

Injection

The magazine from ENGEL for the plastics industry

April | 2022



Constant monitoring:

energy and resource efficiency

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and Gerhard Dimmler

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Dr Stefan Engleder
CEO, ENGEL Holding

Sticking together

Recent weeks have shown that some events can turn the world on its head practically overnight. It has taught us by necessity that every conceivable scenario – and even every scenario we might have thought inconceivable – has the potential to become a reality. That makes a strong sense of togetherness more important than ever. ENGEL Group employees right across the globe are currently demonstrating that spirit in impressive style. At the production plants and many subsidiaries, aid campaigns for people affected by the war in Ukraine were launched in next to no time. We are pleased to see how generously so many people are getting involved, and how customers and partners are also supporting our initiatives.

What, then, can a customer magazine like Injection give you, our customers, in these uncertain times? The articles we have put together will give you an insight into what we at ENGEL fundamentally stand for and the principles that guide our actions – irrespective of how broader circumstances may change going forward.

Governing everything that we do as a family-owned business on a day-to-day basis is our desire to incrementally improve living standards for the generations to come. This issue highlights a number of customer projects in which we are achieving exactly that goal by working together with you – from a microbiologically sealed dosage system for eye drops to front fascia panels with integrated sensors for electric vehicles. Plastic parts like the ones you produce make our modern way of life possible in the first place, laying the foundation for future generations in turn to enjoy decent, healthy lives.

*Yours,
Stefan Engleder*

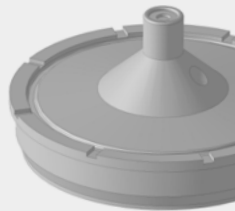
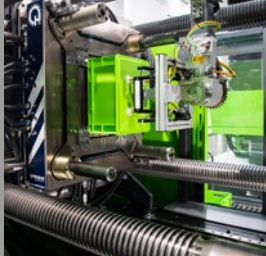
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Greiner Packaging has developed a PP yoghurt cup at a material saving of 20 percent.

The aim: Climate neutrality.

Greiner Packaging, based in Kremsmünster in Upper Austria, has been producing plastic packaging for over 60 years – with a passion and a drive for continuous improvement. One key motivator for the company is sustainability. As packaging becomes lighter all the time and fewer raw materials are required, production processes are having to meet fresh challenges. Thanks to e-speed injection moulding machines from ENGEL, Greiner Packaging is reducing the wall thickness of its food containers while enhancing efficiency.

"The specification was to reduce weight as well as carbon emissions while maintaining container sturdiness and improving recyclability," says Andreas Ecker, Application Engineer at Greiner Packaging. The client – Austrian dairy Ennstal Milch – already applies high standards of sustainability in its thin-wall mono-material cups for Greek yoghurt produced from PP using the IML process. Striving for still greater things, however, the manufacturer of dairy products turned to Greiner. Now the yoghurt cups are produced here using 20 percent less material than previously.

"We managed to reduce the container thickness by 0.1 millimetres to 0.3 millimetres. In-mould labelling supports the lightweight trend," says Ecker. Despite being just under 50 micrometres itself, the label provides extra stability. Extensive product tests revealed no disadvantages, neither in filling, nor in logistics, nor

for the consumer. Even when filled, the new-design yoghurt cups can be safely stacked; when consuming with a spoon, they can be handled with no discernible difference. The cups are suitable for hot filling up to 85 degrees Celsius as well as cold filling. This is important for Greiner as Ennstal Milch and Greek yoghurt are not the only beneficiaries of the new thin-wall range; the new lightweight IML cups are produced in different forms for many other products.

For us, the energy efficiency of the machine was a key factor in our decision. We are committed to cutting consumption year by year.

Engelbert Pranzl, Plant Manager at Greiner Packaging in Kremsmünster

"Injection moulding technology enables considerable variance of shape, with very low production tolerances," says Plant Manager Engelbert Pranzl. Sealing edge or base, round or square – every food producer has its own specific design, and Greiner needs to be able to adapt.

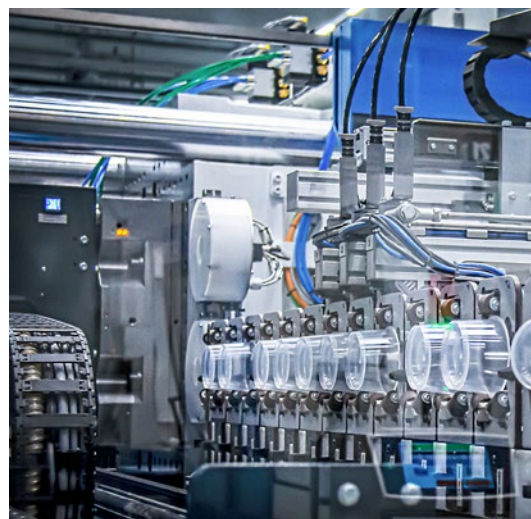
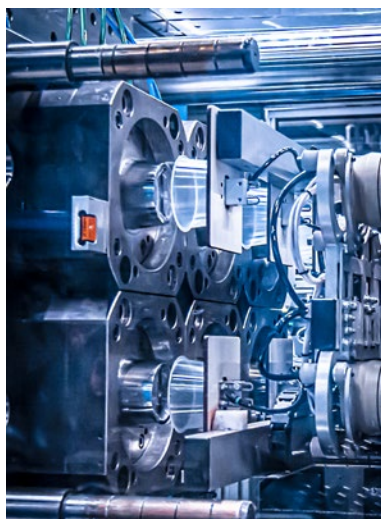
Hydraulic benefits maximised

Adjustments to the production process have made it possible to reduce wall thicknesses in food containers. With this in mind, Greiner invested in a new e-speed 380 injection moulding machine from its long-standing engineering partner ENGEL. "We turn the hydraulic power of the hybrid machine to our advantage," says Ecker. "We need extremely high dynamics in the injection stage, which pushed our electric injection units to the limit. For the yoghurt cups, we have a wall thickness/flow path ratio of 1 to 240." With the high level of stress

Engelbert Pranzl (left) and Andreas Ecker (right) from Greiner Packaging



As food packaging becomes lighter all the time and fewer raw materials are required, production processes (with and without IML) are having to meet fresh challenges.



and strain in mind, ENGEL designed its e-speed machines – which combine an electric clamping unit with a hybrid injection unit – specifically for high-speed thin-wall applications. The toggle lever is encapsulated and ensures a high degree of cleanliness. Expansion of the series over the past year has further enhanced the performance of all clamping force ranges. The hydraulic injection unit with electric plasticising drive now delivers even greater performance. It is designed for injection speeds of up to 1,200 mm per second. The machine base and mould mounting platens have also been tailored more closely to the requirements of thin-wall packaging and the use of multi-cavity moulds – both with and without IML. The main goal is to ensure precision of machine movements while achieving durability. In the case of in-mould labelling in particular, repeatability is critical.

Energy efficiency also maximised

The cups for Ennstal Milch are produced automatically in a six-cavity mould. For this purpose, the 3,800-kilonewton machine is equipped with high-speed automation courtesy of Brink. The robot takes the IML wraps from the magazine and places them in the mould.

After injection moulding, it removes the ready-to-use cups, directs them to quality control and stacks them on a conveyor belt. The stacked cups are then packed into boxes. The quality check is performed visually. Greiner's clients insist on zero errors. The machine, automation and quality control are designed for flexibility, so as to ensure the shape of the container and the form of the label can be changed in a short conversion time. Another consistent priority across the spectrum of products and moulds was maximum energy efficiency.

To utilise energy efficiently even in high-speed operations, the e-speed 380 is fitted with an energy recovery system. "For us, the energy efficiency of the machine was a key factor in our decision," Pranzl notes. "Even though we are continually enhancing the performance of our production systems, we are committed to cutting consumption year by year." Greiner Packaging appointed a dedicated energy efficiency manager to monitor all energy efficiency projects, paying particular attention to production

The requirement was to reduce weight as well as carbon emissions while maintaining container stability and improving recyclability.

Andreas Ecker, Processing Engineer at Greiner Packaging

processes. Within the factory, ageing hydraulic injection moulding machines are gradually being replaced with hybrid and all-electric machines.

Driving development in partnership

ENGEL first delivered an all-electric injection moulding machine to Greiner almost 20 years ago. Since then, Greiner has been closely involved with ENGEL's development of electric drive technology, the two companies acting as development partners on numerous projects. At the top of the agenda at Greiner Packaging is the need to further reduce material usage and carbon emissions in the future. "Our goal is to be a climate-neutral company by 2030," reveals Pranzl.



Find out more about the e-speed

Thin wall expertise from ENGEL



ENGEL worldwide. **Where you are.**

Automation specialist TMA becomes a member of the ENGEL Group

ENGEL has acquired the majority interest in TMA Automation in Gdynia, Poland. This strategic investment sees ENGEL reinforce its leading position in the field of injection moulding process automation. The two businesses have already cooperated closely for many years on numerous customer projects. One regional focus is Poland and the neighbouring eastern European countries. One of the areas in which TMA specialises is the automation of in-mould labelling processes in the medium performance range. "In TMA, we have acquired an accomplished source of expertise; an organisation that is very well acquainted with the specific needs in this performance segment and is ideally suited to serving those needs through customized solutions," says Dr Stefan Engleder, CEO of the ENGEL Group. In the high-performance segment, ENGEL will continue to cooperate with its long-standing partners for IML automation. TMA Automation will remain independent under the ENGEL Group umbrella and continue to be an independent market player in the future. The two company founders, Marek Łangowski and Piotr Orlikowski, will continue to manage the company. Walter Aumayr, Vice President for Automation and Peripheral Units at the ENGEL Group, will provide support to the management team as a third managing director. In cooperation with the strategic investor, ENGEL, TMA Automation can push forward with its growth targets. A site has been purchased in Gdansk in order to start building a new office and production facility in the near future.

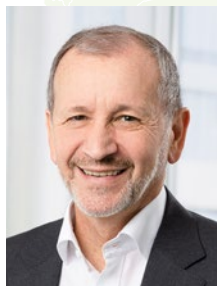


Left to right: Piotr Orlikowski and Marek Łangowski, Stefan Engleder and Walter Aumayr

ENGEL Mexico appoints new Managing Director

Emilio López has been appointed as the new Managing Director of ENGEL de Mexico SA de CV. He brings extensive experience of sales and management in the plastics and chemicals industries to his new role. After studying plastics engineering in Germany, he divided his time between Germany and Latin America. He is working to strengthen after-sales services while expanding the training programme for clients in Mexico and other Latin American nations. In the future, Mexico will be

"In the future, Mexico will be a key service hub for ENGEL's customers in Latin America. We are expanding our training programme further."



Emilio López is the new Managing Director of ENGEL de Mexico SA de CV.

a key service hub for ENGEL customers in Latin America. Mexico is ENGEL's largest Latin American market, offering significant potential across all target sectors. ENGEL is able to respond to this dynamic development through its two established sites in Mexico. The headquarters of ENGEL de Mexico are in Querétaro, near Mexico City. ENGEL runs its own technology centre, training centre and spare parts warehouse at the location. In 2019, a second site was established in Monterrey, in the north of the country.

