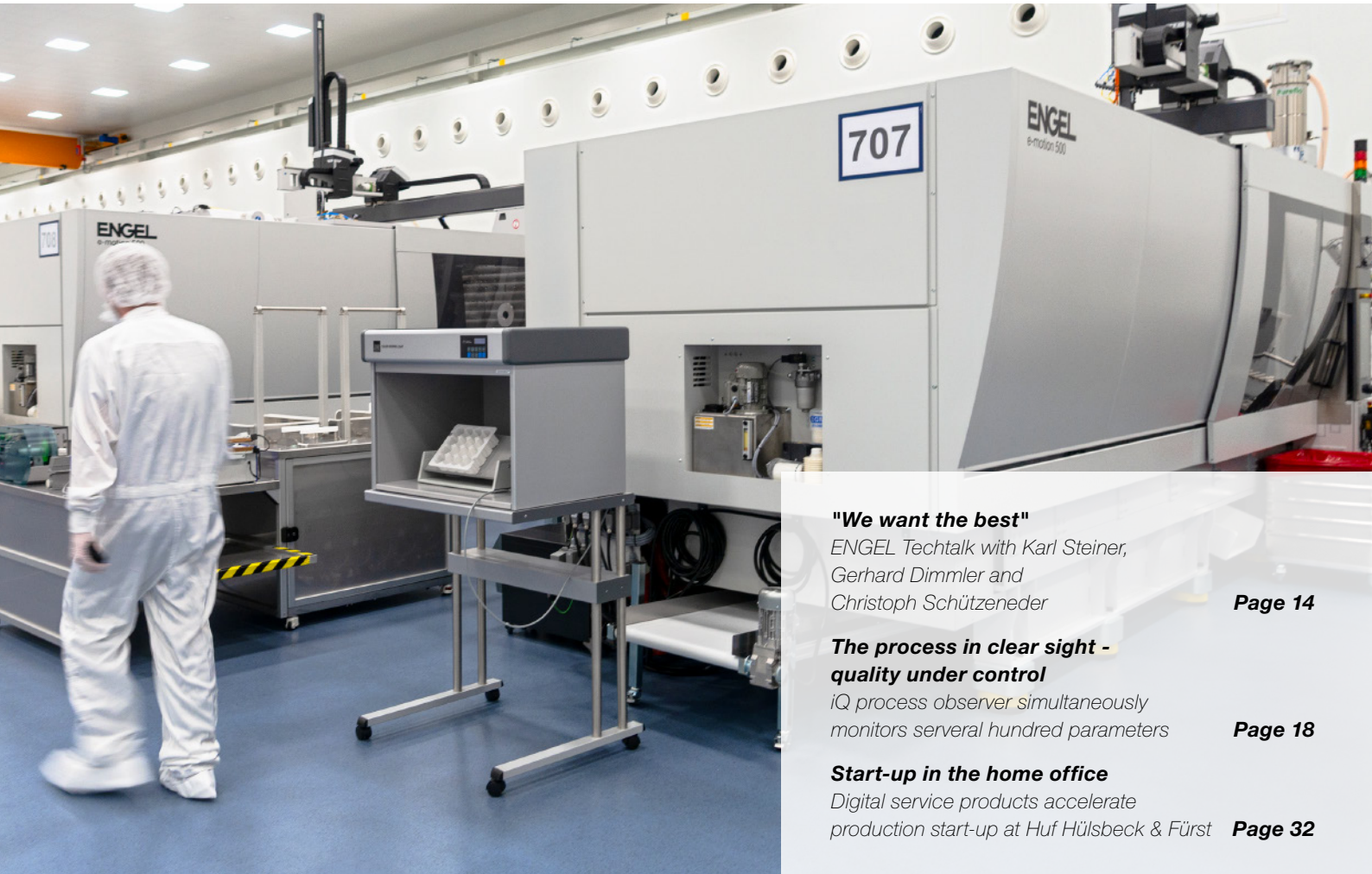


Injection

October | 2021

ENGEL's magazine for the plastics industry



"We want the best"

*ENGEL Techtalk with Karl Steiner,
Gerhard Dimmler and
Christoph Schützeneder*

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**The process in clear sight -
quality under control**

*iQ process observer simultaneously
monitors several hundred parameters*

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Start-up in the home office

*Digital service products accelerate
production start-up at Huf Hülsbeck & Fürst*

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New all-electric machines shorten time to market

Cover Story: Röchling Medical relies on ENGEL in Corona Pandemic

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Dr. Stefan Engleder
CEO ENGEL Holding

Sustainability only works with digitization

Following a long hiatus, Fakuma 2021 is the first major trade show in Europe to be planned as an in-person event. As this edition of Injection goes to press, we are optimistic that the pandemic will not force a cancellation with short notice. We are therefore very much looking forward to welcoming you, our customers and partners, personally in Friedrichshafen.

Personal contact is essential - the restrictions of the past months have made this clear. At the same time, modern digital communication and presentation solutions open up new ways for collaboration, customer support and event design. Our corporate activities are gearing for a hybrid future. An example was the ENGEL Symposium a hybrid event held earlier this year in Asia (page 13). If you did not attend the in-person or virtual event you can visit the 2021 Symposium in our media library. Instructions to access the Symposium are on page 13.

Service also benefits from innovative digital solutions. With performance boost, ENGEL has developed a service with which the automotive supplier HufHülsbeck & Fürst successfully completed an international commissioning project without a single day's delay, despite a lockdown (page 32).

Sustainability is only possible with digitalisation - this was made clear by the Symposium. Digitalisation helps us reach the full potential of the injection moulding machine, which is also key to reducing the CO₂ footprint. For example, the ENGEL solution, sim link, bridges the gap between process simulation and real-life production. Using sim link during the part design phase allows you to optimise the product cycle through resource-saving production and subsequently recycling.

With the iQ process observer (page 18), intelligent assistance reaches the next level. The data analytics solution monitors hundreds of process parameters simultaneously and displays deviations and their causes in an easy-to-understand manner. In this way, we show how you can further optimise your injection moulding process by making good use of your data.

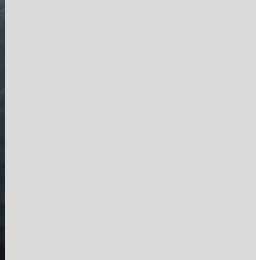
IMPRINT

Publisher: **ENGEL AUSTRIA GmbH** | Ludwig-Engel-Straße 1, A-4311 Schwertberg, www.engelglobal.com

Editorial office: Susanne Zinckgraf, ENGEL | Ute Panzer, ENGEL (responsible)

Design: Marion Maria Furlinger, ENGEL

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The Injection as e-paper:



New all-electric machines

shorten time to market

The fully electric high-performance machines from ENGEL combine efficiency with precision. However, the deciding factor for Röchling Medical to invest in eight e-motion machines all at one time was the overall package, including digitalisation. In the production of nest-and-tube systems, the two largest machines, each with a clamping force of 5000 kN, score points with self-regulating temperature control processes.

Nest-and-tube systems are packaging for liquid pharmaceuticals, presented in vials or pre-filled syringes. Covid-19 has led to a massive increase in global demand, as vaccine vials are also offered in this form of packaging. For Röchling Medical at the Brensbach site in the Odenwald region of Germany, nest-and-tube systems are a new application that requires one thing above all from injection moulding production: flexibility. Focusing on vials, Röchling currently produces the nest inserts in five sizes on two new all-electric ENGEL e-motion injection moulding machines. The same applies to the standardised tubs for all nest sizes, which require the highest clamping force of 5000 kN across the entire range of parts. In order to be able to set up the moulds flexibly, the two machines intended for this application were ordered in size 500 and designed identically. "In the near future, the two 5000 kN machines will be utilized 24/7 with nest-and-tub production," says Marco Treuner, Technical Project Manager at Röchling Medical.

ENGEL offered us the best overall package.

Joachim Lehmann, Director Business Unit Medical Europe, Röchling Medical

Extra features increase efficiency in the clean room

The dimensions of the nest-and-tube packaging are standardised so that they can be used in filling and sterilization systems of different types and suppliers. During the entire filling and processing process, the vials remain in the nest and can thus neither fall over nor collide with each other. In the honeycomb structure, the vials, which are mostly made of glass, are well protected. For 50 ml vials there are 16 vials in the nest. The smaller the filling quantity, the more vials there is room for in a package, and the more honeycombs there are in the nest inserts. POM is used for this demanding component geometry. The material reliably withstands cleaning before the filling process and is also economical. Due to its high shrinkage, however, POM places high demands on the stability and reproducibility of the injection moulding process. Added to this is the mould design with many long, closely spaced cores. "We need very stiff platens and particularly small centering diameters to avoid overmoulding even with the very large platens of the e-motion 500," says Treuner. Designed for maximum performance, the e-motion machines have very stiff platens as standard. ENGEL designed the platens with a particularly small centring diameter of 80 mm specifically for the nest-and-tube application at Röchling.

"ENGEL offered us the best overall package," says Joachim Lehmann, Director Business Unit Medical Europe at Röchling, explaining the investment decision. The two e-motion 500 injection moulding machines in clean room design are equipped with a linear robot from the viper series as well as GMP-compliant conveyor belts - both from ENGEL's own development and production. In addition, there are special solutions tailor-made for Röchling, which make the use of the very large injection moulding machines in the clean room even more efficient. The cable ducts are enclosed, smaller cable bundles are hoses, and the control cabinets have their own heat exchangers to prevent air turbulence at this point. Since the nest components are still too unstable to stack when they are removed from the mould, additional U-shaped conveyor belts were installed above the clamping unit as an after-cooling section. Only 15 minutes after demoulding does the viper robot pick up the components from the post-cooling conveyor and cycle them out via the larger conveyor belts to stack them in boxes.



The viper 20 robots perform two tasks: demoulding the injection moulded parts from the mould and transferring the parts from the post-cooling area to the take out conveyor.



In a GMP C class clean room, Röchling Medical produces, among other things, sophisticated pharmaceutical packaging, consumables for medical diagnostics, and medical technology components at its Brensbach site.

Temperature control assistance for stable processes and more energy efficiency

In addition to the very high precision of the all-electric high-performance machines, a very constant temperature control is crucial for the dimensional accuracy of the sophisticated POM parts, as Marco Treuner explains. "We have to ensure reproducible quality already in the production process." Quality controls take place several times. Both at the Brensbach plant and at the customer's premises. If the customer is located in the USA - as is the case in the current order - sufficient time elapses between production and quality control, after which the recrystallization process, i.e. shrinkage, is completed. At Röchling, part ageing is simulated in parallel over six months with the help of an annealing process.

For precisely reproducible temperature control, Röchling Medical took a step towards digitalisation. Both machines work with iQ flow control, the intelligent temperature control assistant from ENGEL. Equipped with six e-flomo temperature control water distributors and just as many temperature control units from the ENGEL e-temp series, the system uses the software to control and regulate itself over the entire production batch and maintain constant temperature control conditions. The temperature difference serves as a controlled variable for dynamic individual circuit temperature control.

In the ENGEL solution, the injection moulding machines and temperature control units communicate with each other via OPC UA. In this way, iQ flow control is able to adapt the pump speed in the temperature control units to the actual demand. This interaction combines temperature control consistency with very high productivity and energy efficiency. "Even after the short time since commissioning, we can see that the pumps are regulating down significantly. In some cases, they are running at just under 30 percent capacity instead of constantly at 100 percent," reports Treuner. The decisive factor for the investment in iQ flow control was the material, but the benefit for the company is much greater due to the energy savings. "We take care to keep the ecological footprint of our production facilities small

Some of the pumps are running at just under 30 percent capacity.

Marco Treuner, Technical Project Manager, Röchling Medical

and also take this into account when selecting our suppliers," emphasizes Lehmann. Röchling is ISO 50001 certified. The energy consumption displays of the e-motion machines support the processor in systematic energy management.

