

today

The ARBURG magazine

Issue 56

2014



ARBURG



reddot award 2014
winner

freeformer



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IMPRESSUM

today, the ARBURG magazine, issue 56/2014
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ARBURG is the only manufacturer to offer a comprehensive product range for efficient plastics processing: from additive manufacturing with the freeformer, through to injection moulding with ALLROUNDERS.





Dear Readers,

This edition of "today" clearly reflects the development of our product range and of our company.

The topics covered are no longer limited exclusively to injection moulding, but increasingly relate to additive manufacturing with the freeformer. Because this machine impresses not only on account of its unique technology, but also due to its outstanding design, it was bestowed the renowned Red Dot Award in July 2014.

In the present edition, you will also find out which applications and products are more suitable for ARBURG Plastic Freeforming (AKF) and which for injection moulding. You will also receive answers on a wide variety of questions that we have been asked with regard to the freeformer.

The feature on our subsidiaries highlights the deve-

lopment of our company and of our international presence. We have been investing in these continuously for decades and are also expanding them with a view to the future. The objective is to provide first class support and consulting to our customers at the local level.

The fact that this strategy has proved successful can be gleaned, for example, from our article on a US customer that has entered into the injection moulding sector for the first time with ARBURG. Moreover, the reports on projects and applications demonstrate that we implement efficient and reliable production and automation solutions, even for highly complex tasks.

I hope you enjoy reading our new issue.

A handwritten signature in blue ink, appearing to read 'J. Hehl'.

Juliane Hehl
Managing Partner & Managing Director

ARBURG




reddot award 2014
winner

freeformer

Champion!

Red Dot Award 2014: Design award for freeformer

In July 2014, the design world gathered in Essen, Germany, for the presentation of the internationally renowned Red Dot Award. With the freeformer, an ARBURG product has been awarded this coveted, internationally renowned design prize for the first time. The pioneering additive manufacturing system thus takes its place next to products from top brands such as Apple, Audi and Adidas.



"In addition to quality and functionality, a machine's design is becoming increasingly important in the purchasing decision," agree Managing Director Technology & Engineering Heinz Gaub and his predecessor Herbert Kraibühler.

Successful premiere in 2013

Together with Head of Development Dr. Eberhard Duffner, Herbert Kraibühler promoted the development of the freeformer over the past ten years and, as of April 2014, has been actively involved in an advisory capacity for ARBURG Plastic Freeforming (AKF). With the freeformer and AKF, which celebrated their world premiere at the leading international K trade fair in October 2013, ARBURG has entered into the future-oriented market for industrial additive manufacturing.

The Design Tech office in Ammerbuch, Germany and its proprietor Jürgen R. Schmid were brought on board for the design work. The industrial design expert's

remit was to pay particular attention to the recognisability, future sustainability and uniqueness of the freeformer, as well as its aesthetics and functionality. The results include an easily accessible construction chamber with pivoting glass front, simple operating options and a fold-out PC with multi-touch screen mounted on the side. The high-visibility on/off switch also acts as an emergency-stop switch. Furthermore, care was taken to ensure that the freeformer would fit through doors of standard width.

Future-oriented industrial design

The clear, soft lines of the housing are reminiscent of modern telecommunications devices and are well suited for use in a design studio or laboratory environment. The fact that the overall concept is successful in visual terms is evidenced not only by the positive feedback from existing and prospective customers, but also by winning the Red Dot Award seal of quality.

reddot award 2014
winner



There's mo

Functionally integrated: Finished, ready-to-use component in a s

The production of simple moulded parts is no longer an art. There is rising market demand for components with pleasant tactile qualities, with joints, or with insulating or magnetic properties. The wide variety of these additional functions is matched by the options for integrating them. The know-how of the ARBURG experts is in ever greater demand when it comes to finding efficient, value-adding solutions.

"We implement functional integrations with expert partners and in cooperation with our Project department," says Dr. Thomas Walther, Department Manager Applications Technology. At the Fakuma 2014, ARBURG is presenting Particle-foam Composite Injection Moulding (PCIM) as an example of function integration, the subject of the Blue Competence initiative "There's more to plastic", which is the focus of the Plastics and Rubber Machinery Association (KuG) within the German Machinery and Plant Manufacturers Association (VDMA). The system and the expert knowledge on particle foam and its processing were supplied by Ruch Novoplast, the mould technology by Krallmann. Handling of the inserts and finished parts is performed by a mobile robotic cell from fpt Robotik, in which a

small AGILUS six-axis robotic system from KUKA moves along a linear axis.

Integrated thread

A foamed part product made from EPP is produced on the compact foaming system integrated in the injection moulding cell. The six-axis robotic system inserts this into the injection mould, where a thread is moulded on and a positive bond created. "Composite parts of this kind – comprising a foamed EPP and a moulded-on component – can then be easily integrated in foamed EPP housings or panels as standard parts in a further step in order to create mechanical connections or to easily connect watertight media lines," explains Dr. Thomas Walther, adding that this opens up new applications, particularly in lightweight construction and thermal insulation. The integrated thread, for example, enables screw connections for foamed automotive components or the connection of a condensation drain on foamed housings for ventilation and extraction systems.

Targeted combination of properties

Through the use of multi-component injection moulding, properties such as hard/soft, matte/gloss, transparent/opaque or different colours can be

combined in order to produce e.g. high quality fittings, switches and handles for vehicle interiors.

Just how additional joining techniques or downstream assembly operations can be dispensed with through efficient injection moulding technology combined with an innovative mould concept and complex automation is illustrated by the practical example of a rotary encoder.

No assembly required

Using three-component assembly injection moulding, a magnetic disc, a carrier plate and a protective cap are moulded into a functional part in only 30 seconds. Of particular interest are the magnetisation directly in the mould and the swivel mounting of the magnet through overmoulding with a carrier plate. In this complex process, all three injection units, the mould functions and the entire MULTILIFT V robotic system are integrated in the SELOGICA control system. The ARBURG experts developed the application in cooperation with Oechsler (mould) and the Chair of Plastics Technology of the University of Erlangen.

A further example of how complex functions can be integrated into a production cycle through intelligent mould and process design is an LED light strip. This is produced ready-for-use using

BLUECOMPETENCE

Alliance Member

Partner of the Engineering Industry
Sustainability Initiative

re to plastic

single step



Particle-foam Composite Injection Moulding (large photo above) and long-fibre direct injection moulding in conjunction with organic sheets (top photo on left) offer new possibilities in lightweight construction. Thanks to functional integration, the LED light strip can be manufactured ready-for-use (centre photo on left). With the MOLD'n SEAL process, housings can be provided with a PUR seal inline (bottom photo on left).



the three-component injection moulding process. Here, LEDs and resistors are inserted into the mould. The housings and lenses, as well as the conductor tracks made from a conductive plastic component, which contact the electronic components, are injection moulded.

Intelligent linkage of processes

By linking injection moulding with other processes, including extrusion or PUR foaming, additional functions can be integrated into a component. Together with its partner Sonderhoff, ARBURG jointly presented the inline MOLD'n SEAL process, by means of which a PUR seal is integrated into an automotive housing. For this purpose, a six-axis robotic system removes the still-warm moulded part and moves it under a mixing head, which

follows the housing contour in order to produce a two-component foam seal. The curing time is shortened from ten to three minutes. No long curing belts or intermediate storage are necessary. This saves time, costs and space.