JEC *** FIP *** Plastimagen ***

Intelligent solutions for a sustainable future

The rich variety of trade fairs is back, with many shows again being held in person this spring. And ENGEL will be right there, building a bridge between the physical and virtual worlds. In addition to the machine exhibits at the physical booths, ENGEL's virtual showroom will feature more than 20 machine exhibits with a whole host of challenging applications for visitors to explore regardless of time zone, distance or travel restrictions. Beyond this, ENGEL's virtual world will include technical presentations and virtual tours of the company's Austrian production plants.



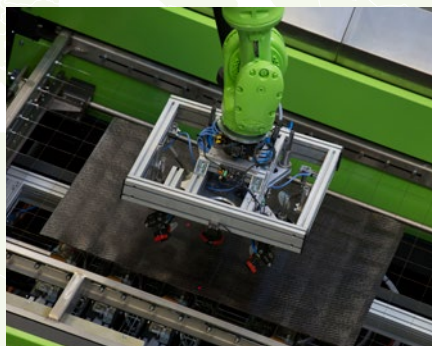
Welcome to the virtual world of ENGEL

JEC World 2022 in Paris

JEC World 2022 will be a platform for every link along the composites industry's value chain. One important part of this chain is forming thermoplastic fibre-composite preforms. The ENGEL organomelt process takes this one step further. Thermoplastic sheets and unidirectional tapes are not just formed, but also functionalised in the same injection moulding step.

At the ENGEL booth, a cell will be producing demo components made of continuous fibre-reinforced polyamide. The cell's main component will be a tie-bar-less victory 50 injection moulding machine equipped with a viper robot for handling preforms and





FIP in Lyon

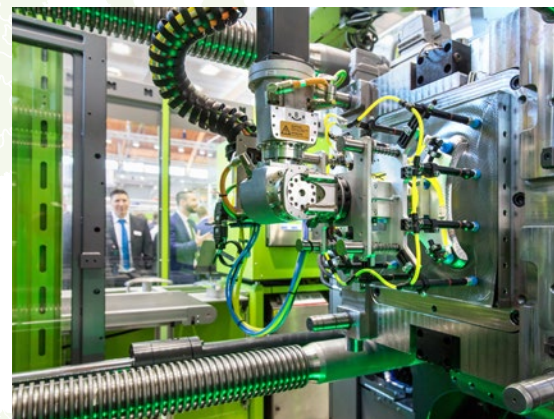
All-electric efficiency was also in the spotlight at the FIP trade fair in Lyon, France. Breakfast boxes made of polypropylene were manufactured on an e-mac 180 injection moulding machine with an integrated viper 20 robot. In the e-mac, ENGEL offers an all-electric injection molding machine that combines high power and energy efficiency with an extremely compact machine design for comparatively little capital outlay. Among the all-electric injection moulding machines on the market, the new generation e-mac machines are some of the most compact worldwide. Thanks to an optimised toggle lever geometry, the e-mac 180 on show at FIP, for example, is 450 mm shorter than the previous 180-tonne version, without reducing the opening stroke. All movements of the ENGEL e-mac – including the nozzle movement and ejection – are performed by servo-electric drives. This means that the machine achieves very high overall efficiency. For precision applications with cycle times of more than four seconds, the e-mac is the most economical solution across many different applications in the field of all-electric injection moulding machines.

finished parts, and a double-sided, vertical ENGEL IR oven. It is provided by Brightlands Materials Center, an industry-focused Dutch R&D centre whose work revolves around sustainable polymer material solutions. The composite blanks are heated in the IR oven, placed and formed in the mould, and overmoulded with PA. ENGEL offers its IR ovens in various designs so that they can be placed extremely close to the mould. The ovens and the robots are integrated with the IMM's CC300 control unit and can be centrally controlled via the machine's display. The victory machine's biggest advantage in this application is its very fast hot handling. Barrier-free access to the mould area makes it possible to position the IR oven very close to the mould. And the robot can take the shortest path to the mould, which means even very thin preforms can be processed.

Composite parts created using the organomelt process combine light weight with strong impact capabilities. This technology, which is in series production in the automotive industry, is suitable for both organic sheets and unidirectional fibre-reinforced tapes with a thermoplastic matrix. Using purely thermoplastic material base enables particularly efficient and automated manufacturing processes, because reinforcement ribs or assembly elements, for example, can be injected after forming in the same process step. At the same time, the organomelt process helps to enhance sustainability, with the consistent thermoplastic approach a crucial ingredient in developing recycling strategies for composite parts.



Plastimagen in Mexico City



Flexibility and efficiency were the focus in the development of the reel-to-reel IMD application that ENGEL exhibited at Plastimagen in Mexico City in collaboration with system partners Leonhard Kurz, Schöfer and Isosport Verbundbauteile. To manufacture complex, three-dimensional sample parts, the duo 350 injection moulding machine with an integrated viper 20 robot uses two process technologies at the same time: foilmelt and foammelt. The latter was included primarily with a view to flexibility. In a one-step process, the system thermoforms, back-injects and punches different decorative foils from reel to reel in the mould in quick succession. The foammelt structural foam moulding, which uses the MuCell physical foam injection process, offers maximum material and energy efficiency. The wide range of applications covered by the production-ready process combination is remarkable. It is suitable for visible components in the vehicle interior, in electronic devices, and for household appliances, among other things. Multi-layer film systems with a lacquered surface as well as structured, backlit or open-pore systems such as wood and, in addition, films functionalized with capacitive electronics can be processed from the roll. Besides PP, ABS, PC or PC/ABS and recycled materials can be used for back injection.

Fraunhofer commissions two ENGEL systems for lightweight construction development

The opening of an extension building has seen the Fraunhofer Pilot Plant Centre for Polymer Synthesis and Processing PAZ, located near Halle (Saale), Germany, strengthen its research into and development of lightweight applications with thermoplastic composites. Two state-of-the-art production cells for the integrated and fully automated production of fibre composite functional components are now available for customer projects. Both systems come from ENGEL.



A trio who will work closely together in the future (left to right): Prof. Peter Michel (Head of the Polymer Applications Business Unit at the Fraunhofer IMWS and responsible for polymer processing at the Fraunhofer PAZ), Claus Wilde (Managing Director, ENGEL Deutschland) and Franz Füreder (Vice President, ENGEL automotive).

"ENGEL combines a great deal of expertise in the field of lightweight construction involving thermoplastic composites with many years of experience in injection moulding and the automation of series production processes. This is exactly what is required to develop highly cost-effective series production processes for the automotive and aerospace industries," said Franz Füreder, Vice President, ENGEL automotive, addressing the attendees at the opening ceremony. "The two new ENGEL systems at the Fraunhofer PAZ make it possible to combine thermoplastic-based composite processes with a variety of injection moulding technologies, such as foaming or coining."

Insight into the entire value added chain

From monomer to polymer synthesis and plastics processing on a pilot scale to the tested series component, Fraunhofer PAZ develops new production

processes and technologies along the entire value chain of lightweight components. This interdisciplinary approach and its scale make the research institute unique throughout Europe. Thermoplastics-based lightweight construction is one development focus.

ENGEL, too, is one of the leading drivers behind the increased use of thermoplastics in lightweight applications. There are two main reasons for this. First, thermoplastic composites allow for cost-effective series production. Second, these materials are very easy to recycle within the material loop.

v-duo and duo flexible to use

ENGEL delivered the two production cells as integrated and fully automated system solutions. An ENGEL v-duo 700 vertical machine was combined with an ENGEL easix articulated robot and a large IR oven – also from ENGEL's in-house development and production. An ENGEL duo 900 injection moulding machine with a horizontal clamping unit and two ENGEL easix robots is the heart of the second production cell. A vertical IR oven is located above the clamping unit, allowing particularly fast handling of hot thermoplastic sheet and blanks made of UD tapes. ENGEL has also integrated injection moulding technology packages, for example, for physical foaming.

"Fraunhofer made a conscious choice to obtain two machines with different designs, both of which are widely used in the global automotive industry," reports Claus Wilde, Managing Director of ENGEL Deutschland. "For each component, this allows an individual evaluation of which machine type and technology enables the most efficient and economical production process." ENGEL and Fraunhofer PAZ are planning to cooperate closely on various development projects in the future as well as taking part in joint events on the topic of thermoplastic composite lightweight construction at the Fraunhofer PAZ in Schkopau. ■

A wealth of
technological
expertise in
lightweight
construction



SPE Grand Award honours

innovative application on the vehicle exterior

The BMW Group has launched a new ENGEL production unit at its Landshut production plant. The kidney-shaped panels on the front fascia of the electric BMW iX are produced at the facility in a cleanroom atmosphere. Both the BMW Group and ENGEL are breaking completely new ground here, prompting the International Society for Plastics Technology (SPE Central Europe) to honour both with the SPE Grand Award 2021.

Previously serving as the radiator grille, this characteristic design feature of all BMW models has taken on a new role following electrification of the drivetrains. The kidney-shaped panel protects the camera and a series of sensors for assisted and, in the future, autonomous driving. The new function means that both the design and the manufacturing process for the kidney-shaped panel has changed fundamentally. In an integrated process, a heatable functional film is back-moulded with polycarbonate and flood-coated with polyurethane. This is a combination of processes that ENGEL also offers branded as clearmelt. "We knew from the start that this process combination would enable automotive designers to think in a completely new way," says Michael Fischer, Head of Business Development Technologies at ENGEL AUSTRIA. "With applications already existing for vehicle interiors, the kidney-shaped panels for BMW's new electric models represent the next step. This is the first time that the combination of film back-moulding and polyurethane flood-coating is being used in the series production of functional components on the exterior, where they are exposed to particularly high stress." The sensitive electronics are well protected under the scratch-resistant polyurethane surface. The high gloss level and depth effect, which even a thin coating of polyurethane achieves, convey a very elegant impression.

Processing three materials in a single step

ENGEL is a system supplier for this demanding project with responsibility for the complete production cell. In terms of process integration and automation, the cell can fulfil particularly exacting requirements. The production cell integrates an duo combi M injection moulding machine with a horizontal rotary table, two large articulated robots for handling the films and parts, a film cleaning system, an inline quality-control station and peripheral units including polyurethane technology. The injection moulding machine's clamping unit and the robot work areas are encapsulated over a length of six metres and a height of more than four metres to achieve an ISO class 7 cleanroom. The

special feature: the cleanroom above the injection moulding machine has a sliding ceiling which can be opened for mould changes and other work in the mould area. All work steps in the cleanroom are automated. The robots also unpack the function films and pack the parts.

A greyroom is adjacent to the cleanroom. This is the work area for the production employees, who transfer the airtight boxes with the functional films to the cleanroom production system and the packed moulded parts to the internal logistics team for downstream processing.

Virtual reality ensures future-proof investment

Another first: ENGEL virtually visualised the entire production unit as early as in the RFQ phase. "In the 3D simulation, we were able to guide

our customer through all the production cell areas, see how the robots interacted, and assess the ergonomic aspects before construction of the cell had even begun," reports Walter Aumayr, Vice President Automation and Peripheral Units at ENGEL AUSTRIA. "This is the future. Virtual reality means that we can give our customers even better investment security."

As the system solution provider, ENGEL is the central point of contact for customers as well as for system components created with partners. Partner companies for the production cell for the BMW's new kidney-shaped panels include Hennecke from St. Augustin, Germany, for polyurethane processing, and Petek Reinraumtechnik from Radolfzell, Germany. ■

ENGEL clearmelt:
scratch-resistant,
self-healing
surfaces with
visual depth effects





Gerhard Dimmler (left) and Stefan Engleder (right)

Constant monitoring: energy and resource efficiency

In spring, Gerhard Dimmler was appointed to the ENGEL Group Board as CTO, having previously served as Head of Research and Development. In this Techtalk, Gerhard and CEO Stefan Engleder discuss their plans, challenges and experiences.

