

today

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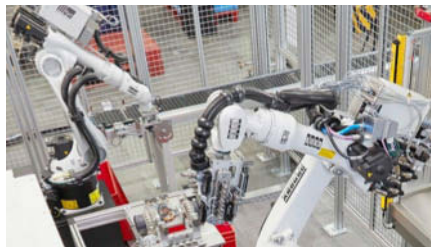
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MASTHEAD

today, the ARBURG magazine, issue 53/2013

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Red carpet and flurry of flashbulbs: ARBURG launches freeformer to the international trade public as big surprise at the K 2013.

ARBURG



Dear Readers,

Every year, we all look forward once again to the third edition of "today". This is because it traditionally covers the programme of the major autumn trade fairs.

Issue 53 of the today for the K 2013, however, is even more special than usual: We will be revealing a closely guarded secret and will introduce our innovative product for a new processing method to the world for the first time: the "freeformer" and "ARBURG Plastic Freeforming". With this move, we are extending our portfolio towards greater production efficiency in a targeted manner: with the ALLROUNDERS, you can produce plastic parts cost-effectively in high unit volumes as previously using injection moulding. With the freeformer, you can now produce one-off parts and small-volume batches - also from standard granulates, but directly from 3D CAD files, without a mould, using

the additive build-up of layers. We will present this groundbreaking invention from a number of perspectives. But don't worry, we will not be neglecting the injection moulding sector. Quite the contrary. Proof of this will be furnished, for example, by some 20 ALLROUNDERS with innovative applications at our stand and on those of our partners at the K 2013. We will of course be introducing these innovations and highlights in this issue.

In this context, I would also like to recommend regularly visiting our website where films and animations, as well as in-depth information are available.

The same applies to the articles in the today, which provide you with valuable insights into the application fields of our ALLROUNDERS and ever new ideas for your production operations.

I hope you enjoy reading our new issue.

Herbert Kraibühler
Managing Director Technology & Engineering



Curtain up

K 2013: Innovations and surprise world premieres

In the run-up to the K 2013, ARBURG has whetted the interest of the international trade public with its claim "Freedom has to be experienced!" and the announcement of world premieres. And there will be no cause for disappointment. As a big surprise, ARBURG is presenting its freeformer for the first time, thereby heralding a new era in plastics processing.

Production efficiency plays a central role at ARBURG, and is also a major focus at the K 2013. In addition to the freeformer as a groundbreaking invention for the additive manufacturing of plastic parts (see pages 6 to 11), ARBURG is also introducing numerous pioneering innovations for the injection moulding industry.

New: large electric ALLROUNDER 820 A

New products include the electric ALLROUNDER 820 A with a clamping force of 4,000 kN and the new size 2100 electric injection unit (see page 12). This machine exemplifies two of the main features among the exhibits: electric and large ALLROUNDERS. With five exhibits, the electric EDRIVE and ALLDRIVE machine series dominate and three further machines represent the higher clamping force range within the ARBURG product spectrum.

New: overhead six-axis robotic system

With regard to automation solutions, the range extends from a simple remov-



al solution through to a six-axis robotic system for complex tasks. The new small AGILUS six-axis robotic system from KUKA, which features an integrated SELOGICA user interface and moves along an additional linear axis, will also be premiered (see page 12).

Future topics: Industry 4.0 and lightweight construction

With innovative applications, ARBURG will present future topics such as lightweight construction and Industry 4.0. The further development of Particle-foam Composite Injection Moulding (PCIM) and the overmoulding of an organic sheet by means of long-fibre direct injection moulding illustrate how functional and high-strength lightweight parts can be produced efficiently (see page 14).

The ARBURG stand at the K trade fair always proves to be a real crowd-puller, as the future of plastics processing is on show here.

Industry 4.0 involves the complete networking of production, products, employees and customers via smart devices. The objective is to render "intelligent" production and "intelligent" products flexible on a comprehensive basis, through to one-piece flow.

This idea is being presented by ARBURG based on a fully automated production cell with inline printing. Visitors are able to have a personal name plate produced for them. An individual QR code is printed on each name plate, via which the most important parameters regarding the relevant production time can be called up on-



line. The ARBURG host computer system is used for this purpose.

Sophisticated applications

Mould technology highlights include a fully electric cube mould application for the packaging industry and a high-speed precision application for droplet irrigation. (see page 13). The offerings in the field of medical and clean-room technology are

demonstrated in the form of a stainless steel version of an electric ALLROUNDER 520 A, which produces electrically conductive pipette tips on a 64-cavity mould in a cycle time of 5.0 seconds.

In terms of applications, multi-component processing has been awarded pride of place with three exhibits. In addition to Particle-foam Composite Injection Moulding and the cube-mould application, the production of suction pads for the logistics sector made from thermoplastic and liquid silicone (LSR), involving the overmoulding of a metallic threaded bushing, are also featured.

Efficient solutions

With a total of more than twenty exhibits at its own and third-party exhibition stands, ARBURG is presenting its entire product spectrum and demonstrating its high-performance at the K 2013. All the exhibits are precisely adapted to the relevant product and production requirements and demonstrate how plastic parts

can be produced even more efficiently using ARBURG technology.

Above and beyond its products, ARBURG is also presenting its comprehensive service offerings, which contribute significantly to enhancing production efficiency. These range from preventive maintenance and training through to set-up time optimisation and energy efficiency.

Trade fair visitors can gain a complete overview of the topic of production efficiency and take home valuable information.





ABBURG

freeformer



The new freedom

freeformer: A new era in plastics processing

When it comes to pioneering inventions for plastics processing, there's no overlooking ARBURG. In the 1950s, a hand-operated machine for overmoulding small parts revolutionised the industry. Some ten years later, the ALLROUNDER principle with a pivoting clamping unit and interchangeable injection unit enabled different working positions, making injection moulding a great deal more universal. The next ARBURG revolution is the freeformer. On view for the first time at the K 2013.

The objective of the ARBURG developers was the efficient mould-less production of one-off parts and small-volume batches from plastic droplets. This basic idea has now resulted in a unique machine and a unique process for additive manufacturing: the freeformer and ARBURG Plastic Freeforming (AKF). This process enables fully functional three-dimension-

al parts to be produced directly from 3D CAD files by applying plastic droplets layer-by-layer, without requiring a mould. A decisive advantage in terms of versatility and costs, is the processing of standard granulates.

Machine manufacturer's touch

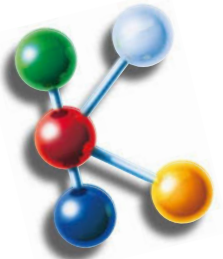
ARBURG's signature can be clearly discerned. The design of the freeformer is highly practical and the technical details such as the size of the working space, the quality of the components employed and the reliability with which the machine operates, are groundbreaking.

The principles of plastic part production have largely been re-thought. In order to apply the material, a movable component carrier precisely positions the product to be built-up under the discharge unit, which generates the droplets. Thanks to the dust and emission-free production process, the freeformer can produce anywhere and is no longer