Added value for competitive edge

“Especially where the unit volumes and cost pressures are high, functional integration is gaining in significance and provides a competitive edge,” says Dr. Thomas Walther. This is also evidenced by the growing demand for turnkey solutions and innovative processes such as long-fibre direct injection moulding in conjunction with organic sheets. Here, continuous-fibre reinforced thermoplastic inserts are overmoulded with a fibre-reinforced plastic, forming a high-strength, but very lightweight composite component featuring bearing eyes, ribbed structures and further functional and reinforcing elements. “Intelligent” material combinations of this kind offer several advantages compared to metal and can open up completely new applications, e.g. in automotive manufacturing.





Sensiti

Riegler: Components

In the case of chronic renal failure or acute poisoning, dialysis can save lives – provided the technical equipment operates 100 percent fault-free. Riegler, a member of the Wirthwein Group, has made a name for itself as a supplier of medical technology and produces plastic components for dialyser housings at its plant in Mühlthal, Germany.

In 2012, Riegler expanded its clean-room production facility to a total of 6,000 square metres. "We produce the tubes and flanges for the dialyser housings in a Class 7 clean room according to ISO 14644-1," explains deputy technical director Georg Arras. Altogether, the products



are available in five sizes with different volumes, depending on patient body weight and the amount of blood being filtered.

The purchaser of the products is Fresenius Medical Care Deutschland GmbH, which supplies hospitals and dialysis centres with the end products.

ve: Renal dialysis

for renal dialysis produced in clean room

The final assembly is performed by Fresenius: semi-permeable polysulfone membranes are fitted to the filter housings and the blue flanges are welded on.

The fully functional dialyser then performs the central blood-filtering function. Inside it, the patient's blood is surrounded by a liquid dialysate containing an individually adapted quantity of electrolytes. A material exchange takes place between the blood and the dialysate at the membrane according to the principle of osmosis. Water and electrolyte pass through the tiny pores, while proteins and blood cells are blocked.

Fully automated concept

With an aim to operate as efficiently as possible in three shifts during the production of dialysis products, Riegler developed a fully automated removal and packaging concept together with ARBURG. "One important point was the requirement of being able to place tubes of different thicknesses into the carton according to a specific position to prevent any mix ups," remembers Georg Arras. This task has been solved with a horizontal MULTILIFT H robotic system which first removes the finished PP tubes from the mould and sets them down on a cooling section.

The 13 moulds for the dialysis products (2-cavity for the tubes and 8-cavity for the flanges) were built by Riegler in-house. The moulds are put to use on ten



Photos: Riegler

injection moulding machines with clamping forces from 1,300 to 2,500 kN.

Up to two seconds faster

"We produce the tubes on five automated hybrid ALLROUNDER 520 H machines. These impress with short dry cycle times and reduce the production cycle times by up to two seconds. The "free falling" flanges are produced on a hybrid ALLROUNDER 570 H and a hydraulic ALLROUNDER 630 S, according to Georg Arras, who is delighted with the reliability of the machines. He adds that during day-to-day practice, the flexible, intuitive SELOGICA machine control system also offers clear advantages.

Moreover, he expressly praises the cooperation with the ARBURG team. "If ever we have a problem with a machine, we receive assistance immediately. The experts from Lossburg have also been able to offer a viable solution for every new challenge – otherwise they quickly improvise one."

The components made by Riegler are used in dialysis units from Fresenius Medical Care Deutschland GmbH (photo on left). A horizontal MULTILIFT H robotic system sets down the finished PP tubes in a specified position on a cooling section so that the subsequent, fully automatic packaging operation runs smoothly (photo on right).

INFOBOX

Name: Riegler GmbH & Co. KG

Founded: 1946 by Fritz Albert Riegler. A member of the Wirthwein Group since 2005

Plants: Production at three plants in Mühlthal and Ober-Ramstadt, Germany

Turnover: Around 35 million euros in 2013

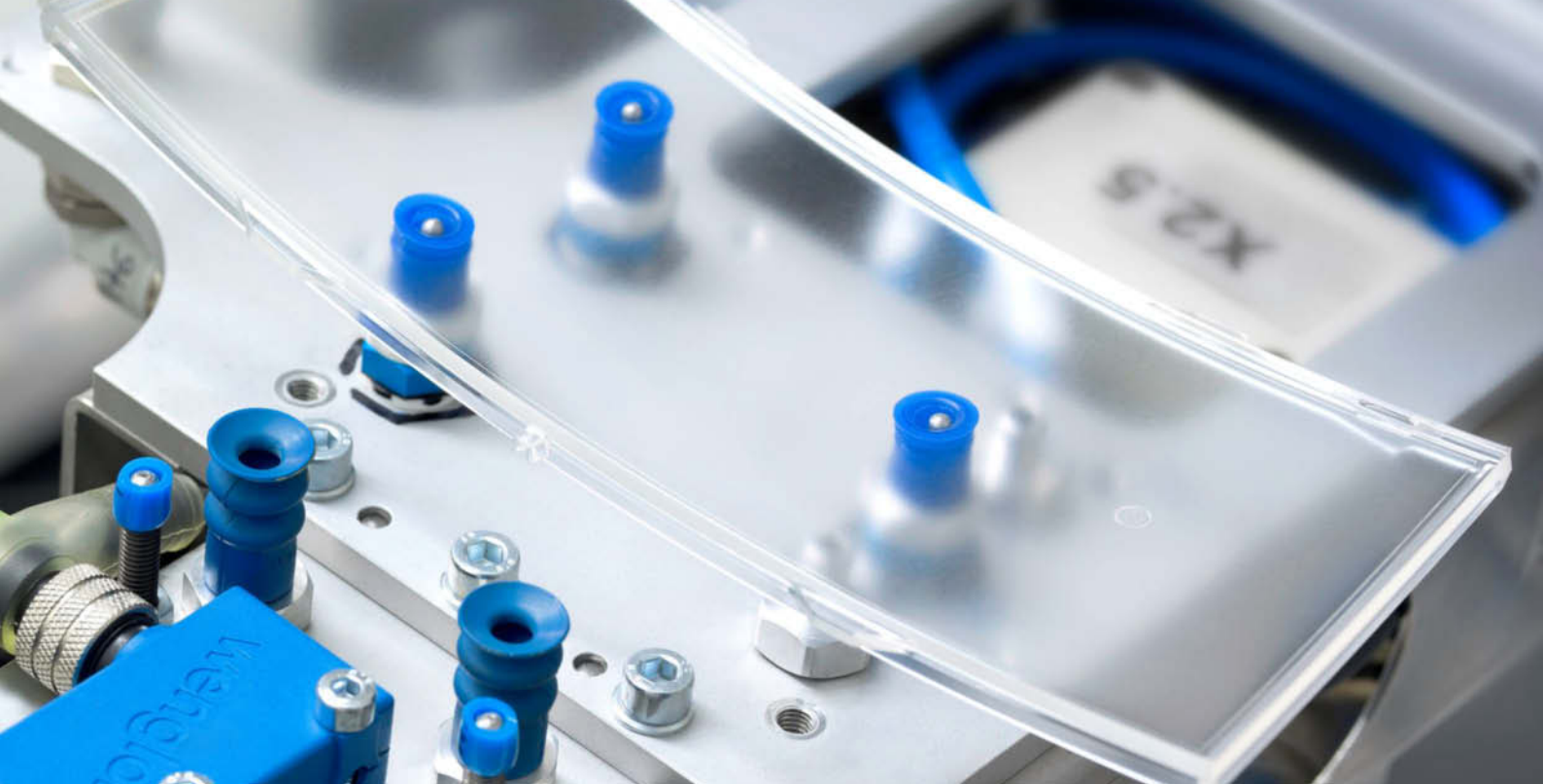
Employees: Approx. 250

Production area: Around 6,000 square metres, mainly clean rooms

Products: Sterile components and assemblies for the medical technology, pharmaceutical, chemical and cosmetics industries

Machine fleet: Around 100 injection moulding machines with clamping forces from 250 to 4,000 kN, including 61 ALLROUNDERS

Contact: www.riegler-medical.com



Precision injection co

Continental: Production cell manufactures aspherical mirrors for

When automotive supplier Continental needs particularly high-precision and reliability at its Babenhausen plant in Germany, electric ALLROUNDER A machines fit the bill. In order to produce aspherical mirrors for head-up displays, electric ALLROUNDER 720 A machines were integrated in fully automated production cells. The technological cooperation between Continental and ARBURG also extended to joint process optimisation in terms of the sequences and programming.