Injection: Gerhard, how has your view of ENGEL's development activities changed with your new position?

GERHARD DIMMLER: The focus of my work so far has been on product development and ensuring we make the most of the synergy at our disposal in the development arena. For example, there is the synergy between our machine range and the underlying technologies, such as control technology and drive technology, or between Development and other departments, such as Purchasing. In my new position, I now also have a degree of responsibility for the company as a whole, which it is very exciting to be entrusted with.

What makes it so exciting to be entrusted with that?

DIMMLER: THE Development team cannot turn ideas into innovations on its own. You always need the entire business for that. My focus has also

become broader in terms of the activities I work on. So, for instance, digitalisation and the circular economy are now part of that mix, and my aim is to ensure that we harness the new opportunities that come with them as successfully as we did when faced with change in the past. In the Development department, we always had a lot of creative licence and the trust of company management. None of that will change going forward.

STEFAN ENGLEDER: Our good working relationship is another thing that will not be changing. It started almost 20 years ago. We were the young upstarts. At that time, we both had specific visions, and over the years we have worked on those areas – albeit from different positions. We have made great progress in implementing many ideas, precisely because we have made use of the latitude we were given. Of course, we also made mistakes along the way, and that was important too.

DIMMLER: In the meantime, we have both grown a bit older, and we are now each in a position to give others that leeway and to let them make mistakes. Now it is us who are the ones looking to be surprised and won over by crazy ideas and scenarios. Of course, it is also up to us to decide which ideas to pursue and not pursue. That is our responsibility. Even if we have to say “no” once in a while, we have to make sure that we do not dampen the creativity of our development staff, just as we did not allow ourselves to be stifled.

What are the priorities in terms of our development activities moving forward?

DIMMLER: We want to continue to be innovation leaders in our core area of injection moulding but also in new areas such as the smart factory. With that in mind, it is becoming more and more important to look at the big

picture when it comes to development activities – including, for example, in the context of digitalisation. And we are gearing our organisation and our teams towards that.

What exactly do you mean by that?

DIMMLER: It is important and will continue to be important to build on solid foundations. So we are consistently working to develop our machine series, too. The focus over the next few years will be on state-of-the-art process optimisation utilizing our products' and solutions' potential even more effectively. This will involve combining machine control and platforms. Processes are no longer exclusively optimised on the machines – they can also be optimised at a customer's desk or on ENGEL's own premises. In every development effort, energy and resource efficiency are two things that have to be constantly monitored. ENGEL took very early action to focus on these factors, and in the future, the company is aiming to always be able to offer the most energy-efficient solution for the application at hand.

How have the needs of customers changed? And what does that mean for ENGEL?

ENGLEDER: I do not think our customers' needs have changed fundamentally. In the past, as is the case today, it was all about one thing: production reliability. The machines have to be running. Availability, stability, safety and security are the basic requirements. Once those are in place, it is about getting even better and improving performance. So the needs are the same. But the thing that has changed is the solutions for meeting these needs. Our inject 4.0 framework offers new possibilities in that regard, ushering in ideas that were not feasible some years ago. It is important to make sure the new solutions are scalable and do not become overcomplicated, otherwise they will not be used in the real world.

What do you mean when you say scalable?

ENGLEDER: What works in the technology centre also needs to work on the manufacturing shop floor. We work tirelessly on those sorts of considerations. After all, we know that it is a tough task getting from the pilot factory to real-world industrial use – especially with digital products.

We have optimised our machine range over the last few years to achieve the lowest possible energy consumption, and our customers are taking particular notice of that fact at the moment.

Stefan Engleder

Are there any other changes from the customer's perspective?

DIMMLER: Generally, it is a more demanding environment. One reason for this is the trend towards customisation and small batch sizes. A few years ago, a long breaking-in period was still necessary if you wanted to achieve a stable process. Our customers do not have as much time and resources these days, and we want to offer solutions that take that into account.

ENGLEDER: Customised system solutions are also increasingly part of the picture. We help our customers to build out their unique selling propositions and strengthen their competitive position. This does not work with off-the-shelf solutions – and certainly not when cost effectiveness is key as well. That is why we have been focusing for many years on optimising our workflows and processes to accommodate these unique orders. We also use digital solutions at ENGEL to help us with this work. The size of our company is an advantage in this context. We can afford to be early investors in new opportunities – not only due to our finances, but also because we have the manpower.

The Development team cannot turn ideas into innovations on its own. You always need the entire business for that.

Gerhard Dimmler

As digital technologies are adopted more widely, companies are becoming increasingly interconnected right along the value chain (i.e. horizontally). At this point, how far are we down that path?

ENGLEDER: Importantly, in the plastics industry, we have recognised the opportunities that come from horizontally interconnected companies. That is a significant source of motivation, because we are still in the early stages of implementation. The process of connecting different companies' portals is not moving as quickly as we had all imagined. This is often not a technical problem, but rather comes from our industry's diverse structure. Many businesses are still very much preoccupied with their vertical solutions. And yet, at the same time, we are currently working on a shared mindset for inter-company collaboration.

DIMMLER: The question is no longer whether we need companies to be horizontally interconnected – instead, it is a case of when we will make that a reality and meaningfully take advantage of it. Just as we optimise a production cell together with the customer today, we will also have to offer the solutions to optimise the value stream in the future. We are preparing our e-connect customer portal for this shift. At the moment, the focus is still on after-sales activities, but that will change. With smart production incorporated more heavily into the system, e-connect will make it possible to evaluate across the entire value chain in the future.

What would be a sensible example of how these solutions could be used, then?

ENGLEDER: We are facing great challenges in the plastics industry, especially in the packaging sector. At the forefront of my mind is climate change and the need to build a circular economy, which we are actively working to advance. We can only solve

*We were the
young startups.
We have made
great progress in
implementing many
ideas, because we
have made use of
the latitude we
were given.*

Stefan Engleder



*We have both
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to let them make
mistakes.*

Gerhard Dimmler



these challenges if we think creatively and enter into partnerships with other companies. The changed framework conditions now automatically bring with them use cases for these horizontal platforms that we had not even thought of a few years ago.

Where do we currently stand in the effort to build a circular economy for plastics?

ENGLEDER: In many individual areas, the technologies for a circular economy are already very advanced. The injection moulding process, for example, is highly compatible with the use of recycled material – and with the help of our intelligent assistance solutions, recycled materials can now be used for demanding applications, allowing for actual recycling rather than down-cycling. The most important thing now is to take lawmakers with us. In Austria alone, there are a slew of different waste laws and no uniform collection systems, meaning we lack the key element required if we want to ensure a closed loop for recyclables. That is why we welcome the fact that the UN is now tackling this issue and wants to develop a global treaty by 2024 to end plastic pollution.

DIMMLER: In creating a circular economy, we have work to do at several levels, which in turn will be conducive to horizontally interconnected companies. First, as well as yielding high-quality recycled materials, the recycling process also has to be energy-efficient. Second, we have to close the loops for different materials so that old margarine tubs are made into new margarine tubs, for instance. On top of that, there are other approaches, and the challenge for us will be to accommodate all these aspects. Rather than looking to one solution, it will be about fitting many small pieces of the puzzle together.

We cannot succeed unless the environment and the bottom line can coexist. Commercially speaking, where specifically do injection moulders stand to benefit from our innovation?

DIMMLER: Energy efficiency is a very important aspect here. With our solutions, for example, we can significantly reduce the amount of energy used to process recycled material. The legal side of things is also important in this context – recycled material can no longer be more expensive than virgin material.

ENGLEDER: We are in an energy crisis, and we have to be prepared that we may be in its grips for a long time to come. We have optimised our machine range over the last few years to achieve the lowest possible energy consumption, and our customers are taking particular notice of that fact at the moment. New systems' ROI is now measured in months rather than years. As a family-owned company, sustainability is part of our DNA across the board. More broadly when it comes to sustainability, what I would like to see is for us to keep having an honest discussion.

What do you mean by an honest discussion?

ENGLEDER: After the plastic bashing period came to an end, we were moving in a good direction. The discussion had become a bit more objective. But now we see solutions that run counter to the goal of a circular economy coming onto the market. That would include packaging that hides plastic behind paper, for instance. I am sure that if we foster an honest debate, we will find the right solutions and won't need packaging solutions that look sustainable but ultimately are not.

The challenges for the plastics industry and the organisations within it are becoming more complex. With circular economy considerations, skills shortages and volatility in the markets, how do you gear up the business to successfully take on these challenges?

ENGLEDER: None of us know where this journey is going to take us or what will happen in the near future. This has been a particularly painful experience we have had to go through in recent weeks. It makes being prepared to be flexible all the more important. Regardless of the size of the company, it needs to be responsive to the circumstances around it. And decentralisation is an important part of that. We have a presence in markets around the world, including in the form of production plants. Our customers have already benefited from this during the pandemic.

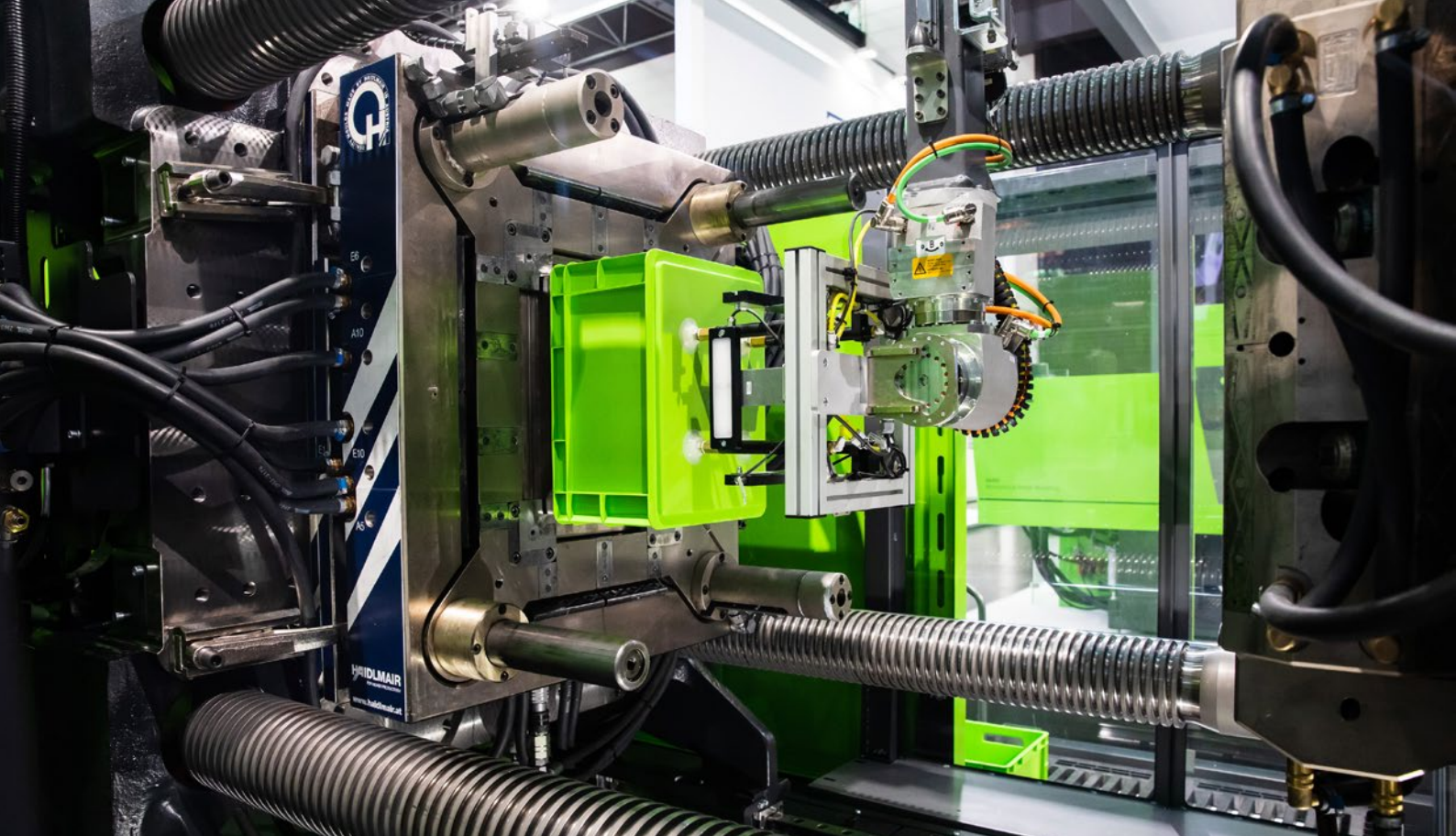
DIMMLER: There was no foreseeing the combination of the recent economic crisis, the pandemic and the war in Ukraine. When I think about how we can deal with this, agile methods come to mind as someone from the development world. How do we need to set up teams that have clear roles and responsibilities, work together, and can act flexibly and quickly? This is the central question and our claim - as a company, as a team and also as an individual employee,

