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injection@engel.at

Only through digitization can sustainability be achieved. Fakuma 2021 is the first time a major European event has been planned as an in-person event in a long time. We are optimistic that the pandemic will not result in a cancellation. Therefore, we look forward to meeting you — our customers and partners — in Friedrichshafen.

F2F meetings are important, as the past few months have clearly demonstrated. At the same time, modern digital communication and presentation solutions open up new avenues for cooperation, customer support, and event design. The future is diverse, and this is the direction of our activities. This year's Asia ENGEL研讨会 participants have gained insights into the前期 experience (page 13). During the live periods, neither participants who were online nor those who were physically present have access to the database of the 2021研讨会. Information can be found on page 13.

This service also benefits from innovative digital solutions. Through performance. boost, ENGEL developed a service that the car supplier Huf Hülsbeck & Fürst, with the help of which they successfully completed an international debugging project in lockdown without any delays (page 32).

Only through digitization can sustainability be achieved – the conference clearly shows this. Digitization helps to fully exploit the potential of injection molding machines, which is key to reducing CO₂ footprints. By linking simulations with production, directions for resource-saving production and subsequent recycling can be set. Intelligent assistance not only reduces energy consumption, but also enables recycling materials in areas where there were previously no options for alternative materials.

Through iQ process observer (page 18), intelligent assistance reaches a new level. The data analysis solution simultaneously monitors hundreds of process parameters and displays the deviation and its cause in an easily understandable way. In this way, we show you how optimization of your injection molding process is possible when using data in a reasonable way.
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ENGEL TechTalk, Karl Steiner, Gerhard Dimmler, Christoph Schützeneder

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G\(\text{\textregi}\)a, ENGEL \# B\(\text{\textregi}\)

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**ENGL** OZ

Joachim Lehmann, Röchling Medical

"NGI...k‰...BB‰"
在位于Brensbach驻地的GMP洁净室内生产要求苛刻的药品包装、医疗诊断耗材和医疗技术组件。

viper 20机械手执行两项任务：将注塑部件从模具中脱模以及将冷却零件从补充冷却段移至输出传送带。
Röchling Medical

The production of high-quality medical devices requires a sufficient amount of time to complete the crystallization process, also known as shrinkage. At Röchling, using a quenching process, six months of component aging can be simulated simultaneously.

To achieve precise and repeatable temperature control, Röchling Medical took a step towards digitalization. Two machines work in conjunction with the iqflow control, a smart temperature control auxiliary function from ENGEL.

The system is equipped with six e-flomo temperature distribution devices and an equal number of ENGEL e-temp series temperature control devices. These control and regulate the entire production batch, keeping temperature conditions constant. The temperature difference is the variable for single-loop temperature control.

In the ENGEL solution, the injection molding machine and temperature control system communicate through OPC-UA. This way, iqflow control can adjust the pump speed in the temperature control unit according to actual needs. This interaction combines temperature constancy and extremely high productivity and energy efficiency.

"After a short period of time, we already noticed a significant decrease in pump speed. In some cases, their performance approached 30%, not always maintaining 100%," said Treuner.

The decision-making factor for flow control was material, but due to its energy-saving characteristics, the company's benefit was much more significant. "We pay attention to keeping the ecological footprint of our equipment small and also take this into account when choosing suppliers," Lehmann emphasized.

Röchling passed the ISO 50001 certification. e-motion injection molding machines support processors in systematic energy management. Medical machines have priority.

Two new large production units are part of a large project ENGEL recently sent to Brensbach. All eight new e-motion injection molding machines, with clamping forces of 1600, 2800, and 5000 kN, are used in cleanrooms for pharmaceutical packaging, diagnostics, and medical technology applications. In addition to clamping systems, Röchling Medical also uses ENGEL injection molding machines to produce drinking straws and microtiter plate supports. As the technology center for injection molding, the Brensbach factory combines injection molding, assembly, and mold manufacturing. Fully electric drive technology is the standard here. In addition to high precision, minimizing oil contamination in the cleanroom is also crucial. In addition, rapid movements are also important. The cycle time for nested parts is up to 40 seconds, and parts with a cycle time of 10 seconds require very high performance.

Due to Covid-19, the two large 5000 kN injection molding machines were particularly under pressure. "At the beginning of the Covid pandemic, we adjusted the processes and set our medical machines in priority," Holger Kast, the sales engineer of ENGEL Germany in Stuttgart, reported. "For the Röchling project, we also accelerated the order processing and delayed the formal work," he added.

One of the advantages of a fast setup for the machines is that they are delivered in two parts without additional charges. "Our gateways are too small for completely assembled 5000 kN machines," said Treuner. "If we had to place the machines in the cleanroom, this would mean a whole week of production loss."

And it's not just about a single product, but a total of ten production units. In addition, the system ensures a short time to market. "With ENGEL, we have a central contact person, achieve direct communication."

Lehmann noted. "Right from the start, the entire production unit was thoroughly planned and all components match perfectly. ENGEL helped us work more easily at the beginning. Few companies can perform such a complex production unit in such a short time."

\( o^\bullet, X_s \)\[ y \in \mathbb{E} \cdot 30\% \]

Marco Treuner
Röchling Medical TNM.-AEV
使用e-temp温控设备显著提高了温控过程的能效。通过OPC UA与CC300机器控制系统连接，温控设备根据需求调整其泵速。得益于补充冷却段，POM嵌套插件可以直接堆叠。Viper机械手将其拾起并通过较大的下方传送带传送。
ENGEL遍 布 全 球 ,贴 近 客 户。此次线上的女生节让年轻女性对职业世界有一个新的认识, 这是女生节的目标。多年来, ENGEL一直为该活动日提供支持, 还参与了今年在奥地利举行的线上版活动。 "女生节是一个典型的双赢局面。" ENGEL全球培训负责人 Werner Wurm说。"我们可以让年轻女性对技术职业感兴趣, 女孩们可以确认自己在技术职业方面有多少天赋。"

Anna Spiegl上学时也在女生节期间参观了工业企业。如今, 她是ENGEL机电一体化的三年级学徒。 "女生节坚定了我的职业决定。"她表示。 "我的工作成果汇入注塑机, 然后交 给 客 户,这真的 很 酷。"

IT技术学徒 Denise Lettner在互联网上认识了ENGEL: "在尝试一天后, 我得出了明确结论: 我想在这里工作。"

ENGEL AUSTRIA约15% 的学徒是女性, 这种趋势正在上升。
新的管理层

ENGEL

Machinery

India

2021年7月1日，ENGEL完成了其孟买分行管理层换届工作。METAI区域总裁Frank Schuster接手ENGEL Machinery India Pvt. Ltd.的管理工作，Stalinjose Selvanayagam是新任销售总监。上一任总裁兼销售负责人Jitendra Devlia即将退休。

在双重领导下，我们正考虑不断增长的印度市场的重要性。我们为印度客户简化与总部的沟通，这加快了定制系统解决方案的项目规划。

ENGEL CSO Christoph Steger博士说。

Frank Schuster留在Schwertberg总部，而Stalinjose Selvanayagam从奥地利回到祖国就任新职。"我们很高兴有Stalinjose Selvanayagam这样一位富有经验的注塑专家担任这一具有重要战略意义的职位，他对欧洲和印度文化都非常熟悉。"

MTA和ENGEL同时庆祝两个周年纪念。左起:ENGEL Italia的Gabriele Formenti、Matteo Terragni、MTA的Giuseppe Falchetti、Antonio Falchetti、Marco Pagliara和Gabriele Gimici。

ENGEL轻量化复合材料业务发展经理兼此次活动组织者Christian Wolfsberger强调说。"我们期待着明年再次以面对面或混合活动形式举办轻量化未来日活动，并欢迎尽可能多的参与者来到Schwertberg。"
五天展会期间，将在具有集成模内标（IML）系统的 e-speed 420/90注塑机上，通过注塑过程用聚丙烯全自动生产即用型人造黄油盒。包括标签在内壁厚为0.4mm的容器由高速侧入式自动设备从4+4多层模具中取出，并在经过基于摄像头的质量控制后堆叠在输出传送带上。参加展会的企业合作伙伴有MCC Verstrate、Plastisud、Campetella、Mevisco和Borealis。