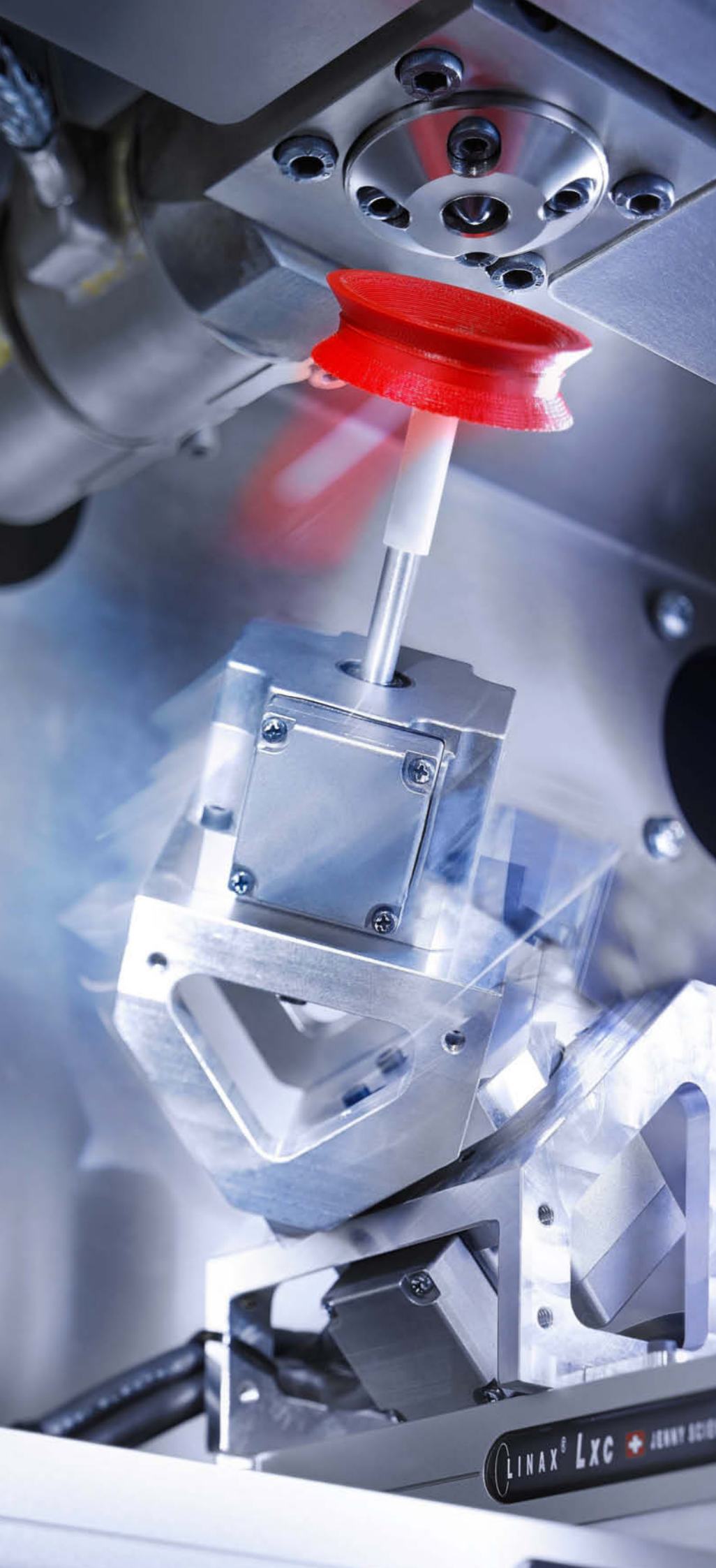
tied to the production environment.

Revolutionary technology concept

As its name implies, the freeformer stands for unlimited freedom in plastic parts production. The machine is completely different and far more than, for example, a 3D printer or a stereolithography machine. It extends the possibilities of additive manufacturing with a completely new process: ARBURG Plastic Freeforming (AKF).



The freeformer produces functional plastic parts layer-by-layer directly from 3D CAD files using droplets. The discharge unit remains stationary, while the component carrier moves (small images).



For all t

ARBURG Plastic Freeform

Additive manufacturing and the advantages of plastic parts built up in three dimensions have been widely discussed, and not only since the hype surrounding 3D printers. ARBURG already recognised the potential of additive manufacturing years ago and has created something completely new with the freeformer. Why? Because the patented ARBURG Plastic Freeforming (AKF) process offers significant advantages for the small-volume batch production of plastic parts.

In order to really understand where the ARBURG product fits in it is important to know a little more about the term "additive manufacturing". This primary shaping process builds up plastic parts layer-by-layer using chemical or physical processes, directly from appropriately prepared CAD component files. Moulds are dispensed with completely during the production of the external geometry. Here, amorphous or shapeless plastic materials are processed. With the 3D printing, rapid prototyping or rapid manufacturing systems previously available on the market, these materials are either powdered, wire-shaped or viscous.

Properties of current processes

The respective weaknesses of the existing techniques to date, such as ink-jet-based processes, stereolithography, fused deposition modelling and selective laser sintering differ in their causes: suitable materials, cleaning and finishing, as well as part quality. Where resins are used, the products are not functional and



Those who want more

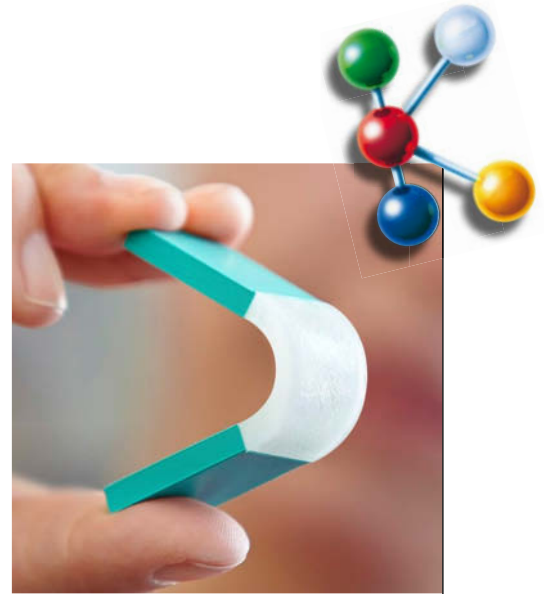
Freeforming: Additive manufacturing reinvented

plastic materials are only available in expensive forms of supply. Free geometries require supporting structures which first have to be built and then removed again.

Unusual technical details

In complete contrast are the ARBURG Plastic Freeforming (AKF) process and the freeformer, which are based on the same values that ARBURG has defined for its ALLROUNDER injection moulding machines: high-end technology, simple operation and excellent day-to-day usability.

No plastics expertise is required for the freeformer. Its control system, which has been developed in-house, generates the necessary parameters from the 3D CAD files and mould-less production is ready to start immediately. Initially, AKF follows the proven injection moulding processes. Material preparation is integrated in the machine. The plastic melt is prepared in



The freeformer produces functional components (bottom photo), also as moveable hard/soft combinations (photo above). During the layer-by-layer build-up, only the component carrier moves (large photo on left).

a conventional plasticising cylinder. From this point onwards, everything is different: in the discharge unit, a patented nozzle closure featuring piezo technology generates plastic droplets from the melt by means of high frequency. During layer-by-layer build-up, a component carrier, which is moveable along three or five axes, positions the product. The module with the nozzle remains stationary. This enables the material and time-saving production of complex parts, e.g. with undercuts, without the need for support structures. The freeformer optionally features one or two discharge units so that two-component parts, for example moveable hard-soft combinations, can also be produced.

AKF provides decisive advantages

The field of application of the freeformer is the efficient production of fully functional one-off parts (one-piece flow) and small-volume batches. The spectrum of all other processes is also covered. The new AKF process, however, offers significant advantages compared

to existing processes. The processing of standard granulates, also with the corresponding additives, enables great versatility. Moreover, no pre-configured forms of supply such as powders or strips, which make production expensive and complicated, are required. Furthermore, the machine operates waste, dust and emission-free, as well as being compact and ready for use at any location thanks to plug-and-play, whether in the office, in the design department or in the machine hall.



Process principle





From vision to reality

Herbert Kraibühler and Dr. Eberhard Duffner: creation and future of the freeformer

With the freeformer and ARBURG Plastic Freeforming (AKF), a new era has begun. **today's editorial team spoke with the "creators" of the freeformer, Managing Director Technology & Engineering, Herbert Kraibühler, and Head of Development, Dr. Eberhard Duffner, who have successfully transformed their vision into reality.**

today: Publications in the trade press and in the general media, as well as new exhibitions and conferences, underline the importance of "additive manufacturing" as an important topic for the future. In line with this trend, the freeformer is

now coming onto the market. Coincidence or strategy?

Kraibühler: The requirements have changed over recent years: rapid technical developments, short product life cycles, the proliferation of variants and the desire for customised products. ARBURG recognised this many years ago and responded. The fact that this future topic is now reaching its first climax is ideal for us.

today: So ARBURG is bringing yet another additive manufacturing system onto the market?

Duffner: No, definitely not. We have not based our development on the existing additive manufacturing processes.

We're specialists in plastics processing and partners to the plastics industry – we don't therefore adapt non-industrial processes until they "somehow just about" meet the requirements of our industry. The "freeformer" offers a new, comprehensively patent-protected process: ARBURG Plastic Freeforming (AKF). The machine and process are something unique and can only be compared with other systems available on the market to a limited extent.

today: What specifically characterises the freeformer?