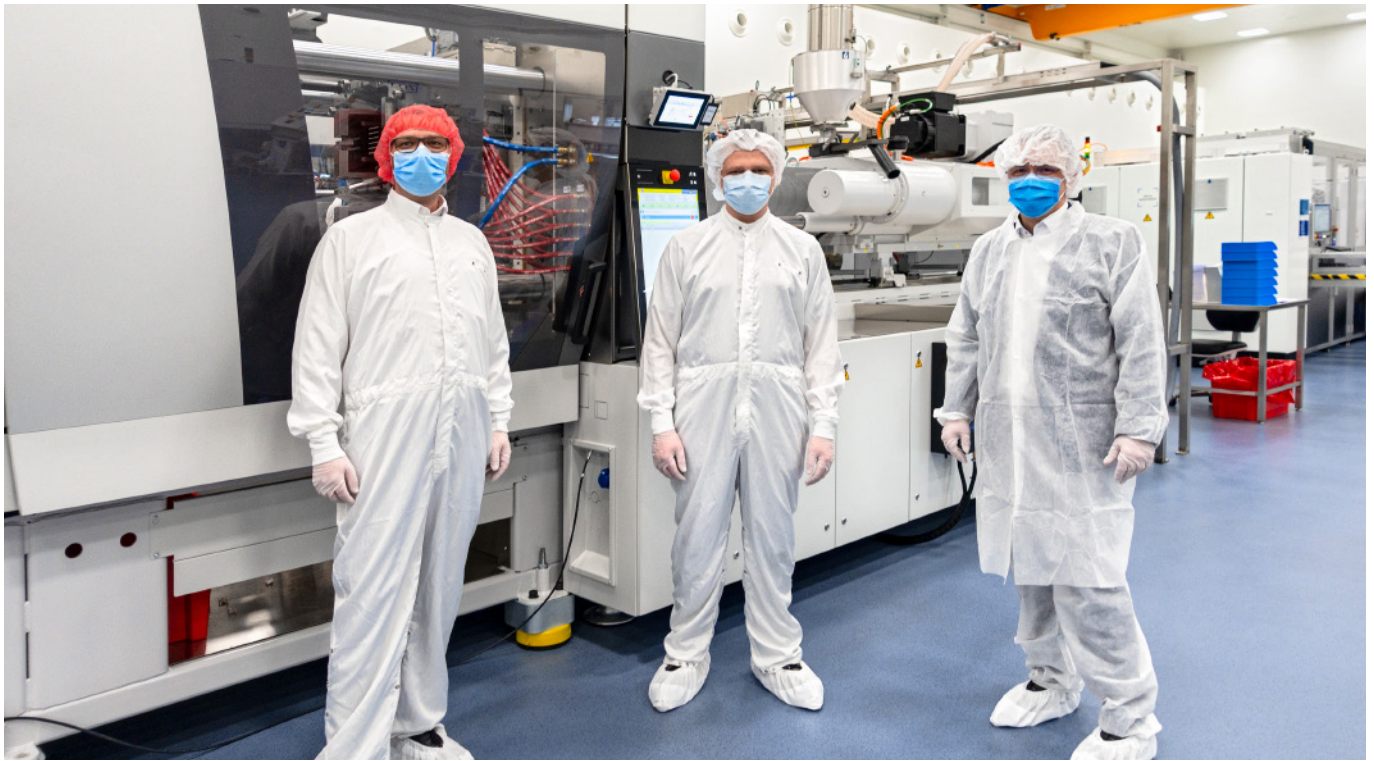
Medical machines have priority

The two new large production cells are part of a comprehensive package that ENGEL delivered to Brensbach in recent weeks. All eight new e-motion machines with clamping forces of 1600, 2800 and 5000 kN are used for cleanroom applications in the fields of pharmaceutical packaging, diagnostics and medical technology. In addition to nest-and-tube systems, Röchling Medical also produces racks for pipette tips and microtitre plates on ENGEL machines. As a competence centre for injection moulding technology, the Brensbach plant combines injection moulding production, assembly and mould making. All-electric drive technology is the factory standard. In addition to high precision, the aim is to avoid oil in the clean room as much as possible. In addition, the fast machine movements are crucial. While the nest parts have cycle times of up to 40 seconds, the tubes require a very high output with a cycle time of 10 seconds.

Triggered by Covid-19, the two large 5000 kN machines in particular were subject to enormous scheduling pressure. "We adjusted our processes right at the beginning of the pandemic and gave priority to medical machines in all plants," says Holger Kast, Sales Engineer at ENGEL Germany in Stuttgart. "For the Röchling project, we also accelerated order processing and pushed back the bureaucratic effort." Another special ENGEL feature contributed to the rapid commissioning of the machines: The machines were supplied in two parts at no extra charge. "Our cleanroom air shower is too small for a fully assembled 5000 kN machine," explains Treuner. "If we'd had to open the clean room to bring in the machines, it would have meant a whole week's production downtime." And that's for several products at once, because there are more than ten production cells in the large GMP-C clean room.

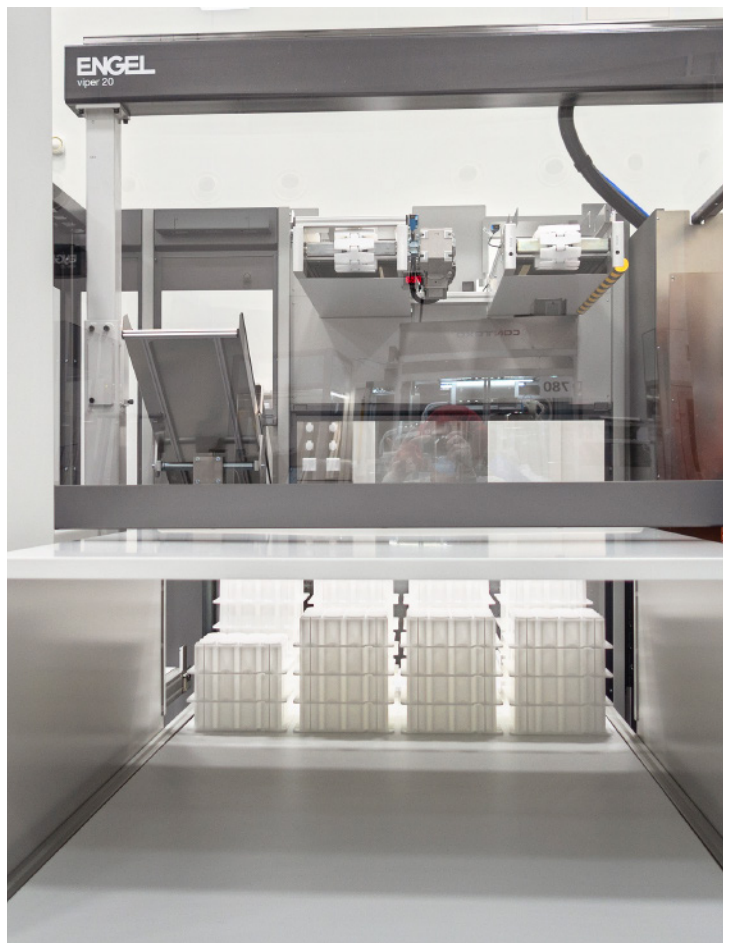
Last but not least, the system business ensures a short time-to-market. "With ENGEL, we have a central contact partner and communicate directly," says Lehmann." From the very beginning the entire production cell was accurately projected and all components were precisely coordinated. ENGEL made it easy for us even in the initial phase. With complex production cells, not many manage that at this speed. ■

From left: Holger Kast from ENGEL Germany, Marco Treuner and Joachim Lehmann from Röchling Medical.



The use of e-temp temperature control units significantly increases the energy efficiency of the temperature control processes. Connected to the CC300 machine control via OPC UA, the temperature control units adjust their pump speed to the demand.

More about
ENGEL's
cleanroom
expertise



Thanks to the post-cooling section, the nest inserts made of POM can be stacked directly. The viper robot picks them up and discharges them via the larger lower conveyor belt.

ENGEL worldwide. **on site.**

120 tonnes less plastic waste

ENGEL is a partner of Plastic Bank



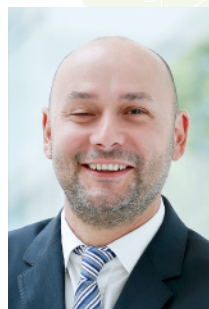
ENGEL supports the work of the environmental protection organisation Plastic Bank in Indonesia. As part of the cooperation, ENGEL is financing the collection of at least 120 tonnes of plastic waste in order to recycle the valuable material. "As a member of the plastics industry, we bear a great responsibility to establish a circular economy for plastics," emphasises ENGEL CEO Dr. Stefan Engleder, and makes it clear: "This requires both technologies and cooperation between market players at international level. This is precisely why we support the work of Plastic Bank. The model has convinced us. It's based on an incentive system that shows that business and climate protection can go hand in hand." The organisation buys plastic waste from private collectors, processes it and sells the granulate back to manufacturing companies. This concept reduces the input of plastic waste into the sea, promotes the development of recycling capacities and combats poverty.



One-stop shop for digital transformation

Sales unit for digital products

With the establishment of a Digital Solutions Sales Team, the ENGEL Group is bundling all sales activities for digital products and solutions from the inject 4.0 programme. Customers now have a central contact for all topics relating to the digitalisation of injection moulding production. inject 4.0 includes, among other things, the intelligent assistance systems of the iQ product family, the shop floor management solutions from TIG, such as the MES authentig, and the e-connect service solutions, such as e-connect.24 and e-connect.monitor. "The three areas of smart machine, smart production and smart service are increasingly intertwined. The bundling of expert knowledge in one



Hannes Zach, Head of Digital Solutions Sales

sales team takes this development into account," says Dr. Stefan Engleder, CEO of the ENGEL Group. "Our customers receive thorough, tailored advice for their digitisation strategy and solutions from a single source." Head of the new Digital Solutions Sales unit is Hannes Zach, previously Head of Sales and Marketing at TIG and with the ENGEL Group since 2000. TIG has been a member of the ENGEL Group since 2016 and will continue to be managed as an independent company in the future. In the areas of development and service, TIG will continue to operate independently of ENGEL.

"We are the global one-stop shop for digital transformation in the injection moulding industry."

ENGEL promotes young female technicians

Girls' Day virtual this time



Women get into technology: Anna Spiegl (left) is training to become a mechatronics technician at ENGEL, while Denise Lettner has opted for information technology.

The aim of Girls' Day is to give young women a new perspective on the world of work. ENGEL has been supporting this day of action for many years and was also involved in this year's virtual edition in Austria. "Girls' Day is a classic win-win situation," says Werner Wurm, global training manager at ENGEL. "We can get young women excited about a technical profession, and the girls can discover their personal of technical talent." Anna Spiegl also visited industrial companies during her school years as part of Girls' Day. Today she is a third-year mechatronics apprentice at ENGEL. "Girls' Day reinforced my career decision," she says. "It's really cool that my work goes into the injection moulding machine that will later be at the customer's site." Denise Lettner, an apprentice in IT technology, came across ENGEL on the Internet: "After the Girls' Day event, it was clear that I wanted to work for ENGEL." Around 15 percent of apprentices at ENGEL AUSTRIA are women, and the trend is rising.

25 years of partnership 100th injection moulding machine for MTA in Italy

MTA, headquartered in Codogno in northern Italy, is one of the few certified companies that produce vehicle fuses. In order to combine its high quality standards with efficiency, the company relies primarily on tie-bar-less injection moulding machines from ENGEL. The 100th machine was delivered to MTA just in time for the 25th anniversary of the partnership between the two family-owned companies. The victory is the preferred machine model in all plants worldwide. From tiny plug-in fuses, connectors, fuse holders and



MTA and ENGEL celebrate two anniversaries at once. From left: Gabriele Formenti and Matteo Terragni from ENGEL Italia, Giuseppe Falchetti, Antonio Falchetti, Marco Pagliara and Gabriele Gimici from MTA.

radiator caps to complete power supply units, MTA covers a very wide range of electronic parts. "Consistent processes and high precision are the be-all and end-all for us. ENGEL victory machines enable us to maintain our high quality standards while producing large quantities very efficiently," emphasises Maria Vittoria Falchetti, Manager Marketing & Communication at MTA. "Quality, technology and innovation - these shared values make up our collaboration."

