is thus the interface and basis for future requirements in the field of IoT, M2M and I4.0.

Condition monitoring

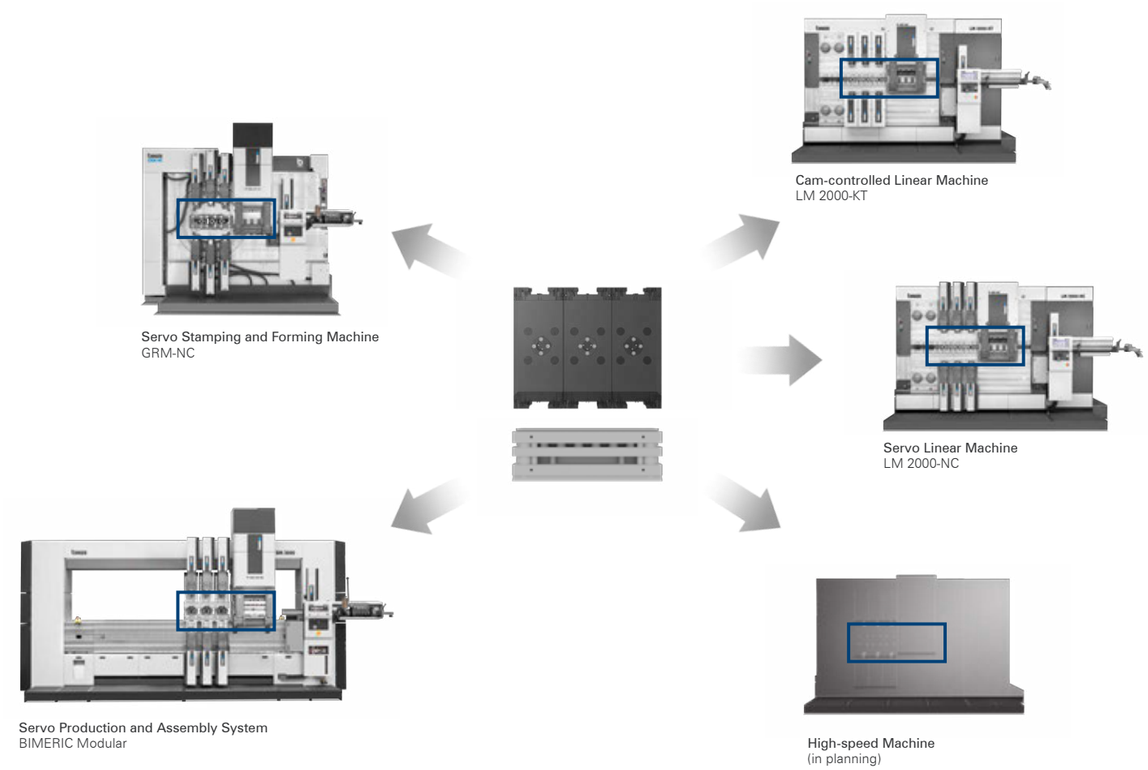
All measured values, parameters and system states of the machine components can be measured, evaluated and monitored in real time (e.g. force, torque, temperatures, flow, oil pressure, ...). If limit values are reached, this is communicated via the machine control. If limit values are reached or exceeded, warning messages are issued or the machine is stopped. This ensures that downtimes are reduced and system deviations are detected. All values are transparently evaluated, displayed and adjusted according to the permissible limit values. This enables an evaluation of the machine condition and individual components for particularly high transparency and safety.

BIHLER MODULAR SERIES

Standardized, modular machine and tooling technology

Ever shorter product life cycles, increasing variant diversity and ever tighter development and time-to-market margins determine market activity in metal parts and subassembly production today. To meet these requirements, Bihler offers the market the new Bihler Modular Series.