Duffner: The freeformer allows you to efficiently produce fully functional components from commercially available plastic



granulates without a mould. This is industrial manufacturing!

today: For what target groups is the freeformer of interest?

Kraibühler: First of all, for all our customers! For those who want to increase their value added, expand their portfolio and render their production future proof. But of course, also for rapid manufacturing service providers and prototype constructors, who also want to produce functional parts. I'm also certain that the freeformer will tap into as yet completely unknown markets in future.

today: How is ARBURG Plastic Freeforming different from injection moulding?

Kraibühler: In future, our central question will be: "How often do you want to manufacture which product?" In the case



today: With groundbreaking developments of this kind, the path to achieving the goal is always interesting. What was it like with the freeformer?

Duffner: A lack of support and time pressure are serious and at times insurmountable obstacles that can lead to new developments failing. In this regard, there were no problems whatsoever at ARBURG. On the contrary, we always enjoyed the full trust of the Partners and were thus able to turn our visions into reality.

today: How did you proceed?

Duffner: At first, there was the question: who if not we knows how to make droplets out of liquid plastic? We presented the idea to the Partners in 2004 and were given the go-ahead for fundamental research work. Basic experiments followed, as did the first patent applications. In 2007, we began a cooperation with the Technical University of Munich in the field of droplet generation and the first parts were produced in 2010.

today: Why is the freeformer only being introduced now?

Kraibühler: As you know, ARBURG is not known for acting rashly or creating a big stir. After all, this was fundamental research in the real sense of the word. We therefore developed the freeformer from scratch, brought it to production maturity and had it tested by initial experts before now launching it onto the market.

today: Speaking of "creating a big stir", you will certainly be creating one now with the global product launch at the K 2013, won't you?

Kraibühler: That's true! Now that we engineers have done our homework, it's up to our specialists from marketing and sales to take up the mantle. And, by their very profession, they're famously not quite as modest as we are (laughs). But on a more serious note: in order to underline our revolutionary step, we want to set a clear signal. And I must admit that those charged with doing so have succeeded impressively.

today: So what's next?

Duffner: To date, we've "only" completed the task of bringing a production-ready machine onto the market. Our work is therefore far from done. Now, it's a matter of using the freeformer for wide-ranging applications in practice and to exploit its potential.

today: Where do you see this potential?

Kraibühler: The consequences are currently not yet apparent. Allow me to mention the term "Industry 4.0" in this context. The freeformer will change the conceptual framework of plastic product manufacturing over the long term.



Proud "creators" of the freeformer (small photo above): Managing Director Technology & Engineering Herbert Kraibühler (right) and Head of Development Dr. Eberhard Duffner

of high unit volumes, injection moulding with an ALLROUNDER is the most efficient production solution. In the case of small unit volumes or one-off parts, it's ARBURG Plastic Freeforming using the freeformer. So, we're enhancing the decision-making scope for our customers!

820 A 40000 ALLDRIVE



Perfectly matched

New products: Large electric ALLROUNDER and small robotic system

Speed, precision, requirements-specific design and optimal utilization of the production area are important criteria in order to enhance long-term production efficiency. The new products which ARBURG is presenting for the first time at the K 2013 make an important contribution here: the electric ALLROUNDER 820 A, and the small six-axis robot suspended from a longitudinal axis.

The high-end electric ALLDRIVE machine series, which impresses by virtue of short cycle times, high precision and low energy requirements, has now been extended by a new machine size.

New ALLROUNDER 820 A: closes gaps in range

Both the 4,000 kN electric toggle-type clamping unit and the size 2100 electric injection unit have been specially developed for the ALLROUNDER 820 A. The gap between 3,200 and 5,000 kN has thus been closed in the ALLDRIVE series. The same applies to the high-performance hybrid HIDRIVE series. The new size 2100 electric injection unit enables shot weights of up to 1286 g PS, significantly expanding

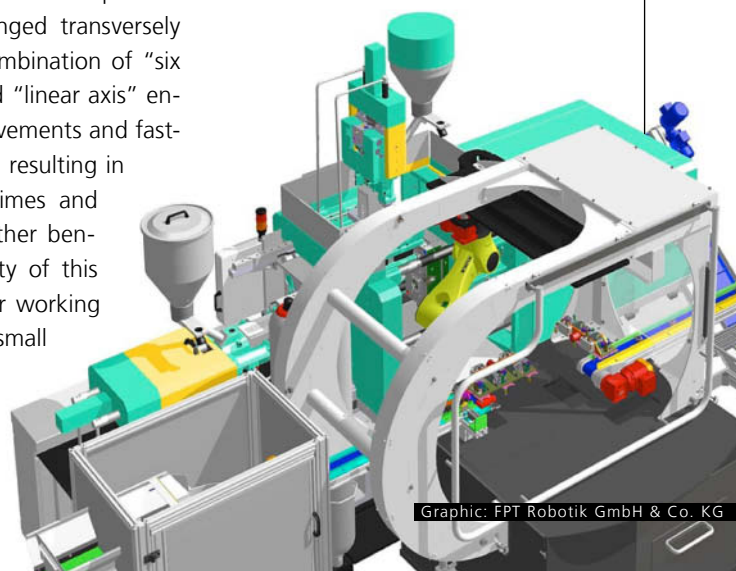
the range of application for the electric ALLDRIVE machines. The two new features enhance modularity. The high-performance electric and hybrid machines from ARBURG will then be even more precisely configured to the application and product in order to further improve production efficiency.

New six-axis robotic system: flexible, dynamic and compact

The use of flexible robotic technology in turnkey solutions is increasing continuously. Accordingly, ARBURG, jointly with its cooperation partner fpt Robotik, is presenting an AGILUS six-axis robotic system from KUKA with integrated SELOGICA user interface. The robot is suspended from a linear axis arranged transversely to the machine. The combination of "six axis robotic system" and "linear axis" enables more dynamic movements and faster entry into the mould, resulting in extremely short cycle times and higher productivity. Further benefits include the mobility of this solution and the greater working area available as the small robot can be moved along the axis, also

allowing the floorspace below to be used without restriction. The AGILUS robotic system, which can carry load weights of between six and ten kilograms and has a range of 1,100 millimetres, is precisely designed for plastics processing requirements and can handle numerous tasks relating to moulded part production.

Compact automation solution:
six-axis robotic system suspended
on a linear axis.





Every gram counts

Lightweight construction: innovative process for new component ideas

When it comes to the efficient use of components, weight is an important factor. The light-weight construction sector has developed dynamically in response. Consequently, ARBURG has, jointly with partners, developed the innovative long-fibre direct injection moulding and Particle-foam Composite Injection Moulding processes, which is being presented with new or enhanced component ideas at the K 2013.

In long-fibre direct injection moulding, fibres with a flexible length of up to 50 mm are fed directly into the liquid melt, where they are evenly distributed.

Long-fibre direct injection moulding combined with organic sheet

The manner in which this process can be combined with continuous-fibre reinforced thermoplastic inserts is demonstrated by ARBURG, jointly with Georg Kaufmann Formenbau AG and fpt Robotik. The result are lightweight parts with a high level of functional integration, produced in short cycle times. For this purpose, a six-axis robotic system picks up the



Lightweight but strong and functional composite parts are created by moulding plastic components onto organic sheets (large photo above) or foamed parts (small photo).

organic sheets from a magazine. The flat inserts are gently heated, process-reliably, using a new technology in the gripper and transferred to the LIPA (Lightweight Integrated Process Application) mould at a precise forming temperature. Here, forming of the insert and injection moulding of the functional and reinforcement elements such as edging, end eyes and ribbed structures are performed simultaneously in a cycle time of around 40 seconds. In this manner, resilient composite

parts are created, which weigh less than 300 grams at a length exceeding 500 mm.

Secure bonding of foam and moulded parts

Particle-foam Composite Injection Moulding (PCIM), which was jointly developed by Novaplast, Krallmann and ARBURG, also offers new possibilities in lightweight construction. By combining foaming and plastics to produce a composite of materials, component functionality, for example, can be significantly enhanced, strength can be increased at very low weights and properties such as insulation and noise reduction can be exploited. Moreover, the process offers a high level of design freedom, excellent resilience and high-quality decorative surfaces.

PCIM is on show as a two-component application for the first time at the K 2013. First, a particle-foam tyre is inserted into the mould, after which a plastic wheel rim is moulded onto it. The transfer of the pre-moulded part is then followed by overmoulding of the tyre with TPE.



