

# innovations

Techniques – Markets – Trends

Volume 13 – 1/2019

## Injection Molding:

*Get to  
the Core  
of the Matter!*



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# Editorial

# Content



**Michael Wittmann**

Dear Reader,

My motto this time: "Back to the future!" – I would like to review the past year and outline my expectations for the year ahead of us in the first issue of *innovations* in 2019. The pure figures indicate that 2018 has joined the series of years which brought new record figures in sales. – Fantastic! – But a closer look reveals that our growth in the course of the year was by no means evenly distributed. The last quarter of 2017 and the first months of 2018 were sensational. But then the global economy began to stutter, which also had an effect on our segment of industry, largely due to developments in the automotive sector which is so important for us. For the first time in a number of years, the industrial associations have announced a decline in the order figures for injection molding machines and most auxiliary appliances. There are many reasons for this.

For example, trade barriers: I am writing this at the time when the G 20 Heads of Government have just finished their meetings in Argentina. Great importance was attached to the joint dinner of Donald Trump and Xi Jinping. Fortunately, this meeting took a positive turn, and there are signs that their mutual relationship has calmed down to some extent. The two trade partners will probably "leave the hatchet buried" for the time being, that is, not risk a further escalation. First effects of this conflict have also been felt by us. We have seen a slow-down in Chinese industrial production, but at the same time no acceleration of US production. The principle of communicating vessels seems to fail in this case and turn into a "principle of leaking vessels" instead, with losses on both sides. The US President Trump should also have realized this by now.

Forecasts have also become more difficult due to the internal problems of Europe. There is the WLTP testing procedure, according to which cars are required to be certified in the EU since September 1. Although VW, for example, certifies its cars in three shifts, not all models have yet been released for sale. The ban on diesel vehicles in some parts of Germany is causing uncertainty among car buyers. E-cars have not yet reached full road capability. Choosing the right drive system is currently not an easy task for car buyers.

Let me return to my initial statement: "Back to the future!" – For 2019, after the partly artificial overheating of the most recent years, I expect that we will see a return to the normal conditions prevailing in 2014 and 2015, that is, without excessive growth rates, but with business continuing on a sound level.

Let me take this opportunity to thank all our associates for their commitment, and all our business partners for our joint success in 2018!

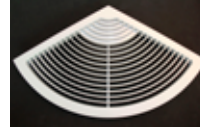
Yours cordially, Michael Wittmann

## **Focus: German Injection Molding** Automotive innovations



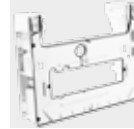
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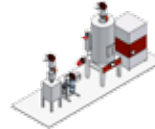
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# Reduction of pollutants through innovative plastics technology in cars

*Lighter weight with equal or higher performance – this is the challenge facing the automotive industry, caused by the demand to reduce the emission levels and fuel consumption of motor vehicles. This is why innovative, extremely hard-wearing plastic parts of superior quality are becoming more and more important. Winkelmann Powertrain Components, a company based in Ahlen, North Rhine-Westphalia, Germany, recognized this trend at an early stage and has relied on thermoset materials for the production of belt pulleys ever since. WITTMANN BATTENFELD supplies the machines for this purpose.*

**Gabriele Hopf**

The company today known as the Winkelmann Group was founded in 1898 by Heinrich Winkelmann and Caspar Pannhoff to manufacture kettles, coffee pots, wash basins, dustpans and milk cans. It has developed into a group of companies which now employs more than 3,000 associates worldwide, of whom about 700 are working in Ahlen, realizing some 500 million euros per annum in sales. In addition to its Ahlen facility, Winkelmann maintains production plants in Poland, Turkey and China. The Winkelmann Group is divided into the business areas of heating and water systems, automotive parts and drive elements, with the first two segments contributing the major part of the company's sales volume.

In the area of automotive parts, Winkelmann specializes in four product lines, namely drive system components, torsional vibration dampers, fuel distribution systems and belt pulleys.

The company's belt pulley production originates from sheet metal cold forming, one of Winkelmann's core competencies. In 1992, the production of plastic parts was introduced in addition to the belt pulleys originally made of steel and later of aluminum. In this context, three fundamental decisions were made: phenolic resin reinforced with fiberglass and minerals was chosen as the material to be processed, this material was to be formed by a unique proprietary injection core compression molding process specially developed for this purpose, with the registered



*All machines at Winkelmann have come from WITTMANN BATTENFELD.*

*Axel Neukirchen, Winkelmann Thermoset Product Manager, and Kai-Uwe Hilker (right), WITTMANN BATTENFELD salesman, in front of an HM 150 equipped for thermoset processing.*

trade mark WIN:DUR, and BATTENFELD was to supply the injection molding machines. The first belt pulleys made of thermoset were delivered to BMW.