Sustainable lightweight construction trends International audience at the Lightweight Future Day

The Lightweight Future Day 2021, hosted by ENGEL, once again made it clear that lightweight construction is a key technology on the way to a CO₂-neutral world - and that thermoplastics will play a major role. Top-class industry experts and representatives of renowned research institutes from all important sectors, such as the automotive and automotive supplier industries, bicycle and motorcycle construction, aviation, and the sports and leisure industries, presented current solutions and approaches to solutions. More than 500 participants gained valuable insights into current developments. Each presentation was followed by a Q&A session moderated by Dr. Norbert Müller, Head of Development smart machine at ENGEL, and Dr. Bastian Brenken, Managing Director of Composites United e.V.. Participants at this year's virtual event came mainly from Europe, with a focus on Germany, the UK and Benelux, but also from the USA. "Personal contacts remain important for us," emphasised Christian Wolfsberger, Business Development Manager Lightweight Composites at ENGEL and organiser of the event. "We look forward to offering the Lightweight Future Day again next year as a face-to-face or hybrid event and to welcoming as many participants as possible here in Schwertberg."



Dr. Norbert Müller, Head of Development smart machine at ENGEL, (right) and Dr. Bastian Brenken, Managing Director of Composites United e.V., (left) led through the programme and moderated the Q&A sessions.

With new management ENGEL Machinery India



Frank Schuster (left), Regional President METAI, is the new Managing Director of ENGEL Machinery India. Stalinjose Selvanayagam (right) moves from Austria to Mumbai as Sales Director.

On 1 July 2021, ENGEL completed the generation change in the management of its subsidiary in Mumbai. Frank Schuster, Regional President METAI, took over as Managing Director of ENGEL Machinery India Pvt. Ltd. and Stalinjose Selvanayagam is the new Sales Director. Jitendra Devlia, the previous Managing Director and Sales Director, is retiring. "With the dual leadership, we acknowledge the importance of the growing Indian market. We are simplifying communication with headquarters for our customers in India, which will speed up project planning for customised system solutions," says ENGEL CSO Dr. Christoph Steger. Frank Schuster will remain at the headquarters in Schwertberg, while Stalinjose Selvanayagam will move from Austria back to his home country for his new responsibilities. "With Stalinjose Selvanayagam, we are delighted to have a highly experienced injection moulding expert for this strategically important position, who is at home in both European and Indian culture."

Fakuma 2021: Hall A5, Booth 5204

Thin-wall injection moulding for tool assembly technology



ENGEL at the
Fakuma

ENGEL's trade fair stand at Fakuma 2021 is all about sustainability. With the production of decorated mono-material food packaging and the processing of regranulate from label waste, a process chain in the sense of the circular economy will be demonstrated. The 4200 kN size of the ENGEL e-speed injection moulding machine will be celebrating its world premiere. The demanding packaging application combines extreme thin-wall injection compression moulding with stack mould technology.

On an e-speed 420/90 injection moulding machine with integrated in-mould labelling (IML), ready-to-fill margarine tubs will be produced from polypropylene in a fully automated injection-compression moulding process during the five days of the trade fair. The containers, which have a wall thickness of 0.4 mm including the label, are removed from the 4+4 stack mould by a high-speed side-entry automation system and stacked on the take out conveyor after camera-based quality control. Corporate partners of the trade fair presentation are MCC Verstraete, Plastisud, Campetella, Mevisco and Borealis.

The continuing trend towards wall thickness reduction is leading to increasingly extreme flow path/wall thickness ratios, often in the range of 1:400. Even from a ratio of 1:300,

in many applications a consistently high component quality can only be obtained by means of injection-compression moulding. Further advantages of injection-compression moulding technology are that, compared to conventional compact injection moulding, lower clamping forces and lower injection pressures are required, and even highly viscous materials can be reproducibly processed. All in all, this leads to lower energy consumption and more competitive unit costs.

However, injection compression moulding is often regarded as a criterion for excluding the use of a stack mould, because the dynamics of the platen movements on many injection moulding machines are not sufficient for a stack mould. This is not the case with the ENGEL e-speed injection moulding machine, which is designed for continuous high performance in the packaging industry. The electrically driven clamping unit and the toggle lever design enable

very fast and, above all, precise, short compression strokes, in the case of the margarine cups, for example, of 4 mm. The parallel movements can be controlled very precisely, which is the prerequisite for matching the embossing stroke and injection profile with the required precision.

e-speed high performance machine in new size

With the new e-speed 420 size with 4200 kN clamping force, ENGEL is further diversifying its product range in order to tailor the injection moulding machines and system solutions even more precisely to the respective application in terms of maximum overall efficiency. The ENGEL e-speed injection moulding machines with hybrid injection and electric clamping units combine very short cycle times,



maximum precision and very high injection speeds of up to 1200 mm per second, while operating extremely energy-efficiently. The energy recovery system absorbs the braking energy of the platen movements and returns the stored energy to the motor for re-acceleration of the platens.

The toggle lever is encapsulated, which ensures particularly low lubricant requirements and maximum cleanliness. The e-speed machines meet the requirements of the food industry.

Intelligent label technology

The labels from MCC Verstraete used to produce the margarine cups at Fakuma are interactive. They are based on Digimarc technology. Similar to a QR code, the Digimarc codes can be

scanned with any smartphone camera. Their advantage is that they extend invisibly over the entire label surface. The camera can capture any point.

From production to trade to recycling, the labels offer added value. When shopping, consumers can find out about the ingredients and the manufacture of the product and packaging. When the packaging has reached the end of its useful life, the label provides information about the recycling process. If the container and label are made of the same material, the packaging is fully recyclable.

From the margarine tub to the protective cover

The margarine tubs produced at Fakuma are made of polypropylene, including the label. At the end of their useful life, the mono-material packaging can be shredded just like the production waste generated during manufacture, and the raw material obtained can be processed into new products. ENGEL will be demonstrating what this looks like in production

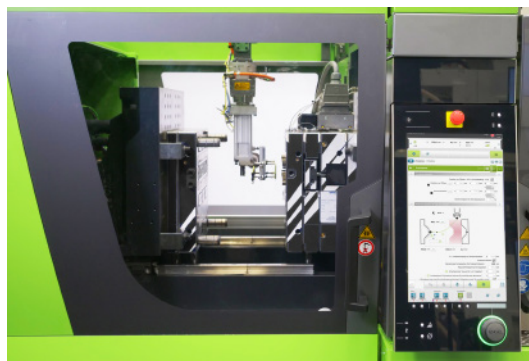
at the trade fair with the processing of label scrap in the form of regranulate. On a victory 460/80, closures are produced in a mould from Pöppelmann. Pöppelmann, based in Lohne - at Fakuma in Hall B5, Stand 5107 - is, like ENGEL, one of the pioneers and drivers in the development of a circular economy. Protective elements from Pöppelmann's KAPSTO division are used in logistics and construction, among other areas. The plastic content of these products consists of 100 percent recycled material.

Recycling, thin-wall technology, energy efficiency and information transparency are important keys to the success of the circular economy. This becomes clear at the ENGEL trade fair stand. ■

Optimized path planning for **shorter cycle times**

ENGEL is expanding its range of intelligent assistance systems at Fakuma. The new iQ motion control product enables linear robots of the ENGEL viper series to make a safe early start into the mould, combined with fully automatically optimised path planning. The user benefits twice over, through time savings in teaching and shorter production cycles.

In many applications, coordinating the movements of the injection moulding machine and the robot reduces the cycle time. This is because the robot arm can already enter the mould area while the machine is still moving, i.e. the mould is not yet fully open. To ensure that the robot moves parallel to the mould mounting platen, individual movement points as well as the velocity and acceleration of the entry movement are specified during the teaching (programming) of the robot. The path (trajectory) along the individual points is conventionally determined manually. The new ENGEL iQ motion control product reduces the teaching effort to a few clicks. The software calculates the optimal travel movement for the respective demoulding process, which further reduces the overall cycle time of the injection moulding process.



iQ motion control works with automatically optimised path planning and thus reduces both the teach effort and the cycle time.

Faster demoulding without waiting times

The prerequisite for parallel movements is that the injection moulding machine and robot use a common database, as is the case with system solutions from ENGEL. When entering the mould area, the robot does not have to wait until the mould is fully open. Thanks to the "early start" feature now integrated in iQ motion control, the robot starts moving parallel to the moving platen.

A suggestion for the early start position based on the setting parameters is displayed in the controller screen. This makes it possible to utilise the advantages even with little experience. The software works with a two-stage safety system to reliably avoid a collision between the robot and the mould half despite the early start.

Large mould opening stroke, large efficiency gain

iQ motion control will be included in the standard scope of all new linear robots of the viper series from October. The efficiency gain is particularly clear in applications with large mould opening strokes, such as the production of deep housing components, boxes or containers that require long mould cores. ■

10 years of temperature control technology from ENGEL

More about
iQ flow control

Are you monitoring your water temperature or just water flow?



Ten years ago, ENGEL embarked on a mission to shed light on mould temperature control. "20 percent of all rejects in injection moulding production are caused by temperature control errors," says Klaus Tänzler, Temperature Control Product Manager at ENGEL, explaining the reason behind this strategic decision. Today, ENGEL supplies integrated solutions for the intelligent control of temperature control processes from a single source, which significantly reduce or even completely prevent temperature control-related rejects.



The basis for this is the electronic temperature control water distributor e-floMo. Based on the measured values determined by e-floMo, the intelligent assistance system iQ flow control dynamically and independently adjusts the temperature control process and keeps the process conditions constant. When using e-temp temperature control units, the pump speed in the temperature control units is also adaptable to the demand and energy consumption is drastically reduced.

Mr. Tänzler, what is special about the integrated temperature control solution?

Changes in one temperature control channel can cause changes in other channels, resulting in uneven water and temperature distribution. Our dynamic system regulates each distribution circuit individually. This means that the thermal conditions

remain constant even in the event of fluctuations.

So the tool is no longer a black box.

Exactly. Even ten years ago, our floMo temperature control water distributor had the task of monitoring the process and making parameters transparent. Until then, conventional systems only indicated whether anything was running through any circuits in the mould. In order to detect an error, the processors had to produce rejects, which wasted energy and time. With floMo, a system came onto the market that - although still static - stopped the machine in the event of a fault.

What does that look like today?

The days when you thought you could achieve more with more water are over. Temperature is more important than the amount of water. That's why I like to ask our customers: Are you monitoring your water temperature or just water flow? Due to the uncontrolled distribution of water, there is a permanent thermal imbalance. We have therefore developed a dynamic system that independently finds an optimum operating point based on predefined parameters.

How does this work in concrete terms?

e-floMo controls the temperature difference between flow and return. We consider each circuit individually. The temperature control cross-section and the proximity to the melt vary from circuit to circuit. In addition, the pressure and flow conditions in the temperature control channels change over the service life of the mould. Therefore, the current e-floMo generation meters the water so that the set temperature difference remains constant in each circuit.

What is the benefit for the processor?

Clearly: a more stable process and less scrap. A stable temperature control process is the prerequisite for consistently high component quality - whether sensitive or simple parts. We make transparent what is happening

in the individual temperature control circuits and can immediately detect any problems that arise before rejects are produced. Transparency is also the key to saving energy.

How much energy is saved?

We have been able to demonstrate savings of up to 60 percent in customer projects. Because we precisely consider the temperature control capacity in the design stage and because the dynamic system automatically adjusts its capacity to the demand. Most customers achieve the return on investment after about two years. This is helped by the fact that wear is cut in half when the temperature control unit is operated at half the pump speed.

What are the recent milestones?

We have expanded the e-temp series. In addition, the automated, sequential blow-out of the manifold circuits is one of the latest innovations. When changing moulds, we use this to ensure that water and dirt are completely removed before the mould is removed. When moulds are installed, in turn, blowing out ensures optimal venting of this temperature control channels. The automated process saves time, which speeds up mould changes. The time saved is particularly clear with the parallel sequential blow-out function.

Where do we go from here?