Teamwork required

Mould technology: High performance coupled with speed and precision

Production efficiency can only be achieved when experts from the relevant departments cooperate and machine and mould technologies are precisely matched. Two excellent examples of this are being presented by ARBURG at the K 2013 with an electric cube-mould and a high-speed precision application.

Owing to the stringent requirements, both moulds operate on electric ALLROUNDER machines from the high-performance ALLDRIVE series.

Cube-mould technology: fully electric

ARBURG is exhibiting the fully electric cube-mould application for the production of juice container closures jointly with partner FOBOHA. On the electric two-component ALLROUNDER 720 A with a clamping force of 3,200 kN, the large size 800 injection unit is arranged horizontally and the small size 400 injection unit is mounted onto and moves horizontally with the moving mounting platen of the machine.

In this application, 'fully electric' means that both rotation of the cube and the linear sliding motion of the 12+12-cavity mould are driven electrically. This results in advantages in terms of positioning

accuracy and cycle time, and consequently in higher system productivity. A further benefit of the cube-mould technology is that, compared to conventional moulds, a significantly larger number of cavities are available on the same clamping surface and a certain production level can be achieved with fewer and/or smaller machines. A smaller footprint is a further benefit. Significant time, volume and cost advantages result during the high-volume production of parts, which are of crucial importance in the packaging industry in particular.

64 thin-walled precision parts in only 1.95 seconds

Together with its partner Männer, ARBURG is presenting the injection moulding of flat drippers for use in drip-let irrigation systems. The thin-walled parts feature complex geometries with sharp-edged serrations and fine bores, which are crucial for their functionality. One hundred per cent reproducibility is a fundamental prerequisite during injection moulding here. Furthermore, the shortest possible cycle times are needed in order to manufacture this mass product in the required unit volumes.

The electric cube-mould application (photo above) and the production of flat drippers (photo below) place high demands on machine and mould.

At the K 2013, the electric ALLROUNDER 470 A operates with a 64-cavity mould and produces flat drippers of a consistently high quality in a cycle time of only 1.95 seconds. The moulded part weight for the delicate precision parts made from polyethylene is 0.15 grams. Here, more than 120,000 units can be produced per hour. This high level of performance is achieved via synchronous ejection and near-contour mould cooling.





Ordered today – delivered tomorrow

Shanghai warehouse: new offering for China and the ASEAN region

As of this year, ARBURG boasts even greater customer proximity in the Asian region and has reduced its delivery times to a minimum. Now, customers here have access to a broad range of ALLROUNDER products, which are stored in China and adapted to customer requirements locally.

The new 1,500 m² machine warehouse began operation in March 2013 in the Waigaoqiao free trade zone to the North-East of Shanghai. "Our customers benefit from the continued supply of high-quality ALLROUNDER machines 'Made in Germany', only much faster than before," explains a delighted Zhao Tong, Managing Director of ARBURG's Shanghai subsidiary. The warehouse holds a selection of hydraulic, hybrid and electric ALLROUNDERS as well as MULTILIFT robotic systems for the Asian market.

Short delivery times – satisfied customers

The delivery times are a powerful argument, particularly for those customers who require new machines at short notice. This is confirmed, for example, by Zhengium Qian, Managing Director of TSP Electronics Technology, Shanghai:

"We'd made a shortlist of several machine manufacturers. Because the quality and delivery times offered by ARBURG were right, we opted for two hydraulic ALLROUNDERS from the GOLDEN EDITION machine series."

Entire Asian region benefits

It is not only the ARBURG customers in China who benefit from the new warehouse, but customers throughout Asia: "If necessary, we're now easily able to deliver machines directly from the Shanghai warehouse to Indonesia, Singapore, Thailand or Malaysia, for example," says David Chan, Managing Director of ARBURG Singapore and responsible for the entire ASEAN region.

Machines retrofitted locally

"Our technicians adapt the modular ALLROUNDERS to our customers' requirements, ensuring fast commissioning on-site," points out Max Man, Managing Director of ARBURG's Hong Kong and Shenzhen subsidiaries, to mention a further advantage. "This allows us to further intensify our operations in Asia."

25 years of presence in Asia

ARBURG has been present with its own organisations in Asia for 25 years. Today,

At the Shanghai warehouse, the modular ALLROUNDERS only have to be adapted to the customer requirements.

around 50 employees assist our customers – from sales, applications technology consulting and training, through to technical support. Whereas initially, the customers were mainly global players from the West, every second customer comes from within the region today. A further trend is that the quality of the machines which ARBURG exports to China is increasing. This is evidenced by a growing proportion of electric ALLROUNDER machines featuring robotic systems and complete turnkey systems.



Buildin

ARBURG and the LEGO

ARBURG and the LEGO Group, the world's third largest toy manufacturer, have been working together for 40 years, particularly with regard to the topics of energy and production efficiency.

On average, every person in the world owns 87 of the famous LEGO® bricks, which have now been in existence for 55 years. It takes just a little imagination and creativity to transform these bricks into any conceivable figure, animal, building or vehicle. Ever since 1958, all the LEGO bricks produced throughout the world have been fully compatible. Precision is called for in order to ensure that the studs and tubes fit together perfectly and don't become detached too easily. Tight tolerances have to be complied with during production. The colourful bricks have been produced on ALLROUNDER injection moulding machines from ARBURG since 1973.

For decades, Managing Director Herbert Kraibühler has offered the best possible technical support for ARBURG's partners when it comes to finding new injection-moulding solutions and designing energy-optimised machines.

Stringent demands lead to innovative products

"The LEGO Group is an innovation driver that challenges and inspires us. The productive cooperation and stringent technical demands are constantly driving us on to create a basis for new developments in the machine sector," says Herbert Kraibühler. The EDRIIVE electric series launched on the market in 2011 and the additional servo-hydraulic drive

g blocks for success

Group: 40 years of cooperation for greater efficiency



Everything fits together perfectly: LEGO bricks (large photo) and the two companies. Inauguration of the LEGO production facility in Mexico (small photo): Henrik Priess Sørensen (2nd from left), LEGO Senior Director Moulding Design & Implementation, with ARBURG representatives Renate Würth (left), Sales, Herbert Kraibühler (2nd from right), Managing Director Technology and Engineering, and Guillermo Fasterling, Managing Director of the Mexican subsidiary.

version first presented to a broad public at the Fakuma 2012 trade fair are new developments that were influenced by this collaboration.

Helmut Heinson, Managing Director Sales at ARBURG, describes the close partnership over more than four decades with the Danish-based company, which produces in Mexico, Hungary, the Czech Republic and Denmark: "The LEGO Group has been and remains one of our most important and demanding customers. Over the years, we have learned a great deal from one another and many of our product innovations have been initiated by our shared dreams and visions."

More than 1,000 ALLROUNDERS worldwide

Currently, more than 1,000 ALLROUNDER machines are in use at the LEGO Group plants. ARBURG has delivered more than 500 machines to Mexico alone. This has not only required optimum performance from the developers and technicians at ARBURG, but also from the logistics experts, the production team at

the company's headquarters in Lossburg, Germany and the service technicians who commissioned the machines on site.

Long-term focus on quality and efficiency

ARBURG and the LEGO Group have a number of special strategies in common:

- both companies are traditional and innovative family-run businesses whose ideas and actions are aimed at long-term sustainability. ARBURG has been run by the Hehl family since 1923, while the LEGO Group has been in the hands of the Kristiansen family since 1932.
- The two companies are internationally active and are developing their international presence over the long term. ARBURG is represented by its own organisations at 32 locations in 24 countries and by trading partners in more than 50 countries. The LEGO Group produces and sells materials for play, discovery and learning in over 130 countries.
- Both continuously develop their machines and plastic products, focusing

on quality, as well as energy and production efficiency. ARBURG monitors the entire value-added chain in machine and moulded part production. The LEGO Group has set itself the target of enhancing the energy efficiency of its production by 5 percent annually until 2015.