Today, Winkelmann has already injection core compression molded some 50 million belt pulleys for water pumps, hydraulic power steering pumps and camshaft drives. Winkelmann expects great future potential primarily for the lat-

ter because of the reduction in weight and the cost savings compared to metal parts. Moreover, this company is one of the few manufacturers offering hybrid pulleys, which are made of thermoset combined with other materials such as metal, thermoplastics and elastomers.

**Thermoset processing with injection stamping technology**

During the injection core compression molding process, phenolic novolak resin is injected into the mold at low pressure to prevent orientation of the fiberglass particles. Next, the stamping core is shifted inside the mold, to generate the necessary cavity pressure and final geometry of the part in the mold. The pressure is subsequently maintained until chemical cross-linking of the phenolic resin has taken place, which can no longer be reversed. This process is responsible for the material's subsequent dimensional stability under thermal stress.

Accordingly, using injection core compression molded thermoset to produce belt pulleys offers a number of advantages.

In addition to the already-mentioned aspect of weight and cost reduction compared to metal, these are high sound absorption, a wear-resistant surface, excellent homogeneity, since the fiberglass is not oriented in any preferred direction, and high media resistance against all known substances in the engine compartment. As the outer skin of the product consists exclusively of resin due to this special process, a long service life for the belt is ensured as well.

Basically, it is also possible to manufacture belt pulleys from fiberglass-reinforced thermoplastics. However, thermoplastic materials with comparable performance attributes are far too expensive because of the complex material composition which is required to ensure the necessary thermal stability, and so they are not competitive. Therefore Winkelmann has never regarded them as an alternative.

Thermoset belt pulleys are currently used in air-conditioning compressors, water pumps and power steering pumps. Primarily due to the enormous reduction in weight compared to metal, Winkelmann sees future fields of application in camshaft drive systems, crankshaft dampers or belt drive systems for power steering, which are currently



still at the prototyping stage. Apart from that, Winkelmann is working on the further development of hybrid components made of steel, thermoset and elastomer, which could have an extensive field of application primarily in the area of damping. Here, the "decoupled" belt pulleys, whose designation is derived from their special design and function, offer the option of decoupling the belt drive and the aggregates connected with it from the rotational vibration of a combustion motor's crankshaft drive.

**Thermoset machines from WITTMANN BATTENFELD**

Winkelmann currently operates its thermoset production plant in Ahlen with 23 injection molding machines with clamping forces ranging from 100 to 150 t, all coming from WITTMANN BATTENFELD. Axel Neukirchen, graduated engineer and Thermoset Product Manager at Winkelmann comments: "During our initial phase in the 1990s, BATTENFELD emerged as the machine manufacturer with the greatest competence and readiness to adapt its machines to the injection core compression molding process, and thus proved to be the right partner for us."

The production was started with the predecessor models of today's hydraulic HM series, the 3-platen machines from the CDC series with central clamping cylinders.

In 2013, the first two machines from the HM series were delivered. These are HM 150/1000 *ServoPower* models with 150 t clamping force, equipped with energy-efficient servo drives, W821 robots from WITTMANN with the R8 control system for parts removal and insertion of metal rings, and WITTMANN temperature controllers from the TEMPRO plus D series for barrel tempering. Moreover, the machines come with the complete package of options required for thermoset processing.

In addition, special execution sequences required for the process in use at Winkelmann have been installed, including relevant monitoring functions. In order to ensure tension-free, perfectly formed parts, an additional core compression cylinder has been mounted on the machine to condense the cavity, with the effect of applying additional force to the cavity by the hydraulic cylinder via the core during the injection process. ♦

*Injection stamping mold: mobile mold half with compression core. Picture below: Fixed mold half with sprue bushing and base plate.*

*Photos on this page: Winkelmann Powertrain Components GmbH & Co. KG*

*Belt pulley with ball bearings to drive an air-conditioning compressor.*

*Thermoset toothed belt wheel for a camshaft drive with integrated setting device for adjustment of the camshaft.*