减小壁厚的持续趋势导致流道壁厚比越来越极端，通常在1:400范围内。从1:300的比例起，只有借助注塑压制才能在许多应用中获得恒定的高质量组件。注塑压制技术的进一步优势是，与传统的紧凑型注塑相比，需要的锁模力更小，注射压力更小，即使对高粘度材料也能实现可重复加工。

用于多层叠模技术的薄壁注塑

ENGEL在Fakuma 2021的展位以可持续性为特点。通过装饰性单一材料食品包装的生产和标签垃圾回收颗粒材料的加工，显示出一条循环经济意义上的工艺链。4200kN的结构尺寸的ENGEL e-speed注塑机庆祝其全球首发。复杂的应用结合了薄壁注塑和多层叠模技术。总体而言，这使能耗更低并且单位成本更具竞争力。但是，注塑常常被视为使用多层模具的排除标准，因为对于许多注塑机，模板运动的动态不足以满足多层模具的要求。ENGEL e-speed注塑机的情况并非如此，它专为包装行业的持续高性能而设计。电动锁模单元和曲杆设计可实现非常快的，特别是精确而短的压制行程，例如在人造黄油盒的情况下为4mm。平行运动可以得到非常精确地控制，这是以所需精度协调压制行程和注射轮廓的前提条件。新结构尺寸的e-speed高性能注塑机借助锁模力为4200kN的新结构尺寸，ENGEL进一步丰富了其产品范围，以更精确地根据相关应用定制注塑机和系统解决方案，实现Fakuma 2021：A5馆，5204展位理想的整体效率。

ENGEL e-speed注塑机配备混合注塑单元和电动锁模单元，周期时间非常短，精度极高，注射速度高达每秒1200mm，并且非常节能。能量回收系统吸收模板运动的制动能量，并将存储的能量再传送到电机，以再次加速模具模板。曲杆为封装设计，确保润滑剂特别低，清洁度极高。e-speed注塑机满足食品工业的要求。智能标签技术在Fakuma上用于制造人造黄油盒的MCC Verstraete标签是交互式的。它们基于Digimarc技术。与二维码类似，Digimarc代码可以使用任何智能手机摄像头进行扫描。其优势在于，它们不可见地分布在整个标签表面上。摄像头可以捕捉任何点。
在Fakuma之际，ENGEL将扩大其智能辅助系统的产品范围。新的iQ motion control使ENGEL viper系列的线性机械手可实现可靠的提前启动，并结合了全自动优化的路径规划。由于节省了时间以及更短的生产周期，用户将获得双倍收益。

经过优化的路径规划缩短周期时间。如果注塑机和机械手相互协调其运动过程，将减少许多应用中的周期时间。因为只要机器仍在运动，即模具尚未完全打开时，机械臂就可以伸入模具区域。为确保机械手平行于模具模板运动，在演示时指定各个运动点以及伸入运动的速度和加速。沿各个点的轨道曲线（轨迹）传统上是手动确定的。新的iQ motion control将这项工作减少到只需几次点击。软件计算相应脱模过程的最佳行程运动，这进一步缩短了注塑过程的整体周期时间。

脱模更快，无需等待时间。平行运动的前提条件是注塑机和机械手使用一个共同的数据库，ENGEL的系统解决方案就是这种情况。伸入模具区域时，机械手不必等到模具完全打开。通过现在已经集成在iQ motion control中的“提前启动”功能，机械手开始平行于可移动的模具模板运动。

在Fakuma上生产的人造黄油盒包括标签在内都由聚丙烯制成。在使用寿命结束时，单一材料包装可以如生产过程中产生的生产废料一样粉碎，获得的原材料可以加工成新产品。在展会上，ENGEL将通过加工回收颗粒材料形式的标签边角料来展示该过程在实践中的情况。在一台victory 460/40上，通过Pöppelmann模具生产锥形盖。总部设在Lohne的Pöppelmann（Fakuma的B5馆，5107展位），与ENGEL一样，是循环经济发展的推动者之一。来自Pöppelmann的KAPSTO业务部门的保护元件用于物流和建筑等领域。这些产品的塑料成分100%来自回收材料。回收利用、薄壁技术、能效和信息透明度是循环经济成功的关键。这在ENGEL的展位上清晰可见。
iQ flow control

About

iQ flow control is based on electronic temperature control of the water distribution. According to e-flomo, the measured values, the intelligent auxiliary system of the iQ flow control system dynamically, independently regulates the temperature control process, thus maintaining constant process conditions. When using e-temp temperature control equipment, the pump speed in the temperature control device can also be adjusted according to need and significantly reduce energy consumption.

You have already implemented temperature control, or you are still using a lot of water to control temperature?

Ten years ago, ENGEL began to research the secrets of mold temperature control. "About 20% of the defects are caused by incorrect temperature control," mentioned Klaus Tänzler, ENGEL temperature control product manager. Nowadays, ENGEL offers an integrated solution for intelligent control of temperature control processes, significantly reducing or even completely preventing temperature-related defects.

Tänzler: What is special about an integrated temperature control solution?

Traditionally, the flow is static. If the temperature control channel changes, it will cause other channels to change, thus making the temperature and water distribution uneven. Our dynamic system separately regulates each distribution circuit. Therefore, even in cases of fluctuation, the heat conditions remain constant. This way, the mold is no longer a black box.

It was like this. Ten years ago, our temperature control分配器的任务 was to monitor the process and make the parameters transparent. Previously, traditional systems only showed whether certain channels of the mold contained water. To find errors, the user had to produce defective parts, resulting in energy and time loss.

flomo made such a system available, in which case, even in static conditions, the process could be stopped when a fault occurs.

How is it now?

We believe the era of using a lot of water to achieve many goals has passed. More important is temperature. Therefore, I like to ask our customers: Are you already implementing temperature control or are you still using a lot of water? Because water distribution is not controlled, there is a permanent heat imbalance. Therefore, we developed a dynamic system that can independently find the ideal operating point based on predetermined parameters.

How does it work?

e-flomo adjusts the difference between inflow and outflow temperatures. We monitor each circuit, as the temperature control cross-section and the proximity to the melt are different for each circuit. Additionally, the pressure and flow conditions in the temperature control channels change with the mold's lifespan. Therefore, the latest generation of e-flomo distributes so much water that the set temperature difference remains constant in each circuit.

What benefits does this have for the customer?

It is obvious: More stable processes and fewer defects. Stable temperature control processes are a prerequisite for constant high component quality—whether it is sensitive parts or simple parts. We make the situations in the temperature control circuits transparent and can detect problems before they occur. In addition, transparency is key to energy savings.

How much energy can be saved?

We have achieved energy savings of up to 60% in customer projects because we accurately define temperature control performance from the start and the dynamic system can adjust its performance automatically according to need. Most customers get their investment back in about two years. This is due to the fact that when the temperature control equipment runs at half speed, wear is halved.

What is the latest milestone?

We expanded the e-temp series. In addition, automated, continuous channel blowoff is one of the latest innovations. When replacing the mold, we ensure complete removal of water and dirt before removing the mold. Conversely, when installing the mold, blowoff ensures that the temperature control channels are optimally ventilated. Automated processes save time and speed up mold replacement. The most obvious time-saving feature is the parallel continuous blowoff function.

What's next?