INFOBOX

Name: LEGO Group

Founded: 1932

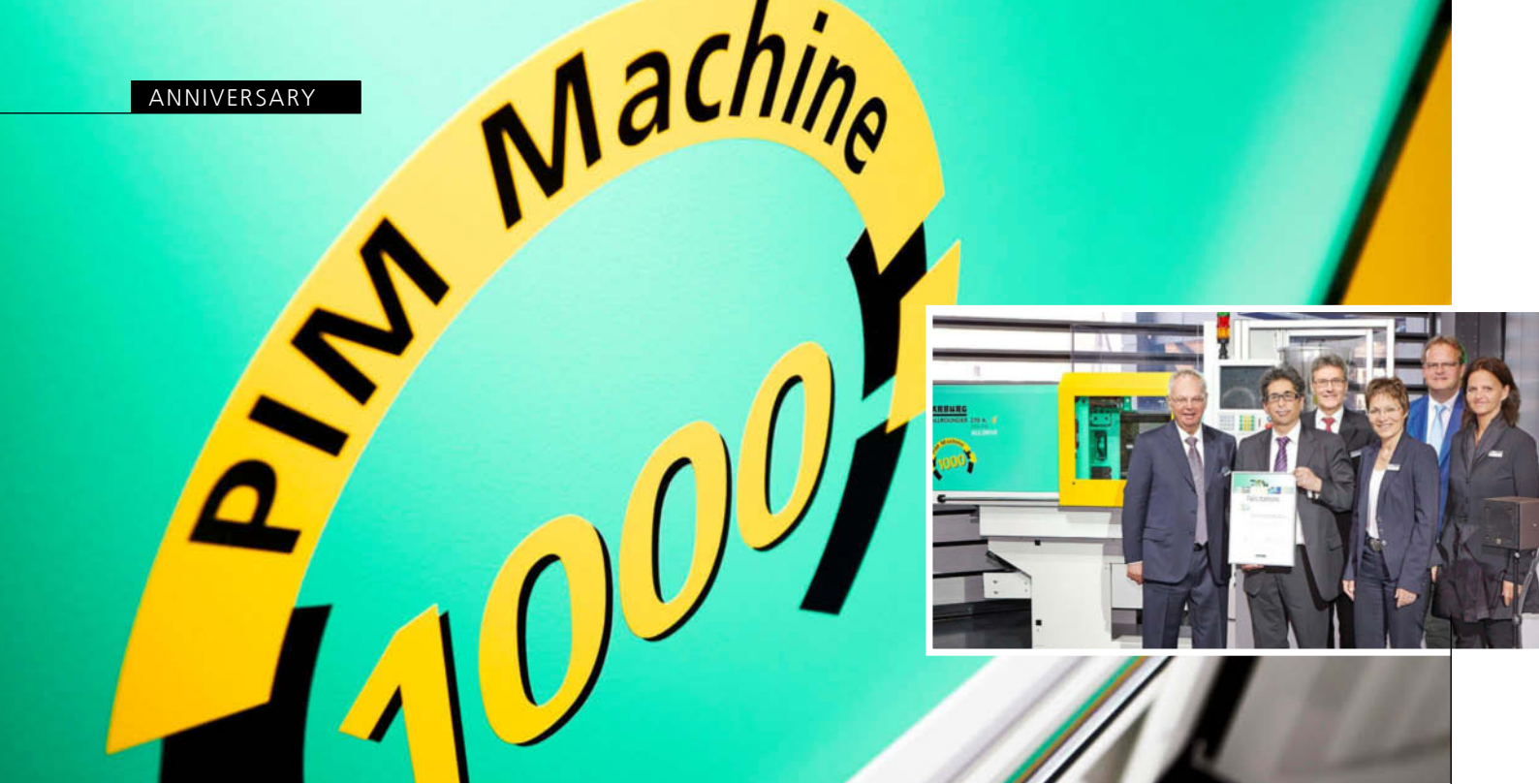
Plants: Production locations in Denmark, Hungary, Czech Republic and Mexico

Turnover: DKK 20,405 million (2012)

Employees: Around 10,400 worldwide

Machine fleet: Around 2,000 injection moulding machines worldwide (2013)

Contact: www.lego.com




1000th machine presented

Powder injection moulding: anniversary machine for Comadur

On the occasion of “50 Years of ARBURG PIM Expertise”, a further anniversary event was held. The presentation ceremony for the 1,000th ALLROUNDER for the PIM industry. This honour went to Swiss-based Comadur, a company that produces high-quality components for renowned watch manufacturers.

Comadur ventured into the powder injection moulding industry over 20 years ago with the support of ARBURG in order to produce chain links for watch straps. Previously, ceramics had already been processed using the pressing and sintering process. In order to expand the range of processes with powder injection moulding, the company invested in a used ALLROUNDER 170 CMD, year of manufacture 1989. In November 1994, the first new ALLROUNDER of the same type followed.

ARBURG Managing Director Technology and Engineering, Herbert Kraibühler, reminisced on the beginnings of the cooperation during his presentation speech:

“At first glance, the production of chain links didn’t seem to pose any problems. At second glance, it did.

Following sintering, cracks appeared at four of the joint seams. In order to determine the cause, Comadur turned to ARBURG and had the mould tested in Lossburg. The fault was quickly found. The mould – a prime example of the renowned Swiss precision – had been machined too perfectly. The air could not therefore escape and became trapped inside the components.

Trust from the very outset

Exhibiting a great deal of confidence in ARBURG’s expertise, Comadur allowed ventilation channels to be manually ground into the valuable mould. With success: the joint seam problem was solved and only good parts were produced from then on. The foundations were thus laid for a successful cooperation and joint developments. Over the years, ARBURG not only acted as a machine supplier, but also as an application technology adviser.”