*Toothed belt pulley prototype made of thermoset for a camshaft drive.*



# Building service appliances – produced with WITTMANN injection molding technology

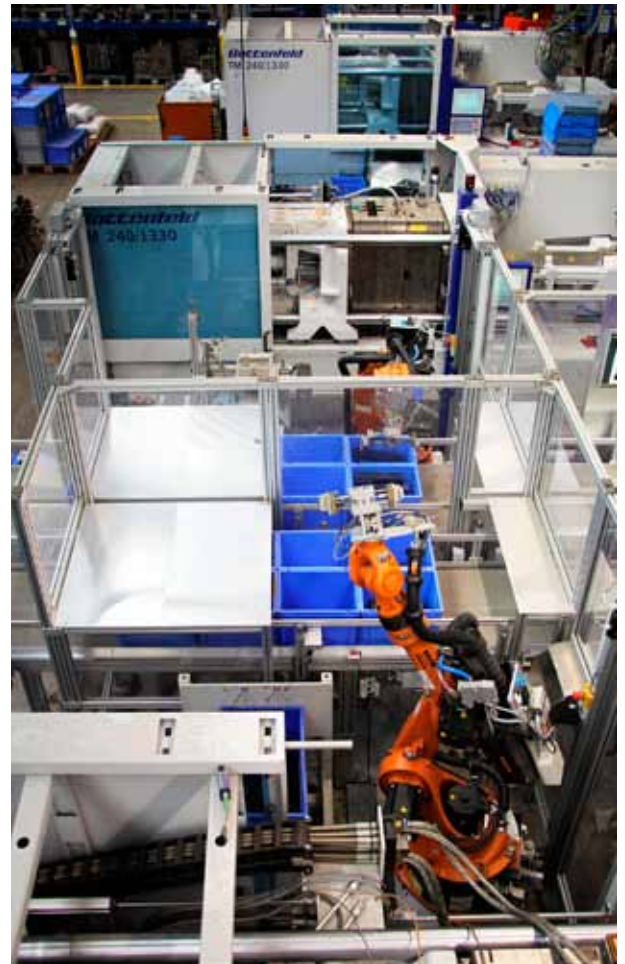
*The STIEBEL ELTRON Group based in Holzminden, Lower Saxony, Germany, ranks among the leaders worldwide in the areas of building services and renewable energy. To manufacture its plastic parts, STIEBEL ELTRON has been relying on technology from WITTMANN BATTENFELD for decades.*

**Gabriele Hopf**

*Dieter Jackel, WITTMANN BATTENFELD (left), and Marko Mühlhausen, Plastics Production Manager at STIEBEL ELTRON in front of the MacroPower 850/5100.*



*Two TM 240/1330 machines – automated by the WITTMANN Group's Nuremberg branch.*



**T**oday's STIEBEL ELTRON Group was founded by Dr. Theodor Stiebel in 1924. The company's first product was the coil immersion heater developed by Dr. Stiebel, which offered a particularly high degree of efficiency due to its special surface structure.

The same principle is still applied today in modern heating systems. In 1927, the first small instantaneous water heaters were rolled out. The present product range of the STIEBEL ELTRON Group includes appliances which work with renewable energy, such as heat pumps, heat accumulators, solar panels and photovoltaic systems, as well as water heaters such as instantaneous water heaters, automatic hot water generators, also hand dryers, heaters and air conditioners.

The STIEBEL ELTRON Group with a current workforce of more than 3,300 employees sells its products worldwide. Its main market is the German-speaking area, where the company is the market leader. The main success factors of the STIEBEL ELTRON Group, which had its most profitable fiscal year ever in 2016, are seen primarily in its uncompromising commitment to innovation, high quality standards,

*Driverless transportation system at STIEBEL ELTRON.*



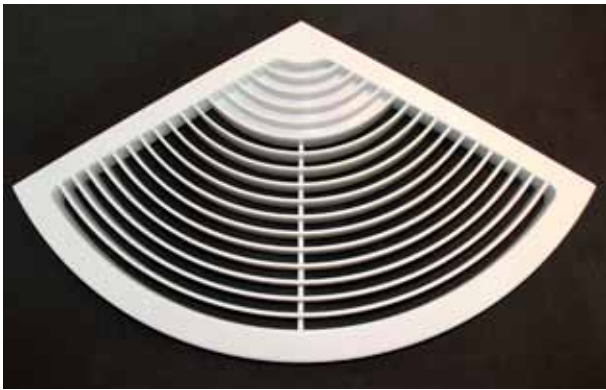


reliability and customer-oriented service. It operates a total of five production plants, of which two are located in Germany, one in Slovakia, and one each in Thailand and China.

