

Injection

The magazine from ENGEL for the plastics industry

September | 2020

"We're increasingly becoming a production support service"

ENGEL Techtalk discusses digitalisation and networking in our after-sales service

Page 8

Recycling that gets under the skin

ENGEL skinmelt paves the way for greater use of recycled material

Page 16

Faster growth thanks to clear-cut standards

Ypsomed relies on ENGEL as system partner for platform strategy

Page 26



Teaming up to combat Covid-19

Production cell for Hagleitner up and running in just three days

Page 4

ENGEL
be the first



Dr. Stefan Engleder
CEO ENGEL Holding

Working together to overcome the crisis

We've been through some challenging weeks – and there are still more ahead of us. Even though it has been possible to lift restrictions in some places, we have to operate on the assumption that we will be dealing with the economic impacts of the Covid-19 crisis for some time to come. As we know, every crisis also presents opportunities – some segments are enjoying an upswing in business. Hygienic and medical products are two examples that spring to mind. And the public is becoming more and more conscious of that fact that our modern lifestyle would not be possible without plastic.

Times of crisis require ingenuity – and we can see a much greater willingness developing to try out new ideas. One example of this trend is in the digitalisation space. The travel restrictions were put into place while Dutch medical technology manufacturer Helvoet was in the middle of a highly time-sensitive optimisation project. By using e-connect.24 and Skype, we were able to provide extensive support to Helvoet without the need for face-to-face meetings, saving our customer time and money (page 24).

Another example is service. A flexible approach is essential, especially in cases where firms make products that are urgently needed to contain the pandemic. Four companies teamed up to help Hagleitner more than double its output of refillable packaging for hand sanitiser dispensers within just a few days, working together and making the seemingly impossible a reality (page 4).

Creating a circular economy continues to be a high priority. We are working together with you, step by step, to ensure closed-loop material cycles in the plastics industry. One of our important priorities here at ENGEL is to offer you solutions that make the use of recycled materials an attractive proposition from your perspective. On page 18, you can read about how you can ensure consistently high part quality thanks to iQ weight control, even if there are varying parameters among the recycled raw material.

Over recent months, we have consistently been able to uphold ENGEL's usual quality as we support you, our customers, in the areas of service, sales and practical application. Our working relationship with you – especially during these challenging times – is proof that, together, we will overcome the crisis.

Stay safe and well!

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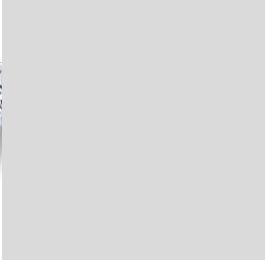
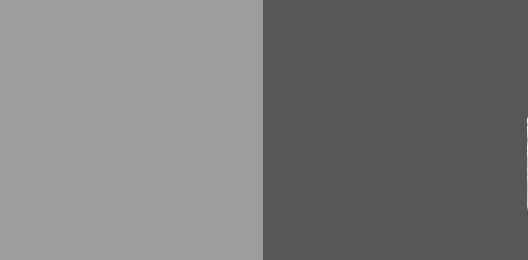
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Retrospect News Articles

ENGEL

4

Teaming up to combat Covid-19

Production cell for Hagleitner up and running in just three days

6

ENGEL worldwide. Where you are.

News in brief from the world of ENGEL

8

"We're increasingly becoming a production support service"

ENGEL Techtalk discusses digitalisation and networking in our after-sales service

12

ENGEL to exhibit new products

e-connect.monitor for barrier screws | new e-mac generation |
e-speed series expanded | micro-injection unit for LSR

15

75 years of ENGEL – discount packages to celebrate a milestone year

To mark its anniversary, ENGEL is bundling inject 4.0
and service products into attractive combo packages

16

Recycling that gets under the skin

ENGEL skinmelt paves the way for greater use of recycled material

18

iQ weight control: opening the door to a wide range of applications for recycled material

Increasing process stability in the production of storage boxes

22

New kinematics for greater efficiency and availability

New pic A pneumatic sprue picker

24

Virtual site visit

Digital process optimisation at Helvoet

26

Faster growth thanks to clear-cut standards

Ypsomed relies on ENGEL as system partner for platform strategy

30

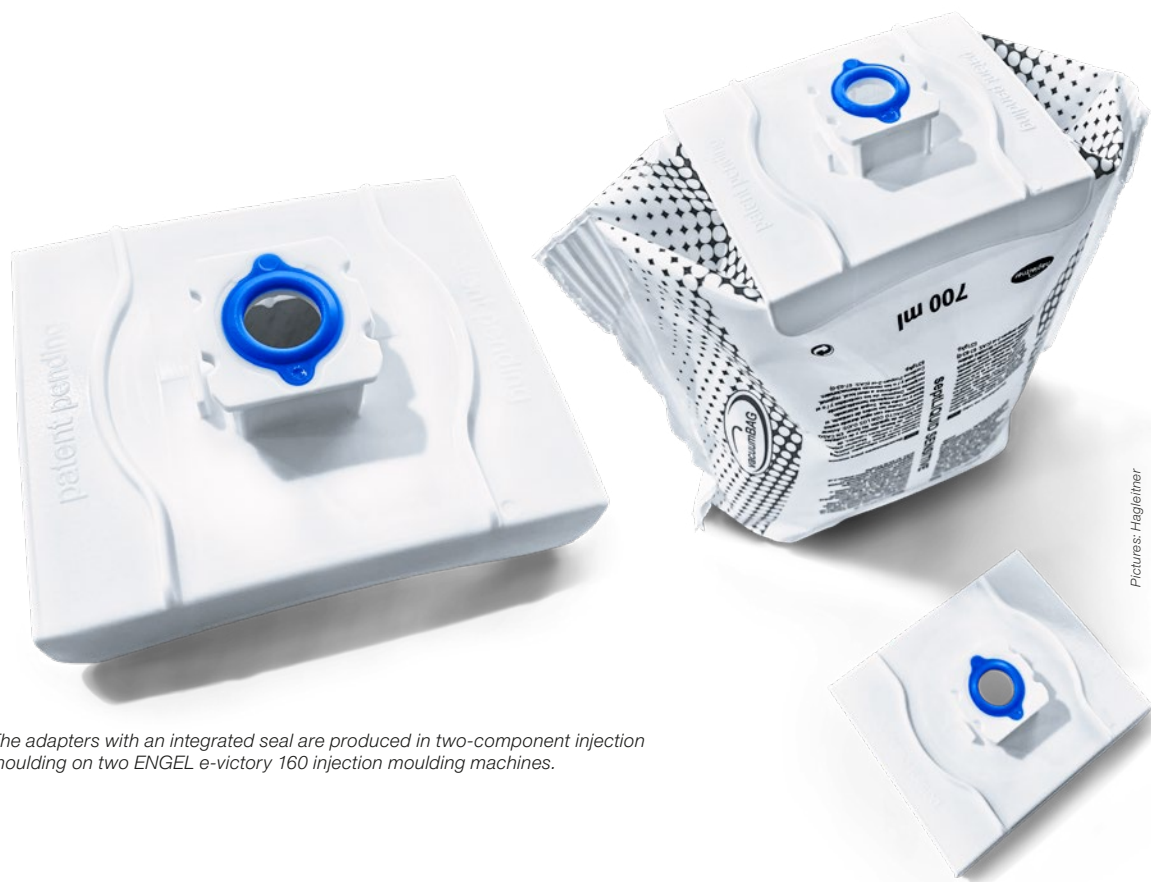
Tie-bar-less technology for more efficiency and safety in the cleanroom

Samaplast banks on ENGEL e-victory for sensitive medical products

34

Maximum quality with low unit costs

Toy manufacturer Polesie benefits from energy-efficient, tie-bar-less ENGEL machines



Pictures: Hagleitner

The adapters with an integrated seal are produced in two-component injection moulding on two ENGEL e-victory 160 injection moulding machines.

Teaming up to combat Covid-19

Hand sanitisers have been among the most sought-after products since the beginning of the coronavirus pandemic. In order to be able to meet the sharp rise in orders, Austrian hygiene specialist Hagleitner more than doubled its production volume in less than a week. This record-breaking pace was made possible by the far-sightedness of the management as well as excellent teamwork between long-standing partners ENGEL, ALPLA and Meister-Quadrat.

Hand sanitiser dispensers have long since become standard equipment, and not only in hospitals and nursing homes. Businesses offer sanitisers to their employees and visitors – and to help contain the Corona pandemic, public institutions and shops also have a duty to provide hand sanitiser. In order to be able to refill the practical dispensers, which allow contact-free dispensing, in a quick and easy way, Hagleitner has developed vacuumBags. These refill packs consist of a tubular bag and an adapter with integrated closure. When the bag is inserted correctly into the dispenser, the closure is automatically forced open. Hagleitner, headquartered in Zell am See south of Salzburg, used one production unit to manufacture 10,000 refill packs a day in two and a half shifts, five days a week, covering the needs of its customers throughout Europe. "And then the coronavirus arrived," says Hans-Jürgen Landl, division manager for injection moulding, dispensers and mould making, reporting on one of the most exciting retrofit projects the company has experienced in its nearly 50-year history. Virtually overnight, the demand for

hand disinfectants more than doubled. Hagleitner made every effort to ramp up output as quickly as possible.

Production cell up and running in just three days

Injection moulding production was the bottleneck. The adapters are produced in a two-component process on an ENGEL e-victory 160 injection moulding machine in a 4+4-cavity rotary plate mould. First, the shoulder plates are moulded in white polypropylene, and after the mould has rotated, the seal – made of blue TPE – is injected directly. Increasing production from five to seven days a week, and from two and a half to three shifts, fell well short of coping with the sharp rise in demand. This prompted the decision to launch a second injection moulding cell. This was possible because Hagleitner had already ordered a second, identical mould for the adapters two years ago. "As a replacement mould in case the production mould should ever fail," as Landl explains. "So that we could continue to deliver whatever happens." Nobody had thought of a pandemic back then.



"And then the coronavirus arrived." Hans-Jürgen Landl, division manager for injection moulding, dispensers and mould making at Hagleitner, had to more than double hand sanitiser output.

In order to ramp up production with this replacement mould quickly, the idea was to convert an injection moulding machine. The Zell am See facility is home to 18 injection moulding machines, including further e-victory 160 machines, but none that are actually identical in design to the machine used for the adapter pieces. The special feature in the production of the adapter pieces is the additional small injection unit for gating the TPE component, of which only one was previously available among Hagleitner's machinery. This is not a product that can be re-ordered off the shelf with a short lead time. The fact that a second e-victory 160 with the replacement mould was nevertheless able to go into production in just a few days is thanks to Hagleitner's excellent network of partners. Packaging and recycling specialist ALPLA in Vorarlberg has been supplying Hagleitner with canisters and bottles for many years. Michael Meister, the owner of the Meister-Quadrat engineering office based in Niklasdorf, Styria, knew that identical small injection units were used at the ALPLA plants. Without hesitation, Meister contacted ALPLA. And ALPLA sent a unit to Zell am See to help contain the pandemic in collaboration with Hagleitner.

Platform strategy accelerates retrofit

To convert the e-victory machine, Michael Meister travelled to Hagleitner along with ENGEL service technician Rene Zwischenberger. It was no trivial task that they were faced with, as there was no spare parts order and matching bill of materials due to the urgent nature of the work. The components required for installing the small unit, as well as hydraulic valves and the mould swivelling device required by the additional core-pull of the adapter

mould, were removed from another machine and installed in the e-victory 160 designated for the job. This is where Hagleitner's platform strategy paid off. Six years ago, the company started a standardisation campaign in cooperation with Meister-Quadrat. "Our injection moulding machines all have a very high technical specification and have a large number of inputs and outputs to support flexible use", says Landl. "The coronavirus pandemic once again confirms that a strategy of future-oriented investment is the right choice".

"We benefited massively from this modularity", confirms Gerhard Hochstöger, service scheduling team leader at ENGEL's headquarters in Schwertberg, Upper Austria. "Being able to access hardware from another machine is not something you can take for granted. Within two days, we had all the parts and even the machine software with all the required adjustments in place, so we were able to get started on the conversion work."