Digitalization and networking through OPC UA is opening up great potential, and we are gradually using it.
ENGEL-传统内部展会首次以线上方式进行，具有非常广泛的范围。参与者来自近90个国家。除德国和奥地利外，墨西哥、美国和土耳其的参与者特别多。线上平台使来自世界各地的客户、合作伙伴和关注者能够在疫情持续的情况下安全参与。“我们收到了许多积极的反馈。”ENGEL营销传播副总裁Ute Panzer说。“这不仅证实了人们对新技术的极大兴趣，也表明了对交流和网络的迫切需求，即使所有人都期待着很快再次参与面对面活动。通过线上研讨会，我们为非常高效和紧凑的知识传递开发了一项顶级活动。会议、工厂参观和大量网络空间数字化可能性如何转化为机遇？哪些技术具有提高竞争力的潜力？可持续性和经济效益如何结合？在专题报告和商务会谈中，来自ENGEL和其他企业的专家回答当前紧迫的问题。所有内容提供七种语言版本。在三天的直播中，演讲者在报告结束后立即在问答环节中回答了参与者的问题。在一对一会议中，资讯库的用户也可以联系演讲者和所有其他ENGEL专家。“个人交流是ENGEL关注的焦点，即使是在虚拟形式下。”Panzer说。为研讨会开发的新服务是奥地利ENGEL工厂的线上参观，这仍然可以作为一对一会议的一部分。由于ENGEL近年来在工厂现代化和客户技术方面投入了大量资金，因此在所有驻地都有创新值得探索。包括总部的最新公司展览还没有迎来众多的参观者。因此ENGEL为客户把展览送上门。充分利用资讯库的前提条件是注册e-symposium，这仍然是可能的。

欢迎来到ENGEL的虚拟世界迎来数千名参与者的ENGEL live e-symposium 2021在线研讨会取得了巨大成功。除在线会议、商务会谈和虚拟工厂参观外，参与者还借此机会通过一对一会议亲自交流并探索虚拟展厅。–您没能参加？没问题！所有专题报告和商务会谈均可在资讯库中观看，虚拟展厅仍然开放。

亚洲混合活动形式的先驱除线上服务外，ENGEL还在三天的直播期间邀请其亚洲客户来到分支机构。根据卫生规则，疫情大流行法允许在夏季在那里举行面对面活动。例如，ENGEL在上海面对面接待120位客人。迎接他们的是一个个性化节目安排，包括现场讲座以及来自奥地利的专题报告和现场机器展览。另有200名来自中国的参与者通过互联网加入。因此，2021年上海研讨会提供了了解计划的未来混合活动形式的机会。“我们结合了两个世界的优势。”Panzer强调说。“面对面活动和线上平台的结合，比以前可能实现的更有针对性地响应各个区域的要求。无论地点、时间和旅行限制如何，所有客户都能高效、安全地参与。”一年365天，我们向客户、合作伙伴和关注者全天候提供25台机器展品、专题报告、商务会谈和工厂参观活动。Ute Panzer，ENGEL营销传播副总裁
Steiner: You use all kinds of injection molding machines and drive systems for production. The latest investment reflects the trend towards full-electric drive technology. Why?

Steiner: For us it is clear: We want the best. We produce highly accurate complex technical parts. We see, especially in the processing of high-performance materials, that the tolerance range of deformation narrows. Therefore, we must rely more on the injection process, and the fact that we can replicate values repeatably. Therefore, we need a high-precision injection unit, benefiting from parallel motion, which means that we need multiple pumps in hydraulic machines. In electric machines, part ejection is more stable, especially in short cycles of less than ten seconds. Of course, there is also the aspect of energy. How is the situation?

Steiner: We aim to produce energy efficiently. This is the advantage of full-electric injection machines. Cooling energy should not be overlooked. While in hydraulic machines, the temperature is usually set at 80-90°C, the energy efficiency is maximized in electric machines, where the temperature is typically set at 40°C.

In SKS AG's Injection TechTalk, board chairman Karl Steiner, ENGEL's R&D manager Gerhard Dimmler, and ENGEL's electric injection molding product manager Christoph Schützeneder discussed full-electric drive technology, decision criteria, and current trends.
In hydraulic machines, this has been minimized, but it is still higher than that of all-electric machines.

Schützeneder,

Is this also something you've heard from other customers?

CHRISTOPH SCHÜTZENEDER:

Of course. In summary, there are three factors that make more and more injection processors switch to all-electric machines. First, based on components or quality channels. If very high accuracy or very short cycle times are required, hydraulic solutions reach limits faster. Then, it's about cost decisions. Investments are preferred where the returns on investment (ROI) are shorter or the total ownership cost (TCO) is lower. That means considering the entire lifetime of the machine, including energy and maintenance efficiency, and here, electric machines usually perform better. And third, processors choose all-electric injection machines for strategic reasons. It's a strong trend we've seen across all industries. It involves investing in highly environmentally friendly technologies, reducing CO₂ emissions to a minimum. These companies choose highly energy-saving production technologies that are designed to position themselves for the future.

Is this a global trend?

SCHÜTZENEDER:

The most active region is Europe. In the last few years, the share of all-electric injection machines for smaller and medium-sized machines has risen from around 20% to above 30%. We expect this trend to continue. In Asia, all-electric drive technology has been very strong for a long time, and in North America, it's been relatively stable. In the smaller machine segment, all-electric machines make up around 50%.

Dimmler, what does this mean for ENGEL?

GERHARD DIMMLER:

Very considerable. Over the last 20 years, we've been working on this topic, learning a lot along the way. Of course, competitors in Japan were already well ahead because they were completely committed to all-electric machines early on. So, our goal was to use the advantages of electric drive technology, especially in high-performance machines. The energy-saving potential of electric drive devices is particularly large. Electric drive systems are not only used in all-electric injection machines, but also in hydraulic machines with variable drives, robots, and auxiliary units. From feeding to feedback, from multi-axis systems to single-axis high-performance devices, from standard axis solutions to custom axis solutions, ENGEL uses a very wide range of drive technologies. This is achieved through a long-term and very close technical partnership with our drive suppliers. No drive supplier can meet all requirements in the best possible way.

SCHÜTZENEDER:

We work with our customers to decide together which injection machines and drive technologies provide the most benefit for the respective application. We have high-performance machines, such as e-motion, e-cap, and e-speed, which are frequently used in the packaging and medical sectors, while our e-mac is a full-electric range that can provide very economic solutions in the standard performance area. Additionally, the e-motion TL series, ENGEL injection-2021-10_15
我们必须形象地想：如今50吨机器已经不需要比吹风机更多的能量。
It combines full-electric drive technology with the advantages of the locking unit.

Currently, we use all the series of machines we offer in our small machines.

Steiner Sir, your latest order includes two \textit{e-mac} injection machines. These machines are intended for which products?

We have many components weighing less than a gram to two grams and produced in 16 or 32-cavity molds. A large thermofluid with small injected weights requires very sturdy injection machines and very stable and at the same time high-precision units. Our machines average 12 to 15 years of use with various molds. Against these requirements, we believe that \textit{e-mac} is a very flexible and economical solution and is attractive in price.

Would you see electric drive technology in \textit{SKS}?

Steiner: Because of cost reasons, we might choose a hydraulic machine sometimes. For us, the investment price is not the main criterion. We are investing in the long term. The most important is precision and operational reliability. The machines must run 24/7. This is valuable. Finally, all of this must be linked, so we not only need good machines, but also well-trained professionals to truly exploit the potential of the machines.

Dimmler: \textit{Engel} offers which solutions to maximize overall efficiency?

Dimmler: Nowadays, there are differences between electric machines. In the case of high clamping force, extremely fast cycle times require feedback. For cycle times of ten seconds or longer, feedback solutions are more suitable. However, efficiency analysis now goes far beyond traditional drive technology. We consider indirect savings.

Steiner Sir, you mentioned cooling performance. Other examples include speed-controlled pumps or electric ejection for temperature control. In my opinion, when we talk about efficiency, we always involve electric drive devices and intelligent specifications. We have many plans in the future in this area.

Steiner: We must imagine: today, 50-ton machines do not need more energy than a hair dryer. When we talk about overall efficiency, I also think about machine compactness. Productivity per unit area. Especially in the medical field, if produced in a clean room, this is also a standard.

Steiner: This topic is becoming increasingly important to us. Currently, the medical parts we produce do not require a clean room, but our customers have increasingly higher requirements for cleanliness. With the compact \textit{e-mac} injection machines, we are in a favorable position. It is also for this reason that we ordered this machine with a sealing rod. The rods are especially painted white so that leaks or wear can be immediately seen. These measures also strengthen customer trust.