### Own plastics competence center

Eschwege in Hesse is the home town of the STIEBEL ELTRON Group's plastics competence center. Here, all plastic parts for the European facilities are produced in three shifts, as well as small appliances consisting mainly of plastic components, such as small water reservoirs holding 5 to 15 l, hand dryers, hot water boilers or quick-response heaters.

*Housing components for a wall storage heater – manufactured on the MacroPower 850.*



With 170 employees, the plant produces 26 million plastic parts annually, ranging from 2 g to 2.5 kg in weight. Most of the molds come from the company's own mold making shop. The plant also has its own compounding system, which enables in-house production of the polyamide required for heater components. Marko Mühlhausen, Plastics Production Manager in Eschwege, is particularly pleased with the newly installed driverless transportation system (DTS), which has contributed significantly to increased efficiency.

*Ventilation grille – manufactured on the MacroPower 850.*

### Long-standing and productive partnership

To manufacture the plastic parts at STIEBEL ELTRON in Eschwege, processes such as 2-component injection molding, back molding and injection stamping are used, in addition to standard injection molding. Of the 24 injection molding machines installed in Eschwege, which are virtually all equipped with linear or industrial robots, about half are from WITTMANN BATTENFELD. They include toggle lever machines from the proven TM series. Two of these TM 240/1330 machines with 2,400 t of clamping force were each automated by the WITTMANN Group's Nuremberg subsidiary with an articulated robot from KUKA.

*Heating insulator for an instantaneous water heater made of material compounded in-house – manufactured on the TM machine automated by WITTMANN.*



Marko Mühlhausen reports that this equipment replaced similar equipment which had also been automated by WITTMANN, and that the replacement of the machines proceeded smoothly within a very short time. Apart from the TM series models, STIEBEL ELTRON has also installed several machines from WITTMANN BATTENFELD's PowerSeries, among these an all-electric EcoPower 110/750, which features extreme energy efficiency and precision, a 2-component MacroPower 500/3400H/210S with 5,000 t of clamping force and a MacroPower 850/5100 with 8,500 t of clamping force. The most recently delivered MacroPower 850 is equipped with a W843 robot from WITTMANN, a conveyor belt and a safety barrier.

*Examples of finished appliances from STIEBEL ELTRON: hot water boilers and instantaneous water heaters (picture below).*



The cooperation between STIEBEL ELTRON and WITTMANN BATTENFELD has continued for more than three decades. Marko Mühlhausen is very satisfied with the machinery from WITTMANN BATTENFELD. Apart from the high standards of precision and repeatability offered by these machines, he specially appreciates their easy operation, and even more the excellent service. Marko Mühlhausen: "Good service is vital for us, and in this area WITTMANN BATTENFELD has a definite edge on its competitors." ♦



# "Plastics in top form" with injection molding technology from WITTMANN BATTENFELD

*Under the motto of "plastics in top form", the Metak GmbH & Co. KG, based in Burgwald, Hesse, Germany, makes sophisticated, high-quality plastic parts for a great variety of applications. To manufacture its products, Metak has been relying on injection molding technology from WITTMANN BATTENFELD for more than 50 years.*

**Gabriele Hopf**

*BATTENFELD machine built in 1968 – today only of interest as a museum piece.*

*Picture right: Dieter Jackel, WITTMANN BATTENFELD salesman, with Jonas Åkesson, owner-manager of Metak, and Frank Hoffmann, Sales Manager at Metak (left to right) in front of the SmartPower 60 with insider cell delivered last year.*

**M**etak was established in Thuringia in 1933 by August Metzger, the great-grandfather of today's owner-manager Jonas Åkesson. Since 1948, the company has been located at its present domicile in the Hessian town of Burgwald. Its first customers were furniture manufacturers such as Thonet, Mauser and Voko. In the 1970s, Metak entered the heating industry by delivering parts to Viessmann. These two branches of industry are still the mainstay of Metak's customer base today.

## Highest demands

The requirements Metak has to meet are exacting, above all in the heating industry. For example, the materials processed must meet stringent criteria in terms of flammability values or resistance to acids, or the parts must provide airtight sealing, which means that they need to be absolutely free of warpage. To supply the required quality standard, Metak monitors parts production with thermal sensors inside the mold and uses camera technology in parts removal, in order to supply its customers with products 100% free of defects.

Apart from manufacturing technically faultless parts in mono- and multi-component technology, the surface quality of its products plays a vital role mainly in the furniture industry, but also in the automotive industry for the visible parts in vehicles. To fulfill all of these demands, a great variety of processes are used at Metak, with constant testing of new approaches.