After just three days, the cell went into production. This means that two machines are now producing 15,000 vacuumBags per day around the clock, and seven days a week. "What made this record time possible is that this project brought together people who have known and trusted each other personally for many years," Michael Meister says in summary. "We were able to get started immediately and ignore the red tape. We all knew that this project was about human lives. Everyone had done their part." ■

Across its entire product range, Hagleitner increased output fivefold in response to Covid-19.



ENGEL worldwide. Where you are.

Committed to improving sustainability Verpackung mit Zukunft

PLATTFORM
VERPACKUNG
MIT ZUKUNFT



ENGEL teamed up with six other companies from the Austrian packaging industry to found

the Packaging with a Future (Verpackung mit Zukunft) platform. The aim of the initiative is to improve public awareness of how to use packaging sensibly while playing an active role in advancing a global circular economy for plastic packaging. "Reduce, replace, reuse, recycle" are the tasks that must be completed to ensure that packaging has the least possible impact on the environment. The seven companies that founded the platform – Alpla, Greiner, Coca-Cola Austria, Nestlé Austria, Interseroh, Erema and ENGEL – are already

using their technologies to help make this vision a reality. The focus of the joint commitment is plastic packaging. Even though it often has a smaller carbon footprint than packaging made of other materials, plastic packaging has a particular need to make up lost ground when it comes to meaningful handling, disposal and recycling, which has caused it to lose consumer acceptance. The platform's members are setting new benchmarks with their innovative developments. In an open dialogue with policy-makers, organisations and the public, they are working to foster a nuanced debate around plastic packaging.

"We are leveraging our know-how to ensure that packaging can be produced, used, disposed of and recycled in a sustainable manner worldwide."

Stefan Engleder, CEO, ENGEL

New managing directors

ENGEL France: Romain Reyre



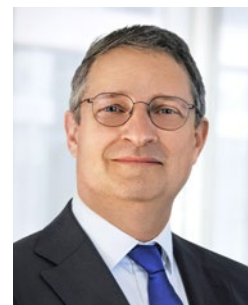
Romain Reyre is now returning from South East Asia to his native France.

ENGEL France SAS has completed a generational change in its management. Philippe Sterna, Managing Director of the sales and service subsidiary for 20 years, has now retired. His successor is Romain Reyre. Reyre has been with ENGEL since 2016 and was most recently Regional President, managing ENGEL's business in South East Asia. He is now returning to his home country of France. "We are pleased to be able to fill this important position internally", says Dr. Christoph Steger, CSO of the ENGEL

Group. Romain Reyre brings some 30 years of experience in the international plastics industry to his new responsibility and knows the French market just as well as the international market.

ENGEL Benelux: Arthur van Dijk

ENGEL Benelux B.V., based in Houten in the Netherlands, also welcomed a new managing director at the beginning of May with the appointment of Arthur van Dijk. Van Dijk, who holds a degree in mechanical engineering, joined ENGEL from the raw materials industry and can draw on no less than 25 years of experience in the plastics industry, where he has held various technical, commercial and business management positions. Franz Hinterreiter, who managed ENGEL Benelux in the interim, is returning to his previous position as head of sales for automotive at the Schwertberg headquarters as planned.



Arthur van Dijk is the new managing director of ENGEL Benelux, based in Houten in the Netherlands.

Getting closer to the customer New location in Belgium

On 1 July, ENGEL opened a new sales and service office with its own training centre in Belgium, bringing itself even closer to its in-country customer base. The new office is located in Oostakker near Ghent, one of the most important industrial centres in Belgium. It is part of ENGEL Benelux in Houten, the Netherlands, the base from which ENGEL previously managed its sales and service activities in Belgium. The new

location is managed by David Deliever (Sales) and Jurgen de Maesschalk (Service). "We have simplified decision-making processes for our customers in Belgium and made it possible to hold project meetings, seminars and training sessions locally in a very efficient way and with little travel overhead", stresses Arthur van Dijk, managing director of ENGEL Benelux. Belgium is a particularly innovative and technologically demanding market. With its high level of expertise in systems solutions, ENGEL is one of the preferred suppliers to the plastics processing industry in the country.

Forging partnerships to contain the coronavirus pandemic

Face masks in record time

Together with business partner Haidlmair, ENGEL is committed to improving the global supply of face coverings that protect the nose and mouth. In record time, Haidlmair developed and implemented a new mould solution for the production of reusable masks, which is now being used by plastics processing companies worldwide. ENGEL is delivering injection moulding machines geared for this - also in record time. The two-piece masks, which are developed by German firm Providee and injection-moulded from TPE, provide lower-face protection for use in everyday situations. The masks can be cleaned and disinfected and different filter materials can be inserted. In countries that have exempted face masks from medical device legislation due to the Covid-19 pandemic, these masks can be produced and marketed by companies from a huge range of different industries. Thanks to their collaboration, ENGEL and Haidlmair have been able to help companies change their production at short notice, allowing them to take action in the fight against the further spread of Covid-19. The ENGEL plants are giving top priority to producing the machines ordered for Haidlmair's face mask moulds. ENGEL's decentralised machine production ensures the shortest possible lead times worldwide.



High-volume production of test swabs

The demand for test swabs for nasal and throat swab tests continues to grow strongly due to Covid-19. By providing an integrated systems solution and process-focused advisory services, ENGEL and Hack Formenbau are helping plastics processors to roll out high-volume production of two-component test swabs with a short lead time. The test swabs have a stable thermoplastic handle and a head made of a thermoplastic elastomer to make the procedure less uncomfortable for the patient. Hack Formenbau developed this design, which can be tailored to meet individual customers' needs and is intended to combine high product quality with high-volume output and great cost-effectiveness. With a 32-cavity mould and a cycle time of 6 to 8 seconds, processors can achieve an output of up to 320 test swabs per minute with a single production unit. High efficiency is ensured by the integrated production process, which ENGEL specifically adapts to the mould solution developed by Hack.



"We have had excellent collaboration with our mould-making partner, which our customers continue to benefit from."

Christoph Lhota, Vice President, ENGEL medical

Tailor-made thermoplastic composites for highvolume production

JEC Innovation Award 2020

ENGEL and one of its partner companies, FILL, were jointly selected as winners of this year's JEC Innovation Award in the Process category. The two partners received the accolade for their development of a highly automated production line for the manufacture of tailor-made prepregs, which paves the way for mass production of thermoplastic composite parts. In order to efficiently construct these prepregs from both glass and carbon fibre reinforced tapes with a thermoplastic matrix, the production line includes a



tape laying cell and a consolidation unit. It turns out fit-for-purpose prepregs with 15 to 30 tapes in a cycle time of just a few minutes. It was this high level of production efficiency that convinced the international jury. Every year, the JEC Group acknowledges the most innovative composite material projects in the world with the JEC Innovation Awards.

The criteria are technological excellence and originality, market potential and cooperation between different players in the value chain. These coveted awards are usually presented at the JEC World trade fair, which did not take place this year due to the coronavirus pandemic. ENGEL and the other 2020 winners received their awards as part of an online celebration.



Christoph Steger

Harald Wegerer

"We're increasingly becoming **a production support service**"

Digitalisation and networking are opening up new possibilities in after-sales service to boost the availability of production plants. And the coronavirus pandemic has given a further boost to smart service. In this ENGEL Techtalk, Dr. Christoph Steger (CSO) and Harald Wegerer (Vice President, Customer Service Division) discuss what this means for the cooperation between ENGEL and its customers.

Injection: Social distancing and travel restrictions have made traditional service call-outs to customers' premises more difficult, if not impossible, in the first half of 2020. What long-term changes has the pandemic brought for the service division?

CHRISTOPH STEGER: The development of digital ways of collaboration has been accelerated by the coronavirus pandemic. Virtual meetings and even virtual service calls are now part of our everyday life, which makes many processes even more efficient.

HARALD WEGERER: Especially for service, digital solutions have helped us immensely over the last months. Thanks to e-connect.24 – our remote service and online support solution – we have been able to provide our customers with excellent support across the board, despite social distancing and travel restrictions,

both for ongoing projects and in urgent service situations. The importance of these tools for production availability has become particularly clear during the pandemic. This has been a new experience for some people. It is still the case that not all manufacturing companies are leveraging these opportunities, but they are now looking at how they can better position themselves for the future to protect their productivity in the event of a crisis. This is a very big issue at the moment – driven by the pandemic. On the one hand, it is about smart service solutions such as e-connect.24, but also about smart machines.

Injection: What role can smart machines play during the crisis?

WEGERER: It's about smart assistance systems, such

as iQ weight control, that automatically readjust certain machine parameters during production. This means they can ensure consistently high quality, even if the machine operator cannot be on site all the time.

Injection: What new requirements has the pandemic imposed?

WEGERER: As we have focused on digital solutions in both development and service for many years, we already had a big scope of digital products and features

» **It's about giving our customers the assurance of knowing that their production is running smoothly throughout."**

Christoph Steger

before the pandemic. But one thing that has become particularly clear right now is that the systems have to work easily. Obviously plug and play, and the systems also have to be easy to use. At ENGEL, we refer to this as "simplicity", and simplicity has played a leading role in our R&D work for quite some time. Our experiences during the pandemic have confirmed this approach. We are now increasingly taking simplicity on board for the further development of our smart service solutions.

INJECTION: More broadly speaking, besides the coronavirus, what trends have you observed?

WEGERER: Production units are becoming increasingly complex. This brings the challenge of supporting our service technicians in a different way in the future. The question is how we can ensure that our technicians have precisely the in-depth knowledge they need at the right moment. For me, knowledge management is the biggest challenge that we will have to face in the service area in the coming years. On the one hand, it is a matter of administrative tools, but also of diagnostic systems on the machine.

INJECTION: How is ENGEL positioning itself to meet this challenge?

WEGERER: We are continuously investing in training of our 650 service technicians worldwide. We recently opened a new training centre at our headquarters in Schwertberg, where we can train our technicians in an even more targeted way. We precisely analyse which subjects, which technologies and which applications are relevant in the respective markets and have tailored the training programmes accordingly. This means that every technician benefits from their own individual training programme.

STEGER: The second important fact is that we are establishing experts in the individual regions and building up specialist knowledge in a decentralised way. This includes experts for specific business units, such as packaging, or specific technologies, such as foam-melt structural foam moulding, but also experts in drive technology, hydraulics and electronics. These experts are like a second brain for the service technician. This is exactly why it is so important that the experts are available locally – in the same time zone! Of course, we are continuing to rely on digital support for our on-site service technicians from specialists at headquarters.



In the future, methods such as augmented reality will help us to handle service assignments more efficiently and in a more solution-oriented way than ever before.

INJECTION: Are virtual tools also gaining importance in the area of training and professional development?

WEGERER: Regular training at our training centres is the essential prerequisite for an effective service

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With our digital service solutions, we have been able to provide our customers with excellent support despite social distancing and travel restrictions.”

Harald Wegerer

organisation. We are already making very successful use of the digital opportunities that we have on our e-learning platform, especially during the Corona pandemic. This is our hub for everything related to digital knowledge transfer, from e-learning content for self-study to webinars with trainers.

STEGER: We began digitalising our knowledge and making this available in digital formats a number of years ago. Initially this was intended for our service technicians. Today – and the coronavirus has again accelerated the development here – we can offer our entire range of standard seminars for our customers online.

INJECTION: And how well has that been received?

STEGER: We are still at the beginning of this journey, but we can see that there is a lot of interest. The benefits are obvious: e-learning is independent of time and location and works even if personnel resources and travel budgets are tight. In the future people will increasingly ask themselves whether a business trip really makes sense or whether the objectives can be achieved by digital means and perhaps even more efficiently because of this.

INJECTION: During the pandemic, ENGEL carried out machine acceptance tests virtually (on Skype) for the first time. What has your experience with this been like?

STEGER: It's been very good. And you have to bear in mind that we were not as well prepared for this topic as we were for online support. Nobody had expected a situation in which we were unable to receive any visitors for a period of time. But our IT team has given us great



support and empowered us to work with live images all around the machine or the entire production unit. Our customers were positively surprised by the high quality of digital machine acceptance tests.

INJECTION: You mentioned the limited manpower available at manufacturing companies. To what extent has the lack of skilled workers affected cooperation with your customers?