The Bihler Modular Series includes five next-generation machine models - the GRM-NC servo stamping and forming machine; the LM 2000-KT and LM 2000-NC linear machines; the BIMERIC Modular servo production and assembly system; and a high-speed machine that is currently in pre-development. These high-performance machines all have standardized interfaces and uniform quick tool clamping systems, which makes them fully compatible with one another in terms of the linear stamping and forming tools that they use. This interchangeability among the machines greatly reduces the need for numerous machines, as well as the need for a variety of production solutions. The notion of a fixed assignment of one particular tool to one particular machine has been completely eliminated.



Servo Stamping and Forming Machine
GRM-NC

Cam-controlled Linear Machine
LM 2000-KT

Servo Linear Machine
LM 2000-NC

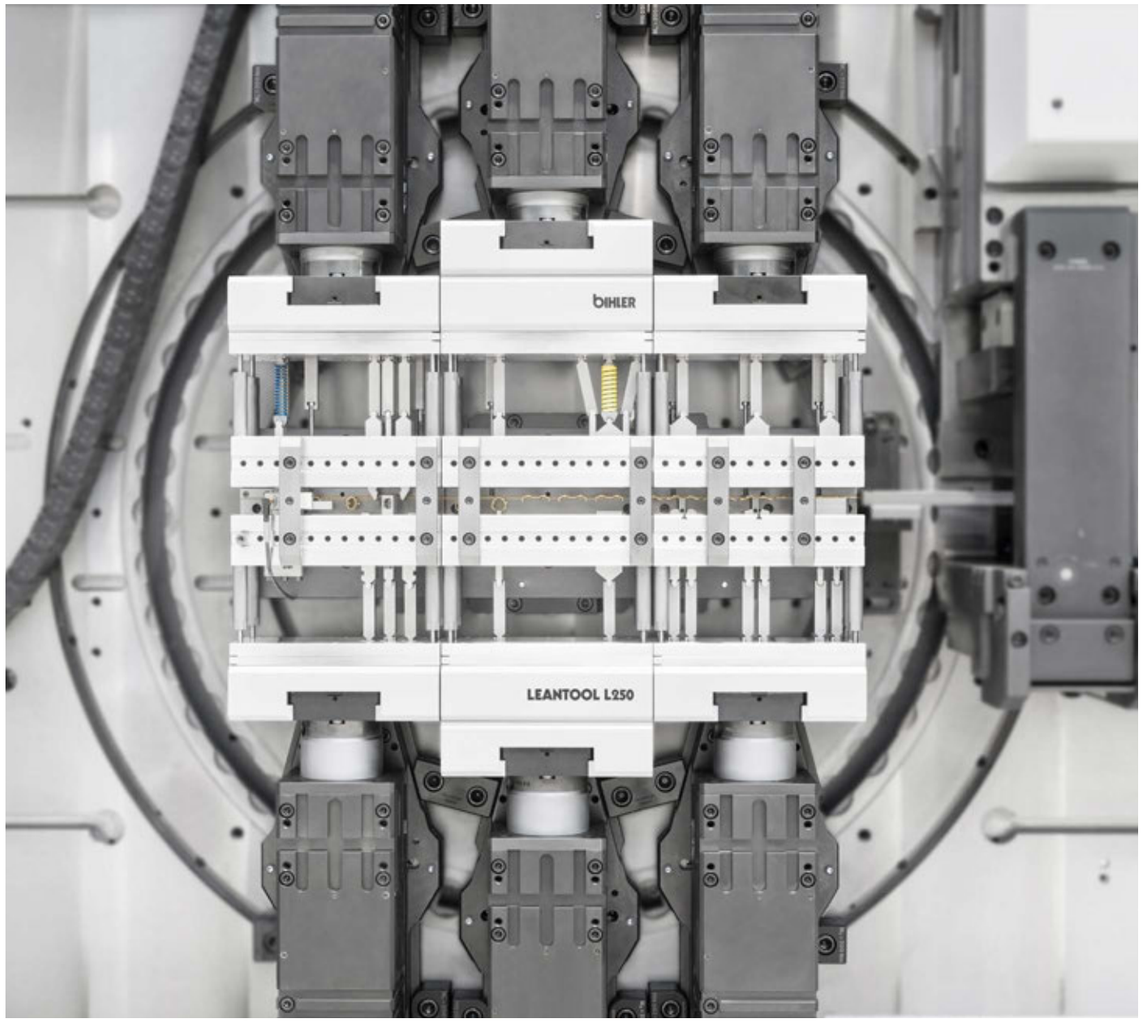
Servo Production and Assembly System
BIMERIC Modular