In addition to individual parts, Metak also makes complete assemblies. Various processes are used on the parts as finishing steps, such as hot stamping, varnishing or laser printing. The company with a workforce of 116 also has its own mold making shop, where primarily repairs,



*Assembly of components at Metak.  
Photo: Metak*

maintenance work and adaptations are carried out on tooling. Mold design and engineering also take place in-house. Metak delivers most of its products to the European market, primarily to Germany.

Some 1,500 different products with weights ranging from 0.5 g to 6 kg are manufactured every year from all commonly available materials, such as PVC, PA, ABS, PC, PP, PE, POM, HDPE, PPS and others. The most frequently used materials are stored in silos and fed to the machines via a central materials handling system.

Since 2014, the company has also supplied private consumers with products sold via the Internet. For the most part, these products are made of recycled materials, primarily for environmental reasons.



To improve both productivity and product quality, Metak is currently working on introducing continuous flow production to make arm rests, and also on increasing the degree of automation.

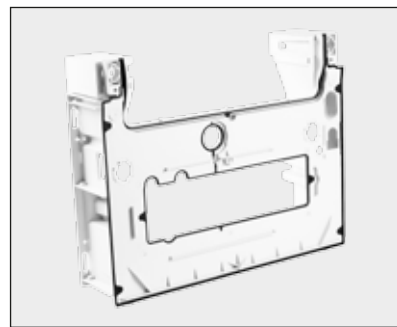
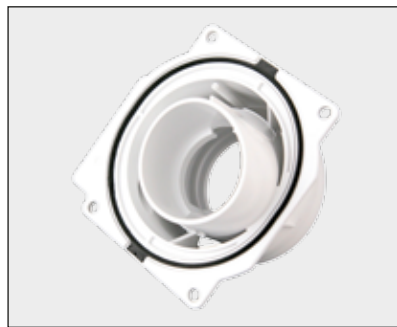
### Equipment from the WITTMANN Group

To manufacture its parts, Metak uses a total of 50 injection molding machines with clamping forces ranging from 250 to 13,000 t, among which are several older models of the hydraulic HM series and toggle lever machines of the TM series from WITTMANN BATTENFELD, as well as three machines from the servo-hydraulic *SmartPower* series.



Plastic building blocks (picture left) and mug holders, produced by Metak.

Photos: Metak



From left to right: Plastic containers exhaust gas adapter in 2C technology and housing part for heaters in 3C technology.

Photos: Metak



These are a *SmartPower* 25/130 model with 250 t clamping force equipped with a WP80 sprue picker from WITTMANN, a *SmartPower* 60/350 with 600 t clamping force and a *SmartPower* 210/1330 with 2,100 t clamping force. The two latter machines are equipped with an insider cell, which means that the parts removal robots, a W808 and a W821 respectively, a conveyor belt and other peripherals for upstream and downstream production steps are compactly integrated inside the injection molding machines. This solution offers significant advantages, including considerable savings in space requirements and a noticeable improvement in material flow, as well as shorter total robot cycle times due to shorter traveling distances and direct parts depositing on the conveyor belt.

mal energy consumption and simultaneously maximum dynamism, speed and accuracy of the machine's movements. Since some parts of Metak's production floor are built above a basement, the weight of machinery is an important consideration for this company.

Here also, the machines from the *SmartPower* series offer a compact design especially in combination with insider cells and thus meet the requirements of Metak in every respect. A particular benefit according to Jonas Åkesson is the good accessibility of the machines, a distinctive feature by which, in Åkesson's opinion, the *SmartPower* machines with their freely accessible, pivotable injection unit set themselves apart from other models.

Metak's business relationship with BATTENFELD has a long tradition. The first injection molding machine was already delivered in the 1960s. Today, Jonas Åkesson appreciates, apart from the quality and technology of the BATTENFELD machines and WITTMANN robots, primarily the excellent after-sales support and good spare parts service provided by WITTMANN BATTENFELD. And last, but not least, some praise also goes to the expert advice provided by the sales staff, which has enabled Jonas Åkesson to get exactly the equipment he needs for his specific requirements. ♦

Chair back in 2C technology.

Photo: Metak

# Successful with innovative technology

New production hall at Fröbel in Blaufelden with machines of the PowerSeries from WITTMANN BATTENFELD.