Digitalization and networking via OPC UA still open up a great deal of potential, which we are gradually using. ■

ENGEL live e-symposium in the media library

Welcome to the **virtual world of ENGEL**

With several thousand participants, the ENGEL live e-symposium 2021 was a very big success. In addition to an online conference, business talks and virtual plant tours, participants took the opportunity to exchange ideas in person in one-on-one meetings and explore the virtual showroom. You could not be there? No problem! All technical presentations and business talks are available in the media library, and the virtual showroom is also still open.

For the first time, ENGEL's traditional in-house exhibition took place virtually, and with a very high reach. The participants came from almost 90 countries; particularly well represented were Germany and Austria, Mexico, the USA and Turkey. The virtual platform made it possible that, despite the ongoing pandemic, customers, partners and interested parties from all global regions could safely attend. "We received a lot of positive feedback," says Ute Panzer, Vice President Marketing and Communications at ENGEL. "This not only confirms the great interest in new technologies, but also shows how great the desire for exchange and networking is, even if everyone is looking forward to attending face-to-face events again soon. With the virtual symposium, we have developed a top-class event for a very efficient and compact transfer of knowledge."

Conference, plant tours and plenty of space for networking

How can the possibilities of digitalisation be turned into opportunities? Which technologies have the potential to strengthen competitiveness? And how do sustainability and profitability go together? In keynote presentations and business talks, experts from ENGEL and other companies provide answers to the burning questions of the moment. All content was offered in seven languages.

During the three live days, the speakers were available to answer questions from participants in Q&A sessions immediately after the presentations. In one-on-one meetings, the speakers and all other ENGEL



Online conference, business talks, plant tours, virtual showroom and one-on-one meetings for personal networking. The ENGEL live e-symposium 2021 combined a wealth of formats.

experts were also available to users of the media library. "Personal exchange is the focus at ENGEL, even virtually," says Panzer. A new offer developed for the symposium is the virtual tours of the Austrian ENGEL plants, which are still available as part of a one-on-one meeting. There are new things to discover at all locations, as ENGEL had invested heavily in the modernisation of its plants and in its customer technical centres in recent years. The new company exhibition at the headquarters has also not yet been able to welcome many visitors. That's why

**25 machine exhibits,
keynote lectures, business
talks and plant tours are
available to our customers,
partners and interested
parties around the clock,
365 days a year.**

Ute Panzer, Vice President Marketing and Communications, ENGEL

ENGEL is bringing the exhibition to customers' homes. The prerequisite for accessing the media library is a simple registration form.

Asia pioneers hybrid events

In addition to the virtual offer, ENGEL invited its customers in Asia to its subsidiaries during the three live days. In compliance with hygiene regulations, the pandemic laws there permitted face-to-face events during the summer. For example, ENGEL was able to personally welcome 120 guests in Shanghai. They were treated to an individual programme consisting of both live lectures and keynotes broadcast from Austria, as well as live machine exhibits. A further 200 participants from China connected via the Internet. The 2021 symposium in Shanghai thus provides a glimpse of what hybrid events planned for the future will look like. "We are combining the best of both worlds," Panzer emphasizes. "The combination of an in-person event and a virtual platform addresses the requirements in the respective regions even more specifically than was previously possible. Regardless of location, time zone or travel restrictions, all customers can participate efficiently and safely." ■

The virtual world
of ENGEL





From right: Karl Steiner, Christoph Schützeneder and Gerhard Dimmler

"We want **the best**"

The question of drive technology is a very current one. For vehicles, but also for injection moulding machines. In both areas, drive technology has a major impact on sustainability. In the Injection Tech-talk, Karl Steiner, Chairman of the Board of Directors of SKS AG in Switzerland, Dr Gerhard Dimmler, Vice President Research and Development at ENGEL, and Christoph Schützeneder, Head of Product Management Electrical Machines at ENGEL, discuss the ongoing trend towards all-electric drive technology, decision-making criteria and current development priorities.

Mr. Steiner, you use a wide range of injection moulding machines and drives in your production. With the latest investments, a trend towards all-electric drive technology is emerging.

What are the reasons for this?

KARL STEINER: For us it is clear: We want the best. We produce highly demanding technical parts that require very high precision, and we see that tolerances have become tighter in terms of distortion, especially

when processing high-performance materials. That's why we have to be able to rely all the more on the injection process, on achieving constant repeatability. For this we need a high-precision injection unit, and we benefit from parallel movements for which we would need several pumps with hydraulic machines. Ejection of the parts is much more constant with electric machines, especially with short cycles of less than

ten seconds. And then, of course, there is the energy point of view.

In what way?

STEINER: We are committed to energy-efficient production, and this is where all-electric injection moulding machines have an advantage. The cooling energy should also not be ignored. Although it has been reduced to a minimum with hydraulic machines, it is still higher than with all-electric machines.



Mr. Schützeneder, are these typical requirements that you also know from other customers?

CHRISTOPH SCHÜTZENEDER: Absolutely. In summary, there are three considerations that are causing more and more injection moulding processors to switch to all-electric machines. First, there is the part- or quality-based approach. If very high precision or very short cycle times are required, hydraulic solutions reach their limits more quickly. Then there is the cost-based decision. Investments are made in the machine that has a shorter return on investment (ROI) or the lower total cost of ownership (TCO). The entire life cycle of the machine is considered, including energy consumption and maintenance efficiency, and here electric machines generally perform better. Thirdly, processors are opting for all-electric injection

moulding machines for strategic reasons, and this is where we see a strong trend that runs through all industries. It's all about investing in the most environmentally friendly technology that enables the lowest CO₂ footprint. Companies are opting for the most energy-efficient production technology they can find on the market and want to position themselves accordingly for the future.

Is this a global trend?

SCHÜTZENEDER: The most dynamic development is in Europe. Here, the share of all-electric injection moulding machines in the small and medium tonnage segment has risen from around 20 to over 30 percent in recent years, and we expect this upward trend to continue. In Asia, all-electric drive technology is traditionally very strong, and North America has also been relatively constant for many years at around 50 percent all-electric machines in the small and medium machine segment.

Mr Dimmler, what is the significance of all-electric drive technology for ENGEL?

GERHARD DIMMLER: It is extremely significant. We have been working intensively on this topic for over 20 years and have learned a great deal during this time. Of course, the Japanese market competitors had a head start because they focused purely on all-electric machines very early on. From the very beginning, our goal was to apply the advantages of electric drive technology primarily to high-performance machines. The energy-saving potential is particularly great in this area. Electric drives are not only used in all-electric injection moulding machines, but also, for example, in hydraulic machines with variable-speed drives, in robots and also in auxiliary units. ENGEL offers a variety of drive technology solutions, among them regenerative drive systems and also customised solutions for all or individual axis to increase performance where it is needed. This has been made possible by long-standing and very close technological partnerships with our drive suppliers on an equal footing. No single drive supplier is able to cover all requirements "best".

SCHÜTZENEDER: We decide with our customers which injection moulding machine and which drive technology offers the greatest benefit for the respective application. We have the high-performance machines, such as the e-motion, e-cap and e-speed, which are often used in the particularly demanding areas of packaging and medical, and with the e-mac we have an all-electric series with which we can offer very economical solutions in the area of standard performance. In addition, we have the e-motion TL series, which combines all-electric drive technology with the advantages of a tie-bar-less clamping unit. SKS currently uses machines from all series that we offer in the small machine sector.

Mr Steiner, your latest order involves two e-mac machines. For which products are these machines intended?

STEINER: We have many precision parts weighing less than one to two grams that run in multi-cavity moulds 16 or 32-cavity. The combination of large hot runners with small shot weights requires a very robust machine with a very stable and at the same time highly precise injection unit. Our machines are in operation for an average of twelve to 15 years and run with a large number of different moulds. For these requirements, we see the e-mac as a very flexible and economical solution, at an interesting price to boot.

Will electric drive technology prevail at SKS?

STEINER: We will probably decide in favor of a hydraulic machine every now and then for cost reasons. The investment price is not the primary criterion for us. We invest for the long term. What counts most is precision and operational reliability. The machine must run 24/7 with process stability. That is worth money. In the end, everything has to fit together, and for that we need not only the best machines, but also good specialists who understand the machine in order to really get the full potential out of it.



*You have to imagine
it figuratively:
A 50-tonne machine
today already
needs not much
more energy than a
hairdryer.*

Karl Steiner, SKS AG



More about the
machines



Mr Dimmler, what solutions does ENGEL offer to maximise overall efficiency?

DIMMLER: Nowadays, not all all-electric machines are the same. Particularly fast cycles with high clamping force require regenerative power supply. For technical parts with cycle times of ten seconds and more, the feed-in solution is more effective. However, efficiency considerations now go far beyond classic drive technology. Let's think about indirect savings. Mr. Steiner, you mentioned cooling capacity. Other examples are temperature control with speed-controlled pumps or electric core pulls. In my view, when we talk about efficiency, it's always about combining electric drives with intelligent specifications. We still have a lot of plans here in the future.

STEINER: You have to imagine it figuratively: Today, a 50-tonne machine already needs not much more energy than a hairdryer.

When we talk about overall efficiency, I also think about the compactness of the machines. The productivity per unit area. Especially in the field of medical technology, when production takes place in a clean room, this is also a consideration.

STEINER: This topic is becoming increasingly important for us. At the moment, the medical technology parts that we produce do not yet require a clean room, but our customers' requirements in terms of cleanliness are becoming stricter. With the compact e-mac machines, we are well positioned here. We have ordered them - also for this reason - with an encapsulated toggle lever. The toggle levers are deliberately painted white so that any leakage or wear can be seen immediately. These measures also strengthen the confidence of our customers.

Mr. Schützeneder, is the trend generally towards more cleanliness?

SCHÜTZENEDER: Yes, from my experience I can confirm that. In the e-motion high-performance machines, the entire lubrication system of the toggle lever has been completely encapsulated as standard for quite some time. In the meantime, however, we are seeing that cleanliness requirements are also increasing in the automotive industry and in technical injection moulding. This reflects the trend towards greater ease of maintenance. The machines should remain clean and be easier to clean. Hence ENGEL's decision to offer enclosed toggle lubrication as an option for the e-mac series, which is used in a wide range of industries.

What other trends are you observing?

STEINER: Digitalization is an important topic for us. We have already invested a lot in data exchange and the evaluation of process data over the last few years. This is about traceability, but above all about quality assurance.

DIMMLER: In the next few years, it will be increasingly important to prove sustainability in addition to quality. This is a new aspect. An injection moulding machine generates the majority of its CO₂ footprint in the operating phase. That is why we are continuing to look at where even more energy can be saved. In further development, we are taking a close look at braking energy and heating power, for example. Digital solutions are helping us to make consumption transparent. Transparency is a key issue in digitization - at all levels. Our customers are increasingly asking for support in analysing process data. In the coming years, we will increasingly be able to describe the injection moulding process as a model. In this way, we will advance intelligent assistance. However, the goal is not completely autonomous assistance. It is precisely the know-how of the processor that makes the difference and is his competitive advantage. However, we will manage to support the machine

operators at an information level that is not yet available today. The topics of sustainability and digitalisation in combination with model understanding will significantly advance the injection moulding process, which has moved in rather small steps over the last 50 years. ■

SKS AG

Highest precision is the specialty of the Swiss SKS AG. In Laupen in the canton of Zurich, the family-owned company with 100 employees produces 700 different products from 200 different plastics. Of the more than 40 injection moulding machines, 90 percent are hybrid or fully electrically driven. The product range includes gear wheels, housing components and technical parts for electronics and telecommunications, medical technology and mechanical and apparatus engineering. SKS AG offers the entire value chain from toolmaking and series production in injection moulding to assembly and logistics services.



The process in clear sight – quality under control

iQ process observer, the new process monitoring platform from ENGEL, monitors hundreds of injection moulding cell parameters simultaneously in the background and displays deviations in such a way that injection moulders can easily identify them and their cause. In many cases, the new assistance system of the iQ product family even provides a suggested solution. In this way, the intelligent data analytics solution helps to reduce scrap and downtime.