High-speed Machine
(in planning)

Uniformly designed linear tools

Depending on the production task, the uniformly designed linear tools - type LEANTOOL Linear, parts from LEANTOOL Linear, or the user's own compatible linear tool standard - can be set up on any of these five machines in accordance with the „plug & produce" concept. If the production requirements should subsequently change, either in terms of batch size, or in terms of a need for further processing steps, the stamping and forming tools can be relocated, reused, and, if necessary, adapted between the machines.

The strip material processed does not have to be lifted in the linear tool. This means that the production process usually requires only one carrier strip, reducing material costs. Standardized machine interfaces enable tool set-up times of less than one hour. The consistency of the standardized LEANTOOL tooling system (up to 70 percent standard parts) from planning to design, manufacturing and production guarantees that new components to be produced achieve a fast „time to market".



Advantages of the Bihler Modular Series

Compatible machinery
Flexible production options over the entire life cycle from stamped and formed parts to complete assemblies (in all batch sizes): Initial sample, pre-series, small series, large series, continuous production and component production, aftermarket

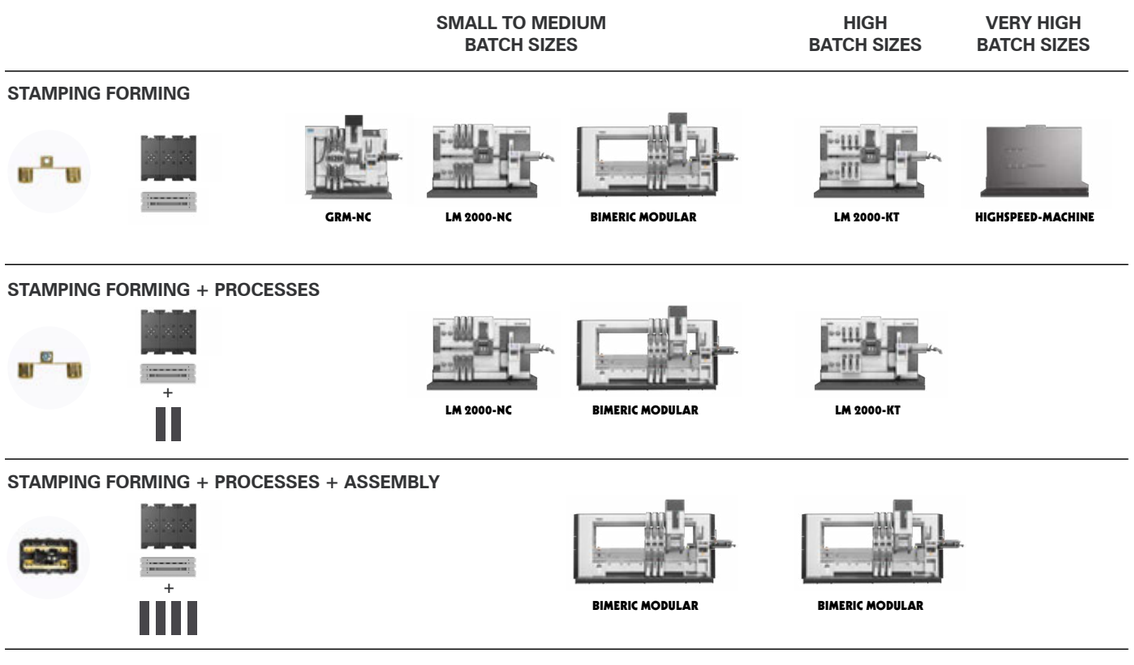
Machine-independent tool design
The uniform design guideline for stamping and forming tools enables the user to design the tools independently of the machine. The independent design capability conserves valuable design time and capacity.