WEGERER: The numbers of skilled workers at companies is falling all the time – we are already noticing this today. As a supplier, we are having to consider the consequences of that trend at an even earlier stage. We are making our products even smarter in order to cushion this shortage of experts, and we are preparing to take on tasks for our customers that skilled employees previously handled themselves. As a result, cooperation with our customers will become even closer at various levels. Another trend, for example, is for processors to completely outsource spare parts management to us as their supplier. The buzzword here is vendor managed inventory. At our logistics hub at Vienna International Airport, we have specifically created rental warehouse capacity for this purpose that can be called up very quickly on demand.

STEGER: The expectations in terms of service are



increasing across the board. Especially when it comes to ramping up highly complex systems, our service

technicians will increasingly need to compensate for the lack of specialists employed by our customers. Therefore our highly decentralised service structure also offers massive benefits. We have our own service technicians around the world, who we have trained and developed ourselves, and who are particularly well-versed in our technologies.

INJECTION: How is the interaction between sales and service changing due to the new requirements?

STEGER: At the end of the day, it's all about lifecycle management. We give the customer a complete package, which removes the barriers between machine sales and machine maintenance. What this means for us is that our sales staff are increasingly the first contact person in the case of service issues, and that conversely our service technicians are also consultants of a kind when it comes to purchasing a new machine or systems solution. We raise our employees' awareness and offer training with this in mind.

WEGERER: Sales and service together form a team. They need to work hand in hand for us to be able to offer our customers the best possible support.

STEGER: This is a mindset change that is already well advanced in many areas. After-sales is no longer just about getting a machine or production unit up and running again quickly or delivering a spare part. It's about giving our customers the assurance of knowing that their production is running smoothly throughout. Our mission is to be there for the customer when the worst comes to the worst, but also when it doesn't. We're increasingly becoming a production support service. ■





Quality levels are affected by abrasion on the flights of the plasticising screw. e-connect.monitor determines the screw condition without any need to take the system apart.

ENGEL to exhibit **new products**

Even without Fakuma being held, ENGEL will be using different methods to exhibit its innovative developments on a case-by-case basis in autumn 2020. Something the plastics industry can look forward to! We preview four top-class innovations below.

e-connect.monitor: condition monitoring now possible for barrier screws

ENGEL is expanding the range of applications covered by its condition monitoring solution for preventive maintenance. Now, e-connect.monitor can also be used to analyse the condition of barrier screws and define their current state.

In typical maintenance contexts, the barrel is a black box. Its condition can only be assessed by interrupting production and removing the plasticising screw. A time-consuming and resource-intensive process that is rarely undertaken at many companies, resulting in quality issues and, in turn, unscheduled downtimes. But systematic use of machine data makes it possible to reduce maintenance costs and increase machine availability. e-connect.monitor is the only system on the

market that allows users to keep track of the screw's condition without having to disassemble the plasticising unit.

The measurement system can be installed outside the barrel. It operates via ultrasound, which it uses to evaluate the condition of the plasticising screw through the barrel wall and all the way through the molten plastics. The measurement is carried out by an ENGEL service technician, with the entire data collection process only taking a few minutes. The measurement results are transmitted to ENGEL via a secure data connection, and automatically evaluated and interpreted using specially developed mathematical models. The processor can view the results at any time on the e-connect customer portal. When the condition of the screw is regularly monitored, the Maintenance Department can evaluate



the degree of wear and plan for when it next needs to be replaced. Making optimum use of the screw's lifespan means that downtime can be reduced to a minimum. The solution has already begun to be used for three-zone screws. Barrier screws are particularly demanding in terms of analytics technology due to the complexity of the screw geometry, the varying flight pitches and the range of different varieties available. They require a separate algorithm, which has been developed by ENGEL. Barrier screws are mainly used on large machines and for 24/7 applications with high material throughput. Unexpected system downtime is critical in this



Now even more compact: the all-electric ENGEL e-mac.

context, especially since disrupting operations to remove and assess the screw can take two working days. e-connect.monitor offers a faster solution to this problem.

New e-mac generation: compact, flexible, cost-effective

ENGEL will present the next generation of all-electric e-mac injection moulding machines, which will be used to produce pipette tips. Offering maximum flexibility for individual customer requirements, the e-mac is now even more compact.

The quality of pipette tips largely depends on the precision of the injection process. At the same time, the long cores in the mould require absolutely precise movements of the mould mounting platens. All-electric injection moulding machines are therefore the preferred solution in this segment, where cost-effectiveness is a decisive factor in choosing a machine. With the e-mac, ENGEL's product range includes a machine that combines high output and energy efficiency with an extremely compact machine design, ensuring the lowest possible unit costs even in a cleanroom environment. ENGEL has now reduced the footprint of the e-mac machines even further. Thanks to an optimised toggle lever geometry, the e-mac 265/180 presented for the new generation's launch is 450 mm shorter than the previous 180-tonne version, without reducing the opening stroke. Among the all-electric machines on the market, the new-generation e-mac machines are the most compact anywhere in the world in their respective performance segment across the entire series.

A 64-cavity mould made by Tanner will be used to produce pipette tips from PP. The cycle time is six seconds, which is exactly the range in which the e-mac machines fully play to their strengths. For precision applications with cycles lasting more than four seconds, the e-mac is often the most economical solution in the field of all-electric machines. Apart from medical technology, the machine is used in the fields of packaging,

New size: e-mac 130

The sales launch for ENGEL's new machine generation will mark an expansion in the systems solutions provider's e-mac series. A new addition to the product range is the e-mac 130, which boasts a clamping force of 1,300 kN. This enables manufacturers of electronic components in particular to fine-tune the machine size even more precisely for the relevant application. As a result, the e-mac 130 allows manufacturers to set up highly compact and highly cost-effective production cells. A typical application for the new machine size to be used on is connectors, which are often produced in moulds with high numbers of cavities.



ENGEL e-speed: ENGEL and its partners are committed to delivering sustainable packaging products.



ENGEL e-mac: all-electric precision and cost-effectiveness for the production of pipette tips.



New micro-injection unit for LSR: the parts are just 1.7 mm in length and 0.9 mm in diameter.

teletronics and technical moulding.

The automation makes an additional contribution to the system's very small footprint. A viper 20 removes the pipette tips from the mould and transfers them to the integrated compact cell for cavity-sorted depositing. The new ENGEL automation cell houses all automation components and downstream process units, such as quality control, a tray server or box changer, and is significantly narrower than conventional safety guarding. Its standardised build-up allows for speedy mould set-up of the production unit.

e-speed: series expanded for more sustainable packaging

Designed for continuous high performance in the packaging industry, the ENGEL e-speed injection moulding machines are the cleanest and most energy-efficient hybrid machines on the market. The e-speed 280 sees ENGEL expand the series into the lower clamping force range, with a focus on manufacturers of thin-walled containers, buckets and lids.

The new e-speed, which boasts a clamping force of 2,800 kN, will produce 1-litre yoghurt containers made of PP at its market premiere. It will also be equipped with an interactive IML solution for the occasion. The new size sees ENGEL further optimise its extra-cost-effective hybrid machines, which combine an electric clamping unit with a hydraulic injection unit. Going forward, the series, covering clamping forces from 2,800 to 6,500 kN, will be designed with the performance upgrade. The time-tested inline injection unit with its electric plasticising drive achieves even faster injection performance in the new generation of e-speed machines, hitting injection speeds of 800 to 1,200 mm per second. The machine base and mould mounting platens have also been geared even more closely to the requirements of thin-wall packaging and moulds with a high number of cavities. Thanks to the new features, the e-speed machines are the ideal way to accommodate the trend towards thinner walls and short cycle times. Excellent energy efficiency is one of the series' unique selling points. In order to achieve extreme energy-efficiency in high-speed operation, the machines with clamping force levels of 3,800 kN or higher are equipped with an energy recovery system. This system absorbs

the braking energy from the platen movements and releases the stored energy back to the motor as required – for example, to speed up. The toggle lever is encapsulated to ensure particularly low oil consumption and maximum cleanliness. The e-speed machines meet the requirements of the food industry.

The mould and IML automation come from Brink, while the interactive labels come from Verstraete IML. These labels are based on technology by Digimarc and, much like a QR code, can be scanned with any smartphone camera. The big advantage is that they invisibly cover the entire label surface without intruding on the packaging's design. From the shop floor to the retail store to the recycling facility, the labels offer added value. Consumers can find out about the ingredients and manufacturing information for both the product and the packaging. And when the packaging has reached the end of its useful life, the label provides information on the recycling process. It is fully recyclable.

LSR micro-injection unit: ultra-high precision for ultra-low shot weights

A tie-bar-less, all-electric e-motion 50/30 TL machine equipped with the new micro-injection unit will be used to produce minuscule, liquid silicone rubber precision components for the ophthalmology market, each weighing 0.0013 grams. This innovative development combines absolute precision with the highest levels of flexibility and cost-effectiveness.

The LSR micro-injection unit, which was jointly developed by ENGEL and ACH Solution, makes it possible to manufacture precision parts from liquid silicone rubber with shot weights significantly below 0.1 grams. Its practical potential will be demonstrated by producing connecting elements used in instruments for diagnosing eye conditions, which will be made using a valve gated cold runner mould with 32 cavities. The intricate parts are 1.7 mm in length, have a diameter of 0.9 mm and weigh 0.0013 grams. The e-motion 50/30 TL injection moulding machine is equipped with an LSR metering pump from ACH Solution, a viper 6 linear robot and a camera system for quality control, also supplied by ACH. Ensuring a high degree of flexibility was a priority when developing the micro-injection unit. The high-speed coupling system makes it possible to replace the unit with a

conventional screw injection unit in less than 30 minutes. Another of the tie-bar-less injection moulding machine's unique selling points is its large platen surfaces. Large multi-cavity moulds can fit on relatively small machines, which reduces the system's footprint while ensuring unit costs are kept as low as possible.

In addition to the medical technology sector, the other target group for the e-motion TL machine and new micro-injection unit is the consumer electronics

industry, which manufactured products include minuscule precision parts and high-grade optical components for smartphones. The trends towards electric vehicles and autonomous driving also mean that car manufacturers will require a larger number of micro-parts made from LSR in the future. ENGEL will also be carrying out multi-component processes using the new micro-injection unit – for instance, to inject seal elements directly onto a primary part.

75 years of ENGEL – discount packages to celebrate a milestone year

Buy the First

Along with their machine, all new ENGEL customers will be receiving five years of ENGEL protect – ENGEL's intelligent service package – as a complimentary extra. The service product includes free correction of most malfunctions, including the necessary spare parts, as well as the connection licence and machine hardware for e-connect.24. This service guarantees online support and remote maintenance from competent ENGEL technicians around the clock, seven days a week, and supports cross-departmental and cross-facility collaboration within the client's organisation. The result is significantly greater machine availability. Buy the First also includes a training package, start-up support and an online mould performance check. It gives ENGEL customers a faster way to operate



“

e-connect.24 helps us to reduce our travel times and makes our manufacturing more effective and productive. That, in turn, makes us much more competitive.”

Dirk Horn, Industrial Engineering – Injection Moulding, Huf Group (Velbert, Germany)

productively and enables them to unleash the full potential of their new ENGEL machine right from day one.

Smart Machine

The Smart Machine Package boosts quality, reduces the numbers of rejects and extends the lifespan of machine components. With iQ weight control, iQ clamp control and iQ melt control all part of the package, it includes three smart assistance systems in one. While iQ weight control automatically keeps the shot volume constant, iQ clamp control determines the optimum clamping force. Meanwhile, iQ melt control identifies the most suitable plasticising time, improving the melt's homogeneity and increasing process stability. The package also includes the EUROMAP 77 interface for integration into an MES, such as TIG's authentig. To mark the occasion of ENGEL's 75th anniversary,



“

Parts that were not completely filled had been a problem with our thin-walled products in the past. With iQ weight control, complaints have dropped considerably.”