to solve the challenges - which will also still come - quickly, flexibly and successfully.

What is the greatest challenge you have faced to date in your career? Then what strategy did you use to overcome that challenge, and what did you personally learn from it?

ENGLEDER: One of my biggest challenges, which has been with me for many years, is the ENGEL Process Optimisation System (or EPOS for short). We developed this system from a production perspective and have since made it applicable to most areas of the business. Of course, a system like that takes on a life of its own after a certain time, and that is also intentional. After all, you have to let your child go out into the world at some point, too, so they can have their own experiences – and every mum and dad knows how difficult that is. The challenge I see with EPOS now is maintaining its authenticity yet continuing to take the system to the next level. This means we regularly need to strip the system back to its core so that it does not become overly complex. Especially with decentralised structures in place, that is not easy, but it is worth the effort. EPOS will only properly serve its purpose if we all work with it willingly.

DIMMLER: For me, addressing matters that I have little or no idea about is always a major challenge. In those types of situations, my experience has been that I can rely on my team and colleagues, because we have established mutual trust and open communication with one another. This experience has brought me to where I am today in my professional life, and it is something that will also be very valuable for my new role. ■



If the robot enters the mould area while the mould is still undergoing its opening movement, this can reduce cycle time. iQ motion control is the first cross-machine and cross-robot assistance system from ENGEL.

Wanted: early start

Where the injection moulding machine and robot coordinate their movements, this reduces the cycle time in many applications. This is because the robot arm can already move into the mould area while the machine is still moving – even though the mould is not yet completely open. iQ motion control now enables a safe early start combined with fully automatically optimised path planning.

There are a whole host of different moving “parts” inside an injection moulding cell, some of which have a crucial effect on the injection moulding process’ cycle time. These include the robot’s movements in and out as well as the mould’s opening and clamping times. If the robot only starts moving once the mould is completely open, cycle time is wasted. With ENGEL acting as the single supplier of the injection moulding machine and automation system, every component within the production cell accesses the same control platform and database. This, in turn, provides the best conditions for minimising cycle times overall.

Optimised path planning saves cycle time

Linear robots move from one point to another. These individual points are determined during the teach-in process. To achieve an ideal path, the system operator has to determine the trajectory manually, setting a large number of points to optimise the paths to be travelled. An optimised path plan has already been implemented on the iQ motion control smart assistance system,

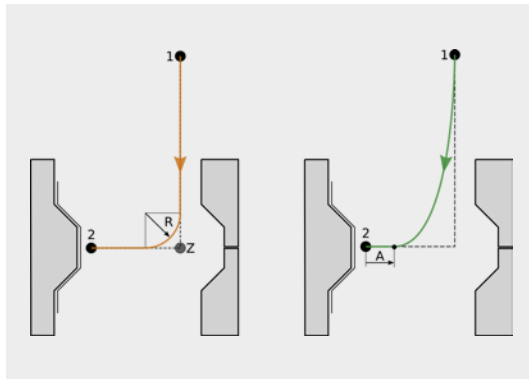
which is part of the standard equipment that comes with all new viper linear robots. The linear robot calculates its path on its own, meaning significantly fewer parameters have to be set or positions taught in. This substantially reduces the injection moulding process’ cycle time as well as the time required for teaching in.

Robot and machine reach end position simultaneously

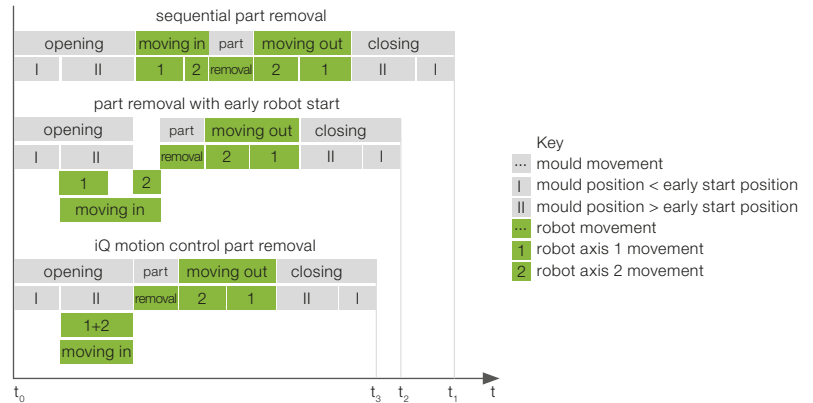
To ensure that the robot reaches the take-off position exactly when the mould is fully opened, certain factors need to be taken into account. One is

the parameters set by the user, such as positions, linear distances and the movement of the mould. Another is the robot-specific limit values for speed, acceleration and other parameters. The optimum entry movement is determined in three steps, which iQ motion control executes automatically:

1. Determining the optimum trajectory duration: Based on the last cycle, the time span is measured between when the set early start position is reached and when the mould is opened.
2. Calculating the shortest possible robot trajectory: The calculation is based on the robot-specific kinematic limits (maximum speed, maximum acceleration, etc.) of the individual axes and the linear distance defined by the operator.



iQ motion control works with automatically optimised path planning (right). The path is calculated in a comprehensive manner without smoothing the trajectories of individual axis movements, as was previously the case.



This comparison demonstrates iQ motion control's significant potential in terms of cycle time reduction.

3. Scaling the trajectory: When the early start function is activated, the robot movement's trajectory duration must be kept greater than or equal to the ideal duration that has been determined. To avoid a collision, the trajectory is scaled.

Since the robot in an ENGEL injection moulding cell has direct access to the machine data, such as mould opening stroke and moving platen position, the movements of the robot and machine are coordinated – ideally meaning that the two are at the mould opening position or take-off position at the same time for part removal. As a result, with the mould not having to wait for the robot, iQ motion control cuts the cycle time. A suggestion for the early start position based on the robot and machine setting parameters is displayed on the CC300 machine control unit's settings screen. This allows even less experienced machine operators to take advantage of iQ motion control.

Multiple steps to ensure safety

iQ motion control works with a two-stage safety net to safely rule out the possibility of a collision between the robot and the moving mould half despite early entry into the machine area.

The first stage involves correcting the robot's movement if any deviations from the planned mould movement are detected. The second stage ensures that, in the event of an exceptional situation or an emergency stop, the robot can still come to a stop in time before colliding with the mould.

This reliably prevents damage to the mould and gripper.

Even processes with simple take-off movements can be optimised to a high degree of effectiveness using iQ motion control. Users who produce moulded parts with substantial depth (such as housing components, boxes or containers with long cores) particularly stand to benefit, as the machine has to run an extra-large mould opening stroke for such items. ■

iQ motion control for
ENGEL viper series
linear robots



iQ weight control – what are the benefits?

Feature	Effect	Benefits
Optimised path planning	Fewer parameters or positions need to be taught in.	Reduced operating and cycle times
Direct access to machine data	The robot and machine execute a coordinated movement.	Reduced cycle time with no need for either the mould or the robot to wait
Multi-stage safety equipment	The robot stops if there is a risk of a crash.	Prevents mould and end-of-arm tooling damage
Joint machine and robot data management	In the event of a mould change, parts data only needs to be loaded once.	Lower risk of errors and faster mould set-up
User-friendly, intuitive settings screens	The operator only has to set a few parameters themselves and receives graphical support in the process.	Time savings when teaching in



ENGEL developed the all-electric e-cap series specifically for the production of caps and closures.

iQ weight control for caps and closures

Quality control is good, but a stable process is even better. A process that does not change is not a guarantee, but it is both an indication and a prerequisite for consistent part quality. Smart assistance systems play a role in this. One example is iQ weight control, which is used worldwide with great success; for instance, in the manufacture of parts with strict requirements and automotive components. In addition, substantial quality improvements are now achieved in the high-performance range with very short cycle times.

Fluctuations in the ambient conditions and raw material change the molten plastics' flow properties during injection and can also impact on the quality of the moulded parts. In the worst case, the result is rejects, and this can quickly become very expensive in the manufacture of caps and closures with extremely short cycle times and very high cavity counts. Smart assistance systems that continuously analyse and automatically adjust quality-critical parameters open up huge potential, even in high-performance applications, as ENGEL is able to demonstrate based on tests with iQ weight control.

Consistently high quality

In each individual cycle, iQ weight control analyses the pressure and screw position profile in real time during the injection phase and compares

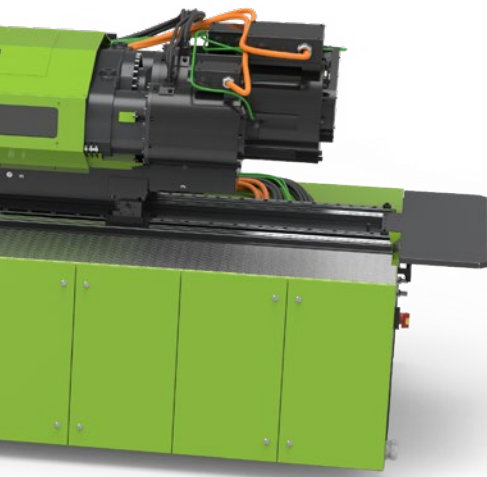
the measured values with a reference cycle. On this basis, new process parameters are calculated and process settings are automatically readjusted for the current cycle. This process control system governs the speed profile during injection, the switchover point and the holding pressure profile without lengthening the cycle time. This means that fluctuations in the raw material and ambient conditions are automatically detected and compensated for. As a result, iQ weight control achieves consistently high product quality and reduces rejects to a minimum.