Head-up displays made by Continental are installed in motor vehicles of various brands. With the aid of aspherical mirrors, they project all the information relevant to driving, such as the current speed, onto the windscreen and therefore directly into the driver's field of vision, contributing significantly to driving safety.

In order to display this information on the windscreen free of distortion,

high-precision, accurately moulded surfaces are required. During manufacture of the mirrors, it is particularly important that the differing windscreen curvatures be exactly taken into account for a number of vehicles.

Specially equipped ALLROUNDERS

The mirrors, which are made from cyclic olefin copolymer (COC/COP), a special transparent thermoplastic, are produced to a large extent on electric ALLROUNDER 720 A machines with a clamping force of 3,200 kN, a size 400 injection unit and injection compression moulding equipment. A sensor in the mould records the compression gap and mould cavity pressure during the compression process. The SELOGICA machine control system monitors these measurement signals.

The mould also features a hot runner system for off-centre injection and near-contour temperature control in up to twelve individual temperature zones.



The sprue is separated directly inside the mould.

Each moulded part can be identified

Following the injection moulding process, a six-axis robotic system with a specially adapted gripper removes the mirrors without bending them and transfers them to a laser station. Here, each part is marked with its individual production data so that it can be immediately iden-



A head-up display projects all the important driving information directly into the driver's field of vision on the windshield with the aid of mirrors (top right photo). The precision-moulded part is removed by a six axis robot (bottom photo) for transfer to the subsequent processing station (top left photo).

mpression moulding

head-up displays

tified and the production details tracked. This step meets the requirements of Industry 4.0.

The mirrors are then set down onto a cooling station and cooled with ionised air from below. Next, 100 percent measurement is performed and a highly reflective aluminium coating is vapour deposited onto the front face.

High precision and cleanliness

In terms of the moulded part, the permissible deviation from the target geometry is less than seven microns and therefore less than the diameter of a human hair. The entire process, including the packaging, takes place fully automatically in a clean room. This reliably prevents contamination through dust particles.

Machines for production in a clean environment, equipped for injection compression moulding and with electric drives – all of these features characterise the

ALLROUNDERS delivered to Continental in Babenhausen, which run in three-shift operation, seven days a week.

Excellence in technology, expertise and service

The benefits of ARBURG injection moulding technology has been appreciated by the company since 1970 and it is highly satisfied with the cooperation. Above all, the combination of high machine availability, repetition accuracy, precise control, robust processes, intuitive operation and freely programmable compression control, as well as expert support, all receive a very positive assessment according to Bernd Stenger, Departmental Manager for Precision and Optical Components. "We value high quality solutions from a single source," adds Stenger, "as well as quick and flexible solutions." ARBURG offers us both with short response times, highly competent applications technology

and employee training as well as high quality machines." Smooth cooperation such as this pays dividends: Continental is already planning further production starts for head-up displays, which would be inconceivable without state-of-the-art injection moulding machines of this quality.

INFOBOX

Name: Continental:

Plant: Babenhausen, Germany

Products: Driver information systems for the automotive industry

Materials: Thermoplastics, e.g. ABS, PC, PMMA, PMMI, POM, PBT, PPS, COC, COP, PP, PA

Contact: www.conti-online.com/
www/automotive_de_de/general/interior/business_units/bu_instrumentation_de.html



For you, we have

Portfolio: freeformer and ALLROUNDERS for efficient plas



You produce plastic parts in varying batch sizes and are thinking about which process is the most cost effective? As the only manufacturer offering a comprehensive portfolio of products and processes for efficient plastics processing, from additive manufacturing to injection moulding, ARBURG has the answer.

With the freeformer, ARBURG offers a further industrial manufacturing technology for plastic parts alongside the ALLROUNDER injection moulding machines, providing an efficient produc-

it all!

tics processing

The comprehensive ARBURG range for efficient plastics processing extends from the additive manufacturing of one-of parts with the freeformer (photo above) through to the injection moulding of mass-produced articles using the ALLROUNDERS (photo below).

tion solution, whatever the requirements: from single-unit and small batches through to mass production of high-quality plastic products.

How many parts in what quality?

“The central question which we ask together with the customer in this context is: How many parts have to be produced cost-effectively and to what level of quality? The answer points the way,” says Managing Director Technology & Engineering, Heinz Gaub. Generally speaking, injection moulding with ALLROUNDERS is the

most efficient production solution in the case of high unit volumes. When it comes to low unit volumes, it is ARBURG Plastic Freeforming (AKF) using the freeformer. But there is no fixed, defined limit in this regard. This must be determined on a product-specific basis.

How much time is available?

A further criteria is the lead time. In the case of injection moulding, the mould has to be built and in some cases modified. Moreover, the production process must be optimised prior to a production start. With the freeformer, the 3D-CAD data for the component is all that is required.

AKF requires no detailed knowledge

The necessary parameters for the layer-by-layer build-up of the parts are generated using the in-house-developed freeformer control system. This receives the 3D CAD data for producing the components in the form of STL files, processes it automatically through slicing, and production can start. No special programming or material processing knowledge is required.

A further point is the required quality (see also today 54, page 14). In addition to geometric precision, this also involves part strength, which, in the case of additively manufactured components, amounts to approximately 80 percent of that of injection moulded ones. Due to the droplet structure, the density and therefore the tensile strength of the parts is slightly lower than with injection moulded parts. In many cases, however, strength values of 100 percent are not necessary for the components. With the freeformer, plastic parts can also be produced which cannot be produced using injection moulding, e.g. hard/soft combinations which can be reversed by twisting or part geometries that would be impossible to demould. “During selection of the suitable and most

efficient process, multiple aspects must therefore be taken into account,” explains Heinz Gaub, emphasising the great importance of the relevant consulting.

Qualified consulting vital

“In terms of injection moulding, ARBURG’s well-founded, detailed and professional consulting has been well-known for decades – on a worldwide basis,” says Managing Director Sales, Helmut Heinson. “This will of course remain the case with the freeformer. We will also continue to develop our process expertise.”

“Because the AKF process is a completely new technology, we place even greater value on cooperating closely with our customers,” emphasises Heinz Gaub. “We will therefore also be providing you with comprehensive application technology support, e.g. during the qualification of materials and part design.” On this subject, Helmut Heinson adds that, “This also includes checking whether prospective customers’ components can be produced reliably to the required quality before supplying a freeformer.”

The two Managing Directors agree about the importance of the process: “The freeformer as an industrial system for additive manufacturing completes our portfolio to perfection, whereby injection moulding will certainly remain the process of choice for the mass production of plastic parts in the future.”