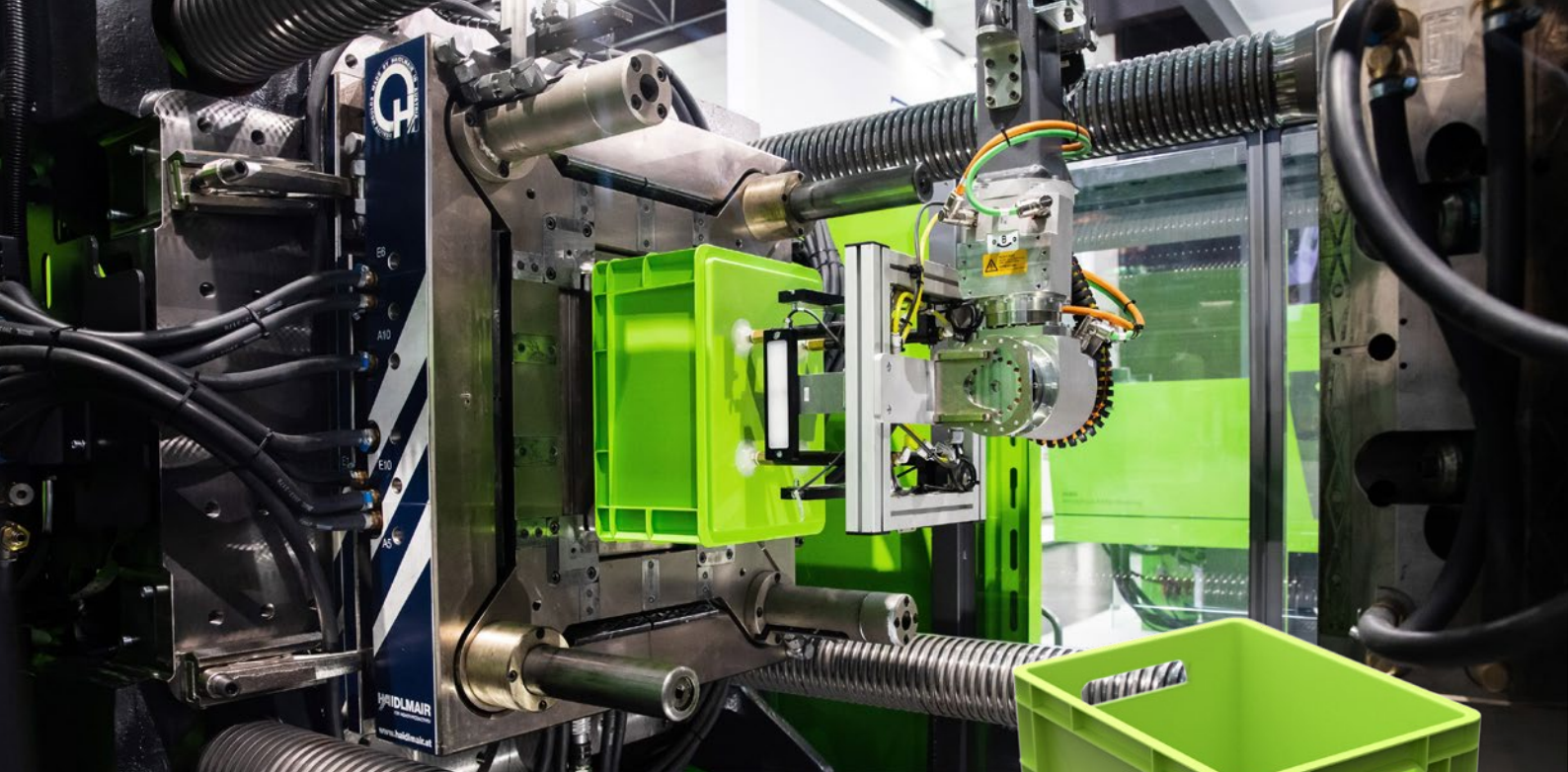
Rolf Schaupp, CEO, LAWAL Kunststoffe (Langenau, Germany)

customers can save a full 75% compared with the individual product prices.

Efficiency

The Efficiency Package pulls out all the stops to ensure higher energy efficiency and lower production costs. It includes six options to cover every angle. First, the barrel insulation saves up to 40% in energy costs. Second, the graphical process data monitoring enables users to keep track of up to six process parameters and issues a warning when limits are exceeded. Third, the activity check automatically shuts down energy-depleting systems during system standstill. Fourth, the ecograph

plus continuously measures the machine's actual energy consumption and provides transparency. Fifth, the adjustable switch-off cycle, including automatic barrel purging, reduces the amount of time required. And sixth, the start-up programme safely re-calibrates the system after a production stop while providing ideal mould protection. The discount package available to mark ENGEL's 75th anniversary is 75% cheaper than buying the options individually. ■



ENGEL skinmelt: recycling that gets under the skin

Process technologies used to produce multi-layer and multi-component products offer great potential for recycled plastic waste to be used more frequently in the manufacture of plastic parts that are particularly demanding in terms of surface quality, product protection or consumer safety. The key is for the recycled material to be used on the inside, while the surface is made of virgin material. In its skinmelt technology, ENGEL has developed a version of the sandwich injection moulding process that makes it possible to achieve high recycled content levels even with complex part geometry.

As specified in the European Commission's strategy for plastics in a circular economy, the amount of recycled materials used in the production of plastic products should be more than doubled by 2025. Achieving this goal will require commitment from the players in the market, higher capacity for the processing of separated plastic waste and, in particular, new processing technologies to facilitate the use of recycled materials in a wider range of products with even higher levels of recycled content. ENGEL skinmelt is playing a big part in making this vision a reality.

The two-component process was developed for the production of sandwich parts, which have a core made of recycled plastic waste and a surface made of virgin material. One new feature is the ability to achieve high recycled content levels, even when working with complex component geometries. skinmelt was showcased for the first time at the K show in 2019, where it was used to produce transport boxes. These were made with more than 50% recycled content. Both material

types used in the process – recycled and virgin – were polypropylene. Using the same type of material in the core and on the skin ensures that the sandwich-moulded products can also be easily recycled.

Unlike classic coinjection, the skinmelt process involves successively layering the two melts prior to injection in the main injection cylinder. The skin – the virgin material – is first to reach the cavity. It is pushed forward by the inflowing recycled PP and pressed against the cavity walls, while the core is filled with recycled material. The proportion of recycled material that can be used is essentially determined by the geometry of the moulded part and the flow pattern in the cavity. The injection position and the relative viscosity of the skin and core materials have a significant influence on this outcome. Excellent repeatability in the moulding process is necessary to also ensure dimensional reliability and stability in products with a high level of recycled content. For this purpose, ENGEL has engineered an especially compact production solution based on a duo dual-platen

injection moulding machine. ENGEL worked together with partners for the exhibition at the K show, with the mould coming from Haidlmair and the recycled material coming from Der Grüne Punkt – Duales System Deutschland. The PP regrind, produced under the Systalen brand, originates from household refuse that is collected in recycling receptacles and then sorted.

Usability confirmed

To confirm the usability of the skinmelt boxes, they were stacked during pressure tests at the Transfercenter für Kunststofftechnik in Wels, Austria. In each instance, pressure was applied to compress three stacked boxes at a speed of 10 mm/min, with the force and displacement signals plotted as time progressed. As a comparison, testing was also performed on geometrically identical, non-sandwich transport boxes, some of which were made entirely of virgin material and others made entirely of recycled material.

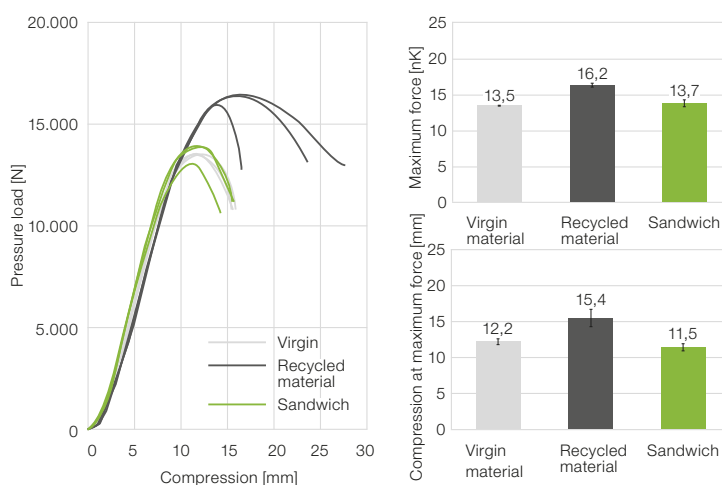
Interestingly, the boxes made purely of recycled material achieved by far the highest numbers for maximum force and compression (see graphic). However, it is clear from both the force-displacement curves and the extent of the standard deviation for the compression figures that varying performance levels must be expected when processed plastic waste is used. By comparison, the tests on boxes made solely of virgin material show roughly congruent curves for the three test runs, and the resulting standard deviations are small. Similar to the boxes made only of recycled material, the skinmelt boxes exhibit a slight tendency towards greater variance, although there are no losses in terms of the maximum force that can be borne. The fact that the recycled material's evidently higher load-bearing capacity is not more clearly reflected in the stability of the skinmelt boxes is most likely a result of the comparatively low recycled material content in the reinforcement ribs, which provide stability. These represent the end of the flow path and are therefore predominantly filled with skin material, which explains why the stability of the boxes produced using the skinmelt technology are comparable with the stability of the boxes produced entirely from virgin material. By extension, this means that a less efficient recycled material could

also be used for the production of stackable boxes – at least as far as stacking properties are concerned.

Recycled material increases strength

Further testing was carried out together with Johannes Kepler University in Linz in order to conclusively evaluate product safety – in particular, to examine impact and long-term use characteristics. To this end, small multi-purpose test specimens were punched from the long side walls of the transport boxes.

The Shore D hardness measurement confirmed that boxes made of virgin material and skinmelt boxes were equivalent, as was expected after the preliminary tests. The core material's higher level of surface hardness is covered by the skin material. In addition, values for modulus of elasticity, strength and elongation at break were determined from monotonic tensile tests at a constant test speed of 10 mm/min. The modulus of elasticity of the side walls made from virgin and recycled material hardly differed, and the sandwich composite in turn had approximately the same rigidity values. Nonetheless, there is a relevant difference in terms of strength. At 28 MPa, the strength of the recycled material is significantly higher than that of the virgin material (23 MPa), which has an effect – albeit minor – on the strength of the sandwich composite.



Boxes made only of recycled material show the highest values for maximum force.

Summary

ENGEL skinmelt offers users the opportunity to increase their levels of recycled content, even in products that are particularly demanding in terms of visual appearance and surface functionality. Due to the skin material's customisability, even applications in the food industry are a realistic possibility. A carefully selected processing method and mould design mean that the component surface can be made entirely from virgin material while at the same

time reaching a recycled content level of over 50%. Some of the characteristics of the recycled material in the part's core, such as colour and surface hardness, can be completely masked by those of the skin material. At the same time, other properties of the core, such as potentially higher rigidity and strength, can have a positive effect on product performance in the sandwich composite.



iQ weight control

opening the door to a wider
range of applications for recycled material

Smart assistance systems are paving the way for self-optimising injection moulding production. iQ weight control, for instance, identifies fluctuations in the raw material and the ambient conditions while adapting the injection profile, the switchover point and the holding pressure for each individual shot to current production conditions. ENGEL showcased the software for the first time at K 2019 with an application based on recycled material. Extensive tests, which ENGEL carried out in partnership with recycling specialist EREMA, confirm its significant potential for a circular economy.

Transport and storage boxes are ideally suited for the use of recycled raw materials. Several ENGEL customers are already processing recycled materials into a wide variety of containers on a large scale, using iQ weight control to increase process consistency. "We can process recycled materials from different sources while minimising the rejects rate thanks to iQ weight control. This makes it considerably easier to use recycled materials", notes just one ENGEL customer – a well-known international company.

Fluctuations in the properties of the recycled material pose a major challenge for the processing of plastic waste. Even perfectly sorted and pre-treated waste shows higher fluctuations than virgin material, since the properties of the recycled material are also affected by the type and levels of soiling on the waste, as well as the process used to clean, pre-treat and regrind these items. In the recycled material processing sector, recycled materials are often purchased from various suppliers. The variation when switching from one batch to another is particularly high, as the recycling companies use different technologies.