Injection moulders are familiar with this: On the one hand, changing environmental conditions, sudden changes in material properties and increasing wear on moulds and machines constantly create new boundary conditions. In addition, there are not so rare problems with material supply and automation, which lead to short interruptions in production. These disturb the thermal equilibrium in the melt cylinder and mould. On the other hand, many things are controlled in modern injection moulding machines, such as axis movements, temperatures and pressures. In

addition, intelligent water distributors are increasingly providing controlled conditions for mould temperature control. Recently, modern process controllers such as iQ weight control even ensure that the injection volume remains constant.

The fact is that many, but not all changes can be controlled. When "uncontrollable" process changes occur, they are often detected too late or not at all - the production of rejects is pre-programmed. The search for the causes is time-consuming and requires experts. However, experts with process knowledge and experience are in short supply.



Identifying the problem is more important than identifying the solution, because accurately presenting the problem leads to the solution.

Albert Einstein

Recognise process changes - prevent rejects

One hundred percent quality control is expensive and therefore only makes sense for special applications. Therefore, it is generally recommended to monitor the process instead. A stable, unchanging process is not a guarantee, but equally an indication and prerequisite for consistent part quality. But when is a process stable? Until now, it was common to select certain process parameters, assign them tolerances and monitor them. But it is not that simple: While there are clearly defined specifications and tolerances for the quality of components, the selection of parameters and the definition of tolerances for process monitoring is usually subjective and based on experience. So here again the expert and time are in demand, whereby different experts usually come to different results.

Data analysis - replacement or help for the expert?

Now, a down-to-earth and, at first glance, somewhat paranoid data analysis approach provides a remedy. It goes like this: take all the relevant parameters you can get your hands on and monitor them. Better to monitor everything than to miss something important. This gives you a holistic view of the process, a kind of fingerprint. However, "all relevant parameters" can be very, very many, so the approach raises two issues:

- 1.) The effort for setting monitoring limits increases with the number of monitored parameters.
- 2.) The effort to interpret the results increases as well.

iQ process observer eliminates these problems: Although hundreds of parameters are monitored, the adjustment effort for the user is almost zero. This is because the available parameters are pre-configured at the factory. The actually installed plant equipment is already taken into account. At runtime, the software recognises which zones of the cylinder or tool heating or how many points from a speed profile are actually being used and are therefore

worth monitoring. In addition, tolerance limits are automatically learned on the basis of the current process. The learning process is monitored by the "built-in expert knowledge" and, if necessary, corrected in such a way that very small or very large scattering of individual parameters does not result in unusably narrow or wide tolerances.

Now to the interpretation of the results: Let's assume that 40 parameters would change at the same time. What is the best way to inform the user about this? Should he receive 40 notifications on his smartphone or just a list with the names of the 40 changed parameters? Do we show him the time courses of the 40 parameters as curves so that he has all the information immediately available? Neither! Because too many details can quickly lead to losing sight of the essentials. The iQ process observer initially presents the monitoring results to the injection moulder from a bird's eye view, as a kind of "executive summary" (**Figure 1**). For each of the four process steps - plasticizing, injection, cooling and demoulding - traffic light symbols highlight the current status. All green means everything is okay. A yellow traffic light indicates that there are changes or deviations from the reference state.

When the plant manager sees a yellow light, he wants to know: What exactly is deviating? How did it come about? Clicking on the traffic light leads to the detailed view, in which the course of events is shown along the last cycles. However, only what is relevant at the moment is shown.

Figure 2 shows the visual language of the detailed view. In many cases, this level of detail is ideal for getting to the bottom of changes and their causes. For all those who want to know exactly, there is of course also the possibility of penetrating to the individual parameter concerned in order to see the curve progressions or to read off the exact numerical values from them.

The iQ process observer does what a process engineer would do when analyzing a problem, namely prepare data in such a way that something can be read out of it. However, this activity can be very time-consuming. The software, by its very nature, does this much faster and without gaps after each shot. The process engineer can concentrate fully on interpreting the story that his trusted injection moulding assistant is telling him and thinking about possible solutions to the problem. Recognising the problem is more important than recognising the solution, because the exact representation of the problem leads to the solution - as Albert Einstein already said.

The Observer speaks plainly

Manufacturers of injection moulding machines are developing more and more solutions aimed at a more constant or better adjusted process. At first glance, the question arises: Why do you need a monitoring solution like the iQ process observer? The answer is: all these assistance systems - called "iQ products" at ENGEL - complement each other and grow together with the iQ process observer. Optional sensors in the mould or in the cooling water circuits complete the picture that the iQ process observer can provide of the process. The process control "iQ weight control" and the setpoint assistant "iQ clamp control" provide valuable additional key

figures for the process with the injection volume, the viscosity change or the mould breathing, without the need for additional sensors.

As previously described, the basic principle of the iQ process observer is to visualize the data for the user in such a way that he can interpret it in the best possible way and derive conclusions and actions from it. However, the software goes one step further and helps the user a bit if he might not immediately recognise possible solutions: In each cycle it is checked whether certain known error patterns or optimization possibilities can be recognised from the current observation image and whether it would be advisable to take an action. If such a condition is detected, the user is offered assistance. With a click, the user receives hints on the cause or suggestions for process optimization or elimination of the problem.

A "living" product

The development team at ENGEL has set itself the goal of continuously developing the iQ process observer. Among other things, the process notes are constantly being expanded to include new error images and optimisation suggestions, so that the product grows over time and

becomes more and more powerful. For this reason, special attention was paid to the simple updateability of the software. The calculations are performed in a dedicated hardware, the edge device from ENGEL. This keeps the computing load for data analysis away from the machine control unit (**Fig. 3**). The calculation results are returned to the machine control unit and visualised there. The iQ process observer uses the modern and secure IoT infrastructure of the edge device. With the help of a connection to the Internet, the edge device - after approval by the user - automatically searches for available updates. Of course, no data leaves the machine or the edge device without separate approval. The step to connectivity is often not an easy one. In some cases, the prerequisites - such as a network



Figure 1: The overview page of the iQ process observer summarises all information about the current process status.

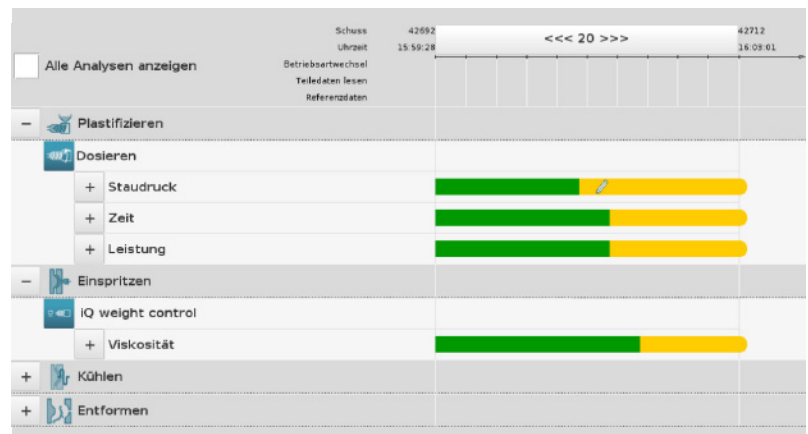


Figure 2: Example of the course of process changes in the last 20 cycles: The yellow areas signal the time range of the change in actual values. The expert can deduce from this that the actual value changes shown are a consequence of the setpoint change of the dynamic pressure carried out by the user - recognisable by the pen symbol. Thanks to iQ weight control, it can be seen that the change in dynamic pressure also results in a change in melt viscosity.

Figure 3: The algorithms of the iQ process observer run on the edge device outside the machine. The external computer also supplies data to web applications on request and thus represents the gateway to the world of digitalisation.



cable to the system - are not yet in place. Many companies have concerns and questions about security. This is where ENGEL provides its customers with advice and support. The benefits that can be derived from the networking of plants increase

year after year, which means that the investments are amortised very quickly. Connectivity forms the basis for future products. With iQ process observer, networking also has advantages for the user that

go far beyond the simple update option. iQ process observer will also be available as a web version in the future. Here, the user not only has the individual machine in view, but all machines are clearly displayed with all necessary information. In addition, there will be a variety of additional useful features that may not even exist on the machine. ■

The principle of the iQ process observer

- Monitor everything:**
 The relevant parameters from all available sensors are assessed in terms of change or deviation from the reference state and marked with the colours green or yellow. Green means everything is okay. A yellow signal, on the other hand, indicates that there are deviations from the reference state.
- Telling a story:**
 The course of the assessment is presented along past cycles. This allows the user to see the chronological order in which the changes occurred.
- Start with the bird's eye view:**
 Parameters are grouped into logical groups. In this way, the user does not always have to deal with each individual parameter, but is given a higher-level view.
- Filter by the essentials:**
 Only what has changed is shown without too many details. The user's view is thus directed to the essentials.
- Provide additional information:**
 Everything is displayed that could serve as an explanation for changes, i.e. also the setpoint changes carried out consciously by the user or, for example, interruptions in production.

The tape-based organic sheet is overmoulded with a regranulate produced from scrap of the same organic sheets.



100 percent material utilisation

Thermoplastic composites pave the way for lightweight automotive construction in the circular economy. The processing of organic sheets is currently the most important thermoplastic composite technology. One focus of further development is the recycling of production waste, such as trimming residues. ENGEL has been able to demonstrate that regranulates made from organic sheet scrap can be processed by injection moulding while retaining the material properties. This makes it possible to keep the composite raw materials completely in the cycle.

Organic sheets consist of continuous fibres embedded in a thermoplastic material. The thermoplastic approach enables the efficient integration of forming and functionalization of the semi-finished products, which reduces unit costs and makes the technology especially interesting for the automotive industry. For processing, the organic sheets are heated, formed in the injection mould and then immediately finished with the desired detailed geometries by injection moulding. As a rule, materials from the group of base materials of the organic sheet are used for injection moulding. In the future, reclaimed trim from the organic sheets will also be used. In this way, components could be produced that consist entirely of a single fibre-reinforced thermoplastic and could be recycled easily at the end of their useful life in the sense of the circular economy.

Even with optimum nesting, waste is produced both in the manufacture of the sheet material and during processing. Small amounts of waste are between 5 and 10 percent of the organic sheet surface, but with unfavorable positioning or complex component structures, the amount of waste can be 35 percent or more. Recycling this production waste is not only

a contribution to greater sustainability, but also a cost savings.

To prove the feasibility, injection moulding machine manufacturer ENGEL and PURE LOOP, a company of the EREMA Group, have carried out a series of tests to investigate the processing of organic sheet waste and the subsequent processing of the regrind to suit the material.

Preserve the length of the glass fibres

For the tests, a granulate was produced from organic sheet scrap based on unidirectional (UD) tapes. For this purpose, the cuttings were

shredded and the fibre content reduced during melting by adding unreinforced base material. Organic sheets typically have a fibre content of up to 72 wt%, which would be too high for processing by injection moulding. When reducing the fibre content, the fibres must be uniformly dispersed in the base amount. The aim is for the regranulates to achieve a property level comparable to that of virgin material in the case of long glass fibre granulates. The high mechanical strength of the material can only be ensured if the length of the fibres is maintained and the fibres are evenly distributed in the base. The challenge in recycling the continuous fibre-reinforced organic sheet semi-finished products was to establish a preparation and injection moulding process that leads to the retention of the longest possible fibre lengths. For the trials, ENGEL used scrap from



to series material. As a reference, a long glass fibre reinforced virgin material, a PP GF40 of type GB477HP from Borealis, was processed. Both materials were plasticized at three different screw speeds in order to assess the process consistency. From the almost linear metering curves without dips, perfect metering behavior can be derived.

The regranulate was premixed in a masterbatch mixer on a trial basis in order to simulate the influence of an optional homogenization step - for example, in a silo using an agitator. Weighing the components showed slightly higher standard deviations for the regranulate compared to the virgin material. In absolute terms, however, the standard deviations were very small for both materials.