Batch change without process modification

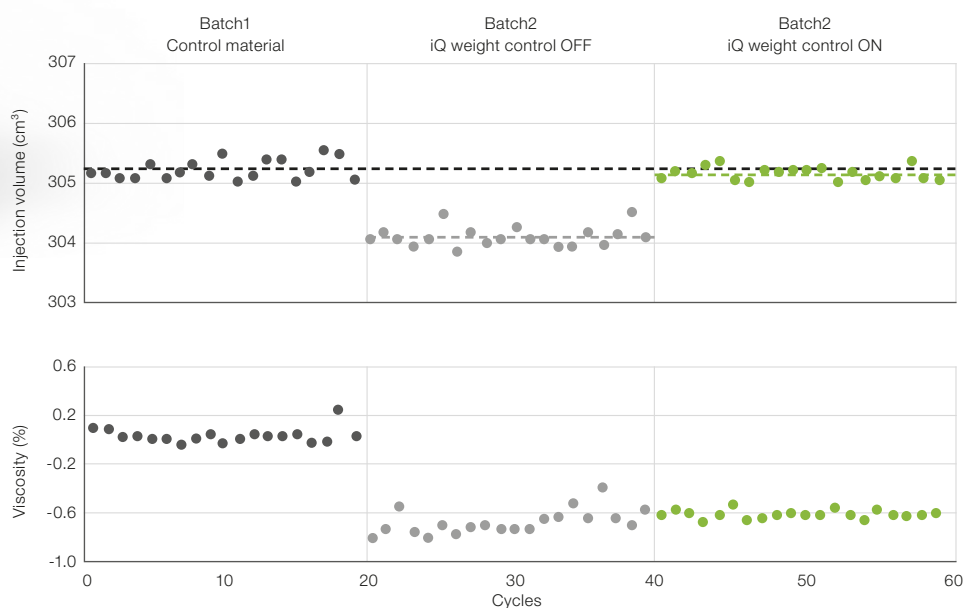
To demonstrate iQ weight control's capabilities in high-performance applications, injection moulding tests were carried out, including with a 96-cavity

mould for 29/25 caps for still water from Plastisud. A type MB7541 HDPE by Borealis with an MFI of 12 was processed. The part weight was 1.25 grams, yielding a total shot weight of 120 grams. An all-electric 380-tonne injection moulding machine from the ENGEL e-cap series was used; ENGEL developed this machine specifically for cap and closure production. The cycle time for this application is below two seconds with an injection time of less than 0.3 seconds.

To assess the performance of iQ weight control, process modifications were deliberately made, including by changing the raw material batch several times. The changes resulted in the critical quality characteristics of the caps produced being outside the tolerance range. The melt volume injected, for example, deviated from the reference value by 1.5 cm³. With



ENGEL packaging
solutions with iQ



Without iQ weight control, the melt volume changes after a batch change to an extent that may result in rejects. Activating iQ weight control improves process consistency and allows for highly efficient production throughout.

iQ weight control on, this figure returned to the reference value. This allowed good parts to again be produced from the very first shot after the batch change. In addition, the process stability was improved by 66 percent. The testing clearly shows that iQ weight control makes it possible to offset process fluctuations even in high-performance applications with very brief injection times of a few tenths of a second, rendering process adjustments obsolete when changing batches. As the use of recycled materials grows in the packaging industry, smart process assistance is becoming increasingly important. Recycled materials typically mean greater batch variations than virgin material. Using iQ weight control means that recycled materials can be used in a very cost effective way for demanding packaging products. ■



In the production of 29/25 caps on an ENGEL e-cap injection moulding machine with a 96-cavity mould, iQ weight control more than doubled process stability. The cycle time remained the same at less than two seconds.

New WebViewer tool combines web and control applications

Machine operators use the injection moulding machine's central control unit to control and optimise the production process as a whole. To directly integrate external systems as well as proprietary solutions that do not have a standardised interface, ENGEL uses a technology that is already widely used in everyday life. Using a browser, external websites can be securely integrated into the injection moulding machines' CC300 operator panels with the new WebViewer tool.



The WebViewer tool on the machine control unit integrates auxiliaries with web interfaces as well as data from internal and external systems that is accessible via a browser.

The CC300 control unit offers an extensive range of opportunities to easily, safely control and continuously optimise the entire production process. To really benefit from digitalisation in production, it is crucial to access data and information not only from the injection moulding machine and automation system but also from devices and systems in the auxiliary equipment and outside the manufacturing cell. There are various options for CC300 communication with temperature or hot runner control units, for example. OPC UA and VNC Viewer are widely used integration methods, which can

also be used to visually display different systems in the ENGEL injection moulding machines' CC300 control units. The challenge, however, is that not all device manufacturers offer standardised data interfaces such as OPC UA or VNC. Proprietary systems, as are to be found in established production environments, can usually not be incorporated either. These devices and systems then require their own additional operating devices, which end up being installed above or next to the machine's operator panel. This creates data islands – self-contained systems that lead to a wealth of information remaining unused.

Digital worlds grow together

ENGEL is setting out to address this challenge with WebViewer. The solution? External web servers and sites can be called up directly on the CC300 machine control unit via an integrated browser. External systems' data can be viewed and also edited through the web interface. In that context, complex data interfaces are just as superfluous as separate screens on the injection moulding machine. As on smartphones, favourites can be added as separate screen pages for quicker access. The WebViewer tool can be retrofitted to all ENGEL injection moulding machines with CC300 control units delivered since October 2021.

One application, for example, could be to show a filling simulation that was previously created by the customer's development team but could not be viewed on the machine. The simulation results and filling simulations from the software solution that was used, such as CADMOULD from SIMCON, can be displayed on WebViewer. The advantage this brings is faster, more direct and closer interactions between engineering and machine set-up staff. In addition, the calculations are made on an external system, so do not have any adverse impact on the injection moulding machine. Another plus point with WebViewer is the machine software version's independence from the simulation program, as long as the results can be displayed via a browser.

Integration throughout the value creation process

As digitalisation continues to advance, there is an increasing amount of overlap between the application of data from the machine, production planning, maintenance, development and other areas along the value chain. The same is true of the amount of data held online. The ability to integrate any webpage into the production cell's control interface means there are no longer any limits to the machine operator's use of data. Error catalogues and expert systems can be integrated just as easily as mould documents, set-up instructions and customer-specific checklists.

The integration of production planning systems is another use case. If the machine operator wants to know which mould needs to be set up next, they no longer need to go to the central master computer. Via the MES's web view, they can retrieve the plan directly from the CC300 control unit. And WebViewer is already pre-configured for authentig, TIG's MES. In the event of a malfunction, the user will also benefit from the integrated data overview. The malfunction can be logged directly via the web interface in the MES, resulting in shorter downtimes and improved machine utilisation.

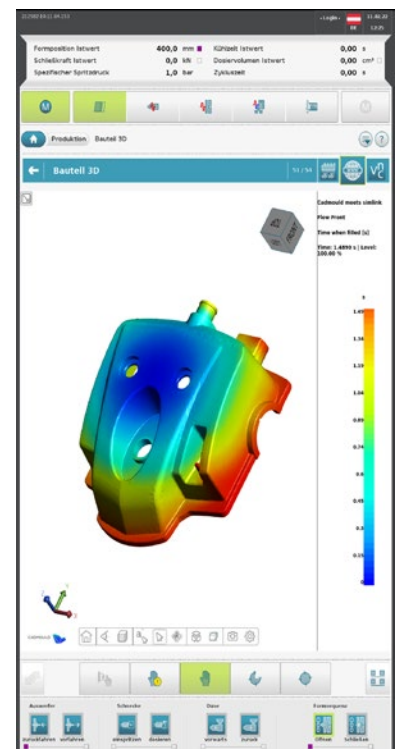
A safe and secure road ahead with data containers

The convergence of different data sources has real benefits for machine operators and a positive impact on production efficiency. But ensuring the highest levels of data security is key. For this reason, ENGEL decided to encapsulate the systems within the machine control unit when developing WebViewer. WebViewer is integrated into the control system through what is known as containerisation. This means that no data can be exchanged with the production system, and working on external systems does not lead to any loss of performance. In addition, WebViewer can use certificates and transmit data in encrypted form. The new WebViewer tool allows ENGEL to support its customers as they undertake digital transformation in their injection moulding activities, going

far beyond simply optimising the injection moulding process and automation solutions. In the production systems of the future, members and components within the injection moulding cell will link up with the adjacent systems and platforms across the entire value creation process. To make this possible, ENGEL has rethought the conventional injection moulding machine control unit. WebViewer is an important building block in the smart factory of the future. ■



Additional screens are superfluous, with web-based dashboards able to be shown right there on the CC300.



The user can benefit from the new WebViewer in the event of a filling simulation, for instance. The results of the filling assessment can be displayed regardless of the simulation program used.

Need a machine that does it all?

Look no further!

R+M/Suttner has upgraded its machinery with nine victory injection moulding machines (including robot) and smart assistance systems. This investment in the future combines a high degree of production flexibility with very high component quality. ENGEL won the contract thanks to its tie-bar-less technology and years of experience in the digitalisation of injection moulding processes.

For more than 50 years, R+M/Suttner has been developing and producing components for high-pressure cleaners and vacuum cleaners for deployment in the harsh environment of industry, civil engineering and car wash businesses. 20,000 different articles – many of which are custom-made – are permanently stocked for more than 3,000 clients around the world. “We are committed to providing this level of flexibility,” says Steffen Zunkel, Head of Research and Development at the Leopoldshöhe production plant near Bielefeld. “Our customers can expect us to deliver custom solutions. We have our own injection moulding shop so that we can produce small quantities efficiently.” Four hundred different moulds are in use, with the set-up five or six times in an eight-hour shift. “To us, fast mould set-up is critical – start-up times need to be very short,” says Zunkel, outlining the company’s priorities when modernising its machine park.

Saving space with integrated conveyor belts

In one fell swoop, all injection moulding machines were replaced with new ones. For reasons of cost efficiency, and in view of the limited space of the production floor, the aim was to cover the full range of parts with as few machines as possible. Shot weights vary greatly from 0.2 grams to 400 grams and the spectrum of materials is wide, incorporating hard-to-process, high performance polymers.

“Our challenge was to cast a giant umbrella over the various applications and cleverly combine clamping forces and screw sizes to utilise the new machines equally,” recalls Sebastian Rinke, Deputy Head of Injection Moulding at R+M/Suttner.

“ENGEL was one of a handful of suppliers able to offer an approach that would cover our entire range with very few mould conversions,” confirms Zunkel. Ultimately, two factors were decisive in awarding the contract: tie-bar-less technology and smart assistance systems from the iQ product family. Both features speed up mould set-up, which caught the attention of R+M/Suttner.

The nine new ENGEL victory machines cover a

Maximum precision even with the lowest shot weights

With a length of 10 millimetres and a diameter of six millimetres, the small black tubes include seven fine hollow channels, each of which has a diameter of just 1.5 millimetres. These stream shapers are among the most sophisticated and, with an individual shot weight of 0.2 grams, the smallest injection moulded parts



We go digital where it actually helps us, not because it's the fashion.