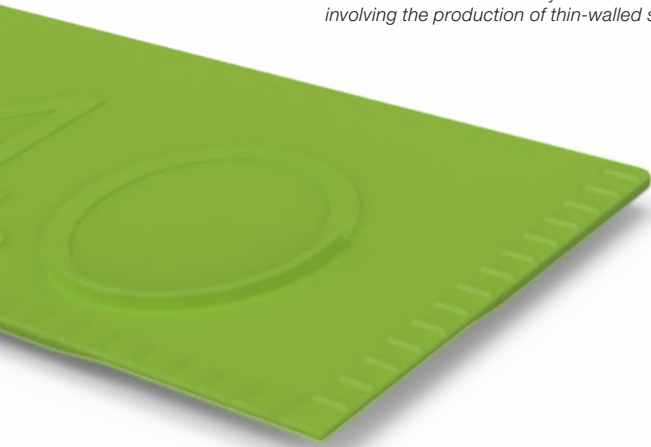
ENGEL took action to address this challenge at the K show. Fully recycled ABS was processed into

elongated sample parts on an ENGEL victory 120 injection moulding machine. The process involved using batches of recycled material from two suppliers that use different pre-treatment technologies and procure their raw materials from different sources. Visitors of the trade show were able to initiate a material change themselves and view on the victory machine's CC300 controller how iQ weight control adapts the processing parameters to the new melt viscosity, enabling it to produce good parts right from the first shot after the batch change. As part of the demonstration at the show, iQ weight control was alternately switched on and off shot by shot during a batch change (**Figure 1**). Without iQ weight control, the parts were no longer completely filled after the batch change, which resulted in rejects.

Testing regrinds with different pre-treatment methods

If a circular economy is to be established in the plastics industry, it is first essential for pre-treated plastic waste to be used in a much more varied manner for the production of new and, most importantly, high-quality plastic products. ENGEL is playing a significant role in

ENGEL exhibited the iQ weight control smart assistance system for the first time at K 2019 with a recycled material application involving the production of thin-walled sample parts.



this area as an injection moulding machine manufacturer, by increasing process stability. Being on the market since 2012, iQ weight control was first established successfully in the processing of virgin materials. To assess its potential for processing recycled materials, ENGEL and EREMA teamed up to investigate the software's effectiveness in recycled material processing in greater detail.

Sample parts made of polypropylene were manufactured on an ENGEL victory injection moulding machine. The recycled materials processed were initially made from geotextiles, which had been used as non-woven fabrics on construction sites and were heavily soiled as a result. The textiles were cleaned, pre-treated on EREMA machines and reground. Four different

combinations of recycling technologies and processing parameters were used in order to simulate realistic conditions and make it possible to carry out batch changes. The four resulting regrinds have varying melt flow indices (MFIs) within the 15 to 30 g/10 min range and consequently have different characteristics during processing.

In an initial test series, tension rods were injection moulded. When it came to assessing process consistency and resulting part quality, the main focus was on how well the parts were filled and on the mechanical properties, such as impact strength, which were determined in the laboratory. As with viscosity, mechanical properties depend on the molecular weight of the processed polymer. iQ weight control can identify even small deviations in viscosity from a reference value. As a result, a change in viscosity detected by iQ weight control is an indicator that something may have changed in the polymers' chain length distribution. By adjusting the injection profile, switchover point and holding pressure profile, the assistance system keeps the filling volume consistent even if the viscosity fluctuates, preventing the system from producing short shots, which are parts that are incompletely filled. The more consistent filling results also help to ensure that the same level of density is maintained across different batches. Deficits in strength caused by the reduced molecular weight in the raw material cannot be compensated.

Clearer results than MFI

Figure 2 clearly illustrates the software's potential. The MFI is often used as a key metric for fluidity, although this disregards the impact of shear rate on viscosity. As the shear rate increases, the viscosity decreases due to the shear thinning behaviour of molten plastics, which in turn improves fluidity. Since significantly higher shear rates occur during injection moulding than during MFI measurement, the MFI is only of limited use for assessing fluidity under processing conditions.

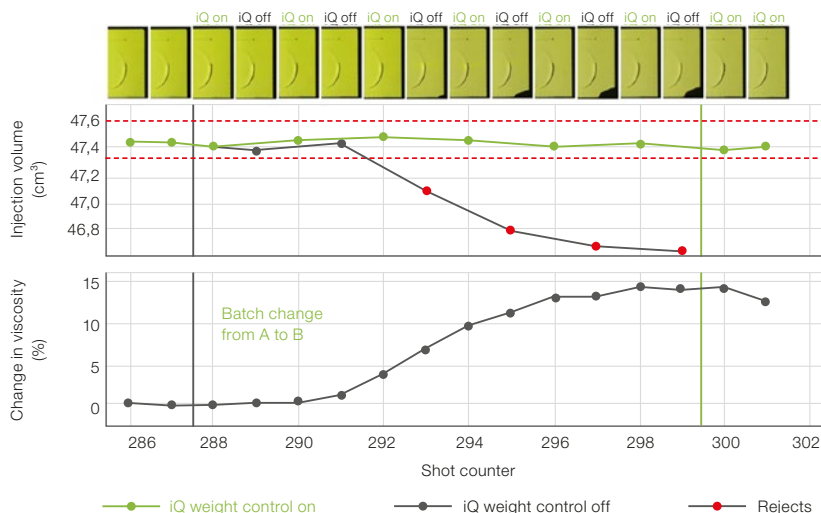


Figure 1: At the K show, visitors were able to initiate a batch change. During the change, iQ weight control was switched on (green) and off (grey). Good parts were only produced on a consistent basis when iQ weight control was activated.

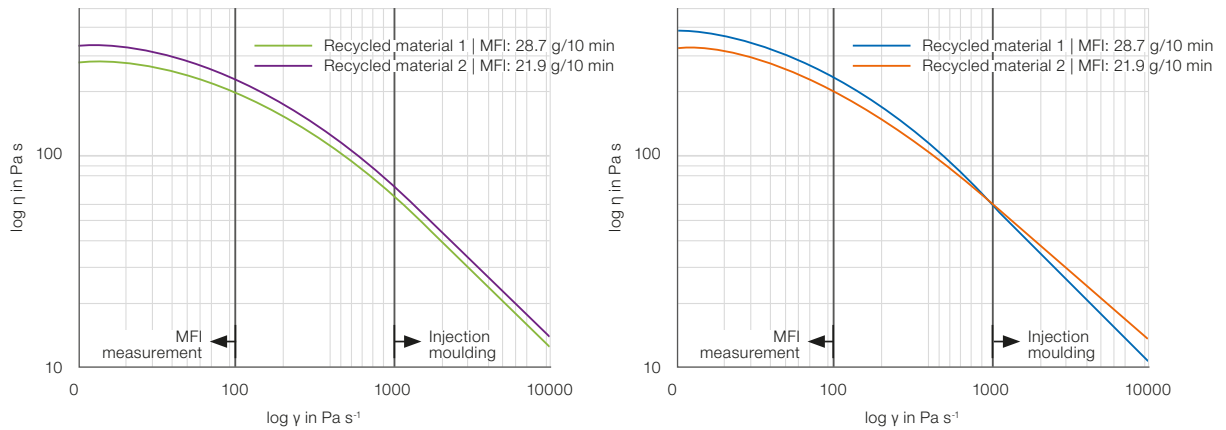


Figure 2: The two graphs show shear rate-dependent viscosity curves for different recycled materials measured on a high pressure capillary rheometer (HPCR) as a double logarithmic plot. MFI measurements are taken in the lower shear rate range, while significantly higher shear rates occur in real-world injection moulding processes. The viscosity change identified from the process data often provides clearer results than an MFI-only comparison.

iQ weight control determines the change in viscosity based on the shear rates actually present during the process, producing more accurate results. Closely in line with the measurement on the high pressure capillary rheometer (HPCR), the MFI measurement at a low shear rate yields a 23.7% difference in fluidity between the two materials under evaluation. In the real injection moulding process, however, iQ weight control calculates a viscosity difference of only +11.7%, which corresponds very well with the 12.4% difference determined from the HPCR measurement with the correct effective shear rate (**Figure 2, left**). If the curves for the shear rate-dependent viscosities intersect, a less fluid material according to MFI measurement can even flow more easily under real-world process conditions. Again, iQ weight control delivers the correct result of -5.4% (**Figure 2, right**).

Putting moulded parts with more complex geometry to the test

To evaluate the effectiveness of iQ weight control for moulded parts with more complex geometries, a test mould was used for the production of multi-step panels with several wall thickness gradations as part of a second test series (**Figure 3**). Along the central strip, the panels have a wall thickness of 3 mm. The panels branching off from this have wall thicknesses of 2, 1

and 0.5 mm, with the thinnest areas located at the end of the flow path. Two of the four recycled materials pre-treated by EREMA were processed for the tests, with one used as the control (recycled material 1). When the switch was made from the control material to the other material (recycled material 2), it became evident that the shot weight falls significantly in the absence of the smart process control and the cavity is no longer completely filled (**Figure 4**). When iQ weight control was switched on, the shot weight increased into the results range achieved with the control material and completely filled parts were produced on a consistent basis.

This result was supported by analysis of the cavity pressure curves that were recorded (**Figure 5**). In this case, the process was still controlled using the machine's injection pressure transducer, as this is the typical method used in practice. During the filling phase, pressure levels increased significantly with the less fluid recycled material 2. The switchover point – marked with the vertical line in Figure 5 – and the holding pressure level were adjusted accordingly using iQ weight control (**Figure 5, top**).

Two distinct pressure increases are identifiable from the cavity pressure curve, which are highlighted in the graph with vertical dashed lines. The first pressure increase occurred when the flow front reached the

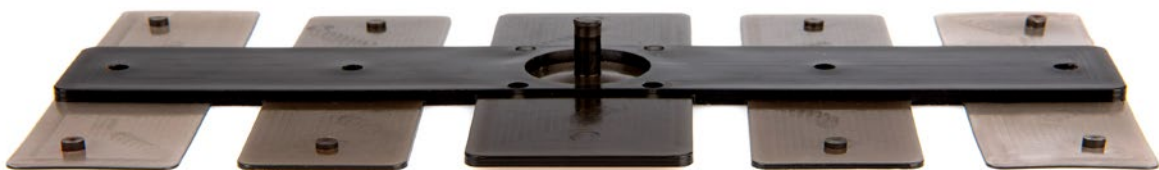


Figure 3: The central strip of the multi-step panel had a wall thickness of 3 mm. The panels branching off from this have wall thicknesses of 2, 1 and 0.5 mm, with the thinnest areas located at the end of the flow path.

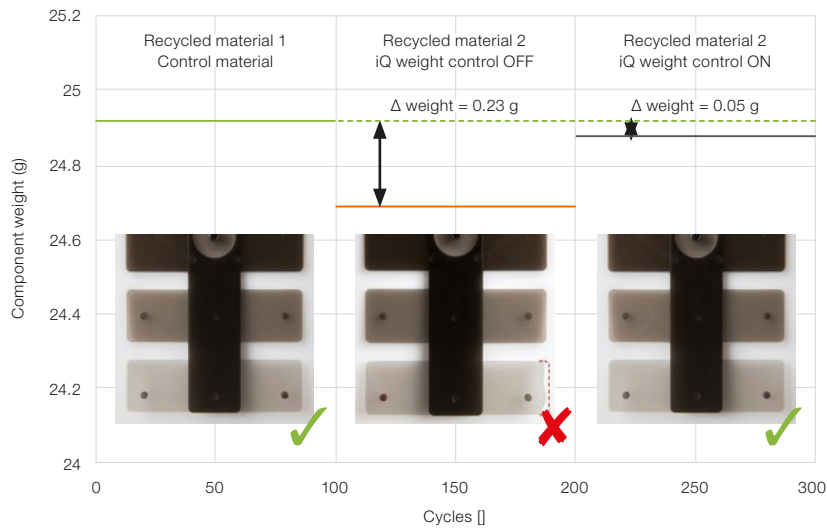


Figure 4: When the recycled material was changed, the shot weight fell significantly, resulting in the production of defective parts. Thanks to iQ weight control, the shot weights were increased to the control material's weight range.

cavity pressure transducer, and the second pressure increase was due to the complete volumetric filling of the cavity or the flow front prematurely freezing where parts were not completely filled. Filling is delayed in the absence of iQ weight control, which is reflected in the delayed pressure increase in the mould, a significantly lower cavity pressure curve during the holding pressure phase and, ultimately, incomplete filling of the cavity. When iQ weight control was used, on the other hand, a cavity pressure curve almost identical to that of the control material was achieved by adjusting the switchover point and holding pressure level (**Figure 5, bottom**).

Summary

Batch-by-batch fluctuations stemming from different parent materials and recycling technologies present a major challenge for the circular economy. The practicality of iQ weight control as a process control system in recycled material processing was confirmed in the tests undertaken. In this context, the smart assistance solution can play a major role in helping to achieve a successful circular economy.