Fakuma 2014



ILLUSTRATION P. ZIPFEL

**ARBURG at the
Fakuma 2014**



High-speed mass-produced items –

electric 820 A

48 consumer items in a cycle
time of around 5.5 seconds



LSR processing – electric 470 A

Processing of liquid silicone
under clean room conditions

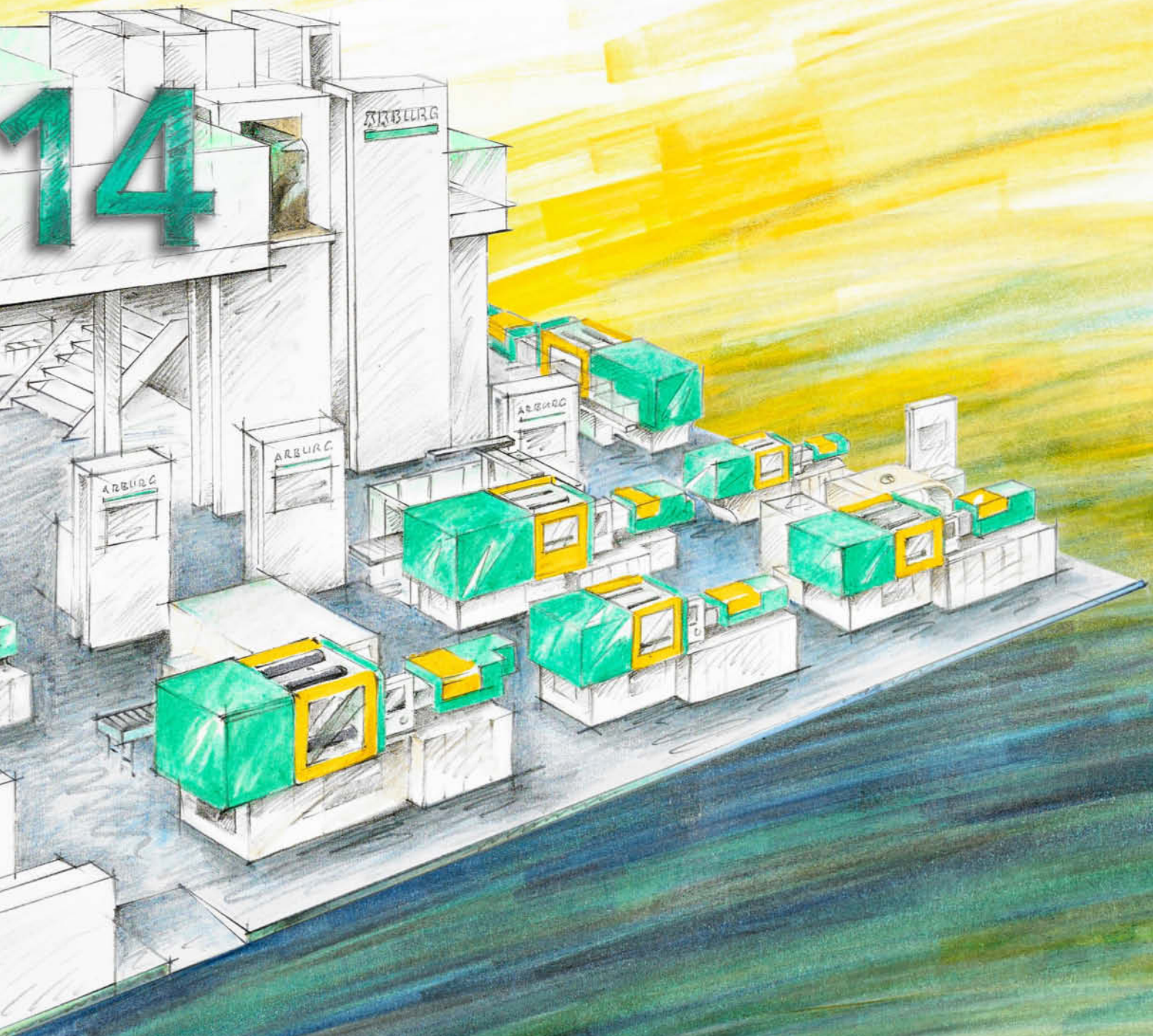


New micro-injection unit –

electric 270 A

Delicate 0.03-gram
precision parts





Industry 4.0 – electric 370 E



“Smart” traceable products, human/robot cooperation, ARBURG host computer system

Three-component injection moulding – hydraulic 630 S



Functional integration, soft-touch surface through hard/soft combination

Additive two-component manufacturing – freeformer



Two-component parts with easily removable supporting structures

Thin-wall IML application –



hybrid 520 H
“Packaging” version
New tub type with extremely thin wall thickness

Particle-foam Composite Injection



Moulding – hydraulic 470 S
Functional integration, combination of foamed and injection moulded components

Additive individualisation of moulded parts – freeformer



Interaction between ARBURG Plastic Freeforming and injection moulding

Long-fibre direct injection moulding – hydraulic 820 S



Glass-fibre reinforced lightweight part for the automotive industry

Service – hydraulic 270 C



GOLDEN EDITION
Service offerings, e.g. preventive maintenance

You ask – we answer

freeformer: everything you always wanted to know

In the context of events, during conversations and through an appeal in issue 55 of “today”, the ARBURG freeformer experts were confronted with a number of questions. The “today” editorial team has compiled a selection of the most interesting questions and answers.

Question: My vintage Mercedes Coupé dating from 1967 has an original Blaupunkt Frankfurt radio. Unfortunately, one of the plastic buttons has broken off. Can the freeformer make the relevant replacement part?

Answer: The production of one-off parts is a typical application for ARBURG Plastic Freeforming (AKF). This also certainly applies for radio buttons. All that the operator of the freeformer needs to produce the replacement part is the right material and the appropriate 3D CAD data. In future, it will also be possible to scan the broken part, “bond” it back together again digitally and produce the replacement part on that basis.

Question: The freeformer could be interesting for our injection moulding facility in order to quickly produce small-volume batches. How long does it take to master the system?

Answer: The training requirements are negligible: all the operator needs to do is read in the STL files from a 3D CAD model and define the material. The basic knowledge can be learned in as little as one or two days. The control system is based on the proven SELOGICA control system used in our ALLROUNDER injection moulding machines. However, comparatively few parameters need to be entered in the case of the freeformer. This is extremely simple via the gesture-controlled multi-touch-

screen. Here, we also remain faithful to our philosophy of making complex technology simple to operate.

Question: At the ARBURG Technology Days, I saw the freeformer producing a switch. Why does the liquid plastic not drip when it is applied from the nozzle onto the component carrier?

Answer: The processing of liquid materials is the key to and also the art behind the AKF process. In the temperature-controlled construction chamber, the individual droplets are placed next to one other so that they overlap slightly. Because they are only 200 to 300 microns in size, they cool quickly and fuse with one another automatically. No UV light or other special processes are required for curing.

Question: One of my hobbies is railway steam engines. I have an old technical drawing of a factory plate, which I would like to make for a 7¼ inch gauge model. Can this be done with additive manufacturing?

Answer: First of all, the drawing would have to be converted into 3D data. This is easy to achieve for both experts and amateurs with the relevant CAD knowledge. From the generated STL file, the freeformer can then produce the factory plate, provided it fits into the construction chamber. In other words, it must not exceed the dimensions of 230 x 130 x 250 mm. Further decisive factors include wall thicknesses and the degree of detail.

Question: Does ARBURG accept orders for additively manufactured functional components?

Answer: The same applies to the freeformer as to the ALLROUNDERS. We do not produce plastic parts to order. In this case, a service provider with the freeformer in its portfolio would be the correct contact. We would be pleased to provide the relevant information.

Question: ARBURG is evidently always good for a surprise. What major innovations can be expected in the field of additive manufacturing in future?