Steffen Zunkel, Head of Research and Development, R+M/Suttner

clamping force spectrum from 280 to 3,000 kN. With a 15 millimetre screw, the new machinery can now offer the ideal solution for even the smallest shot weights. The machinery was supplied in a package, complete with integrated ENGEL viper linear robots and smart assistance systems.

With space limited, R+M/Suttner ordered manufacturing cells with a compact design. The conveyor belts are integrated into the extended movable safety gate of the injection moulding machines. A conventional design would only have allowed the shop floor to accommodate eight manufacturing cells instead of nine. “We have a flexible modular system. The new machines can really do it all,” says Zunkel.

in the R+M/Suttner range. They are fitted into many high-pressure washer nozzles, including the rotor nozzle with its rotating point jet for especially powerful cleaning. Water presses through the fine channels at 400 bar, producing high back pressure at the tube cross-section – and the component must be able to handle this. “If the material gave way and the water squeezed the channels, the nozzle would be blocked,” explains Zunkel. “As far as we know, we are the only company producing stream shapers from PEEK.” Compared to conventional metallic materials, polyether ether ketone offers greater scope in terms of shaping; it is also more cost-effective

Energy efficiency is a high priority for us. The new victory machines allow us to improve our carbon footprint significantly.

Sebastian Rinke, Deputy Head of Injection Moulding, R+M/Suttner

to process, and finished parts are easier to press into the nozzle. Precision and repeatability are the main requirements as regards machine performance – and the victory machines comfortably meet this need. One reason for this is the outstanding parallelism of the mould mounting platens, which is maintained by the tie-bar-less clamping unit even when building up clamping force and during injection. The strengths of the new 15 millimetre screw also come to

the fore in the manufacture of the stream shapers. "A small screw allows us to improve the dosing of PEEK, which is expensive, while limiting material degradation during plasticising," says Rinke. "Thanks to the new machines, rejects in the production process are now a thing of the past." Aside

from resource-conserving plasticising, the smart assistance offered by the victory machines has helped to bring this about. iQ weight control's influence on the level of process consistency is especially evident. The digital assistant establishes a stable process in no time at all – including after mould set-up – increasing the injection moulding machine's productive time. "We go digital where it actually helps us, not because it's the fashion," says Zunkel. ■

Since the conveyor belts are incorporated into the extended movable safety gate of the injection moulding machines, they take up very little space.

The PEEK stream shapers are used in many high-pressure washer nozzles, including the rotor nozzle with rotating point jet for especially powerful cleaning.



R+M/Suttner has installed nine new ENGEL victory injection moulding machines with robot and inject 4.0 technology at its Leopoldshöhe production plant.



These items are among the most sophisticated injection moulded parts in the R+M/Suttner product range. The diameter of the hollow channels is just 1.5 millimetres.



The tie-bar-less ENGEL victory for efficient production of parts with strict requirements.

Towards the **self-optimising machine**

“Improving our products’ quality and production processes is the strongest driver towards digitalisation,” says Ingo Specht, Managing Director of Interroll SA in Sant’Antonino in the Swiss canton of Ticino. For injection moulding production, this means smart assistance. Supported by machine manufacturing partner ENGEL, Interroll is further expanding its digital injection moulding production worldwide.

As one of the world’s leading handling systems suppliers, Interroll ensures an efficient material flow in a wide range of industries, including postal services and e-commerce, food and fashion, and the automotive and industrial sectors. Its products include conveyor rollers, drives for conveyor systems as well as complete conveyors, sorters and flow storage systems. Almost all its products contain plastic components. There is more than meets the eye with Interroll Poly-V housing, a two-part component that transfers rotary motion in a key account’s transport systems. The two components are produced on ENGEL victory injection moulding machines at the company’s headquarters in Ticino. The outer of the two round parts is particularly challenging, as it wraps around a ball bearing. On top of this there is the material, which is difficult to process: carbon fibre-reinforced polyamide. “For a long time, we only injection moulded the housing parts ourselves and had the bearings assembled at the customer’s end,” reports Production Manager Matteo Tonolla. “But the reject rate was too high.” This prompted the decision to shift the complete process to in-house and invest in a new integrated manufacturing cell. The customer benefits, too, as they can cut down on the number of production steps and no longer require storage capacity for intermediate products.

We don’t want to have to check the quality; we’d rather be able to rely on it.

Piercarlo Balducci, Technical Sales, Interroll

The new manufacturing cell consists of a tie-bar-less ENGEL victory 120 injection moulding machine and an ENGEL viper 12 linear robot. The viper robot takes the bearings off the infeed conveyor and deposits them in the cavities of the 2-cavity mould, where they are overmoulded. The same robot removes the plastic-metal hybrid components and deposits them on a conveyor belt. “The integrated process now ensures that we have stable rotational characteristics,” states Piercarlo Balducci, who works in technical sales at Interroll. “Our focus is firmly on the quality of our products. In addition, we have streamlined the production process by using overmoulding.”

High-quality, complex parts with a high degree of automation in injection moulding and the downstream assembly processes are increasingly being produced in-house. The list of machinery in Sant’Antonino is growing. “When we invest in new machines and equipment, we always have innovative technologies in mind,” Specht emphasises.

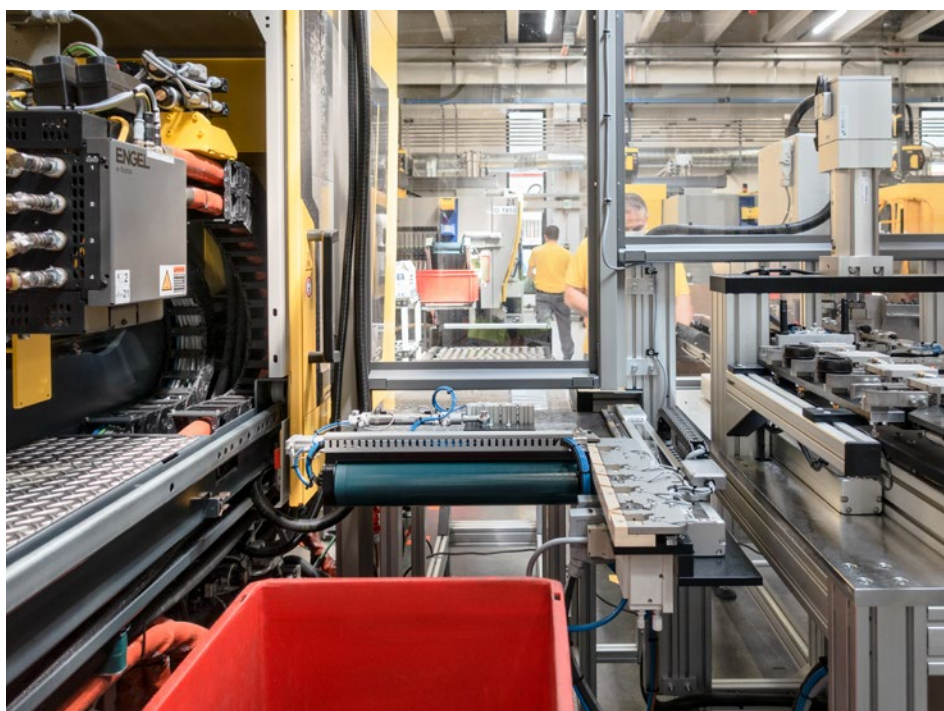
Smart assistance keeps the process constant

Equipped with smart assistance systems, the new victory 120 injection moulding machine for Interroll points the way to the future. In the case of the Interroll Poly-V housing, it is primarily two smart assistants that ensure consistently high injection moulding quality: iQ weight control and iQ flow control. For each individual cycle, iQ weight control analyses the pressure profile in the plasticising screw during injection

and compares the measured values with a reference cycle. The injection profile, the switchover point and the holding pressure are automatically adjusted to the current conditions. Readjustment takes place in fractions of a second and does not extend the cycle time. In this way rejects are proactively prevented.

iQ flow control in turn reduces rejects caused by temperature control. In each temperature control circuit, the software actively manages the temperature difference between the feed and return lines. “20 per cent of all reject mouldings in injection moulding production are caused by temperature control errors. This is precisely why smart products like iQ flow control and iQ weight control are one of ENGEL’s development priorities,” notes Matteo Terragni, Managing Director of the ENGEL subsidiary in Italy, which also serves customers in the Italian-speaking part of Switzerland.

By investing in the new production cell and digital solutions, Interroll has not only brought the production of Poly-V housing completely in-house – it has also streamlined the process. “We have substantially reduced the overhead required for quality control,” says Tonolla. “The process is now so stable that we can completely



The tie-bar-less clamping unit of the victory machine is an efficiency factor for Interroll. Fast mould set-up processes, easy scale-up and compact integration of upstream and downstream processes.

Interroll Poly-V housing: The outer part, a black ring, is tricky. The ball bearing is overmoulded with carbon fibre-reinforced polyamide in the integrated process.



Products for material handling: the machinery at Interroll's headquarters in Switzerland comprises around 30 injection moulding machines.



eliminate the need for external quality control." Previously, the quality of each of the 800,000 components per year was manually inspected.

"Making greater use of smart solutions is our goal," says Specht. "We want to eliminate disruptive factors. When we open the door to the production floor, we don't want it to interfere with the process any more. We are moving in the direction of guaranteed process stability through data monitoring on the one hand and a self-optimising machine on the other," Balducci emphasises. "We don't want to have to check the quality, but rather be able to rely on the production cell to deliver consistently high quality."

Good parts soon after a batch change

iQ weight control compensates for fluctuating production conditions just as reliably as for fluctuations in the raw material. A certain amount of recycled sprue waste is mixed into certain products, and some materials are sourced from two or more suppliers. iQ weight control ensures that good parts continue to be produced soon after a batch change. Given the currently volatile supply chains in the polymer market, this aspect is becoming increasingly important. "One tonne comes from China, another from America, and 300 kilograms from Switzerland – and yet we have to deliver consistent product quality,"

Specht explains. "That's where the injection moulding machine with smart assistance comes in very handy." A total of ten injection moulding machines are already equipped with iQ weight control. The software was retrofitted on some of them. All new machines are ordered including iQ weight control and iQ flow control. In addition to process consistency, Interroll also has a second focus: energy efficiency. "The temperature control ratios are now absolutely stable. On the machines equipped with iQ flow control, we can reduce the volume of water required for temperature control to 20 percent of previous consumption," says Tonolla.

Tie-bar-less technology boosts efficiency

Inspired by efficiency – Interroll's motto is hard to overlook on a visit to the company's headquarters in Sant'Antonino. You can see it in several places in large letters on the walls and doors.

Digitalisation is an important key to efficient production processes, but not the only one, as Matteo Tonolla explains. "We prefer to use tie-bar-less injection moulding machines because they help us set up far faster." Product variance is high. On top of this, Interroll's customers have reduced their storage capacity, which means batch sizes are dropping. "2019 was our record year. We had 4,200 mould set-ups on this

The temperature control ratios are now absolutely stable.

Matteo Tonolla, Head of Production, Interroll

site in that year," Tonolla reports. In the meantime, this figure has levelled off at 2,500, but the challenge of faster mould set-up is still huge. On average, it takes the mould setters 23 minutes to set up a victory machine with a barrier-free clamping unit. Compared with this, mould set-up on a tie-bar machine takes an average of 72 minutes at Interroll.