Since the materials are well homogenised during injection moulding processing, no significant differences between regranulate and virgin material were expected in the evaluation of fibre lengths and proportions, which the tests confirmed. The additional homogenisation in the masterbatch mixer did not further improve the already good values. In summary, it can be stated that the regranulate can be processed in the injection moulding process just as well as virgin material. After the successful tests, the question of transferability to real components arose. ENGEL and PURE LOOP worked together with the LIT Factory in Linz to produce near-series sample parts in an integrated process. The continuous fibre-reinforced organic sheets were heated in an IR oven, inserted into the mould of the ENGEL duo injection moulding machine by the articulated arm robot, formed and overmoulded with the regranulate of the trim waste. The very good component quality achieved and the high efficiency of the integrated manufacturing process demonstrate the great potential of processing organic sheet trim waste for series applications in lightweight automotive construction. ENGEL and PURE LOOP are continuing to work together to exploit this potential. ■



At the LIT Factory in Linz, Austria, near-series sample parts were produced in an integrated process.

Provano brand organic sheets from Profol, which are made up of UD tapes with 72% by weight glass fibres in a polypropylene base material. An ISEC evo 302 system from PURE LOOP was used for the regranulation. The special feature of this line is that the shredder and extruder screw are mounted on a common shaft. The feeding was done with approx. 1.5 meter long organic sheet strips. The aim was to dilute the fibre content to 40 wt.%. Unreinforced PP was fed in pellet form and the material mixture was plasticized. A filter in the extrusion area was not used, as this would remove the long fibres. Finally, the material was demoulded off and dried. The resulting granules were ashed to optically evaluate the glass fibre lengths. It can be seen that sufficiently long fibres are retained. Glass fibres with a length of more than 4 mm were present. The adjustment of the fibre

content can be optimised when cutting the trim pieces. The smaller the pieces, the more uniformly they are ground and mixed with the base material. Calculated back from the density, the recyclate has a fibre weight content of around 35 wt.%.

The successful reprocessing of production waste shows the potential for automotive components at the end of the vehicle's useful life. After cleaning the components and removing any metallic inserts used, they can be recycled into regranulate in the same way.

Injection moulding no difference to virgin material

In ENGEL's technical centre, sample parts were produced from the regranulate obtained on an e-victory injection moulding machine. The tests focused on the process behaviour of the regranulate in comparison

Coinjection revolution

The new coinjection process, which ENGEL developed together with Top Grade Molds, enables a high proportion of recyclate to be completely enclosed in virgin material during the production of pail and is thus superior to conventional processes for sandwich injection moulding. In the production of 5-gallon pails during the ENGEL live e-symposium 2021, the new process played out its advantages to the full. In combination with the new ENGEL duo speed injection moulding machine, very short cycle times were achieved.

More in the
ENGEL Blog



To demonstrate the high recycled content, a transparent skin material made of virgin material is combined with a black recycled material.



ENGEL's compact two-platen technology is one of the factors contributing to the high level of efficiency.

Political pressure to use recycled plastic materials is growing worldwide. Several countries already mandate a minimum recycled content for certain products. In the western USA, for example, some market sectors require a 25 percent share for pails. In addition, there is the requirement that the dark recycled material not be visible even at the injection point. These trends drove the development of the new coinjection process. With a recycled content of more than 30 percent, the 5-gallon pails produced during the ENGEL live e-symposium clearly exceed the very strict American specifications by international standards.

Very short cycle times

ENGEL's development partner is Top Grade Molds in Canada, a mould manufacturer specialising in packaging applications. The pail mould for the world premiere is provided by US pail manufacturer M&M Industries. It ran during the live e-symposium on

a duo speed machine developed by ENGEL to meet the requirements of producers of pails and containers. This new machine type combines productivity and efficiency with short cycle times. Coinjection ensures just as short cycle times as single-component production.

Coinjection allows the recycled material to be concentrated in the component core and completely enclosed in a layer of virgin material. In order to also be able to recycle the sandwich products at the end of their useful life, virgin material and recyclate are made of the same plastic. HDPE was used for the 5-gallon pails, with the recyclate coming from post-consumer collections.

Highest product quality

The biggest challenge in sandwich injection moulding is to achieve a high recycled content without sacrificing product quality and performance. One focus of development was therefore on bringing the two plastic melts together in the mould without mixing them beforehand. As a result, a valve gate system is used to switch from recyclate to virgin material directly at the injection point.

5-gallon pails are used in North America for a wide variety of products. Since the two material fractions - core and skin material - are strictly separated from each other in the processing operation and the recyclate is also enclosed by virgin material at the injection point, the new process is also interesting for the food industry.

With the new coinjection process, ENGEL is further strengthening its expertise in the production of sandwich products with recycled cores. While the skinmelt process presented at K2019 is used for the production of technical parts as well as logistics boxes and pallets, the coinjection process developed with Top Grade Molds meets the requirements of manufacturers of pails and other smaller packaging products and is also suitable for the use of multi-cavity moulds.

Increasing the use of recycled materials is a prerequisite for the circular economy, which ENGEL is intensively promoting together with its partners. ■



The aim of the innovation is to process plastic flakes, for example from post-consumer collections, directly in injection moulding without granulation.

Process **plastic flakes** directly

With a new process, ENGEL makes it possible to process plastic waste as flakes in injection moulding directly after grinding. As a complete process step, granulation, is no longer required, the innovation significantly increases cost efficiency in plastics recycling. ENGEL demonstrated the great potential at its live e-symposium 2021. The new process also brings advantages for the production of very large and thick-walled components with high shot weights.

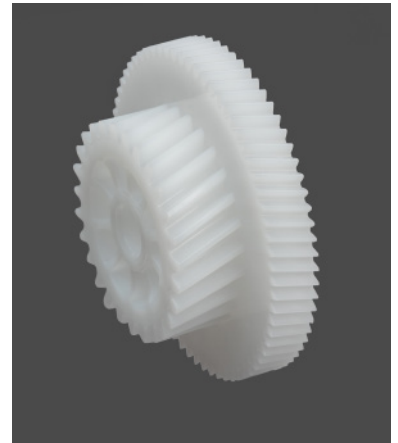
The key to shortening the recycling process is the division of plasticizing and injection into two independent process steps that are very well coordinated with each other. In the first stage, the raw material, for example plastic flakes originating from post-consumer collection, is melted in a conventional plasticizing screw. The melt is transferred to a second screw for injection into the cavity in the second process stage. The two-stage process makes it possible to integrate a melt filter and a degassing unit on the injection side of the injection moulding machine, so that products with a consistently high quality are obtained even from contaminated plastic flakes. With this innovation, ENGEL is making a further contribution to the development of a circular economy for plastics. The granulation of the recycled material is an energy-intensive process

The granulation of the recycled material is an energy-intensive process. If this step can be eliminated, the CO₂ balance is improved and recycling costs are reduced.

that also usually requires logistical effort. If this step can be eliminated, the CO₂ balance is improved and recycling costs are also significantly reduced.

More efficiency even for very large components
As an alternative to an injection screw, the plasticizing screw used for melting can be combined with a

piston unit. In this variation, the two-stage process is also very efficient for processing very large shot weights of up to 160 kg with a comparatively low injection pressure requirement. The two-stage process enables a more compact system design and lower unit costs than is possible with a conventional single-stage plasticizing and injection process. ENGEL has developed a new plunger design to eliminate the disadvantages of plunger injection units when changing materials, which have been common up to now. The rheologically optimised plunger tip supports uniform flushing around the plunger, thus enabling fast material and colour changes. Typical applications are containers, pallets or even large fittings. Already from a shot weight of 20 kg, the processing efficiency increases significantly due to the splitting of the plasticizing and injection process. ■



The gears for charging plug locks of electric vehicles place the highest demands on the precision of the injection moulding machine.

Highest repeatability:

Fully electric e-motion TL with smart-shut

In the production of filigree gears, maximum accuracy is required for every shot. It is essential to repeat the precision with a high repeat accuracy in a process-stable manner. The Sauerland-based company Grote + Brocksieper produces the precision parts on fully electric and tie-bar-less injection moulding machines of the e-motion TL series from ENGEL, equipped with the smart-shut feature.

In Kierspe, Sauerland, maximum precision is essential in the production of technical gear wheels made of polyamide with glass fibre content, which are installed in a complex assembly of a charging plug lock for electric vehicles. The gear wheels with dimensions of 25 x 30 millimeters have a demanding tooth geometry with tolerances of up to 0.03 millimeters; after all, one cog must fit precisely into the other. The concentricity in connection with the profile and flank lines of the gears is particularly important. Precisely because of the high technical requirements, these parts with shot weights between 0.6 and 4 grams are technically no lightweights in the production world of Grote + Brocksieper GmbH + Co KG. "Our claim is to map the complex shaping process reliably," explains Managing Director Jörg Becker.

The optimal coordination of the process chain is crucial at this point, as technical manager Fabian Crummenerl emphasizes. "The precision and repeatability of the injection moulding machines has enabled us to initiate targeted corrections to the injection moulds produced in our own mould shop

in the course of sampling and to verify them metrologically in-house using computer image sectioning without any loss of time." For the production process with a mould that has four cavities, Grote + Brocksieper was looking for a suitable machine concept that would meet several requirements at once.

"We have professionally secured the process test. For this purpose, samples were taken on an injection moulding machine with a clamping force of 50 tonnes at ENGEL's technical centre in Schwertberg,

Austria," recalls Jörg Becker. The first impression of the process stability and the performance of the machine convinced the customer. The company then invested in two fully electric and tie-bar-less e-motion 50/30 TL machines, each with a clamping force of 30 tonnes. In the end, two reasons tipped the scales in favour of this choice, in addition to precision and repeatability. Firstly, the high energy efficiency of ENGEL's all-electric drive technology, and secondly, the compact design of the tie-bar-less e-motion TL machines. Added to this is the extra flexibility. Thanks to the tie-bar-less clamping unit, the platens can be used right up to the edge, meaning that comparatively large moulds fit on smaller machines. At the main plant in Kierspe-Grünenbaum, the machines could only be installed on a very limited floor space.



Pictures: Manuel Thomé

The footprint is a decisive factor for Grote + Brocksieper when selecting a machine, both in terms of footprint and energy consumption.

Energy savings of 65 percent

Injection moulding machines of the e-motion TL series are equipped throughout with electric drives that provide clean performance in production. Oil mist is unacceptable. However, high performance combined with efficiency were the decisive attributes for Grote + Brocksieper. "We compared the power consumption of the new e-motion TL with our old hydraulic machines and came up with energy savings of 65 percent," Jörg Becker can confirm the efficiency of the machine with figures from practice. These savings, which ultimately led to the entire investment being classified as eligible for funding by the BAFA (German Federal Office of Economics and Export Control), also confirm the company's environmental policy.

"The customer has invested in the future," emphasises Dominik Cordes from ENGEL Sales. And that doesn't just apply to the injection moulding machine. For quality control, a large number of products are measured and evaluated using the in-house computer image sectioning and gear-specific software. "We invest in machines and systems that help to optimally implement the desired requirements in both technical and economic terms. According to Grote + Brocksieper, there are only a few accredited measuring institutes in Germany that are even capable of measuring these fillgree gears. In addition, the decision-makers at the company were concerned with being able to map the entire process chain independently, from the creation of the injection mould, to the use of the efficient high-performance injection

moulding machine, to the measurement and evaluation of the complex geometries. "Ultimately, this enables us to shorten the phase between initial sampling, mould correction loop and series production status," says Jörg Becker.

The all-electric parallel movements of the machine once again ensure an increased output of parts, millions of which are delivered every year. Without having changed the machine parameters compared to the original production method, the use of the new e-motion TL machines alone resulted in cycle reductions and associated productivity increases.

High operating comfort

This is also confirmed by Jan Marczinkowski, who as a process mechanic operates the youngest offspring in the machine park. "The convenience

of these machines, the multitude of evaluations I can use, surpass anything I've ever known before." For years, ENGEL has been offering a uniform operating philosophy across all products for all injection moulding machine and robot series with the CC300 machine control unit. "The machine operator thus finds his way around very quickly on the most diverse products from our company. Monitoring and documenting processes is conceivably easy at this point," assures Cordes. Incidentally, machine acceptance was carried out purely virtually thanks to Corona. The company Grote + Brocksieper, which currently produces with 90 employees at two locations in Kierspe, has been an owner-managed medium-sized family business for more than 80 years. The resulting classic advantages such as long-term thinking, short decision-making processes and personal commitment are combined with professional processes, transparency and an employee-oriented corporate culture. Starting out as a pure tool-maker, the company has developed into a full-service provider for injection moulds up to 96 cavities and high-precision plastic components.