Answer: As a company which excels in terms of its innovative strength, we will be driving the advancement of additive manufacturing in a targeted manner for the long term. We will demonstrate what we are working on at various trade fairs such as the Fakuma and the Euromold in autumn 2014 as well as at our Technology Days and the HANOVER FAIR in spring 2015. One aspect on display will be the individualisation of plastic parts.





Electronics set the pace

Hehnke: Fully automatic stamping, bending and injection moulding

Over the past 18 years, Hehnke has developed from a two-man contract manufacturer to a high-volume component manufacturer. Complex turnkey systems from ARBURG ensure high quality serial production of complete functional units for motor vehicles. One example is the production of sensor housing covers for the electronic accelerator pedals of several premium automotive manufacturers.

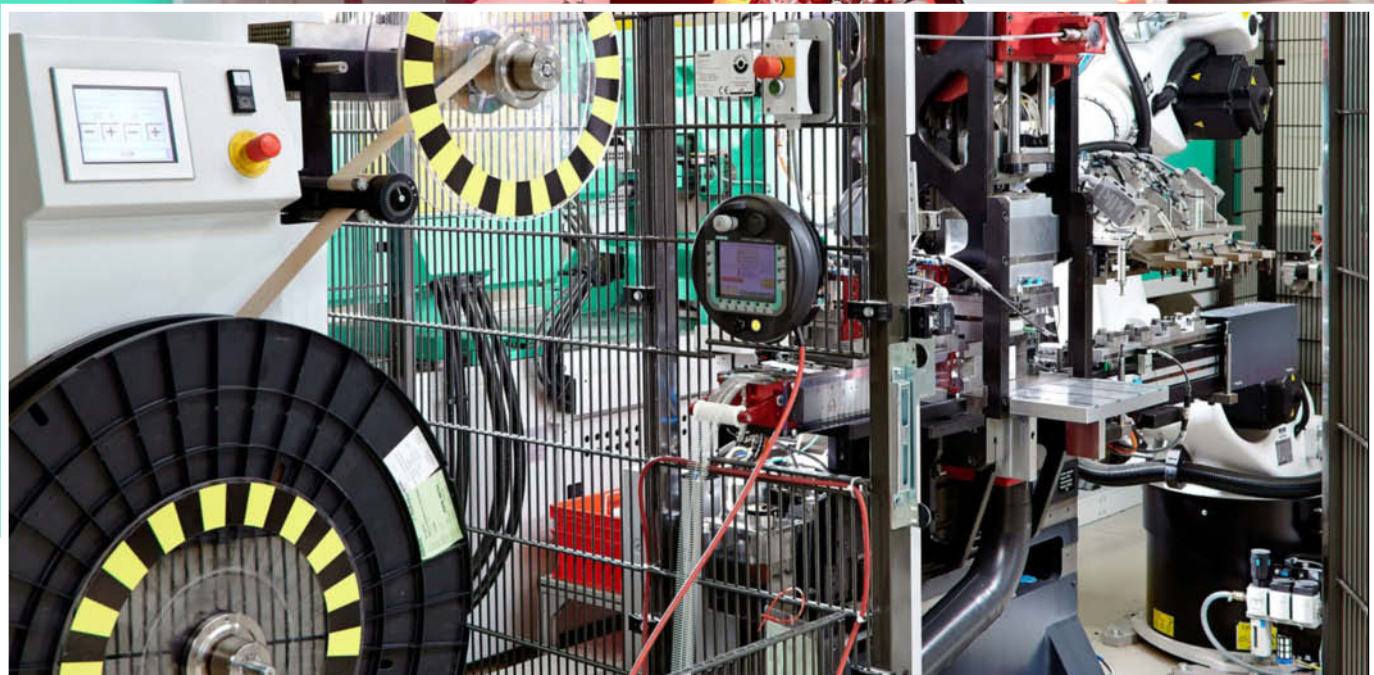
In modern motor vehicles, actuation of the accelerator pedal is processed via the

engine control system. A sensor, usually designed as a double potentiometer, communicates the relevant pedal position to the control unit. In premium vehicles, low-wear, although more expensive sensor technology is mainly employed. Two voltage values, for example, can be transmitted to the control unit, as well as digital setpoint signals where CAN bus networking is used.

Hehnke is a primary contractor for AB Elektronik GmbH / TT Electronics plc., a recognised development and production partner for accelerator pedals in passenger and commercial vehicle applications for established OEMs (Original Equipment

Manufacturers). All the components for these modules are produced at the Hehnke headquarters in Steinbach-Hallenberg, Germany. They are then delivered to tier-one OEM AB Elektronik GmbH, which is responsible for the development and manufacture of the complete pedals and where assembly takes place.

The turnkey system for production of the sensor housing covers is one of the most ambitious created by the ARBURG project department to date. The complete upstream and downstream production equipment, including a stamping/bending unit from Creative Automation, the grip-



per and testing technology from Kiki, as well as a palletising station, are arranged around an electric ALLROUNDER 570 A with a clamping force of 2,000 kN. For the various housing covers made from PP GF 30 and PA 6.6 GF 3, three 4-cavity moulds with replaceable inserts are used in order to produce a total of six versions for the premium automotive manufacturers. The insertion of metal contacts for electrical connection is the same for all parts supplied to the respective car brands. The sensor covers serve to connect the electronic accelerator pedals from AB Elektronik to the OEM engine control units.

Decisive: correct position of contacts and central control

One of the most important tasks of the complete system is the correct positioning and orientation of the individual contacts, which is maintained throughout the entire handling and insertion process. The highly complex electric and mechanical interface connection necessary to enable full integration of the production cell control via the SELOGICA machine control system, as well as the extensive optical and mechanical quality monitoring in the mould and in the production cell, represented particular challenges. Movement of the contacts

in the mould, for example, is prevented through volume-related withdrawal of positioning pins during the holding pressure phase. Dual stroke cylinders enable a double-row of contacts to be inserted with a precision of 0.1 of a millimetre.

Two robots operate hand-in-hand

The contacts are fed in the form of a strip from a coil into the upstream stamping/bending unit, which was provided by Hehnke. The progressive die prepares the contacts for overmoulding by stamping, bending and separating them from the strip. In each cycle, four groups of six individual contacts are inserted into a four-position loading plate, which acts as a transfer station to the six-axis KUKA KR 30 robotic system.

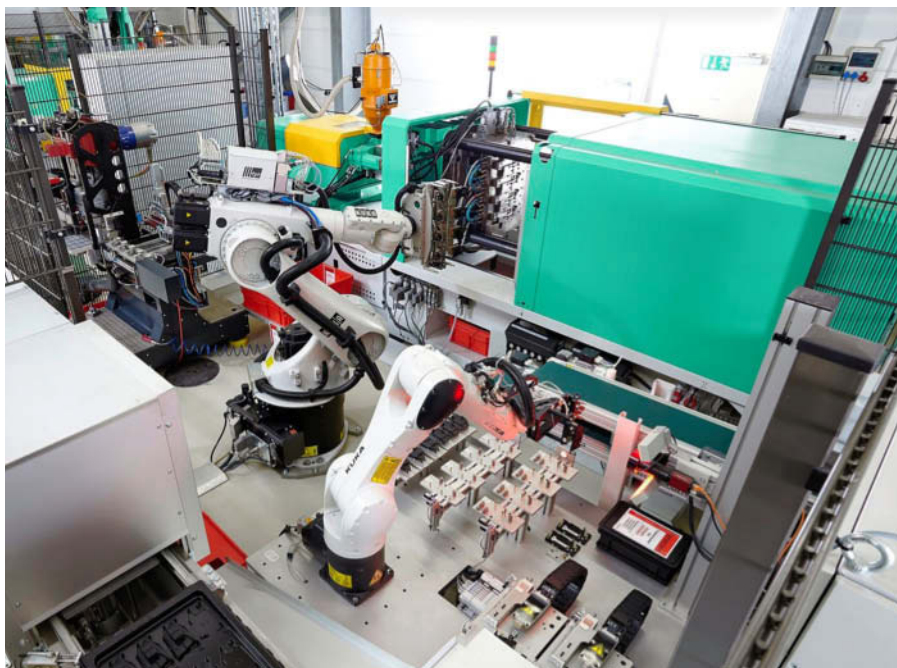
The insertion and removal gripper of the six-axis robotic system picks up four sets of six individual contacts from the loading plate of the transfer unit, fixes them in position and enters the mould. Here, the four previously overmoulded parts are first picked up. The gripper then moves further inwards and places the contacts to be overmoulded into the cavities. It holds the contacts in place until the core pull has extended and the contacts are centred, securely positioned and clamped in place.