*The Fröbel GmbH, a widely known manufacturer, based in Blaufelden, in Baden-Württemberg, Germany, is a synonym among its customers for expertise, quality and absolute reliability. To manufacture its high-quality plastic products, Fröbel has been relying on technology from WITTMANN BATTENFELD for more than 50 years.*

**Gabriele Hopf**

*Joachim Fröbel shows Erwin Neugebauer from WITTMANN BATTENFELD the base for a stool manufactured on the 2-component MacroPower.*



*Picture right Joachim Fröbel and his son Tobias Fröbel with Erwin Neugebauer, WITTMANN BATTENFELD in front of the MacroPower COMBIMOULD (from left to right).*



**F**röbel, a family-owned company in the second and third generation, was established in 1949 for flat glass processing under the name of V+F OHG. The year 1960 marked its entry into the plastics industry with the purchase of a used injection molding machine. The first products the company brought to market were thermometers. In this sector, Fröbel is still active today on a small scale.

Fröbel's products are delivered to virtually all non-automotive sectors of industry. The company's major customer industries are white goods, the furniture industry, building construction, the installation, packaging and toy industries. Fröbel's product portfolio is just as diversified as its customer base, ranging from individual parts and complete assemblies to finished products. For some customers, the company even handles logistics for deliveries directly to end customers. Typical product examples are thermometer housings, medical stools, brackets,

cable reels, glass scrapers, thermos flasks, housings and interior of disinfection units, flush-mounted sockets or packaging for animal food. Fröbel produces 100% of the molds for its products in-house. This is the only way to maintain its high quality standards and flexibility, which is appreciated by the company's customers, a major proportion of which are located within a 200 km radius.

To meet the market requirements in terms of productivity, Fröbel manufactures its products in batch sizes from 1,000 to 100,000 units. The company with a workforce of 60 processes virtually all engineering plastics, including transparent plastics, plastics with filler content, conductive and anti-static materials, and thermoplastic elastomers.

Apart from the company's reliability, Fröbel's customers appreciate above all its cooperation in partnership and its comprehensive service, ranging from new product design to complete series production. Together with



# y from WITTMANN BATTENFELD



Picture left:  
Wavy stool seat.  
Picture right:  
Finished stool  
made of poly-  
propylene with a  
rounded 2-com-  
ponent base for  
controlled free  
movements.



Picture left:  
Thermos coffee  
flasks.  
Picture right:  
Housing of disin-  
fection unit.

Photos:

Fröbel GmbH

its customers, Fröbel generally finds technically and economically feasible solutions even for highly complex components.

### *The WITTMANN Group as a supplier*

36 of the 40 injection molding machines installed at Fröbel, ranging from 150 to 6,000 t in clamping force, have come from WITTMANN BATTENFELD. The first one was delivered in 1964, the last one in 2017. The robots, a total of 30, are also from the WITTMANN Group. The machines delivered most recently are three machines from the *MacroPower* series with 4,000 t clamping force, and a 2-component machine with 5,000 t clamping force, which is used, for example, to mold the bottom parts of stools. The compact design of these large machines is very convenient for Fröbel, which has already extended its production area several times. In 2016, its third hall

including a new high-bay warehouse was opened. Moreover, the company has installed four machines of the all-electric *EcoPower* series with clamping forces ranging from 550 to 1,100 t and two machines from the servo-hydraulic *SmartPower* series, a *SmartPower* 120 and a *SmartPower* 350 with the new UNILOG B8 control system. These machines stand out primarily by their high precision and energy efficiency, attributes which are regarded as very important at Fröbel.

For Joachim Fröbel, the company's CEO, the most important qualities of his machines are, that they offer excellent technology and are simple to operate. "The machines from WITTMANN BATTENFELD have a clear design, and their UNILOG control system, based on Windows™, is easy to understand and to operate", he says. His son Tobias, who manages the company jointly with his father, adds: "The service from WITTMANN BATTENFELD is also good, which is another very important aspect for us." ♦

**Gabriele Hopf**  
is the Marketing  
Manager of WIT-  
MANN BATTEN-  
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brunn, Lower  
Austria.

# Plastisud automates production with WITTMANN robots

*WITTMANN BATTENFELD France SAS provided the Plastisud company in France with a W837 double-arm robot for automating a high-end working cell for the production of closures.*  
**Julie Filliere**



*The Plastisud production plant in Castelnaudary, France.*



*Views of the W837 double-arm high-speed lateral robot from the WITTMANN Group.*



In 1964, the Plastisud company was founded in Castelnaudary in the south of France. Today, Plastisud is one of the world leaders in the design and manufacturing of high-precision molds. The company is managed by Laurent Buzzo, representing the family business' second generation. Plastisud's turnover is constantly growing, reaching 55 million euros in 2018 and 90% of that total being realized on an international basis.