The foundation for this was laid by customers in the aerosol and pump industry and the associated growth since the 1960s.

What was true then is even more true today. "The idea of precision has always continued. We had the expertise to build complex injection moulds very early on," says Becker. Today, the 15-employee precision mould shop primarily designs and manufactures multi-cavity moulds for automotive, but also for other business segments, such as the bicycle and furniture industries and the medical sector. The demand for precision that Grote + Brocksieper places on its own injection moulds is also projected onto the three-shift injection moulding lines, of which 48 machines with clamping forces of up to 320 tons are currently in operation. In addition to gears, the focus is also on functional and precision parts, design-oriented injection moulded articles with decorative painted or chrome-plated surfaces and graining, two- and three-component injection moulded parts as well as metal-plastic compounds. Grote + Brocksieper supplies around 1.3 million plastic parts worldwide every day.

Controlled closing process without backflow of the melt

Whenever very small shot weights and very delicate articles are involved, the switchover point is a factor that determines the resulting product quality. "The closing behaviour of the non-return valve is an elementary component for the safeguarded process," explains Dominik Cordes. The smart-shut positive-closure non-return valve developed by ENGEL is now also available for very small screw diameters from 15 mm. It works functionally up to a diameter of 80 mm.

This development is also part of the e-motion 50/30 TL supplied to Grote + Brocksieper. Smart-shut influences the repeatability in series production with a controlled injection process that ensures a defined melt supply to the four cavities, but at the same time prevents an uncontrolled backflow of the melt into the first screw flights. For this purpose, the locking ring is moved to the rearmost position in a controlled manner before the respective injection process. After the metering process, the plasticizing screw is turned back and closed with a gate control. The tip then transfers the force to the lantern piece and moves it axially into the sealing position. The process is controlled by a control element specially developed by ENGEL. The decisive advantage: turning the screw back by an optimised

angle of rotation in the opposite direction of the metering ensures that the non-return valve closes even before the start of the injection movement. This prevents an undefined loss of the melt triggered by a leakage flow. Thus, smart-shut has a positive effect on the shot weight consistency for all cavities in series production.

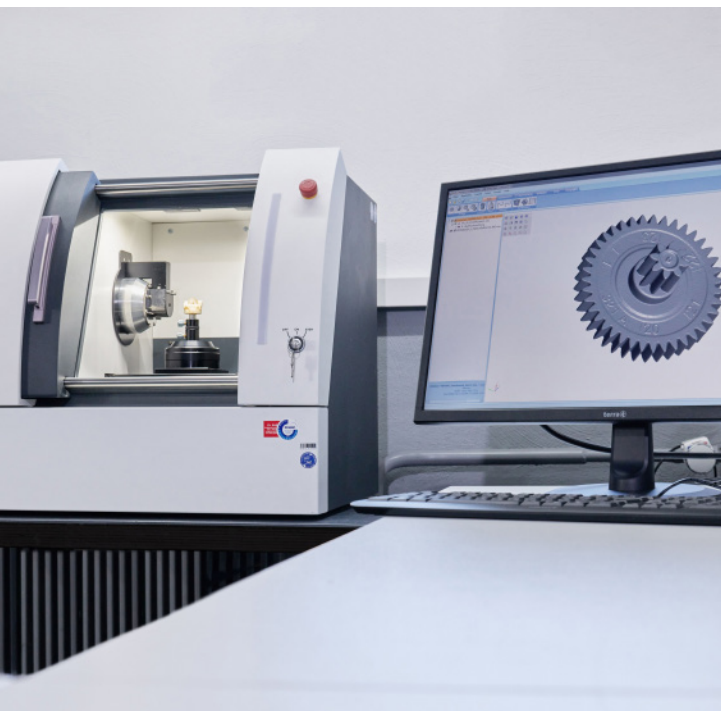
The test trials in Schwertberg were already run with smart-shut. During the tests for the application, the degree of filling was examined and documented in a filling study in which the part weights were also traceable. Smart-shut reliably delivered the desired safety.

Jörg Becker and Fabian Crummenerl draw a positive conclusion for the investment. "The overall package was the decisive factor," they both affirm in unison. In addition to the technical requirements, which are completely fulfilled by the all-electric machines, the compact design, the high degree of energy efficiency and the versatile applicability of the machine were decisive factors. In particular, the solution-oriented cooperation with ENGEL, starting with the test trials in Austria, through virtual machine acceptance, to the commissioning and training of Grote + Brocksieper employees on site in Kierspe. ■

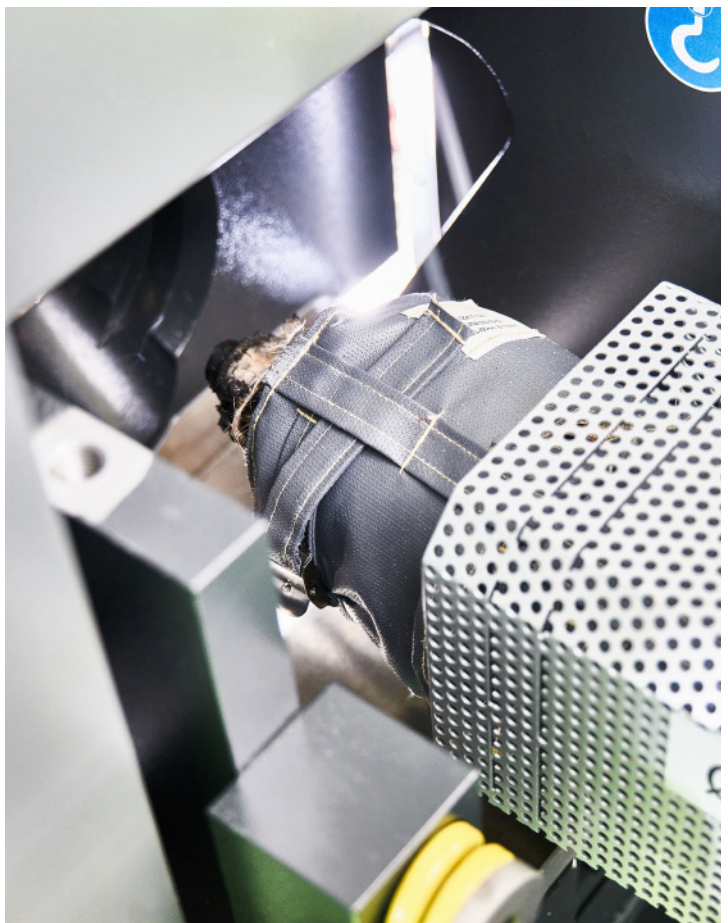
Tracking down efficiency potential together: Fabian Crummenerl, Technical Manager at Grote + Brocksieper, Dominik Cordes, Sales ENGEL Germany, and Jörg Becker, Managing Partner at Grote + Brocksieper (from left).



Pictures: Manuel Thomé



An in-house computer image sectioning in conjunction with gear-specific software enables Grote + Brocksieper to measure components quickly, reliably and without contact.



Smart-shut ensures high process consistency for very small shot weights. ENGEL also offers the positive-locking non-return valve for very small screw diameters.

Uncompromising **precision**

Dallmer is investing in the future with new injection moulding machines from ENGEL. State-of-the-art production is an important competitive factor for the Sauerland-based specialist in building drainage. The focus is primarily on two topics: Industry 4.0 and sustainability.

The name Dallmer stands for innovative sanitary technology. The simple design, a narrow shower channel or a fine grate made of high-quality stainless steel in the floor catch the eye of the bathroom user. The technological expertise of Dallmer's engineers and technicians is not obvious at first glance and is certainly not fully visible. Essential parts of the drainage system are hidden in the floor, cast into the concrete. The cutaway models in the meeting and presentation room reveal technological sophistication. After all, reliable and quiet building drainage is not something that can be taken for granted, but is the result of continuous development work. The drainage systems consist of a large number of components, most of which are produced from plastic in an injection moulding process and each of which fulfils an important function. "Sound insulation is one of our ongoing development focuses," gives production manager Andreas Föltz an insight. Insulation systems decouple the drain from the floor slab so that the neighbours can continue to sleep while others are taking showers at night. Dallmer develops, designs and constructs all products itself. The in-house toolmaking department is directly adjacent to the production halls. "We have short distances and can implement new ideas on short notice," says Föltz.

Process stability and flexibility decisive

DallDrain is the name of the latest innovation from Sauerland. The point drains for floor drainage are offered in different styles. There are three drain housing types that can be combined with 18 different attachments. In total, this results in a large number and variety of injection moulded parts for a product series.

Injection moulding machines with clamping forces from 800 to 13000 kN comprise the Dallmer machine park. Their average age has just been significantly reduced. ENGEL has delivered a whole series of new injection moulding machines to Arnsberg, together with several robots of different types. The preferred machine type for small

With the new injection moulding machines, we are more efficient and sustainable. They require significantly less energy than the old ones.

Johannes Dallmer,
Managing Partner of Dallmer

and medium clamping forces: the ENGEL victory, which is used for the components of the DallDrain series. The largest components, the housing and the ball joint, are produced on a victory 120, and the sleeve that connects the concrete and the floor covering is produced on a victory 120 combi using multi-component injection moulding.

"We rely on very high impression accuracy to ensure that the ball joint seals permanently," explains Föltz. "Precision and repeatability are our key requirements. The victory machines ensure us a high level of process stability here." Among other things, the excellent parallelism of the platens, which is also maintained during clamping force build-up and injection, is responsible for this.

iQ clamp control increases quality and repeatability

For an additional plus in safety, Dallmer is taking a step towards digitalisation with the newly supplied injection moulding machines. All machines are equipped with intelligent assistance systems from ENGEL's inject 4.0 range. "iQ clamp control surprised us the most," reports Föltz. The software determines the optimum clamping force for the respective injection moulding process on the basis of mould breathing and regulates down from 1200 to 800 kN in some cases during production of the DallDrain components. "We are thus increasing quality and repeatability even further," says Föltz. "We can reliably eliminate overmoulding and burrs, and on top of that we improve mould breathing and slow down wear."

The iQ systems are only one aspect of Dallmer's overall very comprehensive digitalisation strategy. "Our goal is more transparency. We want to centrally manage all components of the production, record and evaluate quality-relevant process parameters shot by shot in order to continuously improve the process," says Föltz. It is particularly important to the production manager to bring all data together centrally in the course of digitalisation. The CC300 control unit of the

ENGEL injection moulding machines gives him precisely this overview of the entire process, because the assistance systems are fully integrated into the machine control unit, as is the automation. The entire production cell can be controlled via the machine operating panel, and data can be accessed remotely via an internet connection if required. Last but not least, the control integration makes it easier for machine

operators to get fully utilise the new systems. Dallmer also made a digital leap when commissioning the new machines. Due to the corona pandemic, many meetings took place virtually and employee training was conducted online. Using the remote maintenance tool e-connect.24, the ENGEL trainer remotely controlled the machines in Arnsberg from his home office.

Energy demand significantly reduced

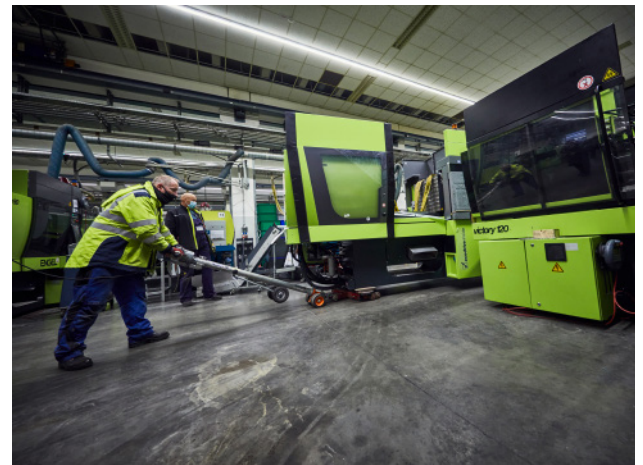
Alongside Industry 4.0, sustainability is the second major strategic issue setting the direction at Dallmer.