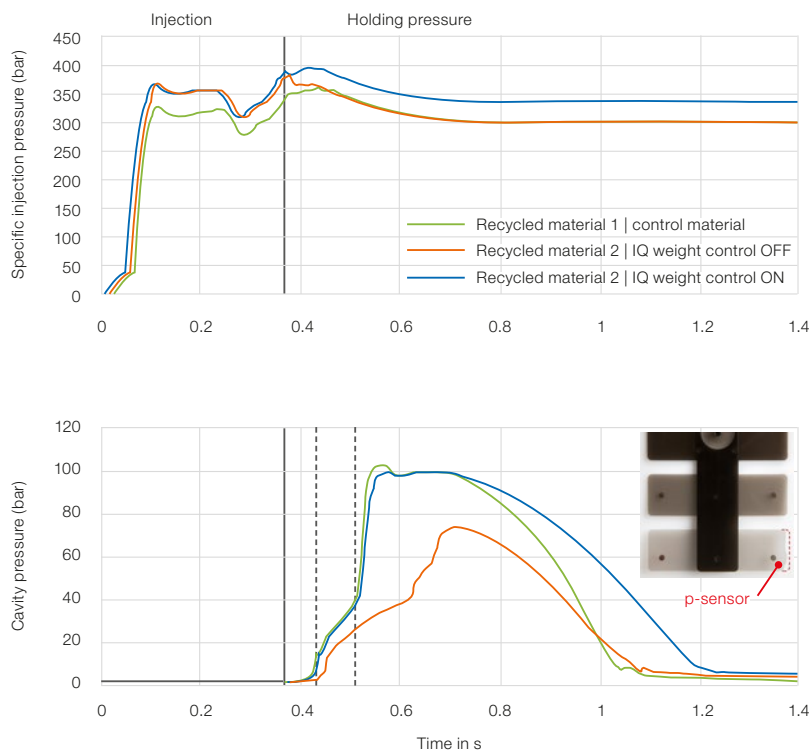




Figure 5: Pressure profiles after batch change from recycled material 1 to recycled material 2. The top graph shows the curve for the specific injection pressure. The cavity pressure curves (plotted at bottom) support the part weight measurement results, as well as demonstrating the more even progression of the filling front with iQ weight control.



The swivel arm replaces the rigid X-axis.



The swivel arm is folded in when it has been moved to park position. The pic A does not need to be disassembled for mould set-up purposes.

New kinematics

for greater efficiency and availability

ENGEL's new pic A pneumatic sprue picker offers the market an ultra-flexible, compact solution for separating sprues and removing small moulded parts in a simple manner. The pic A is the first pneumatic sprue picker that operates using a swivel arm, which helps to ensure high levels of efficiency and availability on the shop floor.

The pic A is set to break two records at once. This new development is intended to be the most durable and compact sprue picker on the market. And customers have already provided some initial feedback on its compact size. Trodat, an international manufacturer of complex stamp products based in Wels, Austria, has extensive experience with ENGEL handling devices. The injection moulding machines at its plant are equipped with ER-USP sprue pickers. Last autumn, the firm purchased its first of the new pic A sprue pickers. "Its compact design and innovative kinematics are beneficial features for us", reports Thomas Dobritzhofer, maintenance and facility manager at Trodat Produktions GmbH. "We can fold the robot arm all the way in, meaning we no longer have to swivel out the sprue picker in the same way for mould changes. That makes it faster to set up our machines." The earlier-model sprue pickers at Trodat are gradually being replaced by the new pic A generation. Faster and simpler set-up processes help to boost the availability of the injection moulding machines – a key factor in cost-effectiveness and competitiveness. If the swivel arm is moved to its "park position", the pic A leaves the entire mould mounting space free – a process that requires conventional sprue pickers with a rigid X-axis to be disassembled or moved.

Movements in ultra-tight space

The pic A is the first robot in the pneumatic sprue picker segment that operates using a swivel arm. Thanks to these kinematics, it is possible to eliminate all the protrusions that would otherwise be present. "The swivel arm was initially not intended for this type of robot", reports Gerald Huber, who was responsible for the design of the new sprue picker at ENGEL's robotics plant in Dietach. The engineer worked through a variety of design concepts in the process of creating the system. In the end, the e-pic robot was the inspiration for the swivel arm. The servo-electric e-pic sprue picker also has a highly compact design thanks to its swivel arm kinematics.

As is the case on the e-pic robots, the new pic A's swivel arm moves in the X-direction, replacing the rigid X-axis. What may look unusual at first glance turns out to be highly simple to use, with the triangular kinematics transforming the vertical drive movement into a horizontal, linear part removal movement so that the setters and system operators do not need to change places.

In the absence of a rigid X-axis, the pic A also proves to be a particularly effective space saver while the system is running. The swivel movement is highly safe and precise with narrow moulds. The part removal stroke

The axis rotates 90 degrees to the side in order to discard the sprues.



The triangular kinematics transform the vertical drive movement into a horizontal, linear part removal movement.

can be set to any value up to a maximum of 400 mm – a feature that is not possible with conventional kinematics. One new development is the ability to adjust the Y-axis module in just a few steps. The A-axis' rotation angle can be adapted to the relevant requirements between 0° and 90°. The pic A has highly robust mechanism to ensure that it reaches a long lifespan. The maximum manipulation weight at the end of the Y-axis is 1 kg. To rotate and discard larger sprues, a B-axis of rotation can be added as an optional feature between the Y-arm and the sprue gripper. Sprues and small injection moulded parts weighing up to 0.5 kg can be manipulated, depending on the end-of-arm tooling.

Consistent operating logic throughout the cell

When used on an ENGEL injection moulding machine, the pic A's control unit is integrated into the injection moulding machine's control unit. The largest plus point for the user is having central, joint control of the machine and sprue picker via the machine display. The consistent operating logic reduces the time and effort required for training on the new sprue picker generation, which also improves overall efficiency.

As part of the integrated solution, power is supplied to the sprue picker via the injection moulding machine. It can be put into operation very easily via plug and play, as the mechanical connection is universally compatible within the ENGEL solution. The discharge chute is compactly built into the injection moulding machines and forms part of the CE safety certification. Since the predecessor model (ER-USP) and the new pic A use the same discharge chute and interface, existing injection moulding cells can be easily converted. The sprue picker is compatible with ENGEL injection moulding machines from the CC200 and CC300 control unit generations.

Extra safety

As a pneumatic sprue picker, the pic A is compliant with the strict EN ISO 10218 robot standard as per performance level d/category 3 and the pic A is already designed for two-channel shutdown throughout. The part removal stroke can be simply and safely set with just one hand. To this end, the pressure in set-up mode is automatically reduced. Set-up mode is activated as soon as the injection moulding machine safety gate or safety guarding door is opened.

ENGEL develops custom-built automation solutions for a vast range of injection moulding applications, from sorting and separation of sprues through product removal and depositing to highly integrated and networked production processes. A comprehensive range of robots and high levels of special automation expertise are the essential ingredients for combining top quality with efficiency and cost-effectiveness. After all, this is the only way to develop neatly tailored solutions that fulfil the relevant requirements in an ideal manner without keeping additional, unused features in place. ■



Compact integration: the discharge chute for the sprues.

Virtual site visit – coronavirus forces a rethink

The end customer expects the component to be optimised in good time. All in a normal day's work if there were not restrictions on interpersonal contact and travel in effect. To save as much time as possible during the coronavirus pandemic, ENGEL is supporting its customer Helvoet in the Netherlands via e-connect.24 and Skype, creating a lasting change in the two firms' working relationship.



Pictures: Helvoet

Cleanroom production at Helvoet in the Netherlands. The company specialises in precision injection moulded products and uses all-electric e-mac injection moulding machines by ENGEL.

The picture is a little choppy, and not quite focused at first. The moulded part has to be held up to the camera and turned over multiple times, to make sure that everyone involved in the Skype chat can look at the images on their own computer screen. The images are encrypted and transmitted securely to three locations in two European countries: Schwertberg in Austria, and Houten and Tilburg in the Netherlands. ENGEL's headquarters is in Schwertberg. This is where Franz Hinterreiter – ENGEL Benelux managing director at the time – sits in front of the computer screen with his colleagues from the application technology team, discussing the technical details provided by the customer in Tilburg. His colleagues Ton Boekelder (team leader for customer training) and Bas de Bruin (sales engineer) are following the broadcast simultaneously from their home offices, not far from the ENGEL subsidiary in Houten.

"Jeroen, can you zoom in on this point again please?" Jeroen Molenschot is not a cameraman or even an influencer, but development manager at Helvoet Rubber & Plastic Technologies BV, which focuses on high-precision injection moulded parts for medical technology, diagnostics and other applications. And he and his colleagues are breaking new ground – uncharted digital territory. This is why the first steps in handling the camera require a little practice. Together with his contacts at ENGEL, he is carrying out a mould and process optimisation procedure for a diagnostics product. A lab-on-a-chip article that poses highest demands on the precision and consistency of the injection moulding process. Helvoet is a member of the Flow Alliance, an association of experts in the field of microfluidics, which constantly seeks to push the limits of what is technically possible in terms of interplay between mould



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As developers, we have to learn to take advantage of these new technologies which are already available to us. To work more effectively – and, in turn, more cost-effectively.”

*Jeroen Molenschot,
Helvoet Rubber & Plastic Technologies*

and injection moulding machine. The product has been under development in Tilburg for several years. Now a technical revamp had to be implemented. "The go-live was right around the corner", Molenschot stresses. The last face-to-face meeting took place at the end of last year. Flights and hotel rooms had been booked early for another visit in March. Then the coronavirus pandemic hit, with social distancing and travel restrictions throughout Europe threatening to disrupt the tightly planned schedule. What seemed to be a curse

both Schwertberg and Houten were able to access the data required for optimising the injection moulding process in real time.

In order to send the results of the optimisation steps back, Jeroen Molenschot grabbed a camera and sent live images from the cleanroom production. A Skype conference was used to discuss the parameters which needed further modification. "The decisive factor for part quality in coining is to mutually correlate the coining gap, the fill level and coining speed, and all of this in combination with the toggle lever geometry of the machine, which is responsible for force transmission", Franz Hinterreiter explains. The level of technical sophistication is high, because the surface structure of the component, which otherwise needs to be manufactured to be absolutely flat, is a real challenge. Highly delicate microstructures had to be placed deeper in the mould than in relation to its diameter.

For Jeroen Molenschot and his team, this project sets a precedent: "Without the coronavirus crisis, we certainly would not have agreed to this process. I would have felt it was very important for someone from ENGEL's headquarters to visit us in person in Tilburg. As developers, we have to learn to take advantage of these new technologies which are already available to us. In order to work more effectively – and, in turn, more cost-effectively."

This example shows the potential that can be tapped here in the future. And, as everyone involved agrees, the bottom line is that it was possible to achieve more than just a reduction in travel expenses. The time factor when it comes to implementation and the flexibility in scheduling an online meeting have also provided room for thought. "And with all these positive aspects, you can't ignore the human factor", Molenschot notes. "The workload for every employee, whether at ENGEL or Helvoet, has also been lightened." ■



Virtual teamwork across three locations: online support and Skype enable Helvoet to meet the tight schedule for process optimisation despite Covid-19 restrictions.

was turned into something positive. The all-electric ENGEL e-mac 75 injection moulding machine, on which the lab-on-a-chip articles are produced using the ENGEL coinmelt injection compression moulding process, includes the e-connect.24 customer portal, the ENGEL solution for remote service and online support. This means that ENGEL technicians from



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Our support does not end when we sell an injection moulding machine. Our goal is to permanently provide our customers with technical support and advice.”

*Ton Boekelder,
ENGEL Benelux*

Faster growth **thanks to certain standards**

More efficiency and safety, greater flexibility and faster industrialisation – these were the main arguments which prompted Ypsomed to standardise its production processes in the course of further global expansion. Integrated system solutions by ENGEL play a key role in the medical technology company's new platform strategy.

The number of people suffering from diabetes grows globally by nine percent each year. For Ypsomed, a leading developer and manufacturer of injection and infusion systems for self-medication, this means increasing sales. The company, with its headquarters in Burgdorf, Switzerland, is consistently pursuing a world-wide course of expansion. Most recently, a completely new plant with 13,500 square metres of production space for injection moulding and assembly was built in the northern German city of Schwerin. At its locations around the world, Ypsomed produces pens, auto-injectors and pump systems for administering liquid medications, such as insulin, for large, brand-name pharmaceutical companies.