In total, Plastisud produces more than 150 large molds per year, making the company a worldwide leading manufacturer of high-precision and high-performance molds. Plastisud is comparable to names such as Tetra Pak, Aptar, Unilever, Nestlé and Becton Dickinson, The business is focussed on three areas: packaging (30%), medical (30%) and closures (40%). For more than 50 years, Plastisud has continued to innovate, offering its customers globally deployable solutions. Plastisud, above all, is a project facilitator, offering its clients solutions for the development of products, including design optimization, reduction of cycle time, increased production rates, monitoring of weak mold areas, and complete turnkey systems.

About 200 employees work in the Castelnaudary production plant. The 14,000 m<sup>2</sup> facility includes a 1,600 m<sup>2</sup> air-conditioned test center, where new and overhauled molds are tested on a dozen injection molding machines with clamping forces ranging from 90 to 750 tons. This





special testing department is a result of continuous resource investment that accounts for 15% of the annual turnover. For example, one of these research results has led to further development work and has ended with the company filing a worldwide patent in the field of injection compression on stack molds that reduced the weight of parts by up to

20%. In this particular context, Plastisud needed a robot to automate a lately acquired 750 ton injection molding machine that completed the test center.

### *Two partners working hand in hand*



Plastisud needed a robot that enabled very short cycle times and also offered the highest accuracy possible. WITTMANN BATTENFELD France responded by proposing an ultra-high-speed W837 double-arm lateral robot, chosen for its reliability, its robustness and, above all, its extensive adaptability.

This robot's configuration (one fixed axis and one moving axis) is ideally suited for being adapted to single molds or two-stage molds, and to working with molds of different thicknesses. The robot is also capable of taking out the finished parts either from the fixed mold half, or from the moving half.

WITTMANN BATTENFELD France was able to provide Plastisud with exactly the system the company needed right at the moment. This system will even allow the integration of In-Mold Labeling (IML) functionality in the future if necessary.

WITTMANN BATTENFELD has always favored long-term commercial relations, allowing the development of expert exchange of ideas and close collaboration. In this manner the partnership between WITTMANN BATTENFELD and Plastisud came into being. Over the past few years, this partnership could also be witnessed on the occasion of some major international plastics exhibitions, like FIP, Equiplast, Fakuma, and Plasteurasia.

These exhibitions have highlighted the skills of the French mold maker, combined with the high performance of the WITTMANN BATTENFELD brand injection molding machines. For example, during the last NPE, this partnership led to exhibiting an EcoPower Xpress working cell that produced 96 1.3 g plastic closures with molded bridges at a single blow, and at a cycle time of less than 2.5 seconds. This project serves as a perfect example of the complementary nature of the two manufacturer's efforts, when developing joint projects. ♦

*Plastisud mold, ejecting plastic closures.*

*The final product: closures with molded bridges.*

**Julie Filliere** is Communication and Marketing Manager at WITTMANN BATTENFELD France SAS in Moirans.

# Robot controls evolve toward greater flexibility, connectivity, ease of use

*There were times when there were simple seven-segment displays, rotary dial timers, and mechanical toggle switches. But robot controls have undergone steady and fairly rapid evolution.*

**Jason Cornell**

*Picture left: Early WITTMANN CNC robot control. Picture right: Today's intelligent robot controls allow the robot to find the optimal time to enter the mold area – even before the mold is fully open – and also can monitor torque applied to the ejector motor to pull the robot arm back as the molded parts come forward.*



In the infancy of automation in the plastics industry, robots were fairly simple machines, utilizing primarily pneumatic cylinders. As the use of electric motors became more prevalent, the capabilities of robot controls had to keep pace. In the 1980s, robots became noticeably more prominent in plastics processing.

As computers became more of a part of everyone's daily life, they were simultaneously becoming critical components of the workplace. The plastics industry was no exception, with robot controls keeping up with new advances in personal computing technology. The goal of computing at the time was not just to make a more user-friendly interface, but to add more powerful features to help increase productivity.

## *Programming debate*

Early on, the robot industry in plastics had two different schools of thought when it came to how the machines should be programmed. One was to give the users complete freedom – within the physical limitations of the robot. Many refer to this style as “open-architecture” programming. The other school of thought brought about “canned” or “mode-based” programming.