Another benefit of the tie-bar-less clamping unit: large moulds can be mounted on relatively small injection moulding machines. Given the increasing production volume that many Interroll products are currently experiencing, this simplifies the scale-up. For the Interroll Poly-V housing, too, a 4-cavity mould will soon be replacing the 2-cavity mould. Thanks to tie-bar-less technology, the part can still be produced on the 120-tonne machine.

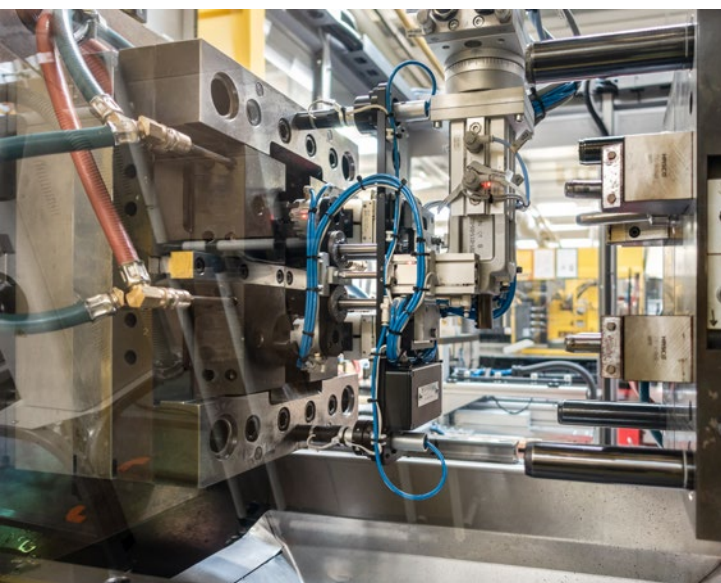
People are still the most important quality factor

"We are pursuing a clear strategy of growth and are looking around for new lines of business," says

Ingo Specht. New production plants have been established in the USA and China. "We regularly evaluate which components we want to bring in-house. The decisive factors are the part complexity and the quantities." Sant'Antonino remains the centre of excellence for injection moulding technology. Research and development for polymers are located there, and it is there that strategy regarding production of the plastic components is decided upon and practised. "In ENGEL, we have a machine manufacturing partner that also supports us in the USA and China," says Specht. Even though the product range varies from location to location, Interroll relies on standardised production technology worldwide, and that means tie-bar-less injection moulding machines with smart assistance that are increasingly networked with each other. To this end, Interroll relies on solutions from ENGEL daughter company TIG.

"You get information that was previously inaccessible and are automatically notified if there are problems," says Ingo Specht, summing up one benefit of going digital. "Having said that, it is still the human being who is responsible for quality. In the future, too, quality – and with it success – will depend on the skills of the people on the shop floor. They are the ones who set the limits for the systems. Whereas employees used to measure the product, it is now their job to configure the machines correctly." ■

Partners en route to the self-optimising machine. From left to right: Piercarlo Balducci (Interroll), Gabriele Formenti (ENGEL ITALIA), Paul Kapeller (ENGEL AUSTRIA), Matteo Tonolla (Interroll), Matteo Terragni (ENGEL ITALIA) and Ingo Specht (Interroll).

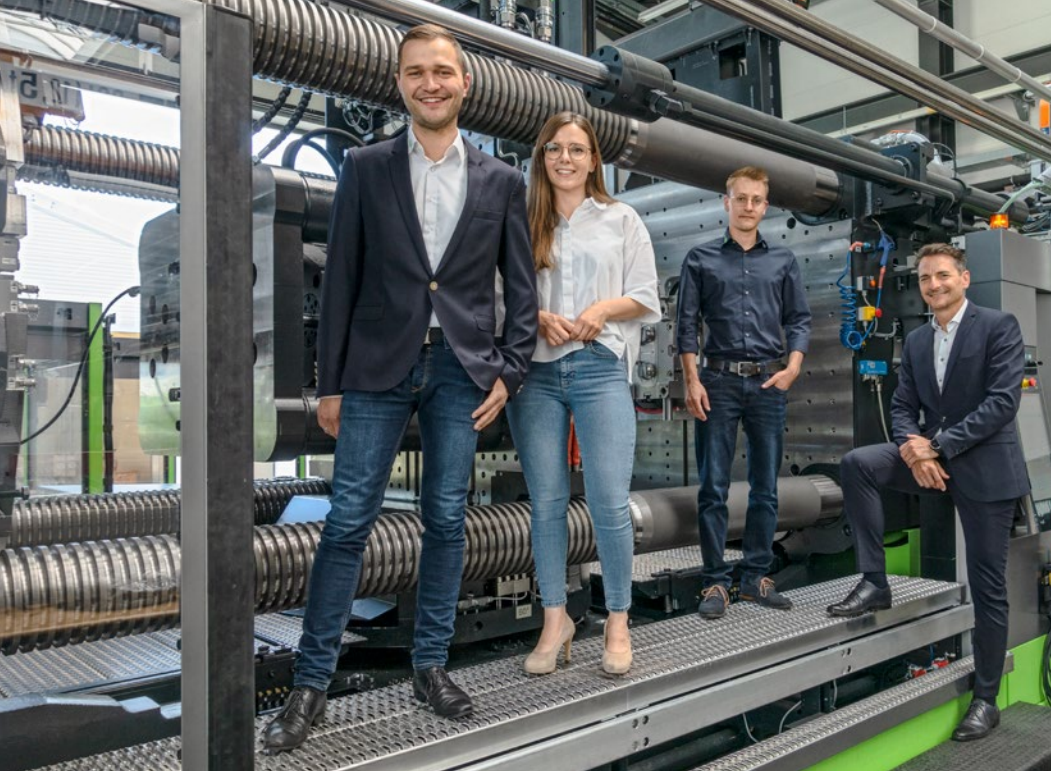


Because no tie-bars get in the way, the viper robot's gripper can move into the open mould directly from the side.

iQ flow control for
consistent and
efficient tempera-
ture control
processes



For the new production process, Interroll invested in an integrated manufacturing cell with an ENGEL victory 120 injection moulding machine and an ENGEL viper 12 linear robot.



Space to spare: the new duo combi M in the technology centre of Zechmayer. From left: Jörg Zechmayer, Nicole Zechmayer, Dominik Will from Zechmayer and Mario Oppelt from ENGEL Deutschland.



An injection moulding machine **with an eye to the future**

Mould maker Zechmayer wanted something special for its new technology centre – and in ENGEL, the company found just the partner to realise its ambitiously creative plans. Visible and decorative parts for automobile interiors and exteriors, among other applications, are highly demanding. The new machine is designed to handle both very large and very small shot weights, back injection, flow-coating, injection compression moulding, foaming and multi-component requirements. The result of the partnership is an injection moulding machine that is fully equipped in the truest sense.

"The only thing it can't do is fly," says Jörg Zechmayer, Managing Director of Zechmayer GmbH in Grafenwöhr, southeastern Germany, with a twinkle in his eye. "But it can do almost everything else – we have big plans for this injection moulding machine." The company had made an enquiry that had ENGEL intrigued. The extensive technical workload was initially going to be split between two injection moulding machines. However, deciding on how to perform this division in such a way that future requirements would not be restricted proved difficult. So why not combine all functions into a single machine? ENGEL stepped up to the challenge – and ultimately met the client's wishes in full. ENGEL even managed to shorten the installation length by nearly two metres on account of the available space. The result was a 15-metre-short hydraulic ENGEL injection moulding machine in the duo combi M series with 1,500 tons of clamping force and numerous additional functions:

a machine unmatched anywhere in the world.

Sophisticated parts – visible and decorative

Given that the dual-platen injection moulding machines in the ENGEL duo series are compact as standard, and ideally equipped to handle the highly flexible production of large parts such as the visible and decorative parts made by Zechmayer, the duo series was a natural starting point when planning the customised machine. "For visible parts and decorative parts, two-component technologies

are almost always needed. As far as our applications are concerned, an injection moulding machine must be able to perform the back injection of films as well as polyurethane coating to form a high-gloss and scratch-resistant protective layer," says Dominik Will, Plastics Technology Project Manager at Zechmayer, outlining his firm's minimum requirements. In the combi M design, the horizontal rotary table divides the closing area in order to accommodate two moulds in parallel, either to support multi-component injection moulding or to double output using two identical moulds. The duo combi M is ideally suited for these purposes thanks to its two injection units. One is mounted on the stationary platen, the second



The technology centre is linked to the mould production area. Such proximity makes mould set-ups highly flexible.



With its indexing table and rotary table, the duo combi M is ideally equipped to handle all types of multi-component requirements.

unit on the moving platen. For Zechmayer, the moving platen was fitted with a rotary table and with a third injection unit installed in piggyback style on the main injection unit. The combi M design really shows what it can do when back injecting and overmoulding an IMD film simultaneously. "We could not have embarked on this project without investing in the new machine," admits Jörg Zechmayer. This is especially true given that the application with variothermal mould temperature control is also sophisticated in terms of process technology. "Applications are becoming ever more complex," explains Jörg Zechmayer. "We also want to support research work in future, so this was a forward-looking investment."

From development to pilot run

Dominik Will believes the investment in the duo combi M machine will pay off in several ways: "We will be able to offer our clients in the automotive sector a full and improved service at the pre-production stage. This will

start with CAD engineering and Moldflow analysis and extend to mould making, initial functional tests at the technology centre and the production of samples according to VDA or PPAP." In the future, for example, process analyses will also be part of the package. Down to the last detail, the injection molding process can be set up for the customer and even a small series can be produced. A viper 40 linear robot was built into the system for automated part removal and depositing.

The direct link between the company's technology centre and its mould making operations is precisely what makes it so flexible. Since the crane can easily move moulds back and forth between the technology centre and the mould making area, mould changes rarely take more than 25 minutes.

The duo combi M is equipped with remarkably small screw diameters for the size of the machine – 70 millimetre and two 50 millimetres – which support flexibility in multi-component injection moulding. Shot weights of 70 grams to 2.2 kilograms are processed. We are seeing a trend towards more sophisticated structures and back-injected lighting technology. Accordingly, shot weights are getting smaller even as mould sizes stay the same or actually get larger," says Mario Oppelt, sales engineer at ENGEL Deutschland who has been involved in the project from day one.

High intelligence for process optimisation

An accurate and intelligent machine control unit and precise documentation of all parameters are essential for both sampling as well as future process

optimisation and development measures. The machine at Zechmayer's technology centre is ready for that too, with the smart assistance systems of iQ weight control and iQ flow control supporting stable processes and the documentation of all settings. "We can provide the customer with all the details for the series production process. In this way, for example, they can maintain a temperature with minimum energy consumption while documenting the carbon footprint of a component," confirms Dominik Will. The duo combi M is prepared to accommodate for options that are not installed right away. This enables mould maker Zechmayer to adjust to additional requirements of customers and development partners later on. "Already, this very special injection moulding machine is opening up many new options as regards product, mould and process development," says a delighted Jörg Zechmayer. "I can't wait to see the prototype control panels for coffee machines and domestic appliances, or lighting tracks for the automotive area." ■

Automated ophthalmic

product manufacturing with a tiny footprint

Connected to a cleanroom, Aptar Radolfzell GmbH produces an innovative multiple dosage system for the administration of eye drops. The technical highlight? The dosage system is microbiologically sealed and does not require any preservatives. In production, high precision needs to be combined with efficiency. For series production, ENGEL supplied two new production cells, each consisting of e-victory injection moulding machines and integrated easix articulated robots.