Schützeneder Sir, is there a general trend towards higher cleanliness?

Schützeneder: Yes, in my experience, we can say so. For \textit{e-motion} high-performance injection machines, the entire lubrication system has already been entirely sealed in a long period of time. Simultaneously, we have observed that in the automotive and technical injection areas, there is also a demand for cleanliness. This reflects the trend of easier maintenance. Machines should remain clean and easy to clean. Therefore, \textit{Engel} has decided to offer the sealed rod lubrication system as an option for the \textit{e-mac} series, which is widely used in various industries.

You have noted other trends?

Steiner: Digitalization is an important topic for us. Over the past few years, we have already made significant investments in data exchange and process data evaluation. This involves traceability, but above all, quality assurance.

Dimmler: In the next few years, this will increasingly become a matter of quality and sustainability. This is a new aspect. The injection machines generate most of the CO$_2$ footprint. Therefore, we continue to focus on what we can save energy in what way. For example, in the further development, we will pay close attention to the movement energy and the thermal power. Digital solutions help us achieve energy transparency. Transparency is the core theme of digitalization—from all levels. Our customers are increasingly requiring support in the area of process analysis. In the next few years, we will increasingly be able to model how the injection process progresses. We will use this to enhance intelligent assistance. The goal is not entirely autonomous assistance. It is the expert knowledge of the processor that is essential for the differences and its competitive advantage. But, we will achieve this in the currently not available level of information for machine operators.

Sustainability and digitalization topics are combined with the understanding of models, which will significantly advance the plastic process that has not made progress in the past 50 years.
了解：一方面，由于环境条件的转换、材料特性的突然变化和模具及机器的磨损增加，不断产生新的边界条件。此外，导致生产短时间中断的材料供应和自动化问题并不罕见。它们干扰质量和模具中的热平衡。另一方面，现代注塑机的许多方面都受到控制，例如轴运动、温度和压力。此外，在模具温控中，智能水分配器也越来越多地确保条件受到控制。目前，现代过程控制系统，例如iQ weight control，甚至可以确保注射量保持恒定。

关注过程 – 掌控品质

iQ process observer是ENGEL新的过程监控平台，可在后台同时监测注塑单元的数百个参数，并显示偏差，使注塑生产商能够轻松识别它们及其原因。在许多情况下，iQ产品系列的新辅助系统甚至本身就提供了解决方案建议。通过这种方式，智能数据分析解决方案有助于减少废品和停机时间。
前提条件。但是，过程在什么情况下稳定呢？过去，普遍做法是选择某些过程参数，为其提供公差并加以监控。但问题并不是这样简单：虽然对组件的质量有明确的规范和公差，但在过程监控中，参数的选择和公差的确定大多是基于经验的主观决定。因此，这里又需要专业人员和时间，而不同的专家通常会得出不同的结果。

iQ process observer

首先以鸟瞰图向注塑生产商显示监控结果，作为一种“执行摘要”（图1）。对于塑化、注射、冷却和脱模这四个工艺步骤中的每一个，信号灯符号都简明扼要地显示当前状态。全部绿色表示一切正常。而黄色信号灯则表示变化或与参考状态的偏差。

当设备负责人看到黄色信号灯时，他想知道：到底有什么偏差？这是怎么出现的？单击信号灯可进入详细视图，其中将显示最近一个周期的事件过程。但是仅显示当前相关的内容。图2显示了详细视图的图像示例。在许多情况下，这种详细程度是深入了解变化及其原因的理想条件。对于所有想要详细了解的人，当然也可以进入相关的单个参数，以查看曲线变化或从中读取确切的数值。

iQ process observer执行过程工程师在问题分析中会执行的工作，即以可以从中读取信息的方式准备数据。但是这项工作可能非常耗时。软件当然可以更快的操作，并且在每次注射后无间断地进行。工艺工程师可以全神贯注于解释其可靠的注塑助手所提供的信息，并思考可能的问题解决方案。认识问题比认识解决方案更重要，因为问题的确切表现产生了解决方案——正如阿尔伯特·爱因斯坦所说。

Observer

注塑机制造商开发越来越多的解决方案，旨在实现更恒定或更好的过程。初看之下出现了这样的问题：为什么需要像iQ process observer这样的监控解决方案？

数据分析——替代还是帮助专业人员？现在，一个实际的、乍一看有点偏执的数据分析方法提供了帮助。它是这样的：获取可以得到的所有相关参数并对其进行监控。宁可监控一切，而不要忽略重要信息。这将提供过程的整体观察，就像一种指纹。但是，“所有相关参数”可能非常多，因此该方法提出了两个问题：1) 设置监控限制所需的工作量随着监控参数的数量而增加。2) 解释结果所需的工作量也同样增加。

iQ process observer解决了这些问题：尽管对数百个参数进行监控，但用户的设置工作接近于零。因为可用参数在出厂时已进行了预先配置。实际安装的设备已经考虑在内。在运行时，软件可识别哪些气缸或模具加热区或速度曲线的哪些点实际正在使用并因此而值得监控。此外，公差限制根据当前过程自动学习。学习过程受到“内置专业知识”的监控，并在必要时进行修正，使个别参数当前存在的非常小或非常大的方差不会导致无用的窄或宽的公差。

现在解释结果：我们假设40个参数同时改变。如何以最佳方式通知用户？他应该在智能手机上收到40条消息，还是仅收到一个含有40个变化的条目？
iQ process observer的概览页面总结了有关当前过程状态的所有信息。

所有这些辅助系统——在ENGEL称为"iQ产品"——互补，并与iQ process observer一起发展。模具或冷却水回路中的可选传感器完善iQ process observer可以提供的过程图像。

"iQ weight control"过程控制和"iQ clamp control"额定值助手提供注射量、粘度变化或模具排气等有价值的过程附加关键数据，无需额外的传感器装置。

如上所述，iQ process observer的基本原则是针对用户进行数据可视化处理，使其能够以最佳方式解释数据，并从中推导出结论和操作。但是，如果用户可能无法立即识别可能的解决方案，软件将更进一步，为用户提供一些帮助：在每个周期中检查是否可以从当前的观察图像中识别某些已知的错误类型或优化可能性，以及是否建议采取措施。如果识别到这样的状态，将向用户提供iQ process observer使用边缘设备的现代和安全的物联网基础设施。借助互联网连接，边缘设备在得到用户批准后自动检查可用更新。当然，在未经单独批准的情况下，不会有数据离开机器或边缘设备。实现连接性的步骤通常不是一件容易的事。在某些情况下尚不具备前提条件，例如连接到设备的网络电缆。许多企业对安全性有顾虑和疑问。

ENGEL在这方面为客户提供建议和帮助。从设备联网中能够获得的效益逐年增加，这很快地摊销了必要的投资。连接性构成未来产品的基础。通过iQ process observer，联网对用户具有优势，远远超出简单的更新方案。将来iQ process observer也会提供网络版本。在这里，用户不仅可以看到单个的机器，而且全部机器都清楚地显示了所有必要的信息。此外还有机器上没有的大量其他有用的功能。

图2：最近20个周期的过程变化示例：黄色区域表示实际值变化的时间范围。专业人员可以推断出显示的实际值变化是用户执行的背压额定值变化的结果——可通过铅笔符号识别。

凭借iQ weight control可以看出背压变化也导致了熔体粘度的变化。帮助。点击一下，用户将收到有关原因的提示或者过程优化及消除问题的建议。

一个"活"的产品ENGEL的开发团队为自己设定了持续开发iQ process observer的目标。过程提示信息持续扩展，其中包括新的错误类型和优化建议，使产品随着时间的推移而增长，变得越来越强大。因此，软件便捷的更新得到了特别重视。计算是在自己的硬件，ENGEL的边缘设备中进行。这意味着数据分析的计算负载远离机器的控制系统（图3）。计算结果返回到机器控制系统并在那里进行可视化处理。

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 JZOU,X IC E sy "X π%
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iQ process observer, X

ENGEL injection-2021-10_21
Organic panels are made from continuous fibers embedded in a thermoplastic matrix. Thermoplastic methods can achieve the effective integration of semifinished products and functionalization, reducing unit costs and making the technology meaningful for the automotive industry. During the processing, the organic panel is heated and formed in an injection mold, then immediately shaped into the desired geometric details. Typically, materials from the organic panel matrix are used for injection. Next, recycled granulate materials from the organic panel scraps will be used. In this way, complete components can be produced from a thermoplastic thermoplastic matrix, and they can be well recycled in the circular economy at the end of their life.