It is therefore not surprising that the high energy efficiency of the ENGEL injection moulding machines was the original reason for the cooperation between the two family-owned companies. Thanks to ecodrive, Dallmer saves a lot of energy compared to the previous hydraulic machines without ecodrive. "This also makes the ENGEL machines so economically interesting," emphasises Managing Partner Johannes Dallmer. ■

ENGEL supplied several new injection moulding machines to the Dallmer plant in Arnsberg.



Old against new: With the new even more energy-efficient injection moulding machines Dallmer has further significantly reduced its CO₂ footprint.



Meeting in Arnsberg: Rolf Saß, Managing Director ENGEL Germany at the Hagen site, Dominik Cordes, Sales ENGEL Germany, Johannes Dallmer, Managing Partner of Dallmer, Andreas Föltz, Production Manager of Dallmer, and Christoph Steger, CSO of ENGEL (from left).



On the surface, the design dominates. The technological strength of Dallmer lies to a large extent hidden in the floor, cast in concrete.

Precision work:
Delivery of the new
ENGEL injection
moulding machines at
Dallmer in the video





The Huf team in Arad inspected the parts after each parameter change and reported back to their colleagues in Velbert and to ENGEL's application technology in Austria.

The bearing brackets are produced in the MuCell foam injection moulding process on an ENGEL e-victory 400 injection moulding machine.

Commissioning from the home office

Corona travel restrictions unexpectedly made the injection moulding team at Huf Hüsbeck & Fürst GmbH & Co. KG, headquartered in Velbert, North Rhine-Westphalia, sweat. The design conversion of the bearing bracket for a German automobile manufacturer was a time-critical project. With the support of its mechanical engineering partner ENGEL and virtual teamwork, the specialist for vehicle access and authorisation systems nevertheless succeeded in putting three new moulds into operation within just one week and presenting the customer with good parts. A process that sets an example for the future.

A routine project, it seemed - for quite a while. But suddenly there were fewer and fewer flights from Germany to China and finally the further spread of Covid-19 and the imposed travel restrictions put the original planning in danger. Three new tools had to be taken out of service in China and put into operation in Romania. The daily business of Dirk Horn and his team, the process specialists for the injection moulding business in the international Huf Group. "We travel with the moulds," explains Dirk Horn. "There are times when we spend a lot of time on the plane." Yantai on China's east coast is home to Yantai Huf Tools, the group's in-house toolmaking operation.

The three new tools for the customer project were headed to the production site in Arad, Romania. Last year, a new production hall was inaugurated in Arad. A brand new e-victory 400 injection moulding machine from ENGEL was already ready there for the new moulds. Including the MuCell

technology package, because the bearing brackets are produced from polyamide using physical foaming technology. The machine operators in Arad specialise in MuCell processes. In addition to the new e-victory 400, the machine parks in Arad and at other Huf Group production sites include numerous MuCell machines from ENGEL, which are used for bearing brackets and other light-weight components. High process consistency and system availability are the key requirements, which is

why the automotive supplier has relied on ENGEL injection moulding machines for many years.

Three acceptances and sign offs into operation in just one week

Despite the highly specialized teams in China and Romania, the latest bearing bracket project presented a special challenge. This is because the commissioning expertise, in turn, lies with Dirk Horn and his team in Germany. They are the ones who sample and qualify the tools on site in Yantai and release them for transport to the production location. Once there, it is again Horn and his team who accompany the commissioning and start the series production process.

Covid-19 brought this established procedure to an end. A new plan

the commissioning including the qualification had to be mastered for the first time without the on-site support of the colleagues from Velbert. However, the production team in Arad was not left alone. "The on-site setters walked through the hall with their laptops open, using video to show where challenges still needed to be solved and what the freshly moulded components looked like," reports Christian Muthenthaler, hotline application engineer at ENGEL's headquarters in Austria. The third member of the team was Dirk Horn from Velbert. Using ENGEL's remote maintenance tool e-connect.24, both Muthenthaler and Horn were able to monitor all machine parameters in real time, give instructions or control the machine directly from a distance. Across three locations, the process was not only started up, but also optimised. And this was done for all three moulds within just one week. Because even then, the customer wanted to see good parts. "Postponing the deadline was never an option," says Horn.

Online support for process optimization

Remote maintenance and online support were an issue for Huf long before the Corona pandemic. For many years now, all ENGEL injection moulding machines in the Huf Group have been networked via e connect.24. The tool is used for support by ENGEL, but also so that employees at the worldwide production sites can support each other. These



We accepted the offer immediately, especially because I know what high quality ENGEL offers in service and application technology

Dirk Horn, Head of Industrial Engineering/Injection Moulding at Huf Hülsbeck & Fürst

was needed within a very short time. As a long-standing partner, ENGEL immediately offered its support. "We instantly accepted the offer in service and application technology," says Horn.

Thus, the three new tools were sent to Romania without sampling, where

experiences simplified the rapid change of the usual working conditions. Added to this was the very good teamwork between ENGEL and Huf. "We were a well-coordinated team after just a few hours," says Muthenthaler. "The cooperation worked perfectly. The Huf colleagues in Arad inspected the parts after every parameter change. That's what you depend on as a remote partner, that someone on site can evaluate the parts correctly."

All three tools were started up on time and the customer was satisfied with the parts. The bearing brackets in the new design are now running in series production.

"Digitalization at Huf is constantly progressing, in all

performance.boost:
New from ENGEL



areas of the company. We will also make even greater use of the possibilities offered by virtual tools for injection moulding machines and be even more efficient," says Horn. New technologies are also being evaluated for cross-site collaboration. Smart glasses, for example, are in the test phase. However, Dirk Horn will not be doing without travel in the long term. "It's important to see each other in person on a regular basis. That's what forms the teams, and that's the only way virtual teamwork can work very well."

A view from the outside opens new doors

Covid-19 has brought digital service products into even sharper focus - as ENGEL is also observing at other companies worldwide. What is exciting is that the new solutions not only open up a great deal of potential for critical service cases, but also for the ongoing production process. ENGEL has set itself the goal of exploiting this potential together with its customers with the performance.boost process optimisation service. It combines the processors' in-depth understanding of the product with the detailed expertise of the injection moulding machine that ENGEL technicians bring with them in order to detect even the most subtle optimisation potential. ■

Process consistency is key for stacked fruit crates

High precision and process consistency despite a high variation of products - that's an accurate description of one of the leading manufacturers' of fruit crates and recyclable containers production. At Europlast, they calculate in kilograms and tons - but the quality of the products is tested even more precisely, in grams and millimeters. The climate-neutral company is able to face those challenges with the ENGEL duo injection moulding machines.



Waste container production on an ENGEL duo 4000: recyclate from post-consumer collections is processed.

Apple boxes in use during the harvest. The size of the apple determines the design of the box. The smaller the apple, the higher the filling weight and the more stable the design must be.

50 kilograms of plastic - many injection moulding machines need many cycles for such a quantity. At Europlast in Carinthia, the standards are different. Here, large containers with individual shot weights of up to 50 kilograms are produced: fruit crates for agriculture, logistics and recyclables containers for industry and municipalities, as well as individual large plastic parts made to order - and in an impressive variety of shapes and colours, as a tour of the company premises in Dellach im Drautal shows. Long gone are the days of uniform grey containers - and even the geometric variety of the containers is impressive. Apples require a different box design than pears or plums, and even apples - depending on the

variety and size - do not have uniform requirements. Europlast is one of the three largest suppliers of plastic injection moulded container solutions in Europe. Depending on the product, production is primarily from HDPE, but also from recycled goods from post-consumer material. Environmental awareness is important to the company. "Since 2019, we have been a climate-neutral company. We have achieved this through many energy-saving measures and by switching to 100 percent green electricity," explains Michael Seifert, Head of Technology and Innovation. "In harmony with nature" is the processor's motto, which plays a role in every decision. The topics of

recycling, CO₂ footprint and, above all, the energy efficiency of the company's own production are important. "We try to produce in a resource-friendly way and with as little impact on the environment as possible. That's why we place these requirements on our production machines. In ENGEL, we have found a partner in spirit."

Energy consumption further reduced

ENGEL duo injection moulding machines are located in the spacious production hall. The large-scale machine series offers inherently low energy consumption compared to

other machine types and brands. Contributing factors include the fast clamping unit with low moving masses, short-stroke cylinders, optimised mould movement and the ecodrive servo-hydraulics with a demand-oriented pump output. When the machine is at a standstill, for example during cooling, the motors are also at rest and do not consume any energy. Europlast and ENGEL have been working together since 2004, and from the very beginning ENGEL has adapted the injection moulding machines precisely to the individual requirements of its customer. This applies to the injection units, for example, as Europlast requires comparatively low injection pressures due to cascade control. To save even more energy, the latest duo 4000,

Availability is crucial

Technically, the duo series has everything that is crucial for efficient and at the same time reproducible production of large boxes. The consistently high product quality is crucial for the stability of the boxes and thus a decisive safety factor. "During the apple harvest, up to five tons of weight are stacked high, 14 boxes on top of each other," explains Michael Seiffter. Such towers of apple crates can then grow to a height of around ten to twelve metres. Despite the thin-wall construction, even the lowest crate must be stable.

Depending on the apple variety, the boxes have a shot weight of between 25 and 40 kg. Uniform injection and weight consistency are the prerequisites for completely filling the cavities and achieving a reproducible wall thickness distribution despite the long mould cores. Only then are the boxes load-bearing and can be safely interlocked when stacked.

The clamping unit is also crucial for performance and efficiency. "The ENGEL duo machines are among the fastest machines on the market. Opening, closing and locking are unproductive times. Here, the duo is very fast, which is directly reflected in the cycle time," explains Seiffter, emphasising yet another

The raw materials for the production of the recyclable containers with recycle content come from post-consumer fractions in the sense of the circular economy. The somewhat fluctuating material consistency must be compensated for by the injection moulding machine with its high precision.

The high process stability of the ENGEL machines also proves to be an advantage for Europlast in contract manufacturing. Around 30 percent of production is contract manufacturing for different industries and different sized parts with ever new moulds - and the trend is rising. The production hall in Carinthia is therefore not only home to the large-scale machines of the duo series. "ENGEL supports us very well with customised solutions to be able



We try to manufacture in a way that conserves resources and has as little impact on the environment as possible. Therefore, we also place these requirements on our production machines.

Michael Seiffter, Europlast

delivered in 2020, was equipped with an electric metering drive. Including peripherals and automation, the total energy requirement per cycle is thus less than 11 kWh. "Thanks to their high energy efficiency, the ENGEL duo machines pay for themselves in less than three years," says Seiffter, who is very satisfied with the investment, not only for reasons of sustainability, but also for economic considerations.

aspect that speaks in ENGEL's favour: high system availability. "Fruit crates are not pre-produced in stock, but on-demand at harvest time. I have to be able to rely on the machine being available exactly when I need it."

Process consistency with recycled material

An essential component of resource-saving production is the use of recycle. According to the Foodstuffs Act, recycled materials are not yet permitted for fruit crates, but the proportion of recyclable material containers is steadily increasing. In use, the recyclables containers have to withstand different stresses than fruit crates, which only require static stability because the climatic conditions at the time of harvest vary little. Waste bins, on the other hand, are exposed to dynamic loads, from -30 °C in Scandinavian winters to +45 °C and more in Israel, for example.

to produce flexibly," says Seiffter. In the future, the two "partners in spirit" will continue to work together on new projects in order to meet the requirements arising primarily from the CO₂ issue. "We will continue to work on energy efficiency and increase the proportion of recycled materials," says Michael Seiffter. Above all, he hopes to soon be able to use recyclates for fruit crates as well. ■

Flexible solutions for large-volume parts





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