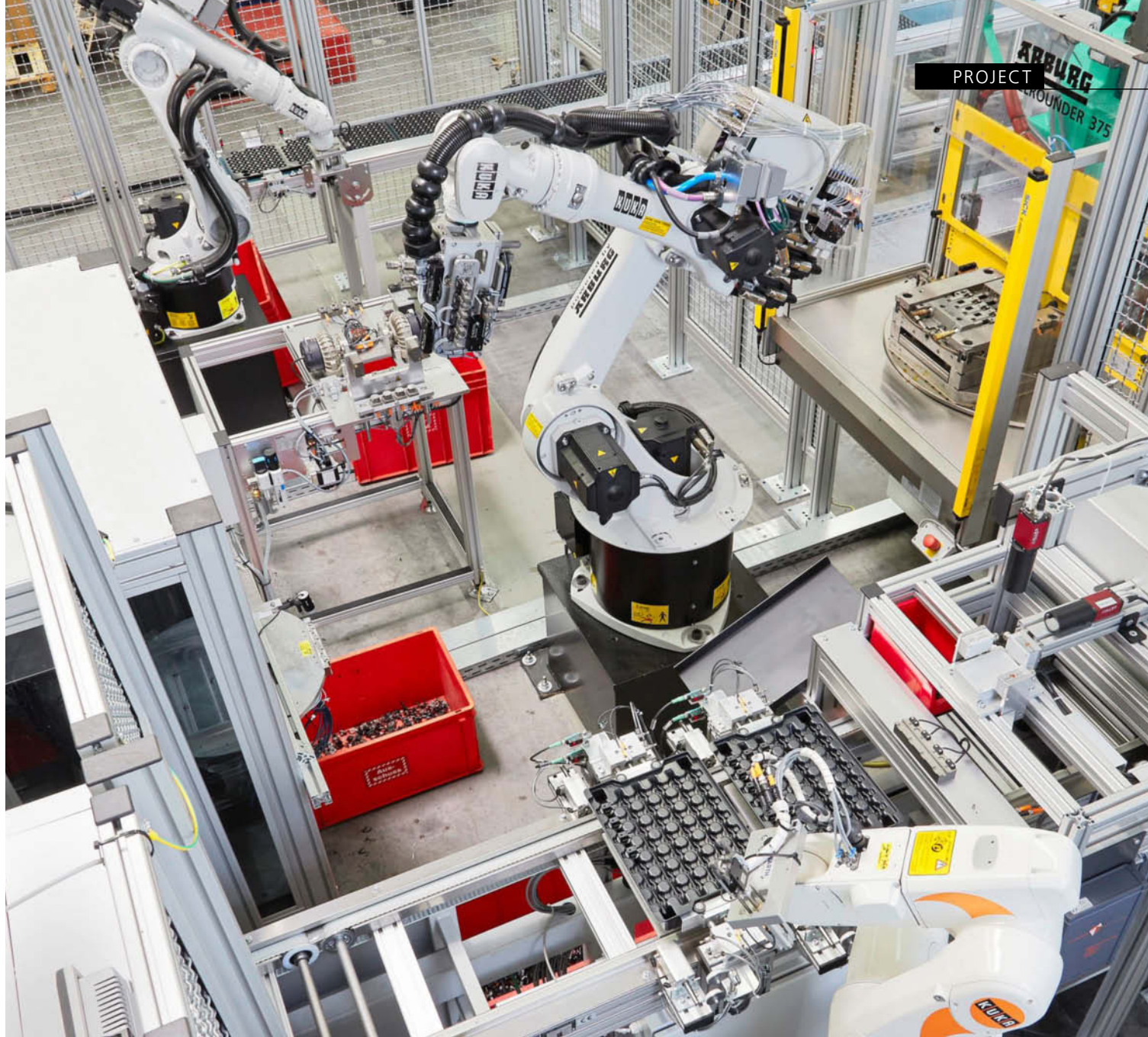
Comadur was also one of the first cus-

Comadur’s Director of Purchasing, Patrice Jaggy (2nd from left), expressed his thanks to ARBURG Partners Juliane Hehl, Michael Hehl and Renate Keinath (right to left) and Eugen Hehl (left), as well as Managing Director Technology & Engineering Herbert Kraibühler (3rd from left).

tomers to use hard-metal screws in order to achieve a longer service life. Together, the companies further optimised the screws, bringing them to production maturity.

First electric machine

During the manufacture of black and white ceramic parts for watch casings and parts for watch straps, Comadur uses ARBURG machines exclusively. The anniversary machine, an ALLROUNDER 270 A, is the first electric machine among the currently 21 ALLROUNDERS.



A perfect trio

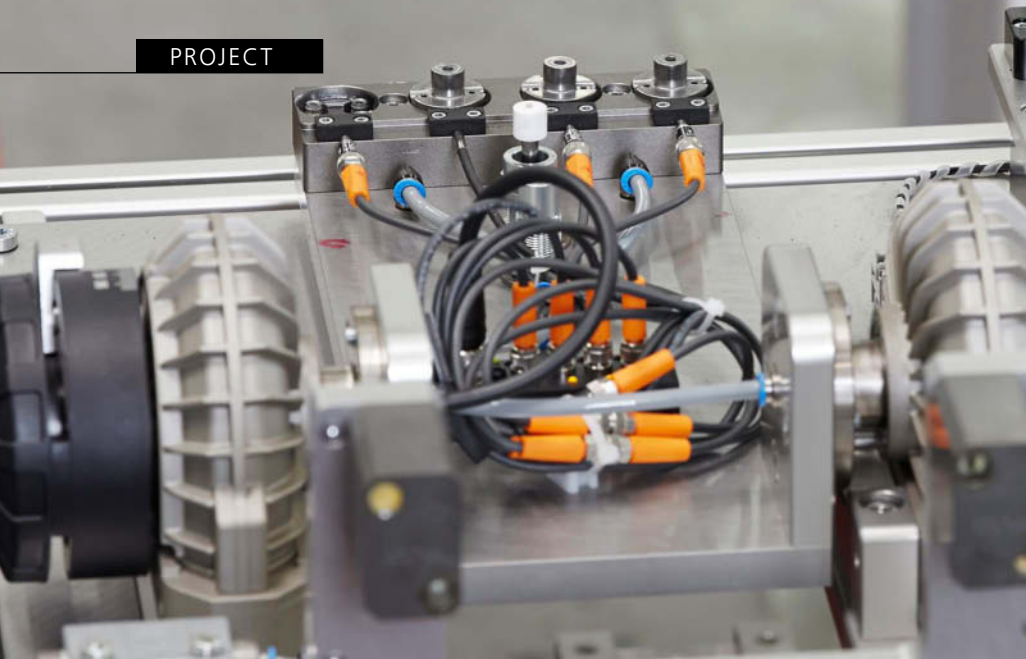
Rudi Göbel: Three six-axis robots and machine operate in synchrony

An injection moulding solution in which machine, robotic systems and peripherals are supplied from a single source. Three six-axis robots which are fully integrated in the control system and operate in a synchronised manner. A production cell which produces automatically around the clock. What sounds like an ideal for efficient injection moulding production is a reality at Göbel.

With this type of ARBURG turnkey solution, the company automatically and reliably produces complete motor-vehicle components for an innovative Start/Stop system. "The component, a so-called connector carrier for the Start/Stop system is manufactured for the international automotive industry. The requirements with regard to efficient high-volume production are therefore extremely high," explains

Peter Baumann, Purchasing Manager at Göbel. The connector carrier comprises a metal insert and pin contacts, which are provided with positional accuracy at two stations and then overmoulded with fibre-glass reinforced PBT.

"We wanted to produce the complete component without any finishing work, around the clock, in three-shift operation on an automated facility at our



German plant in Helmbrechts," says Peter Baumann, outlining the general requirements.

Complete solution from a single source

One significant advantage in his view is that ARBURG was able to deliver a complete solution from a single source. A further benefit he went on to mention was the excellent spare parts supply and generally good pre and after-sales service. This is of particular importance with regard to the continuous operation of complex production cells in particular.

At the heart of the system designed for Göbel is a vertical ALLROUNDER 375 V and three six-axis robots. The inserts are provided via a tray feed and a feeder cell featuring a Scara robot. The system also includes a control station and a conveyor belt for removing the finished parts.

The six-axis robots are fully integrated in the SELOGICA control system. They therefore move in synchrony with the machine. The two robots for handling the inserts are connected serially via a bus interface. Bus communication enables centralised start-up scenarios and facilitates restarting following malfunctions, for example.

The complex 3D movements of the three six-axis robots were programmed by the ARBURG experts from the Project Department in person during commissioning of

the system. Thanks to implementation of the SELOGICA user interface in the control system of the KUKA robots, this is comparatively straight-forward, meaning that further optimisation can be carried out by the operating personnel at any time.

Positionally accurate feed of inserts

The tasks are clearly delineated during the production process. The first six-axis robot is responsible for providing the sintered metal inserts. It removes the parts, which are provided randomly positioned in trays and precisely aligns each one via three sensors using its sixth robotic axis. This task is performed via so-called "event-controlled rotation", whereby three sensors detect the position of the inserts. This special function can be programmed via the SELOGICA control system and replaces an expensive rotary unit that would otherwise be required.

The robot consecutively places four inserts, positionally accurately, onto a transfer station. The station turns and the parts are then ready