No matter in the production or processing of panels, even the best nesting will produce scraps. Lower scrap ratios of organic panel area of 5% to 10%, but in the case of nesting that is not ideal or the component structure is complex, the scrap ratio may reach 35% or more. Therefore, recycling these production waste not only contributes to sustainability, but also saves costs.

To prove feasibility, injection machine manufacturers ENGEL and ERIMA Group's company PURE LOOP conducted a series of experiments, studying the preparation of organic panel scraps and the appropriate subsequent processing of recycled granulate materials. To maintain the length of glass fibers in the process, the granulate material was made from organic panel scraps based on UD (Unidirectional) tape. The waste from the material was cut and then added with unmodified matrix material to reduce the fiber content in the melt. Organic panels with 100% material utilization can enable thermoplastic composite materials to enter the circular economy for automotive lightweight structures. Organic panel processing is currently the most important thermoplastic composite technology. A further development focus is production waste recycling, such as scraps.

ENGEL demonstrates that recycled granulate materials from organic panel scraps can be used in the injection process to maintain material properties. This ensures that the composite raw material can be completely kept in the cycle.

Based on the tape, organic panels produced with the same organic panel scraps as the recycled granulate material were injection molded. Fiber contents usually高达72% (weight), which is too high for injection. When reducing the fiber content, the fibers must be evenly distributed in the matrix. The purpose is to ensure that the recycled granulate material can reach the equivalent characteristic level of long glass fiber granulate materials. Only when the fiber length is maintained and the fibers are evenly distributed in the matrix, can the high mechanical strength of the material be ensured. Therefore, the challenge of the continuous fiber reinforced organic panel semifinished product recycling process is to establish preparation and processing, maintaining the maximum fiber length.

In the experiment, ENGEL used Profol supplied Progano牌有机板材废弃物, these panels were made from UD（Unidirectional） tapes, with 72% of the material being glass fiber. The granulate processing used PURE LOOP's ISEC evo 302 equipment.
在奥地利林茨的LIT工厂，以集成工艺生产可量产的样件。该设备的特点是粉碎机和挤出机螺杆位于一个共同的轴上。装料时以大约1.5米长的有机板条进行。目的是将纤维含量稀释至40%（重量）。未强化的PP以颗粒形式输送，材料混合物进行了塑化。挤出机区域内的过滤器被省略，因为这会去除长纤维。最后，材料在高温下被切断并干燥。由此产生的颗粒材料被焚烧，以便对玻璃纤维长度进行光学评估。结果表明，保留了足够长的纤维。存在长度超过4mm的玻璃纤维。纤维含量的设置可以在切割边角料时优化。零件越小，它们的研磨和与基体材料的混合越均匀。从密度推导，回收材料的纤维重量比例约为35%（重量）。生产废料的成功制备显示了汽车部件在车辆使用寿命结束时的潜力。清洁组件并取出使用的金属插入件后，它们可以以同样的方式返回回收颗粒材料。在注塑中与新材料没有差异。

ENGEL技术和PURE LOOP与林茨的LIT工厂一起，以集成工艺生产了可量产的样件。连续纤维增强的有机板材在集成的红外炉中加热，由关节式机械手插入ENGEL duo注塑机的模具中，在那里成型，并用边角料回收颗粒材料包裹注塑。实现的良好组件质量以及集成加工工艺的高效率显示了有机板材边角料制备在汽车轻量化结构中对于量产应用的巨大潜力。

ENGEL和PURE LOOP将继续合作以利用这一潜力。
使用回收塑料的政治压力在全球范围内日益增长。许多国家已经为某些产品规定了最低回收材料比例。例如在美国西部，桶的一些市场领域要求25%的比例。此外，还要求即使在注塑点也看不到深色回收材料。这些趋势推动了新的共注塑工艺的发展。

ENGEL live-symposium在线研讨会期间生产的5加仑桶的回收材料含量超过30%，明显超过了在国际上非常严格的美国标准。周期非常短

ENGEL的开发合作伙伴是专门从事包装应用的加拿大模具制造商Top Grade Molds。全球首发的桶模具由美国桶制造商Coinjection Revolution与Top Grade Molds共同开发的新型共注塑工艺可以在桶生产中实现较高比例的回收材料并将其完全封闭在新材料中，因此优于传统的夹层注塑工艺。在ENGEL live-symposiums 2021在线研讨会期间，5加仑桶的生产过程中，这种新工艺的优势得到了充分展示。结合新的ENGEL duo speed注塑机，实现了非常短的周期时间。

M&M Industries提供。在live-symposium期间，ENGEL为满足桶和容器生产商的要求而开发的duo speed注塑机投入运行。这种新型注塑机将生产率和效率与短周期时间相结合。共注塑可确保与单组分生产一样短的周期时间。通过共注塑可以使加工材料集中在组件核心，并完全封闭在一层新材料中。为了能够在夹层产品使用寿命结束时得到回收利用，新材料和回收材料由相同的塑料构成。

加工5加仑桶时使用HDPE，回收材料来自消费后收集物。高品质夹层注塑的最大挑战是在不牺牲产品质量和性能的情况下实现较高的回收材料比例。因此，开发重点之一在于合并模具中的两种塑料熔体，而不是事先混合它们。这样，可以直接在注塑点借助一个针阀浇口系统从回收材料切换到新材料。5加仑桶在北美用于各种产品。由于这两种材料成分(核心和表层材料)在加工过程中严格分离，而且回收材料也在新材料的注塑点被包覆，因此这种新工艺对食品行业也相当有意义。凭借新的共注塑工艺，ENGEL进一步加强了其生产具有回收材料核心的夹层产品的能力。在K2019展示的skinmelt工艺用于生产技术零部件以及物流箱和托盘，而与Top Grade Molds一起开发的共注塑满足了桶和其他小型包装产品制造商的要求，也适合多腔模具的使用。加强回收材料的使用是循环经济的前提条件，这是ENGEL与合作伙伴一起大力推广的。

为了展示高回收材料比例，由新材料制成的透明表层材料与黑色回收材料相结合。ENGEL的紧凑型双板技术有助于实现较高的经济效益。更多信息请访问ENGEL博客。
对回收磨料进行颗粒化处理是一种能源密集型过程。如果能省略这个步骤，CO₂平衡将得到改善，回收成本也将显著降低。

缩短回收过程的关键是将塑化和注射分为两个相互独立、协调良好的工艺步骤。在第一阶段，原材料（例如来自消费后收集的塑料片）在传统的塑化螺杆中熔化。熔体传送回第二个螺杆，以便在第二工艺阶段将其注入型腔。两阶段过程使注塑机的注射侧能够集成熔体过滤器和脱气装置，因此即使受污染的塑料片也可以用于制造恒定的高质量产品。通过这一创新，ENGEL为塑料循环经济的发展做出进一步贡献。