New products and manufacturing processes are developed at the company's headquarters. This is also where the company's own mould making and technology centre are located, where new processes are trialled before they start series production at the plants worldwide.

The biggest advantage is fast industrialisation

For a long time, the company's global stock of injection moulding machinery consisted of machines of different types and brands. "This was no longer compatible with our expansion strategy", reports Frank Mengis, Chief Operating Officer (COO) of Ypsomed. This explains why, five years ago, a decision was taken to standardise. "The aim of the new platform strategy is to further improve efficiency, safety and quality while simplifying our processes."

Standardisation is becoming a trend in the medical technology industry, and not only for the big players", as Christoph Lhota, Vice President, Medical Business Unit of injection moulding machine manufacturer and system solution provider ENGEL, observes. "Ypsomed is a role model here. At a very early stage, we defined all the specifications in detail together, worked intensively on the performance specifications and then implemented them consistently".

To date, more than 100 all-electric ENGEL e-motion injection moulding machines have been supplied to Ypsomed locations worldwide on this basis. The

clamping forces vary – 800, 1600 and 2800 kN – but otherwise the machines are identical. Future needs were considered when selecting the options. Not all machines make use of the entire feature set right from the 'beginning. Instead, the aim was to avoid retrofitting and the requalification associated with this later on. In this way, the platform strategy saves a great deal of time and money during operations. "Every change



*Launched at K 2019: ENGEL compact cell.
Houses all the automation components and is still
significantly narrower than standard safety guarding.*



that does not have to go through change management boosts efficiency", says Lhota.

"We can now order injection moulding machines virtually off-the-peg at all locations worldwide", Mengis says. "But the biggest advantage is fast industrialisation. The qualification plans are identical for all new machines. This means we can integrate new machines and new processes into series production

far faster." Ypsomed's all-electric, high-performance e-motion machines allow the company to ensure high-precision, zero-defect production. An important prerequisite for competitive unit costs and trouble-free further processing of the injection moulded parts. A pen, for example, consists of between 11 and 15 parts – depending on the model – and they are assembled fully automatically.



Automation on a minimal footprint

The injection moulding machines started everything off. In the meantime, Ypsomed has also started to standardise the automation of injection moulding processes. "When it comes to the machines, we've had excellent



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"Thanks to standardisation, we can integrate new machines and new processes into series production far faster."

*Frank Mengis,
COO von Ypsomed*

experiences with ENGEL. We are a well-coordinated team", emphasises Mengis. "That's why we chose ENGEL as our partner for automation of injection moulding processes, too."

The e-motion injection moulding machines are now being equipped with ENGEL viper linear robots. And the new compact cell by ENGEL also plays a key role. When developing the compact cell, which was exhibited for the first time at K 2019, ENGEL also focused on standardisation. Thanks to its standardised design, the new automation cell makes it particularly easy to integrate a wide variety of automation components and other downstream process units. It encapsulates all the components while remaining significantly narrower than standard safety guarding.

"In terms of footprint, the compact cell is unbeatable", emphasises Marlon Trachsel, process manager for production technology at Ypsomed in Switzerland. "We had a look at the new solution at the K show and immediately saw the advantages that it offers us."

Uniform control logic for even safer work

Like the machines, the compact cells use an identical design to achieve maximum flexibility. To avoid having to change the auxiliaries during every mould change, the compact cells integrate all components needed

for both free-falling parts and for soft depositing using viper robots. Free-falling parts such as needle holders, which are produced in quantities of millions, are transferred directly into boxes by a conveyor belt and a three-way gate. The compact cell provides trays of two different sizes for the housing parts which are removed from the cavities by the viper robot. The boxes and trays are changed automatically. Irrespective of the high degree of integration, the compact cell ensures that machine operators can quickly access the mould area at any time. When the compact cell is opened, the box and tray changers move to the side. The process units for bulk

material and soft depositing are arranged one above the other. This helps the compact cell to keep the automation extremely compact. "Where we have five production cells today, there will be six systems after the changeover to the standardised automation cells", Trachsel reports. Especially in the cleanroom, this significantly increases cost efficiency. Another advantage of standardisation with ENGEL system solutions is uniform control logic across the entire production cell. Robots and other automation units by ENGEL are fully integrated into the injection moulding machine's CC300 control unit. This allows the entire process to be set up and monitored using the machine display. Production staff do not need to familiarise themselves with a different control philosophy for the automation. Given the trend towards ever greater complexity in production processes, this feature is becoming increasingly important. Simple operation reduces the risk of errors and makes it even easier to produce consistently high quality.

Digitalisation drives trend towards servo-electric moulds

The compact cell was already demonstrated at the K show with a medical application. Housing parts for medical devices were manufactured on an e-motion injection moulding machine. The technological



Ypsomed is expanding. Most recently, a new production plant was built in Schwerin and equipped with all-electric ENGEL e-motion injection moulding machines.

innovation in this application lies in splitting the injection moulding process into two components with the aim of achieving shorter cycle times. Since the wall thickness of the cylindrical devices cannot be reduced for stability reasons, the two-component process is the



“Where we have five production cells today, there will be six systems after the changeover to the compact cells.”

*Marlon Trachsel,
Process Manager for Production Technology, Ypsomed*

only available option for achieving shorter cooling and cycle times. In an 8-cavity mould using Vario Spinstack technology by mould maker Hack Formenbau, and featuring a vertical index shaft with four positions, the basic body is first moulded from polypropylene. The second position is used for cooling while another layer of polypropylene is injected at the third position. "Two thin layers cool down faster in total than one thick layer," explains Christoph Lhota. The parts are removed from the closed mould at the fourth position parallel to the injection moulding process, making an additional contribution to achieving a very short cycle time. The two-component precision mould has a fully servo-electric drive in this application and uses a software programme newly developed by ENGEL. This ensures that the servo-electric movements – for example, the core-pulls – can be controlled in the same way as those of hydraulic systems. This means that the user themselves can program the servo-electric movements without the need for additional qualifications. The software sees ENGEL paving the way for increased use of servo-electric moulds. Medical technology is the pioneer for this trend. Reasons for the use of servo-electric moulds include the particularly high precision of the movements, the complete absence of oil and, increasingly, the digitalisation strategy.

"Servo-electric motors offer more possibilities for sensitive monitoring of quality-critical process parameters so that faults, downtimes and pending maintenance work can be detected at an early stage", explains

Gunnar Hack, managing partner of Hack Formenbau. At the K show, the Moldlife Sense System by Hack Formenbau demonstrated the huge potential for digitalisation of mould technology. Just like intelligent assistance systems such as ENGEL's iQ weight control and iQ flow control provide assistance for

injection moulding machines, it will also be possible in the future to counteract critical conditions in the mould before rejects are produced or damage occurs due to wear.

Leveraging the opportunities offered by big data and artificial intelligence to greater effect

Smart assistance and artificial intelligence are increasingly finding their way into injection moulding production. While the system worlds of the injection moulding machine and the mould have been separate so far, it will be possible in future to merge the data worlds. This is also a major topic at Ypsomed. Standardisation has already been incorporated into the company's digitalisation strategy. In order to increase the opportunities offered by big data and artificial intelligence to greater effect, Ypsomed is working on increasingly linking the IT systems of the individual departments in the company. "The volume of data generated is increasing, but the use of the data is not yet", as Uwe Herbert, Ypsomed's IT Manager, made clear at the ENGEL med. con medical technology conference in February. "If we leverage this potential more effectively, we can further improve product quality while at the same time boosting the efficiency of the production processes." ■



Picture: Samaplast

The first tie-bar-less machine was delivered to Samaplast in 1990. This type of machine has become well established at Samaplast even in cleanrooms.

Tie-bar-less technology

for more efficiency and safety in the cleanroom

Originally developed to fix individual cables or entire cable harnesses, cable ties have long since become universal fasteners that we encounter in all areas of life and work. The design and functional principle of cable ties has even been adapted for medical technology. Samaplast in Switzerland uses ENGEL's tie-bar-less injection moulding machines in the cleanroom to produce connecting elements similar to cable ties for closing the sternum after open heart surgery.

If it were not for the needle at the flat end, the injection-moulded part lying on the conference table at Samaplast's headquarters in St. Margrethen would at first glance appear to be an ordinary cable tie. At the end of the day, doctors are also craftsmen," says Stefan Okle, CEO of Samaplast, jokingly and explains that the idea for this product, dubbed ZipFix, actually came from a heart surgeon. It was finally developed by DePuy Synthes – a Johnson & Johnson Group company – in collaboration with Samaplast. Since being launched in 2011, ZipFix fasteners have been used in more than 100,000 thorax operations.

Cutting through and re-closing the sternum always entails risks. The chest protects vital organs and has to withstand very high pressures – when sneezing, for example. Until the 2010s, closing the sternum with wire loops was standard practice in operating theatres. According to studies by DePuy Synthes, the plastic implant made of biocompatible PEEK offers greater patient safety than wire. In stress tests the material has proven to be more fatigue-resistant and more durable than wire. In addition, ZipFix does not cut into the bone so easily due to the larger contact surface. And the innovation makes the surgeon's work easier. The



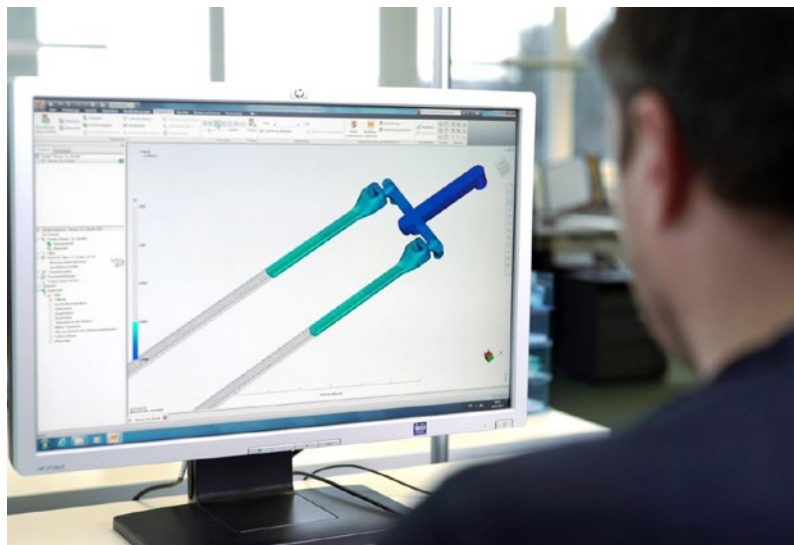
ZipFix resembles an ordinary cable tie at first glance. The connecting elements are used to close the sternum after open heart surgery.

curved needle can easily be pushed through the tissue between the rib arches to thread in the ties. Once all ZipFix elements are in place, the needles are cut off, the tie ends are pulled through the locking heads, secured and the protruding ends are cut off using a cutting instrument specially developed for this purpose. Depending on the anatomy of the patient, three to five ZipFix elements are used per surgery. As with a conventional cable tie, the orientation of the ribbed surface structure in the head element and along the tongue prevents the connection from loosening or even detaching. When tightened, there is another difference to a conventional cable tie: in the ZipFix, the head element lies on the inside of the loop facing the tissue. This detail prevents the fasteners from being permanently visible through the skin as small elevations along the sternum. The fasteners are not usually removed, even though the sternum grows back together over time.

Moulding ultra-fine structures with high precision

Of all the medical products made of plastic, implants pose the strictest requirements for the manufacturing process. As a contract manufacturer, Samaplast specialises in clinically clean products and operates three cleanrooms for injection moulding processing in St. Margrethen in the east of Switzerland.