For production of the housing covers (bottom photo), the contacts to be overmoulded are fed via coils and inserted into the mould following stamping, bending and separation (top left photo). The complete handling of the inserts and finished parts is performed by two six-axis robots operating hand-in-hand (top right photo)

Prior to the overmoulding operation, a special tactile/optical motion and sensor system in the mould checks that all the contacts are correctly and fully inserted before the mould is closed.

The finished parts are set down onto a second loading plate, from where they are consecutively picked up by a small AGILUS six-axis robotic system from KUKA and transferred to an optical inspection station. Here, the components are inspected to ensure the contacts are correctly positioned. In order to subsequently achieve the assembly and solder-free connection





of the push-in contacts onto the board with ease, their position must not exceed a defined tolerance range for each contact, known as the swash circumference.

Multiple quality checks

A sensor optically measures the overmoulding of the contact and at the same time indirectly checks whether the contacts are correctly inserted. The correct height of the push-in zone is determined because a minimum height tolerance is extremely important to ensure correct contact. The part is then inserted into a high-voltage and continuity testing station. If, when applying high voltage, it is detected that current is crossing over to the neighbouring contact, the robotic system discards the part,

which has now been definitively identified as faulty, into a container. If the optical check

indicates that the contacts are faulty, the robotic system places the part on a tiered conveyor belt for scrapping. The same applies to faults detected during continuity testing.

The individual testing of the four finished parts is coordinated with the injection moulding process on the machine. This takes just as long as the six-axis robotic system needs to remove the next four parts from the machine and pass them on to the transfer station. Once the sensor housing covers have successfully completed all the test steps, the good parts are set down in a specific pattern onto the trays of a palletising station.

ARBURG as an ideal partner

Hehnke cooperates exclusively with ARBURG with regard to its injection moulding activities. Managing Director Torsten Herrmann sees clear advantages in this approach: "The single-brand strategy means that we only use the SELOGICA control system, which makes the machines easier to manage. Our ALLROUNDERS are extensively networked using the available management systems for process sequences – ERP resource planning, the ARBURG host computer systems

(ALS) and CAQ quality documentation. Another important aspect is that the reliable family-owned company offers an extensive pool of expertise from comprehensive consulting through to a centralised Service department. The production solution developed in 2013 was positively influenced to a large extent by the close and in-depth cooperation between the two partners and their common knowledge of the sequence details. A similar system is therefore already being implemented."



Film
"Sensor
Housing"

INFOBOX

Name: Hehnke GmbH & Co. KG

Founded: 1995

Plant: Steinbach-Hallenberg, Germany

Employees: 90

Products: Complex injection moulded components and modules made from plastic; primary contractor with in-house development, mould construction and clean room as well as project support

Machine fleet: Thirty energy-saving electric, hybrid and hydraulic ALLROUNDERS, eight of which are integrated in production cells

Industries: Automotive, medical technology, electronics

Contact: www.hehnke.de



More complex, flexi

Automation: Oliver Giesen on the latest robotic and turnkey sys

For many years, automation solutions have become increasingly important. Is this trend likely to continue? How have the requirements changed? What does ARBURG have to offer? Oliver Giesen, Manager of the Project Department who has been involved with automation solutions for more than 20 years, answered these and further questions.

today: How has demand for automation developed over recent years?

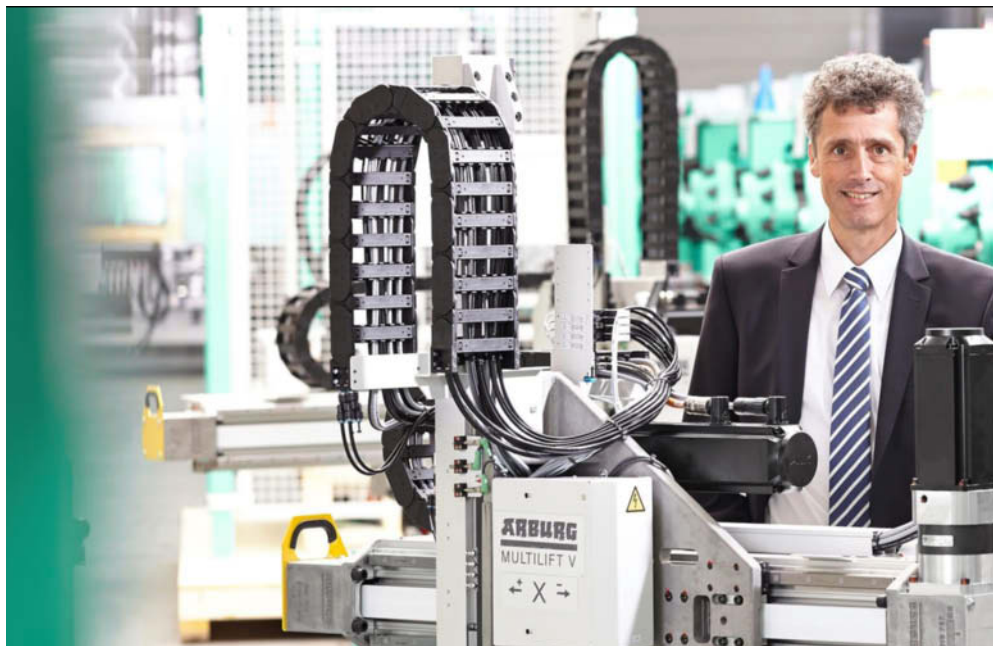
Oliver Giesen: Automation was and remains an important topic and the positive trend will no doubt continue. In terms of the current enquiries, we've observed two trends. On the one hand, the complexity of the turnkey systems is increasing, on the other, customers are seeking very flexible automation solutions owing to ever smaller batch volumes and faster product changes.

today: How is ARBURG meeting this trend?

Oliver Giesen: Through the continuous further developments of our offerings, and not only of our products. We're also investing in our international subsidiaries in order to expand the application technology consulting and automation expertise at the local level.

today: What further challenges arise from the two trends of complexity and flexibility?

Oliver Giesen: The objectives are the same in all cases: high process stability, availability, output and part quality. One frequent challenge is that the require-



ments that the systems will have to meet in future are not yet foreseeable.

today: What solutions does ARBURG offer?

Oliver Giesen: For high-speed applications, for example, we offer our vertically operating MULTILIFT V robotic system with an optional fast-action mould-entry axis, enabling short mould-open times. An advantage compared to specially designed automation systems is that a linear robotic system with three servo-electric axes is not limited to a single application, but can also carry out other insertion, removal and set-down tasks in the case of product changes.