直接加工塑料片创新的目的是在不进行颗粒化处理的情况下直接注塑加工来自消费后收集等渠道的塑料片。对于非常大的组件也能实现更高效率。作为注塑螺杆的替代方案，用于熔化的塑化螺杆可以与活塞单元组合。在这个方案中，对于加工最高达到160 kg的超大注塑重量，同时注射压力要求相对较低的情况来说，两阶段过程也非常高效。与传统的单阶段塑化与注射过程相比，两阶段过程可实现更紧凑的设备设计和更低的单位成本。为了克服活塞注塑单元在更换材料时的常见缺点，Engel开发了一种新的活塞设计。经过流变优化的活塞尖端支持活塞的均匀冲洗，从而能够实现快速的材料和颜色更换。典型应用是容器、托盘或大型配件。从20 kg的注塑重量起，加工效率就可通过塑化和注射过程的划分而显著提高。
在Sauerland地区的Kierspe，生产含有玻璃纤维的聚酰胺制成的技术齿轮（安装在电动汽车充电插头锁的复杂组件中）时，高精度非常重要。尺寸为25 x 30毫米的齿轮具有复杂的几何结构，公差达到0.03毫米，毕竟一个齿轮必须与另一个精确啮合。这尤其取决于与齿轮轮廓和齿面线有关的同心度。正是由于技术要求高，在Grote+Brocksieper GmbH+Co.KG的生产领域中，这些注塑重量在0.6到4克之间的零件在技术上并非轻量级。“我们的要求是可靠地描绘复杂的造型。”公司负责人Jörg Becker解释道。

正如技术负责人Fabian Crummenerl所强调的，工艺链的优化协调在这一点上至关重要。“注塑机的精度和可重复性使我们能够在打样过程中对内部模具车间生产的注塑模具进行有针对性的校正，并在不损失时间的情况下借助计算机断层扫描在公司内部进行验证。”对于具有四个型腔的模具的生产过程，Grote+Brocksieper寻找一种同时满足多个要求的合适的机器概念。“我们在专业上确保了工艺试验。为此，在位于高度可重复性：配备smart-shut的全电动e-motion TL在生产精细齿轮时，每一次注射都事关高精度。以过程稳定的方式塑造具有高水平可重复性的精度很重要。Sauerland地区的Grote+Brocksieper公司使用配备了smart-shut功能的ENGEL e-motion TL系列全电动和无拉杆注塑机制造精密零件。奥地利Schwertberg的ENGEL公司技术中心，用50吨的锁模力的注塑机进行了打样。”Jörg Becker回忆道。过程稳定性和机器性能带来的第一印象使客户信服。然后投资购入两台全电动和无拉杆的e-motion 50/30 TL，每台锁模力为30吨。归根结底，除了精度和可重复性之外，还有两个原因决定了这一选择。一方面，ENGEL全电动驱动技术的高能效，另一方面，无拉杆e-motion TL注塑机的紧凑设计。此外还有灵活性的优势。得益无拉杆锁模单元，模具模板可以得到直至边缘的充分利用，因此相对较大的模具可以与较小的注塑机匹配。在位于Kierspe-Grünenbaum的总厂，这些机器只能安装在非常有限的面积。

节能65% e-motion TL全部配备电动驱动装置，在实践中可以非常清洁地工作。这避免了油雾。但是，高性能与效率相结合对Grote+Brocksieper来说是决定性特性。“我们比较了新型e-motion TL和我们旧的液压注塑机的功耗，结果是节能达到65%。”Jörg Becker用实践数据确认了机器的效率。这种节能特性最终8V 6—65% e-motion TL 2d, X % < F q G ! E P E > 5B » f C... v n M 2 # Y ` n 0 5 E 5 l Z "k P " 6 » [, A B:< O Grote + Brocksieper 9A à n (M * W Z N) e-motion TL ' 8, X %<65% 7, X s f 4 & p 8 v 6 E l f f Jörg Becker ' r C D B B A X Z < X j E f " 8 V 6 t M " 4 u
对 Grote + Brocksieper 来说，在选择机器时，“足迹”具有决定性意义，无论是在占地面积还是能耗方面。

使整个投资被 BAFA（联邦经济和出口管制局）列入适合资助的范畴，也确认了企业的环境政策。

“客户是为未来而投资。” ENGEL 销售部门的 Dominik Cordes 强调道。这不仅适用于注塑机的情况。为了进行质量控制，借助公司内部计算机断层扫描仪和齿轮特定软件对大量产品进行测量和评估。“我们投资的机器和设备，有助于在技术和经济方面以理想的方式实现所需要求。根据 Grote + Brocksieper 提供的信息，在德国只有少数得到授权的测量机构，能够完全描绘这些精细齿轮的测量。此外，公司决策者希望能够绘制从创建注塑机模具，使用高效高性能注塑机到复杂几何形状测量和评估的整个工艺链。"最终，我们成功地缩短了首次打样、模具校正循环和系列标准之间的阶段。” Jörg Becker 说。

机器的全电动同步运动再次确保了零件产量的增加，每年可交付数百万件。与原来的生产方法相比，在不改变机器参数的情况下，仅通过使用新型 e-motion TL 注塑机就减少了周期并相应地提高了生产率。

操作更便捷作为工艺机械师为机器区最新的机器服务的 Jan Marczinkowski 也证实了这一点。“这些机器的便利性，我可以使用的众多评估，超出了我目前所知的一切。”凭借 CC300 机器控制系统，ENGEL 多年来为所有注塑机和机械手系列的所有产品提供了统一的操作理念。“机器操作人员可以很快熟悉我们公司的各种产品。在这里，监控和过程设计得非常简单。” Cordes 确认。

顺便说一句，由于新冠疫情，机器验收纯粹以线上方式进行。

Grote + Brocksieper 公司目前在 Kierspe 的两个驻地拥有 90 名员工，80 多年来一直是由所有者管理的中型家族企业。由此产生的传统优势，例如长期思维、短决策路径和个人敬业精神，与专业流程、透明度和以员工为导向的企业文化相结合。该公司最初从纯粹的模具制造开始，发展到多达 96 个腔的注塑模具和塑料制成的高精度组件的完整服务提供商。
Having a strong foundation in the late 1960s, the company’s ability to manufacture complex injection molds was already in place.

"The idea of controlling the mold has continued. We have been able to produce complex injection molds from the beginning," Becker said.

The company, which employs 15 people, specializes in the automotive industry and also produces molds for the bicycle and furniture industries, as well as other business sectors. The precision required of their injection molds is also reflected in the company’s injection equipment, which includes 48 injection molding machines with clamping forces of up to 320 tons. The company places great emphasis on functionality and precision, as well as decorative coating or chrome surfaces and textured designs.

The company produces approximately 130,000 plastic parts per day worldwide.

Whenever extremely low injection weights and very fine products are involved, the cycle time is a decisive factor in determining the quality of the product. "The closing characteristics of the valve are a basic component of the reliable process," Dominik Cordes explained.

ENGEL’s smart-shut development of a controlled clamping process is currently also used with extremely small screw diameters of 15 mm and below. The largest diameter is 80 mm.

This development is also part of the e-motion 50/30 TL X e / f Smart-shut integration of Grote+Brocksieper.

Smart-shut significantly improves the reproducibility of mass production, ensuring the definition of the melt flow to all cavities, but preventing the melt from flowing uncontrollably back into the first screw thread. For this, the locking ring is moved in a controlled manner to the rear position prior to the injection process. Following the charging process, the plunger of the screw is engaged by the injection plunger.

This process is controlled by ENGEL’s specially developed control elements. Determining the decisive advantage: The screw rotates with an optimized angle in the opposite direction to the charging, ensuring that the valve is already closed at the start of the injection movement. This prevents undefined melting losses caused by leakage flows. Therefore, smart-shut has a positive influence on the constant weight of all cavities in the series. A test in Schwertberg has already used the smart-shut.

In the application trials, the filling degree was investigated and recorded in the study, with the component weight being traceable.

Smart-shut reliably provides the required safety.