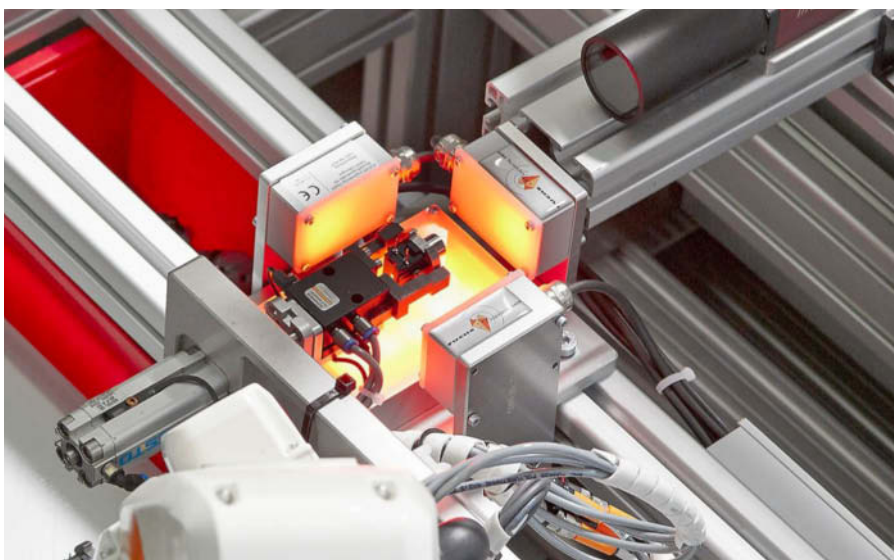
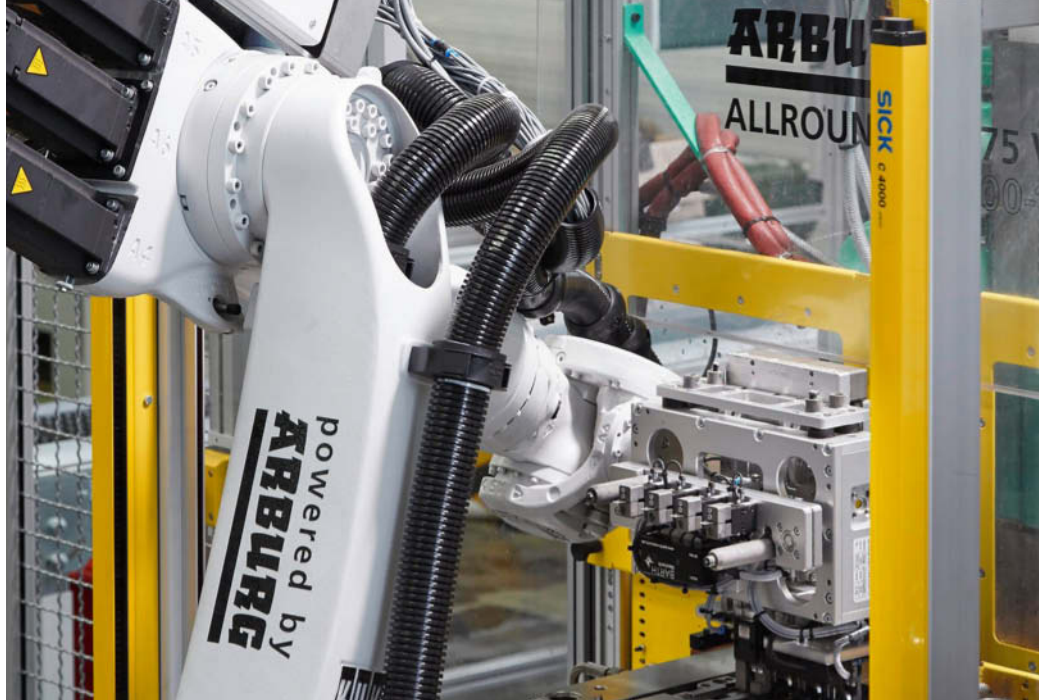
for insertion into the injection mould.

At the same time, further inserts are provided via the feeder cell - two contacts per component. This task is performed by a Scara robot, which is connected via a peripheral interface. Its camera system recognises the geometry of the inserts. The robotic system picks up four sets of two contacts and places them in four positions in an alignment station. This station then rotates through 180°, providing a total of eight inserts in pairs.

Complex gripper performs multiple tasks

Next, the second six-axis robot, which is equipped with a complex gripper, comes into play. This first removes the four metal inserts from the transfer station and fetches the four pairs of contacts from the alignment station of the feeder cell. The robotic arm then moves to the rotary table of the vertical ALLROUNDER 375 V injection moulding machine. Here, it first removes the finished parts from the lower part of the 4-cavity mould before consecutively inserting the four sintered parts and pairs of contacts. The mould, with the inserts in place, is then brought into the injection position via a rotary table. The inserts are then overmoulded with just under ten grams of glass-fibre reinforced PBT. In the meantime, the six-axis robot ejects the





Perfect division of labour: the first six axis robot provides four metal inserts with positional accuracy via "event-controlled rotation" (photo on left). The second robot takes the four inserts and eight contacts from the feeder cell (centre photo) and inserts them in the injection mould (photo on right). The third robot is responsible for camera inspection of the finished parts (bottom photo).

sprues, transfers the finished parts to the control station and moves back to the transfer station.

100% camera inspection integrated in process

Simultaneously with the injection moulding process, the third six-axis robot consecutively passes the parts on to the control station for camera inspection before placing the good parts onto a tray, which is automatically removed via a conveyor belt.

Thanks to the simultaneous and coordinated interaction of the robotic systems, the complete production

process runs exceedingly quickly. "We currently produce around 3000 parts per shift," says Peter Baumann. "At the moment, we're working on further optimising the overall process in order to reduce the cycle time by a further 15 percent."



INFOBOX



Name: Rudi Göbel GmbH & Co. KG

Founded: 1957 by Rudi Göbel

Plant: Helmbrechts, Germany, as well as three subsidiaries in Germany and Austria

Production area: 17,200 square metres, of which 4,500 square-

metre injection moulding shop

Turnover: Approx. 60 million euros (Group)

Employees: 350 in Helmbrechts, approx. 500 in total

Machine fleet: 62 injection moulding machines (Helmbrechts), 37 ALLROUNDERS

Products: Injection-moulded as well as stamped and composite parts for high-performance electronics, the automotive industry, medical technology and instrumentation technology

Contact: www.rgoebel.de

The future is colour

Faber Castell Brazil: faster, better and more economical production

The key to corporate success spanning several centuries for "A.W. Faber-Castell" is enduring innovation. One example of this is injection moulding production in Brazil, where hybrid HIDRIVE machines manufacture a variety of plastic parts with extreme efficiency.

Founded in 1926, the Brazilian subsidiary employs around 3,000 personnel and is one of the most important companies in the globally operating Faber-Castell AG Group from Stein near Nuremberg, Germany. The sales and marketing activities take place at the company's São Paulo location, production is in São Carlos and the plastics processing operation, established in 2006, is based in Manaus.

More than 1000 different products are manufactured in Brazil, sold on the domestic market and exported to more than 70 countries.

Sharpeners, highlighters and felt-tip pens for children are manufactured on a production area of 6,000 m² at the plastics processing plants in Brazil.

Dimensional stability and short cycle times

Hybrid ALLROUNDER H machines can demonstrate their full potential here. Accordingly, the degree of accuracy and short cycles achieved are the main advantages highlighted by the on-site management. "High dimensional stability combined with the rapid production of parts for subsequent assembly are of crucial importance," says Helio Cortazzo Junior, the Managing Director responsible for plastics production in Manaus, where twelve machines produce around the clock. "About two years ago, we decided to invest in modern mould and machine technology to effectively reduce cycle times. Following intensive market analysis, the high-performance hybrid HIDRIVE machines emerged as the clear winner," explains Helio Cortazzo Junior, regarding the latest restructuring measures and the investment in eight

ALLROUNDER 520 H machines with a clamping force of 1,500 kN and three 1,000 kN ALLROUNDER 470 H machines. Two of these machines are equipped with six-axis robotic systems for parts handling.

Efficiency improvements in two-digit percentage range

In addition to speed and reliability, he also values the efficiency of the machines: "With our hybrid ALLROUNDER H machines, we were able to reduce cycle times by 15 percent on average, while simultaneously increasing part quality by 10 percent. Another important factor in our efforts to achieve greater production efficiency was our ability to reduce energy consumption in the production process by an impressive 40 percent compared to conventional machines."

The ALLROUNDERS are equipped with modern 24-cavity and 32-cavity moulds and process PP, PE, PS and ABS. Partial and full hot-runner systems as well as



ful

on thanks to HIDRIVE



highly effective cooling circuits provide for short cycle times of six to nine seconds. Before the hybrid ALLROUNDERS and new moulds were used, cycle times of up to 17 seconds were the norm in some cases.

The installation of further new moulds is scheduled for November 2013 and will represent another step in this direction. For the first time, it should also be possible to use the "Set-up Assistant" integrated in the SELOGICA control system for programming tasks.

Excellent teamwork

The cooperation on a global scale between A.W. Faber-Castell parent company and ARBURG has existed for 15 years and contacts to the Brazilian subsidiary were established two years ago. Helio Cortazzo Junior explains: "For us, ARBURG is a real partner. Sales and Service always provide comprehensive advice on selecting the right machines. ARBURG has also helped us to implement an effective mould strategy. Although our production facilities in Manaus are located far away from the ARBURG location, the specialists there always respond

quickly to our requests for assistance. Since the first ALLROUNDERS were installed in our production facilities, we've had no downtimes or repairs. We also intend to draw on ARBURG's extensive expertise and increase mutual cooperation in the automation sector."

The logo with the two jousting pencil knights (photo above) is famous around the world and makes the Faber-Castell products unmistakable.

In Brazil, pencil sharpeners and felt-tip pens, for example, are produced (photos below).