ZipFix is produced in an ISO class 7 cleanroom on an ENGEL e-victory hybrid machine with electric injection unit and servo-hydraulic, tie-bar-less clamping unit in cleanroom design. The needles are inserted manually into the multi-cavity mould, which Samaplast has produced in its own tool shop, and overmoulded with PEEK. For this purpose, they are first rinsed with



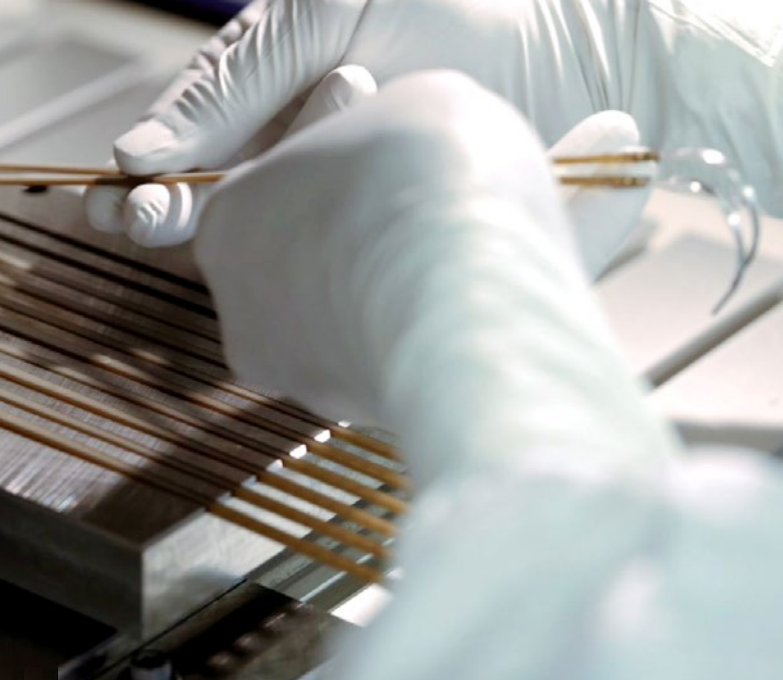
For many customers, Samaplast is not just a contract manufacturer, but also a development partner.

ultra-pure water in an airlock cleaning system, dried and fed directly from the cleaning chamber into the cleanroom. After the injection moulding process, the ZipFix elements are removed by an employee, visually inspected, measured, laser-marked, and packed in sterile packaging.

"The important thing is to precisely mould the surface structure with the fine ribs, otherwise the fasteners will not work reliably", says Boris Scheffknecht, process manager and quality officer at Samaplast. "We need to be able to positively rely on the precision of the injection moulding machines." Two main factors contribute to this: in the tie-bar-less e-victory injection moulding machine, the central Flex-Link keeps the two halves of the mould exactly parallel, even under clamping force, while at the same time the force dividers located behind the moving platen distribute the clamping force evenly across the parting line. "Even when using multi-cavity moulds, this results in consistently high part quality", explains Franz Pressl, product manager for the tie-bar-less e-victory and victory machines at ENGEL.

However, the decisive factor for choosing tie-bar-less injection moulding machines was the fact that the machines are used in the cleanroom. "The barrier-free clamping unit offers enormous advantages for the cleanroom", Okle stresses. "Tie-bars are always potential dirt carriers."

In order to reliably rule out contamination with lubricants, the e-victory's hydraulic system is hermetically sealed. Samaplast uses only food-approved H1 oils, which are delivered to the ENGEL plant for the first fill before machine acceptance. Cleanroom and hydraulics are not mutually exclusive for Samaplast. Fully hydraulic ENGEL victory machines are also used in Samaplast's



After injection moulding, the ZipFix fasteners are tested for quality and laser-marked.

cleanroom. The fact that investments have recently been made in e-victory hybrid machines is attributed to the greater injection precision. "We can achieve a stable process faster," says Scheffknecht.

Clamping unit thoroughly tested

In 1989, ENGEL was the first injection moulding machine manufacturer in the world to come out with a tie-bar-less clamping unit. Just one year later, the first tie-bar-less machine – a 50-tonne unit – was installed at Samaplast. "Our technical manager at the time was totally passionate about technology. He immediately understood the innovative principle and quickly recognised the vast potential of tie-bar-less technology," says Okle, who also reports that some other employees were sceptical about the new design principle. "There was a lot of measuring and experimentation with the moulds going on back then. The new tie-bar-less machine was really

thoroughly tested," says Okle. It passed the test, and soon was established in the company. Of the 28 injection moulding machines at the location today, which are divided between the three cleanrooms and two production areas for technical products, only four have tie-bars. The first tie-bar-less machine from 1990 was replaced only two years ago. By then it had produced many millions of housings and caps and closures for aerosol inhalers.

As a contract processor Samaplast needs flexible machinery. The spectrum of clamping forces ranges from 25 to 400 tonnes. All of the machines are equipped with a robot. A few individual applications run for several weeks at a time, while only a few hundred of some other products are needed each year. This means frequent mould set-ups, and here, too, tie-bar-less technology comes into its own. "We integrated one of our cleanrooms into the existing building, which is why it is particularly low", explains Urs Edelmann, production manager at Samaplast. "There is not enough space above the machines to mount the moulds from the top. This can only be done from the side, which the tie-bar-less machines design is perfect for." Samaplast uses mobile cranes for mould handling. ENGEL equips larger machines with a swivel arm mounted next to the clamping unit as a factory-fitted feature for Samaplast. The extra freedom of movement in the mould installation space makes it possible to mount very large moulds on comparatively small injection moulding machines. This is a further efficiency factor, which is especially beneficial in cleanrooms. "The smaller the machine, the lower the emissions", explains Pressl. This effect is particularly noticeable with multi-cavity



Picture: SpineWelding

Resorbable implants

Implants are one of Samaplast's specialties. The growing field of resorbable implants based on polylactide (PLA) offers two further examples.

Samaplast customer SpineWelding from Schlieren near Zurich recently secured FDA approval for its Elaris Pedicle Screw System. The innovative screw system is used to stabilise spinal segments. For this purpose, Samaplast produces bioresorbable pins made of PLA, which are used to fix the screws in the bone. The pins are inserted through the cavity of the screw and melted with ultrasound so that the PLA emerges at the end of the screw and firmly connects the screw to the bone – much like a screw lock used



Swiss-Austrian teamwork, from left to right: Markus Schertler (ENGEL Switzerland), Boris Scheffknecht and Urs Edelmann from Samaplast, René Okle (ENGEL Switzerland), Franz Pressl (ENGEL Austria) and Stefan Okle from Samaplast.

moulds. This is because the clamping force required for the injection moulding process is often significantly lower than the clamping force required for a tie-bar machine to clamp the large mould.

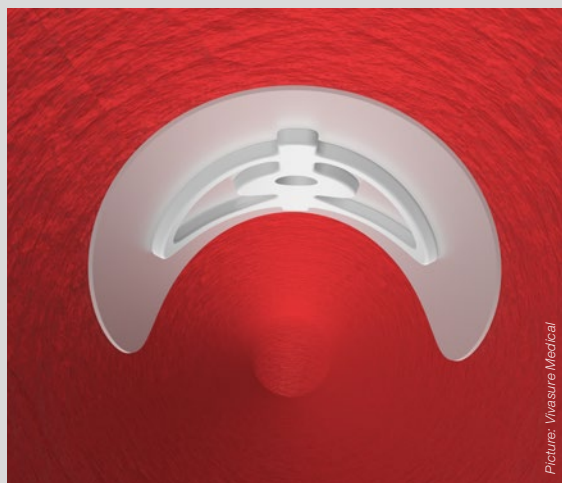
In terms of mould size, an eight-cavity mould for dental implant packaging catches the eye during a tour of the plant. This actually fully utilises the mould mounting platen area on the 120-tonne tie-bar-less machine right up to the edge. If you wanted to mount the mould on a tie-bar machine, the machine would have to be much larger. And the robot for part removal of the containers would be unable to access the cavities directly from the side. At the same time automatic part removal from the top would be totally impossible due to the low headroom.

In the case of ZipFix elements that require manual work

steps, the tie-bar-less technology enhances ergonomics. "In a protective suit and with gloves, you are happy if you don't have to bend down through the tie-bars," says Edelmann.

Over the past 30 years, the special features of the tie-bar-less injection moulding machines have repeatedly won over the younger employees at Samaplast. But technology facts are only one side of the coin. The human factor, cooperation with the mechanical engineering partner, is just as important for CEO Stefan Okle. "Teamwork with ENGEL Switzerland and the Medical division in Austria works very well", Okle emphasises. "They are always receptive to our individual requirements, and the ENGEL team here on site also has an in-depth understanding of medical issues." ■

by tradesmen. But unlike when screws are used in the skilled trades, these do not need to be permanently retained in the body. PLA offers the advantage that it is broken down by metabolism into the body part. Samaplast and its customer Vivasure Medical in Galway, Ireland, also use this material property to close arteries – for example, after procedures involving a catheter. This is a polylactide-based foil system that is inserted and unfolded via the catheter. The foil attaches itself to the inside of the artery wall and reliably seals the opening. This is faster and easier than suturing and is also safer for the patient," says Stefan Okle of Samaplast.



Picture: Vivasure Medical



Maximum quality with low unit costs

Polesie is synonymous with high-quality and safe toys beloved by children of all age groups in Belarus, Russia and more than 70 other countries. Founded in 1998, PP Polesie JV, Ltd. has designed its own products in-house from day one. At its headquarters in Kobrin in the south-west Belarus, the company manufactures products using 98 ENGEL injection moulding machines.

ENGEL delivered the first injection moulding machine, a victory 500/90, to the Polesie plant some 14 years ago. Since then, it has been helping the toy manufacturer to address the challenge of combining high product quality and cost-effectiveness. A key factor in that process has been energy efficiency. This tipped the scales in favour of ENGEL over the long term. "We compared the energy consumption of three technically comparable injection moulding machines from different suppliers in Europe and China", reports Boris Banderuk, head of Polesie's Injection Moulding Maintenance Department. "The results conclusively pointed in ENGEL's direction. The victory 500/90 machine produced 7 to 8 percent more parts during the test period and consumed between 11 and 19 percent less energy than the other two test candidates." Almost 100 ENGEL machines are now in operation at the facility in Kobrin. These include hydraulic victory machines, hybrid machines from the

e-victory series, all-electric e-motion machines and large dual-platen machines from the duo series. The machines cover a total clamping force range of 280 to 9,000 kilonewtons.

60 mould changes in just a single shift

Accounting for 82 of the production units at the plant, tie-bar-less victory and e-victory machines make up the lion's share. The tie-bar-less technology rapidly proved to be another crucial factor when it came to boosting efficiency. This technology makes it possible to set up moulds at extra high speed – an absolutely pivotal criterion in toy production. "We have six staff members in the injection moulding shop, who carry out up to 60 mould changes during one shift", Banderuk says. "Thanks to the open access to the mould area, we can even easily and quickly set up large moulds with protruding core-pulls, which is an enormous help





in our pursuit of high efficiency across all areas."

The moulds can be brought into the mould area from any angle, even without an overhead crane, given that some production areas have low ceiling heights. This design is also beneficial in terms of automation. On tie-bar-less machines, the robot arm can also reach the cavities directly from the side without having to circumvent any obstacles. In addition, it is considerably easier and faster for the machine operators to carry out all their work tasks, such as cleaning, directly on the mould when they no longer have to manoeuvre around tie-bars.

Large moulds on a small machine

Because the mould mounting platens on tie-bar-less ENGEL machines can be fully used right up to their edges, the tie-bar-less technology makes it possible in many cases to use a smaller machine. This, in turn, reduces the consumption levels that factor into unit cost. A striking example is the production of bicycle frames. "The mould has three long core-pulls that extend past the platens, yet it still fits on a 400-tonne victory machine", Banderuk explains. "When using a machine with tie-bars, we'd need significantly higher clamping force just to ensure the tie-bar distance was large enough to mount the mould." The bicycle frame is particularly demanding in terms of precision during the injection moulding process – and the ENGEL victory meets these

needs with ease. Its excellent platen parallelism provides particularly even distribution of the clamping force and the best possible protection for the mould.

Service ensures high degree of efficiency

"ENGEL machines are highly reliable", Banderuk stresses. "But where we benefit the most is in our long-standing and successful partnership with ENGEL. We also receive excellent after-sales support. The service technicians live locally, are all highly skilled and have a great deal of experience with injection moulding processes. We get ultra-fast feedback to all our questions and receive express deliveries for spare parts in emergency situations. This ensures that we enjoy a high degree of efficiency on our shop floor and helps minimise unexpected downtime." ■



Pictures: Polesie

Belarusian firm Polesie uses almost 100 ENGEL injection moulding machines to manufacture a wide range of toys and leisure products.





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