Jörg Becker and Fabian Crummenerl made a positive conclusion on the investment. "The overall concept is of decisive importance." Both agreed. In addition to the complete electrical injection molding machine, which fulfills the technical requirements, the compact structure, high efficiency and the widespread application also have a decisive significance. In particular, the solution-oriented cooperation with ENGEL, from the Austrian test, to virtual machine acceptance, on-site debugging and training of the Grote+Brocksieper staff.
共同发现效率潜力:

Grote + Brocksieper

技术负责人

Fabian Crummenerl, ENGEL

德国销售部门

Dominik Cordes, Grote + Brocksieper

管理合伙人

Jörg Becker (左起)

自有计算机断层扫描仪与齿轮特定软件相结合，使Grote + Brocksieper能够快速、可靠和无接触地测量组件。

Smart-shut 在注塑重量非常小的情况下确保高度的工艺稳定性。

ENGEL 也为非常小的螺杆直径提供强制闭合止回阀。
不折不扣的精度

凭借 ENGEL 的新型注塑机, Dallmer 为未来而投资。以先进的方式生产, 是这家 Sauerland 建筑排水专家的重要竞争因素。重点主要在于两个主题: 工业 4.0 和可持续性。

Dallmer 这个名字代表创新的卫浴技术,也是某种含蓄的表述。映入浴室用户眼帘的是简洁的设计、窄窄的淋浴排水槽或由优质不锈钢制成的精细的地面格栅。Dallmer 工程师和技术人员的技术能力并非常惊艳,甚至都不是那么明显。排水系统的许多部件隐藏在地板内,在无缝地板中浇铸。会议室和演示室的剖面模型揭示了技术的复杂性。可靠而安静的建筑排水系统并不是理所当然的事,而是持续开发工作的结果。排水系统由大量组件构成,其中大多数是由塑料注塑而成,每个组件都发挥着重要的功能。"隔音是我们永远的开发重点之一。"生产负责人 Andreas Föltz 表示。绝缘系统将排水口与地板分离,以便晚上淋浴时不影响邻居的睡眠。所有产品由 Dallmer 自行开发、设计和构建。内部模具制造车间紧邻生产车间。"我们路径很短,可以在短时间内实施新想法。" Föltz 说。

工艺稳定性和灵活性至关重要

DallDrain 是 Sauerland 最新创新的名称。用于地面排水的点状排水口提供不同版本。有三种类型的排水盒,可以与 18 种不同的附件组合。总体上,这使一个产品系列产生了大量和种类繁多的注塑部件。

Dallmer 机器区包括 800 至 13000 kN 锁模力的注塑机。其平均年龄刚刚得到显著降低。ENGEL 向 Arnsberg 交付了一整个系列的新注塑机以及多种不同类型的机械手。中小型锁模力的首选机器类型: ENGEL victory,用于 DallDrain 系列的组件。最大的组件、外壳和球形接头在 victory 120 上生产,连接无缝地面和地板覆盖层的密封圈在 victory 120 combi 上通过多组分注塑生产。"我们依靠非常高的成型精度,使球形接头永久密封。" Föltz 解释道。"精度和可重复性是我们的核心要求。victory 注塑机在这方面为我们确保了高度工艺稳定性。"其原因之一是模具模板具有出色的平行度,在锁模力增加和注塑时也能保持。iQ clamp control 可提高质量和可重复性。为了提高安全性,Dallmer 借助新交付的注塑机向数字化迈出一步。所有机器都配备了 ENGEL inject 4.0 程序的智能辅助系统。"iQ 只让我们的产品惊叹。" Föltz 表示。软件根据模具排气确定相应注塑工艺的最佳锁模力,生产 DallDrain 组件时,在某些情况下将锁模力从 1200 调低至 800 kN。"我们由此进一步提高了质量和可重复性。" Föltz 说。"我们可以可靠地杜绝过度注塑和毛刺形成,还可以改善模具通风和减慢模具速度。

iQ Systeme 是 Dallmer 非常广泛的整体数字化战略的一个方面。"我们的目标是更高的透明度。我们希望集中管理生产中的所有组件,在逐次注射中记录和评估质量相关过程参数,以便不断改进工艺。" Föltz 说。对于生产负责人来说特别重要的是在数字化过程中有了新的注塑机,我们变得更加高效和可持续。它们比旧的注塑机需要的能源要少得多。Johannes Dallmer, Dallmer 管理合伙人
ENGEL 向位于 Arnsberg 的 Dallmer 工厂交付了多台新注塑机。

相会 Arnsberg: 位于 Hagen 的 ENGEL 德国公司负责人 Dominik Cordes、ENGEL 德国销售部 Johannes Dallmer、Dallmer 管理合伙人 Andreas Föltz、Dallmer 生产负责人和 ENGEL CSO Christoph Steger (左起)。

从表面上看, 设计占主导地位。Dallmer 的技术优势在很大程度上隐藏于地面下, 在无缝地板中浇铸。

量身定制: 视频中向 Dallmer 交付新的 ENGEL 注塑机推陈出新: 凭借新的更节能的注塑机, Dallmer 进一步显著减少了其 CO₂ 足迹。

将所有数据集中起来。ENGEL 注塑机的 CC300 控制系统恰好能让他全面了解了整个过程, 因为辅助系统和自动化系统完全集成到了机器控制系统中。通过机器控制面板可以控制整个生产单元, 如有必要, 可以通过互联网连接远程访问数据。还有并非不重要的一点是, 控制集成使机器操作人员更容易使用新系统。

在新机器的调试方面, Dallmer 也实现了数字化的飞跃。由于新冠病毒大流行, 许多会议以线上方式举行, 员工培训在线进行。通过远程维护工具 e-connect.24, ENGEL 培训师可以从其家庭办公室远程控制 Arnsberg 的机器。

能源需求显著降低 除工业 4.0 外, 可持续性是 Dallmer 确定方向的第二大战略主题。因此, ENGEL 注塑机的高能效原本是两个家族企业合作的决定性因素也就不足为奇了。与以前没有 ecodrive 的液压机器相比, ecodrive 让 Dallmer 节省了大量能源。“这就是使 ENGEL 注塑机在经济上也有相当吸引力的原因。”管理合伙人 Johannes Dallmer 强调。
居家办公室的调试

新冠疫情旅行限制意想不到地使总部位于北莱茵-威斯特法伦州Velbert的Huf Hülsbeck & Fürst GmbH注塑团队措手不及。对于德国汽车制造商来说，轴承支架的设计转换是一个时间紧迫的项目。然而，在其机械制造合作伙伴ENGEL和虚拟团队合作的支持下，车辆访问和授权系统专家得以在短短一周内将三种新模具投入使用，并为客户提供合格零件。这是一个为未来树立标准的过程。

每次参数变化后，Arad的Huf团队检验零件并报告给Velbert以及奥地利的ENGEL应用技术部门的同事。

轴承支架在ENGEl e-victory 400注塑机上通过MuCell泡沫注塑工艺生产。这是一个常规项目，似乎已有相当长一段时间。但是突然之间，从德国飞往中国的航班越来越少，最终，Covid-19的进一步蔓延和强制性旅行限制使最初的计划处于危险之中。有三种新模具需要在中国取样，并在罗马尼亚投入使用。这是Dirk Horn及其团队的日常业务，他们是国际Huf集团注塑业务的工艺专家。"我们追着模具跑。"Dirk Horn解释道。"有时候我们会花很多时间在飞机上。"

位于中国东海岸的烟台是烟台Huf Tools所在地，这是该集团的自有模具制造厂。客户项目的三个新模具是为罗马尼亚生产基地准备的。去年，在Arad新建了一个生产车间。来自ENGEL的全新e-victory 400注塑机已经在这里为新模具做好了准备。包括MuCell技术包，因为轴承支架是借助物理发泡技术由聚酰胺生产的。Arad的机器操作人员专门从事MuCell工艺。除了新的e-victory 400，在Arad和Huf集团的其他生产基地的机器组还包括许多来自ENGEL的MuCell机器，用于轴承支架和其他轻量化结构组件。
ENGEL's performance boost.

ENGEL's new "Huf" is being pushed forward in all areas of the company. For injection molding, we will also enhance the use of virtual tools and increase efficiency, said Dirk Horn. In addition, we need to assess new technologies for cross-location cooperation. For example, data glasses are currently being tested. However, from a long-term perspective, Dirk Horn does not intend to forgo出差. Regular meetings are very important. Only then can teams be established, and only then can virtual team cooperation be used to its full potential.

A broad perspective opens up new doors.