INFOBOX



Name: Faber Castell

Founded: 1761 in Stein/Germany, 1926 in São Carlos/Brazil

Employees: Around 7,000 worldwide, 3,000 in Brazil

Turnover: Group, 570.5 million euros (2011/2012), of which 40 percent through Faber-Castell Brazil as the largest subsidiary world-wide

Certification: Europe: EN 71 and CE, America: ACMI - ASTM D 4236 and ANS, **International:** ISO 9001-2000, ISO 14001, FSC (Forest Stewardship Council), Certification of Product Conformity INMETRO

Products: More than 1,000 different pens and implements for writing, drawing and painting, for both adults and children

Machine fleet: Twelve machines in Manaus, of which eight are ALLROUNDERS

Contact: www.faber-castell.com, www.faber-castell.com.br





Firmly secured

SPRINGFIX: Specialists in high-quality vehicle components

Of the approximately 600 key customers of SPRINGFIX Befestigungstechnik GmbH, the majority come from the automotive sector. In order to partially substitute expensive metalwork and exploit the advantages of plastic, the injection moulding process and ARBURG technology play an important role.

“We help our customers to always find the best solutions from us,” says Plant Manager Claus Peter Mendl. Plastics make a significant contribution in this regard.” The benefits he mentions include the material’s corrosion resistance, the high geometrical freedom and excellent damp-

ing properties, as well as low weight. Three interesting products, an actuating shaft, linkage bar and cable clip, illustrate how electric, vertical and two-component ALLROUNDERS are integrated in the production process.

Actuating shafts ensure power

Increased combustion engine power output can be achieved via compression of the intake air. For this purpose, actuating shafts are required in the intake pipes, i.e. at the throttle valves in the intake manifold of motor vehicle engines. SPRINGFIX produces these shafts on a two-component version of a vertical hydraulic

ALLROUNDER 520 V with a clamping force of 2,000 kN.

The simultaneous moulding of the ten bearing points onto the shaft requires a high degree of precision. First, the steel shafts are inserted into the 1+1-cavity mould and the bearing arms are moulded on. For the purpose of overmoulding with the second component, the premoulded parts are transferred within the mould. The bearing arms are made from PA6 GF60 and are covered with a high-quality, friction-optimised PPA with carbon-fibre and PTFE, in order to minimise wear. The plastics employed are high-performance materials for use in the automotive sector.

Linkage rods ensure sensitivity of sensors

Modern motor vehicles are required to provide optimum road illumination without dazzling the oncoming traffic or pedestrians. This is achieved by means of automatic dimming or a shorter light cone. In order to transfer the high-frequency vibrations from the chassis in an attenuated manner to the highly sensitive sensor required for the purpose of online travel sensing, a rod made from a soft, elastic plastic is used. Sufficient hardness is also required in order to avoid impermissible changes in its length. In order to ensure play-free and smooth transmission of the travel, an extremely stable production process is a must. The patented linkage rods made by SPRINGFIX are therefore produced on an electric ALLROUNDER 520 A equipped with a sorter unit. For this production process, TPU is injected into an 8-cavity mould.

2-component cable clips provide hold and dampen vibrations

During driving, cables must remain firmly in place. Tight clamping, however, is impermissible. These requirements have resulted in a two-component part made from a hard outer shell and a soft, elastically resilient and vibration-dampening interior component.

The cable clips made from PP and TPE (Santoprene) are produced in a two-station mould with an electric rotary unit. A two-component version of a hydraulic ALLROUNDER 630 S featuring core-pull control and a sorter unit is used here. The 32+32-cavity mould ensures production at competitive costs, but places high demands in terms of process control.



The right ALLROUNDER for each product

Of the 30 injection moulding machines in Salach, 12 are ALLROUNDERS. These are used according to the relevant products and required clamping forces. Claus Peter Mendl values the technical features of the ALLROUNDERS highly: "With the electric ALLROUNDERS, we see advantages, particularly in precise process control. In general, the operating philosophy of the SELOGICA control system is important in order to ensure a high level of production transparency across the machines. A decisive point for us, however, is also the comprehensive consulting and technical support we receive from our technology partner ARBURG during the implementation of our projects."

The high-end products from SPRINGFIX such as actuating shafts (photo on left), cable clips and linkage rods (photo on right, l to r) place a variety of stringent demands on the ALLROUNDERS.

INFOBOX

Name: SPRINGFIX Befestigungstechnik GmbH

Founded: 1958 in Göppingen, subsidiary of the Italian MSA Group since 2001

Plant: Salach

Turnover: 50.5 million euros (2012)

Certification: DIN ISO 14001, TS 16949

Products: Stamped and bent parts, combination parts made from metal and metal/plastic composite, single and two-component moulded parts, assembly

Machine fleet: 30 injection moulding machines, of which 12 ALLROUNDERS

Contact: www.springfix.de



TECH TALK

Dipl.-Ing (BA) Oliver Schäfer, Technical Information



Elasticity rules

Properties of liquid silicone (LSR) and solid silicone (HTV) compared

The use of silicones is always advantageous where conventional and thermoplastic elastomers reach their limits. Their numerous positive properties consistently lead to new solution and product ideas. They are elastic and dimensionally stable, odourless and tasteless, resistant to temperature, chemicals, UV and ageing, regardless of whether the moulded parts are made from liquid silicone (LSR) or solid silicone (HTV). What, then, is the difference between these two materials?

LSR and HTV are both hot-vulcanising silicone rubbers, in other words, their properties are only attained through cross-linking at high temperatures.

The materials primarily differ from one another – as their respective names imply – in their consistency. Above and beyond this, however, different cross-linking principles and consequently dissimilar processing conditions apply.

LSR: liquid becomes elastic

Liquid silicones are addition cross-linking silicone rubbers made from two liquid standard materials. The catalyst and cross-linking agent are supplied in separate 20 or 200 litre containers, ready for use. Cross-linking can thus be initiated in a targeted manner at the required time. There are no particular storage requirements and long storage periods pose no problem.

A special LSR dosage system is required for processing. This enables individual adaptations of the material through the addition of dyes and additives, and ensures the homogeneous mixing of all the components. One disadvantage, however, is the additional space required for the LSR dosage system.

The prepared, reactive material mixture vulcanises extremely quickly at high temperatures, permitting appropriately short cycle times. No decomposition products

Requirements	LSR	HTV
Complex, delicate part geometry	+	
Small components	+	
Simple automation	+	
Short vulcanisation and cycle time	+	
High number of cavities	+	
Low number of cavities		+
Configurable material		+
Low material costs		+



are generated, which keeps part quality high and mould wear low. During injection, the viscosity of LSR falls sharply. In order to produce high-quality, flash-free moulded parts, moulds with extremely high tolerances of 0.005 mm and less are required. The low-viscosity material, however is advantageous for the formation of complex geometries and delicate structures as well as for production with multi-cavity moulds.

HTV: solid becomes elastic

In contrast to liquid silicones, solid silicones are self-crosslinking silicone rubbers made from a single component. This places certain demands upon correct storage of the material. HTV must be protected from sunlight, at temperatures below 30 degrees centigrade, in sealed containers in order to prevent premature cross-linking. It generally has a shelf life of around six months.

Depending on the production requirements, HTV is custom-made and can optionally be delivered ready-for-processing in bales, blocks or strips.

For the processing of the "solid" feedstock, a special INJESTER tamping device is required in order to ensure a continuous, bubble-free material feed.

Solid silicones also vulcanise quickly in the moulds, which can be heated to up to 220 degrees centigrade. Their viscosity, however, falls just as sharply as is the case with liquid silicones during injection.

This enables the use of simpler mould technology.

Further benefits include the greater tear resistance of HTV, which makes demoulding easier and less "risky" in terms of damage to the moulded parts.

Liquid LSR (left) and solid HTV: both materials require different processing conditions and have different strengths (table, below left).



Materials complement each other perfectly

A comparison of LSR and HTV reveals that both materials offer benefits in different areas. This also extends the application range of moulded parts made from silicone. Processors are free to choose. In order to efficiently produce moulded parts from silicone, an individual examination is necessary.



Freedom has to be experienced! Expand your capabilities: With the freeformer and our groundbreaking process for additive manufacturing – ARBURG Plastic Freeforming. Manufacture small-volume production runs industrially and efficiently – without a mould, from your materials, dust-free and fully-functional. Experience the new megatrend!

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