Flexible tool technology
The five machines provide maximum flexibility by allowing users to use the exact tool technology you need - whether it is the highly standardized LEANTOOL technology, or any parts from it, or the user's own compatible linear tool standard.

Digital transparency
Each of the five machines is equipped, as a standard feature, with OPC UA interfaces, which form the bases for future applications in the IoT, M2M and I4.0.

Efficient maintenance
The five machines utilize many identical components. This decreases the need for spare part maintenance inventories. Efficient and simplified maintenance that serves to minimize effort, time, and cost.

Optimized work
Uniform operating routines for machine control; a standardized cross-machine design guideline for tool design, a large number of identical components for maintenance; and a uniform setup system.



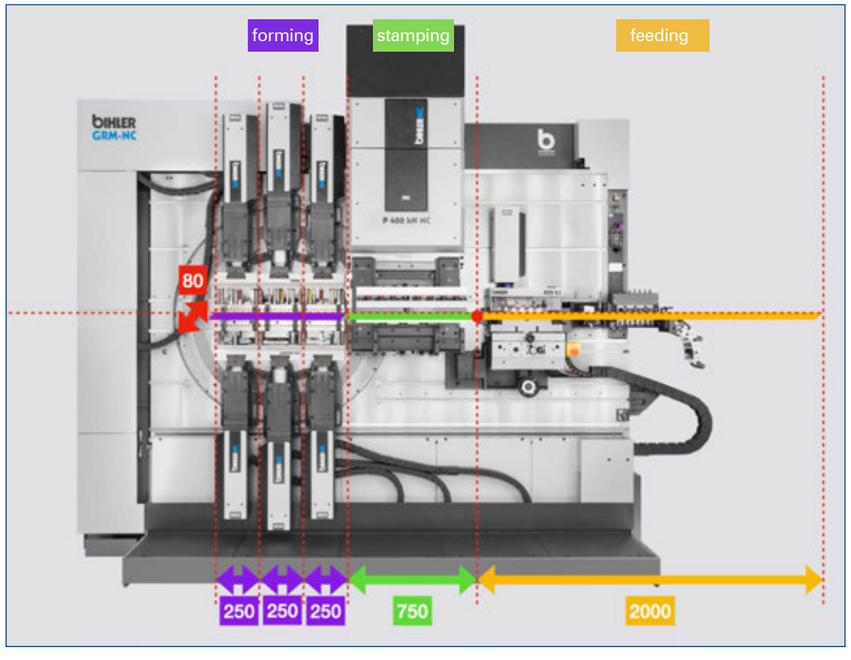
Flexible order scheduling

The Bihler Modular Series offers flexible order scheduling and a simple order planning process. That is, it is possible to transfer the linear tool to all Bihler systems in the Modular Series without adaptation, depending on the manufacturing requirements in the product life cycle.

To accommodate this all of the machines have standard interfaces and a zero-point clamping system with hydraulic clamping functions as well as three identically designed modules:

- Infeed module:
  The 2000 mm long module consists of a RZV 2.1 servo radial gripper feeder and several optional components (strip guards, strip oilers, straighteners, standardized strip guiding blanks).
- Stamping module:
  The 750 mm long module consists of a 400 kN servo press (designed for Meusburger standard SBP 400 and SBH 400 cutting frames).
- Forming module:
  The 750 mm long module consists of three individually controllable forming modules of 250 mm each with a pair of 31 kN NC slides and an optional NC central mandrel. Depending on the task it can be expanded with further forming modules.

Usable in ndent of location
The Bihler Modular Series represents a comprehensive standard in terms of both system and tooling technology, which can be used regardless of location allowing tools owned by large corporations to be relocated worldwide. This ensures the flexibility and scalability with which it is possible to react to decreasing batch sizes and increasing variant diversity.



FURTHER INFORMATION

Successfully realized case studies with stamping and forming technology
https://www.bihler.de/en/magazine/overview-b-inside.html

Technologies that can be integrated into stamping and forming technology solutions
https://www.bihler.de/en/technologies.html

Customer stories – Users of Bihler technology
https://www.bihler.de/en/magazine/overview-applications.html

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