If the customer requires a high degree of flexibility for insertion tasks,

interactive operation with human/robot cooperation is the ideal solution. Because the operator places the inserts manually in the gripper, expensive provision and feed devices for the inserts can be dispensed with and the system can easily be used for other products.

Where both high flexibility and high complexity are required, our mobile robotic cell, which we build jointly with our cooperation partner fpt Robotik, is an ideal solution. Here, a small AGILUS six-axis robotic system from KUKA can additionally be moved along a linear axis. Advantages include short cycle times, a larger working area and the option of flexibly using the mobile cell on different ALLROUNDER machines.

Thanks to complete integration into the SELOGICA machine control system,

ble and international

tem trends



"With our offerings in the field of automation, we offer our customers the complete spectrum from flexible automation solutions through to complex turnkey systems, including highly competent consulting," says a satisfied Oliver Giesen, Manager of the Project Department.

all our robotic systems can be programmed quickly and efficiently.

today: This mobile robotic cell features a total of seven axes. Are more possible? And if so, what's the limit?

Oliver Giesen: In order to integrate tasks into the peripherals as part of a turnkey system, further servo axes are possible. Furthermore, several six-axis ro-

bots can be integrated into a production cell. We've already implemented solutions with three six-axis robots, i.e. 18 axes. On the system for Rudi Göbel, for example, which was featured in issue 53 of "today". The appropriate film is available in our Media Centre ("A synchronised trio" at <http://www.arburg.com/en/gb/media-centre/videos/products/six-axis-robots>).

today: What's the limit with regard to the integration of upstream and downstream operations?

Oliver Giesen: The limit is reached when the individual processes affect the availability of the system excessively and the required output can no longer be ensured. In these cases, the installation of buffer sections or complete separation of the processes makes sense.

Our declared objective is not to integrate everything into the production cell "come what may", although we would earn the most money that way (laughs). We much rather examine the entire production process in order to help our customers achieve a cost-effective solution. This can also mean less automation than was originally envisaged.

today: For which companies and for which products are automation solutions of interest?

Oliver Giesen: Depending on the size of the company, the product and the batch sizes, it's always worth thinking about automation. This also applies to existing product ranges as much more flexible and cost-effective solutions are available today than in the past.

today: The growing turnkey business was one argument for the construction of the new production hall in Lossburg. For what exactly are the new capacities required?

Oliver Giesen: Owing to the increasing demand, the number of systems is increasing. The production cells themselves, however, are also becoming larger, either due to their growing complexity or due to the use of larger ALLROUNDERS with clamping forces up to 5,000 kN, which are increasing in our sector. We're already looking forward with anticipation to the new hall, which, thanks to its infrastructure, will offer our customers and us an optimum environment for commissioning the systems.



Film
"A synchronised
trio"



IML specialists

Serigraph: From the film to the in-mould laminated product

The headquarters of Serigraph are located in the far North of the USA, in West Bend, Wisconsin. The company's name already offers a clue to its area of specialisation. The screen printing specialists originally focused on production of the decorative films often used in in-mould lamination in the in-mould labelling process (IML). Today, system provider Serigraph supports its customers throughout the entire manufacturing process right down to the finished IML moulded parts, which are produced exclusively using electric ALLROUNDER A machines.

The IML process and the products resulting from the process are familiar: backlit displays and instruments for the automotive and white goods industries, a wide variety of containers for the packaging, food and medical sectors, or displays for mobile phones in telecommunications. For Serigraph, the key benefits

of IML moulded parts lie in their resistance to scratching and their chemical resistance. Then there is the great flexibility in terms of colour and freedom of design with regard to 2D and 3D applications – factors that are of vital importance for a decorative film producer.

Entry into IML injection moulding with ARBURG

In order to produce its IML parts, Serigraph uses different materials, primarily PC, glass-fibre reinforced plastics and ABS.

The in-mould lamination of the IML films is carried out exclusively on electric ALLDRIVE series ALLROUNDERS, most of which are equipped with MULTILIFT robotic systems for part handling.

Dan Haas, Senior Vice President – Engineering & Product Development explains: “When we decided on the ALLROUNDER machines from ARBURG, we'd already tested many machines of

other manufacturers. At the time, we were particularly impressed with the SELOGICA control system. Although we had a great deal of experience with the IML and injection moulding process itself and with moulded parts manufacturers who could supply us with the parts we needed, we had no personnel of our own who were familiar with the practicalities of injection moulding. This allowed the intuitive SELOGICA user interface to demonstrate its full potential: it was relatively easy to train our employees in how to use this control system.”

ALLDRIVE and SELOGICA excel at all levels

The decision-makers at Serigraph were also delighted with the excellent storage options offered by the SELOGICA control system and the superior technology of the electric ARBURG machines with spindle drives. The ALLROUNDERS therefore meet all the requirements of the IML special-

ist in terms of precision and repetition accuracy. The sealed, water-cooled servo-motors also ensure the clean production environment that Serigraph requires in the area of cosmetic products, for example.

Automation without limits

Further reasons for the use of ARBURG machines are the space-saving, high-precision integrated control for the hot-runner distribution system and the complete integration of MULTILIFT robotic systems in the machine process in real time. For smooth production, it is particularly important that the distance between tie bars is sufficient to allow the multiple removal grippers to reach reliably inside the moulds. "We also use robotic systems with higher loading capacities, for example the MULTILIFT V with a 15 kilogram



Photos: Serigraph

2,500 kN are operated in three shifts on five to six days per week in West Bend and two more are to be ordered this year. The machines are serviced according to an individual test plan.

"ARBURG collaborates with us very responsibly, so that our engineers only have good things to say about this cooperation," says a delighted Dan Haas. "For us, ARBURG not only offers outstanding, reliable and long-lasting technology, but also fast, excellent and extensive after-sales service."

In order to produce high-quality IML products (photos on left) Serigraph relies exclusively on electric ALLROUNDER A machines at its injection moulding facility, most of which are equipped with MULTILIFT robotic systems (photo above).



load-bearing capacity, for this purpose," says Dan Haas. "This allows us to combine a complex gripper and a removal module for multi-cavity moulds without exceeding the weight limit."

Successful cooperation since 2011

The co-operation between Serigraph and ARBURG began with the purchase of the first machine back in 2011. At present, eight electric ALLROUNDER A machines in the clamping force range from 1,000 to

INFOBOX



Name: Serigraph Inc.
Founded: 1949 by Al Ramsthal; the company was acquired by owner and CEO John Torinus in 1987
Plants: Production facilities in West Bend, USA and Querétaro, Mexico
Employees: Around 500 at the West Bend headquarters
Products: Systems supplier for 2D and 3D film printing, stamping die and mould construction, as well as IML injection moulding
Industries: white goods, automotive, leisure/sports, consumer goods, medical
Contact: www.serigraph.com

Good reasons to cel

Subsidiaries: ARBURG celebrates international anniversaries and



Photos: Joan Tudo

25 years in Spain and Portugal

The Spanish ARBURG S.A. has supported the customers on the Iberian Peninsula for an impressive 25 years. Today, the subsidiary is excellently positioned with two ARBURG Technology Centers (ATC) in Madrid and Sabadell (Barcelona).

The big anniversary event with some 70 guests was held in the chapel of Barcelona's Museum of Contemporary Art (MACBA) on 5 June 2014. On the occasion, Managing Partner and Managing Director Renate Keinath said: "The fact that we can celebrate a silver anniversary is thanks

to our customers and to our dedicated 26-member team in equal measure. Without both of you, we would not be one of the market leaders in Spain and Portugal today."