Digital services products have become popular due to Covid-19—ENGEL is also seeing this globally. The令人振奋的是, new solutions not only offer potential for urgent repair events, but also for ongoing production processes. With the help of process optimization services and shared use of this potential, ENGEL has set the goal of deepening understanding of products with customers and its technicians to combine the detailed knowledge of injection molding machines. This will allow us to discover the potential for optimization.

Stability and equipment availability are key requirements, so automotive suppliers have always relied on ENGEL injection molding machines. In just one week, the sample and put it into operation. Despite the high level of specialization in China and Romania, the latest bearing支架 project brought special challenges. Because the调试 expertise was in Germany with the Dirk Horn and his team. They worked in Yantai to make prototypes on site and approved their transport to the production site. Upon arrival, Horn and his team accompanied the调试 and started批量生产. Covid-19 turned this into a new schedule. Within a short time, we had to develop a new plan. As a long-term partner, ENGEL immediately provided full support. "We immediately accepted the support, mainly because I knew what level of quality ENGEL can provide in terms of service and application technology," Horn said. The three new molds were not prototyped, but sent to Romania, in the absence of Velbert colleagues, they had to be debugged for the first time through testing. However, the production team in Arad was not isolated. "Assembly personnel opened their laptop and walked through the workshop, showing us the challenges and the appearance of the new injection parts via video," Christian Muthenthaler, applications engineer at the Austrian ENGEL headquarters, said. Dirk Horn, third member, joined the team. Through ENGEL remote maintenance tools, Muthenthaler and Horn could track all machine parameters in real-time, send instructions, or directly control the machine remotely. This way, the process was started and optimized from three locations, and all three molds were set up in just one week. Because in such situations, customers also expect qualified parts. "Delaying the deadline is never an option," Horn said.

Process optimization online support.

Remote maintenance and online support were already a major topic for Huf back before the Covid-19 pandemic. Over the years, all ENGEL injection molding machines at Huf have been connected via e-connect.24. This tool was used to provide support and enabled employees at global production sites to support each other. These experiences have accelerated the transition to traditional working methods. In addition, there is a good team spirit between ENGEL and Huf. "Just a few hours later, we formed a well-functioning team," Muthenthaler said. "Cooperation was very smooth. Arad's Huf colleagues checked the parts after each parameter change. As remote maintenance personnel, we need personnel on site to correctly evaluate the parts." All three molds started in the delivery, the customer was satisfied. The new design of the bearing支架 is now in mass production.
50 公斤塑料——对于这样的数量，一些注塑机需要许多周期。在克恩滕州的Europlast有着不同的标准，这里生产单次注塑重量达到50公斤的大型容器：用于农业的水果箱、用于工业和市政的物流和回收容器以及订制的个性化大型塑料部件——这些形状和颜色的多样化令人印象深刻，正如参观位于Dellach im Drautal的公司所在地时显示的那样。统一灰色容器的时代早已过去，甚至容器的几何多样性也令人印象深刻。产品多样化下的高精度和绝对工艺稳定性——这些特点描述了水果箱和回收容器的领先生产商之一的生产。

在Europlast以公斤和吨为单位计算——但产品质量以克和毫米为单位进行检查。凭借ENGEL的duo注塑机，这家气候中立型企业能够调和这些挑战。

适用于堆放水果箱的工艺稳定性

ENGEL duo 4000

垃圾箱生产：加工来自消费后收集的回收材料。

收获期间使用的苹果箱。苹果的大小决定了箱子的设计。苹果越小，填充重量越大，结构必须越稳定。

需要与梨或李子不同的箱子设计，甚至苹果本身由于品种和大小的不同也没有统一的要求。Europlast是欧洲塑料注塑容器解决方案三大供应商之一。根据产品的不同，生产主要以HDPE为原料，但也有来自消费后材料部分的回收材料。环保意识对企业来说很重要。“自2019年以来，我们成为一家气候中立型企业。我们通过许多节能措施以及向100%绿色电力转变实现了这一点。”技术和创新负责人Michael Seifter表示。“与自然和谐相处”是这家加工商的座右铭，它在每一个决策中都起着重要作用。回收利用、CO₂足迹，特别是自身生产的能源效率等主题都很重要。“我们努力以节约资源的方式生产，尽可能减少对环境的影响。因此我们对我们的生产机器提出了这些要求。通过ENGEL，我们在精神上找到了合作伙伴。”
ENGEL duo®型注塑机位于宽敞的生产车间内。与其他机器类型和品牌相比，这种大型注塑机系列具有与生俱来的低能耗特点。其中，具有较低移动质量的快速锁模单元、短行程气缸、经过优化的模具运动和具有需求导向泵性能的伺服液压系统ecodrive等，都有助于实现这一点。如果机器静止，例如在冷却过程中，电机也会停止工作，不会消耗能量。

Europlast和ENGEL自2004年开始合作，从一开始，ENGEL就完全根据客户的个性化需求对注塑机进行调整。例如，这涉及注塑单元，因为Europlast由于级联控制而需要相对较低的注射压力。为了节省更多能源，2020年交付的最新型duo®4000配备了电动配料驱动装置。因此，包括外围设备和自动化系统在内的每个周期的总能源需求低于11 kWh。"由于其高效率，ENGEL duo®注塑机在不到三年的时间内就收回了成本。"Seifter对这项投资表示非常满意，不仅出于可持续性的原因，也有经济方面的考量。

可用性至关重要
从技术来看，duo®系列拥有同时实现高效和可重复生产大型箱子至关重要的一切特性。始终如一的高品质对于箱子的稳定性至关重要，因此是一个决定性的安全因素。"在苹果收获期，需要堆放最多达到五吨的重量，14个箱子相互叠放。"Michael Seifter解释道。这种由苹果箱堆放的塔可以高约十到十二米。尽管具有薄壁结构，即使是最底层的箱子也必须稳定承重。根据苹果品种的不同，这些箱子的注塑重量在25到40公斤之间。尽管模芯很长，均匀的注射和恒定重量是完全填充型腔以及实现可重复的壁厚分布的先决条件。只有这样，箱子才有承重能力，在堆放时能够安全地相互交叠。此外，锁模单元对性能和效率也具有决定性作用。"ENGEL duo®注塑机是市场上速度很快的注塑机之一。开启、闭合和锁定是非生产性时间。在这方面，duo®非常快，直接进入周期时间。"Seifter解释道，并强调了代表ENGEL的另一个方面：非常高的设备可用性。"水果箱不是库存预制的，而是收获时按需生产。我必须能指望机器恰好在那时可用。"工艺稳定性与回收材料资源节约型生产的一个重要组成部分是回收材料的利用。根据食品法，目前还未批准将回收材料用于水果箱，但在回收容器方面，这一比例在不断增加。在使用中，回收容器必须承受与水果箱不同的负荷，后者只需要静态稳定性，因为收获时的气候条件变化很小。而垃圾桶承受的是动态负荷，例如从斯堪的纳维亚冬季的-30°C到以色列的+45°C以上。用于生产含有可收材料的回收容器的原材料来自循环经济意义上的后消费后部分。注塑机必须以高精度来补偿略微波动的材料稳定性。ENGEL注塑机的高工艺稳定性也被证明是Europlast在合同制造中的一大优势。大约30%的生产是使用不断更新的模具，为不同行业和不同尺寸部件进行的合同生产——这一趋势正在上升。因此，在位于克恩滕州的生产车间内，不仅仅有着duo®系列的大型注塑机。"ENGEL通过量身定制的解决方案为我们提供很好的支持，使我门能够灵活地生产。"Seifter说。将来，两个"精神伙伴"将继续合作开展新项目，以应对主要来自CO2问题的要求。"我们将继续致力于提高能源效率，增加回收材料比例，"Michael Seifter表达了简单的看法。最主要的是，他希望很快也能将回收材料用于水果箱。
从本质上看，回收材料与新材料相比受批次波动的影响更大。我们的智能辅助系统和技术在原材料质量波动的情况下也能确保恒定的熔体体积，并因此保持恒定的高品质。