The challenge is to achieve this precision in a cost effective way in multi-cavity moulding with a high level of process stability.“

Ralf Fichtner, Plant Manager, Aptar Pharma

In Germany alone, millions of applicators for eye drops are used. The symptoms for which liquid medications are dripped into patients' eyes are quite diverse. What all eye drops used to have in common was unavoidable contact with bacteria after opening. The systems commonly seen on the market are therefore often single applicators whose contents can only be used for a few hours after opening. Aptar Radolfzell GmbH, an Aptar Group Inc. company, produces a sustainable alternative: a multiple-use dosage system with 5 ml and 10 ml capacity bottles. As a self-contained system, it provides the necessary protection against microbiological contamination that reliably prevents premature expiration of the drug. "Our applicator delivers the drug drop by drop and is free from preservatives. That is the added value of the system," concludes Ingo Korherr, Production Manager at Aptar Pharma. "The advantages here are that this is not a one-off application, which would

be bad for the environment and produce a lot of waste. The multiple dosage system can be used for several weeks, and it is more ergonomic to apply at the same time," adds Ralf Fichtner, Plant Manager at Aptar Pharma in Eigeltingen in southern Germany. In ophthalmology, one of the Aptar Group's product lines, the strategy of manufacturing all plastic parts in-house has been successfully implemented. This has largely been achieved with ENGEL manufacturing systems.

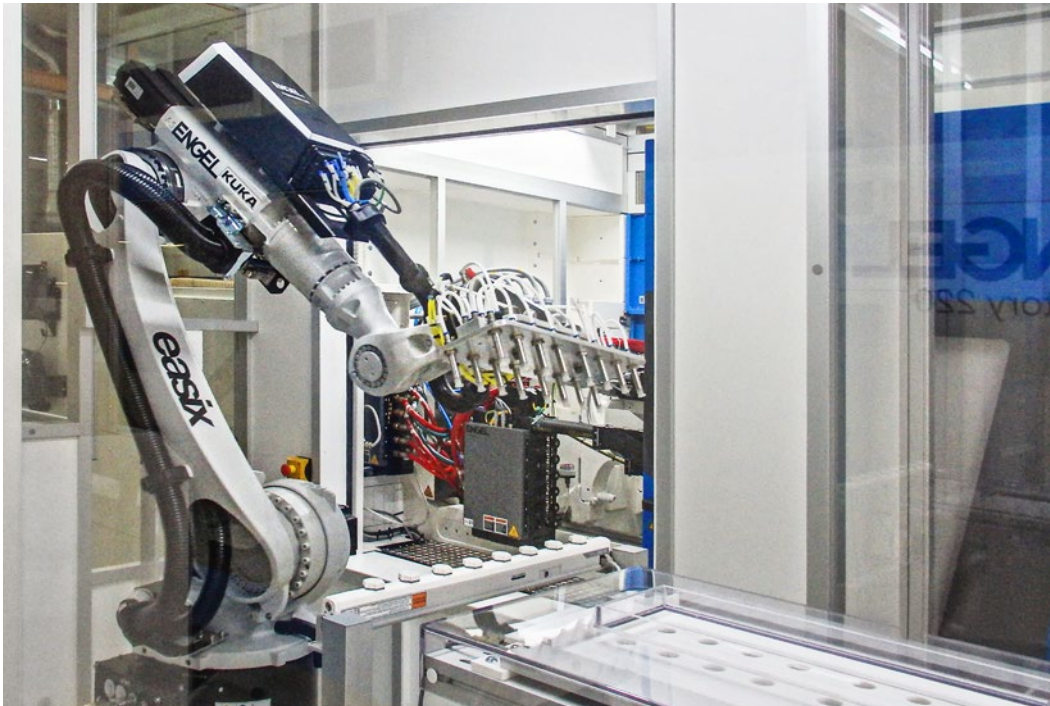
Tie bar-less clamping unit ensures high-precision moulding

The ophthalmic squeeze dispenser (OSD) consists of a total of seven plastic parts with varying degrees of complexity and one metal part. To produce the applicator and the spray pins, capital was invested in two new production cells for the Eigeltingen location; this is Aptar Radolfzell GmbH's second production location in addition to Radolfzell.

The applicator with a diameter of 15 millimetres is produced from polypropylene (PP) in a 32-cavity mould equipped with a partial hot runner on an ENGEL e-victory 740/220 injection moulding machine with a clamping force of 220 tonnes. The total shot weight is 30.5 grams. An ENGEL e-victory 50/90 with a clamping force of 90 tonnes produces the spray pin from TPE with a total shot weight of 1.97 grams in a 16-cavity full hot runner mould. Both parts are product-carriers, i.e., they come into

contact with the medication. With a view to microbiological purity, both production cells have been encapsulated in cleanroom-compatible production units in compliance with ISO 7 requirements. Further ENGEL injection moulding machines with an identical configuration operate in the greyroom.

Where the plastic parts are highly sophisticated, complex and produced in a multi-cavity mould, hybrid e-victory injection moulding machines with an electric injection unit and servo-hydraulic clamping unit often offer benefits. The reason for this is the tie-bar-less clamping unit, which provides sufficient space for large multi-cavity moulds even on machines with comparatively low clamping forces. The excellent parallelism of the mould mounting platens is also maintained during clamping force build-up and injection. Patented force dividers distribute the clamping force evenly across the mould mounting platens, ensuring consistently high



The easix robots are responsible for parts handling and other process steps.

The injection moulding machines and automation are encapsulated in clean-room-compatible production cells in compliance with ISO 7 requirements.



moulding precision across all cavities. These were the factors that tipped the scales at Aptar in favour of capital expenditure on machines from the e-victory series. As ENGEL sales representative Jürgen Fridrich adds: "What was required up front was very high repeatability, shot for shot, and very high availability of the entire production cell in each case. And let's not forget the very strict demands on the mould and the part, which necessitate a high level of precision – requirements which the e-victory series meets in full. The servo-hydraulic clamping unit side from ENGEL runs like clockwork," says Andreas Gräber, Manager Injection Moulding Services at Aptar Pharma. Ralf Fichtner adds: "We process polyolefins, especially PP and PE. There are certainly more dimensionally stable plastics. The tolerance range with two decimal places in which we manufacture our parts, requires very high precision of the mould, the injection moulding machine and the entire process. Polyolefins with this precision are certainly no longer standard, and this is exactly what we specialise in. The challenge is to achieve this precision in a cost effective way in multi-cavity moulding with a high level of process stability."

Integrated control unit facilitates change to articulated robot

The production process is fully automated and 100% monitored. SPC

checks of the parts are also an integral part of the process. After completing the respective injection moulding cycle, the parts are removed by ENGEL easix articulated robots, including separation of the cavities, which is important for traceability. In other applications at Aptar, ENGEL linear robots – vipers and a few older ERC robots – handle the parts. Due to the limited space available in production, the two new production cells were equipped with easix articulated robots. But it was also the production process that necessitated the articulated robots. Different depositing positions are implemented. NOK parts are separated from good parts. For permanent quality control, cleaning and other process steps, the robot needs to approach several positions in a programmed routine.

The servo-hydraulic clamping unit from ENGEL runs like clockwork.

Andreas Gräber, Injection Moulding Services Manager, Aptar Pharma.

The fact that the control unit for the ENGEL robots is fully integrated into the CC300 control unit of the ENGEL injection moulding machines, made the change to articulated robots particularly easy for Aptar. The integrated production cell ensures uniform control logic and the same look-and-feel for the machine and the robot. "One major advantage is that I can see everything on the machine display and do not have to walk around the machine. Of course, I have the hand-held unit for the process settings and teach-in, but that is a one-off thing, otherwise I can control everything from the machine and it is very easy. The employees are familiar with the user interface and do not have to readjust or learn anything new, but can apply what they know 1:1," says Andreas Gräber summing up. In Eigeltingen, this accelerated the start-up process of the new easix robots and ensures an effective approach to work. The manual robot panel and the smart ENGEL CC300 control unit access one and the same database. Another benefit is that both systems coordinate their motion sequences with each other. This reduces the handling time in some applications.

500 million dosing units a year

As experts in innovative medication delivery systems and packaging solutions, Aptar pursue a two-supplier strategy in-house. Of the total of 85 injection moulding machines with clamping forces of 35 to 250 tonnes, ENGEL machines account for more than 60 percent.

Some 850 employees produce more than 500 million dosing units annually at both locations. With several global good manufacturing practice (GMP) production sites, Aptar Pharma ensures both a reliable supply chain and local support for its customers. The division of the company which is headquartered in Radolfzell, Germany, focuses on injection moulding technology. "We buy in other processing technologies strategically," explains Ralf Fichtner. "The answer to the question as to what we do in-house, and what we don't, is driven by the complexity of the parts to be produced." After all, the company name, Aptar, is derived from the Latin word aptare. And that means to adapt, which reflects to the company's philosophy in practice.

An eye to digitalisation

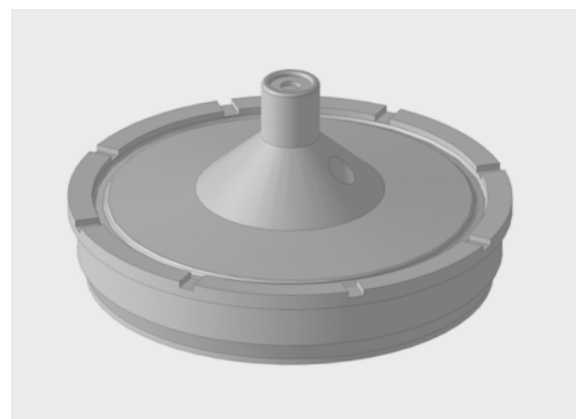
Choosing partners with expertise is therefore elementary for Aptar Pharma. "ENGEL listened to us and delivered on our needs and wishes. ENGEL's innovative strength struck the right nerve with us," says Ralf Fichtner and announces the next joint step: digitalisation. "We have already made great progress there." ENGEL's e-connect customer portal marks the beginning of these efforts. Andreas Gräber, who has been with Aptar for 30 years, uses this tool intensively. "e-connect is performing really well. I use the platform for machine management, which gives me complete plant documentation at a glance." ■

The ENGEL easix articulated robots make a decisive contribution to the space-saving set-up of the production cells.



From left to right: Ingo Korherr, Head of Production at Aptar Pharma in Eigeltingen, Andreas Gräber, Manager Injection Moulding Services, and Ralf Fichtner, Site Manager.

Find out more
about ENGEL's
cleanroom expertise



The applicator (top) and spray pin (bottom) are produced on the two new ENGEL e-victory injection moulding machines. The dosage systems consist of eight parts, seven of which are made from polymeric materials.



Showing our colours – closing material cycles

At ENGEL, we embrace responsibility, helping our customers achieve sustainable injection moulding production. At the heart of this are our inject 4.0 solutions for the smart factory, which also open up new opportunities for the Circular Economy. For instance, the iQ weight control software balances out process fluctuations when processing recycled material. Consistent high part quality increases the range of possible uses for the recycled material.

Technologically, we are also promoting increased use of recycled material. With the new ENGEL skinmelt process, we are enabling a high proportion of recycled material even in complex component geometries.

The bottom line: green is more than the colour of our machines. Check out our inject 4.0 smart solutions and contact us today.



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