Martín Cayre, who has managed the subsidiary since 2007 added: "One success factor for us is the extensive product range. This means that our customers can fully meet their needs in terms of precision, productivity and automation. It puts us in a position to supply high-end solutions to demanding industries such as packaging and medical technology."

The anniversary celebration was follo-

Managing Partner and Managing Director Renate Keinath congratulated the Managing Director of the Spanish subsidiary, Martín Cayre.

wed by an Open House at the ATC Sabadell, during which some 90 customers attended specialist presentations on medical technology and LSR processing, as well as the production of LSR magnifiers on an electric ALLROUNDER E.

celebrate

inauguration



Managing Partner and Managing Director
Juliane Hehl congratulated the Chinese
subsidiary's Managing Director Zhao Tong.

the opening of a machine warehouse in Shanghai are important, but the commitment of our employees also plays a central role in providing first-class customer support." One of these employees is Mark Xiao, who works in Technical Support and Service and received the "Employee of the year" award.

The subsidiary manager joined Managing Director Sales Helmut Heinson in expressing his thanks to the customers for their trusting cooperation. These include Dertin, Hongfa, Kostal and Pigeon, who received "Customer of the year" awards at the event.

Ten years in Shanghai

Since its foundation in 2004, ARBURG Shanghai has very successfully established both close contacts and strong partnerships with its customers.

The ten-year anniversary was therefore celebrated in appropriate style on 24 April

2014 with over 500 guests at the "1933 House Shanghai". Managing Partner and Managing Director Juliane Hehl took advantage of the occasion to thank Zhao Tong, Managing Director of ARBURG Shanghai, and praised the entire Shanghai team for their successful work. Zhao Tong added the following: "Measures such as

New ATC in Austria

ARBURG has further expanded its presence in Austria with the inauguration of an ARBURG Technology Center (ATC) in Micheldorf, the technical centre, spare parts service and training rooms are all housed under a single roof.

The inauguration ceremony was held on 21 May 2014 with some 100 guests at the Benedictine monastery in Kremsmünster. Here, Managing Partner and Managing Director Juliane Hehl underscored the significance of the Austrian market. "We have been systematically building up

With the ATC in Micheldorf, the Austrian customers now have a central point of contact.

our subsidiary here for many years," she said. "The new facilities, with the technical centre at their heart, represent a significant expansion of our services in the areas of technical consulting, spare parts logistics and training," added Eberhard Lutz, Managing Director of ARBURG Austria. The first events and training courses took place in October 2014. "With Peter Ahrens, an additional employee is availa-



ble at the local level, who is able to expertly assist our customers on the telephone hotline and in the context of personal application technology consulting."



TECH TALK

Oliver Schäfer, Technical Information



Red hot

Innovative long-fibre direct injection moulding for strong, light

Lightweight production as a “problem solver” and an important topic for the future is heavily discussed owing, for example, to the increasing fuel prices and the still limited range of electric vehicles. The substitution of metals through plastics is the goal. For this purpose, long-fibre direct injection moulding opens up completely new possibilities, provided that knowledge of the process and of what to look out for is available.

The long-fibre direct injection moulding process, which was developed jointly by ARBURG and the Plastics Centre of Southern Germany (SKZ) involves cutting continuous glass fibre strands and feeding them directly into the liquid melt. This allows not only the material combination, but also the fibre length and fibre content to be individually adapted. The fibres are added into the plasticising unit via a special side feeder. Compared to long-fibre granulates, the new technique offers

a number of advantages (see today 50, page 6):

- Detailed process configuration
- Feed of longer, individually cut-to-length fibres – usually up to 50 millimetres
- Improved mechanical component properties
- Significant cost benefits

The basic requirements for long-fibre direct injection moulding is a matrix polymer with high flowability. In addition to good fibre dispersion and wetting, this permits a low level of fibre damage, i.e. long fibre length is ensured. Plastics such as PP and PA are ideal for this purpose.

Basis: Large injection units

In relation to the machine technology, large screw diameters are necessary in order to meet the requirements. Consequently, the process is suitable for injection unit sizes from 800 upwards. During configuration, a sufficiently long

dwelt time must be ensured. Excessive utilisation of the maximum dosage volume (dosage stroke < 2 to 2.5 D) should also be avoided.

Process-specific design

In order to ensure that the long fibres are present where they are needed, a process-specific, adapted design of the component and mould are decisive. The first consideration is the positioning of the injection points. The flow front should run along those parts of the component which are subjected to mechanical loads. Joint lines should be avoided in these areas. Mould filling simulations are recommendable here.

A further important aspect are large cross sections. Particularly in the case of gates and hot runner systems, excessively small cross sections act like filters for the fibres, i.e. blockages can occur. A simple rule of thumb provides guidance: the larger the gate, the longer the fibres



weight plastic parts

that reach the component. In the case of changing cross sections, it must be ensured that the melt is always routed from the larger to the smaller cross section. This results in a desired laminar flow in the cavity and therefore uniform distribution of the melt and fibres. Moreover, in the area of deflections and bends, there is always the risk of fibres becoming damaged or separated from the plastic matrix. For this reason, sharp-edged corners should be avoided and a maximum deflection radius should be selected.

Adapted process configuration

As with fibre-reinforced thermoplastics, good venting of the cavities must be ensured in the case of long-fibre direct injection moulding. This not only prevents burns to the surface of the parts and ensures complete mould filling, but also achieves better mechanical strength at the joint lines. Joint line strength is also influenced positively by the vario-

therm temperature control. The relevant features for programming and monitoring "special" process sequences of this kind simply and reliably are available in the SELOGICA machine control system. In terms of the process configuration, the additional basic rules should be observed in order to process long fibres in a targeted manner without causing damage to the fibres:

- Minimise back pressure
- Utilise the complete residual cooling time for dosage – keep screw circumferential speed low (do not exceed 24 mm/minute)
- Slow injection
- Avoid long, high holding pressures

As all these examples show, long-fibre direct injection moulding is a complex task, which requires specialised know-how and a holistic solution approach: from correct design of the component and technology through to process configuration. In order to provide in-depth consulting to

Tests such as pre-ashing provide the evidence: Plastic parts can be reinforced in a targeted manner using the innovative long-fibre direct injection moulding process.

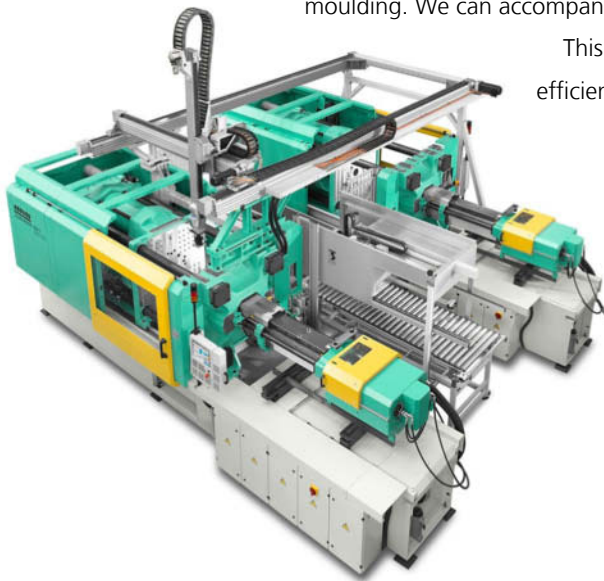
customers for this purpose, ARBURG has the appropriate experts in its Applications Technology department.





Distance counts! ARBURG robotic systems currently cover 36 million kilometres annually for our customers. We are the specialists for complex turnkey systems for plastics injection moulding. We can accompany you along the way to turnkey systems.

This is also what we mean by production efficiency. ARBURG for efficient injection moulding!



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