This style gave the user a handful of options within the program to choose from. Each method had both benefits and drawbacks. For the “open-architecture” programming method, the advantage was that users could create their own custom sequences for anything from inserting applications to controlling downstream automation. The user could do all this without ever needing to contact

the robot manufacturer. This flexibility was appealing to users with existing knowledge of what they wanted to do and how they wanted to do it; and it expanded the range of capabilities to include everything the hardware was capable of.

The main drawback to this style was exactly what made it so advantageous when a custom program was needed. For even a simple pick-and-place application, the user was required to write a line-by-line structured program. But this was not intuitive enough for those with limited programming experience.

On the other end of the spectrum, you had the “canned program” approach. This made it much simpler for the pick-and-place user. There was only a handful of options from which to select, that could carry out basic, but commonly used, functions.

Based on these selections, the operator was then able to specify the required positions and the program, and robot, were ready to go. This made common, simpler applications like pick and place easy and intuitive, but it was limited.

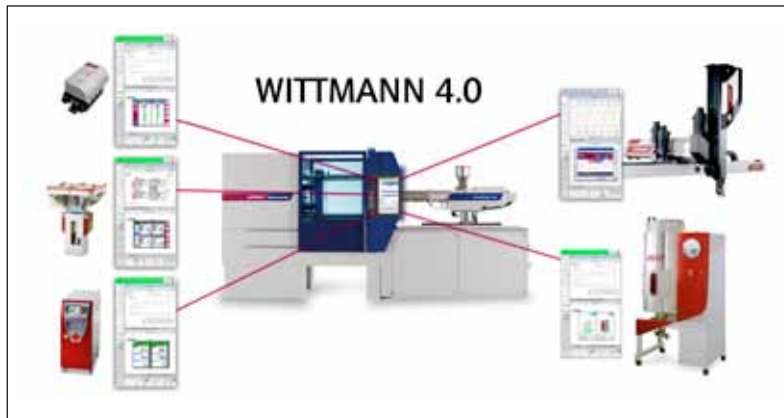
When it became necessary to expand the robot's capabilities beyond what these few basic options allowed, the operator typically had to contact the robot manufacturer to order custom programs. This was usually expensive, and it took weeks or months of lead time.

As mentioned, each style had its distinct advantages and disadvantages. In an attempt to get the best of both methods, robot manufacturers started trying to find ways to marry the two types. Unfortunately, for many years, nobody was able to find an ideal way to do it.



## Storage media and displays

Through the 1980s and 1990s, robot manufacturers used various backup media. The industry seems to have landed on USB drives for its portable media, at least for the time being. The newest control generation also offer networking operations, which gives them the ability to centralize backups and programs to a server. As technology progressed, the old DOS-code displays were replaced by colorful and easy to understand icons/screens. Navigation between necessary tasks was made simple, and learning to use the controls became easy.



## Advanced programming methods

It was not until fairly recently that there finally emerged some companies that began to create a more optimal way to marry the “open-architecture” and the “canned” programming styles. These companies incorporate a “wizard” with “lead-through” programming that walks the user step by step through the basic program setup. These wizards help to make the setup practically foolproof. The user is able to set up basic functions like pick-and-place programs in a matter of minutes.

Generally, once the basic program sequence is created, if the user needs to modify it beyond what is defined in the wizard, they can then move into some sort of “text editor” function to gain complete program freedom. The text editor provides a user-friendly, intuitive way to modify the sequence beyond what the wizard provides, with far more

available options for users in need of more unique functionality. Although there are still the older-style controls in our industry, to get the most out of personnel, molding applications, cycle times, and robots, most users have seen the need to move to robots that offer the features mentioned above.

## Expanded processing power and intelligence

As robots advanced, the controls gained processing power and became increasingly intelligent. One such innovation was mold following. This requires extra hardware to be installed on the press. A transducer is plugged into the robot through a special interface; it allows the robot to know the position of the mold and how fast it is traveling.

Once this information is processed, it allows the robot to enter the mold and follow its opening sequence. This process saves cycle time, as the robot doesn't have to wait for the mold to be all the way open before entering the mold. However, the extra cost and programming have made this option less attractive to some, as the ROI can be slow to develop.

Parallel with the continuously improving simplicity of setup and increased processing power was the evolution of greater intelligence. There now exist features such as artificial intelligence that allows robots to know independently when it is the optimal time to enter the mold, just prior to the complete mold-open signal. This is not the same as “mold following,” where extra transducers are required on the molding machine, but rather it is an intelligent system that allows the robot's initial acceleration stages to happen while the mold is in the process of opening, creating a more efficient process than anyone could program specifically.

## Next up: Industry 4.0

The biggest advance in the 21<sup>st</sup> century has been the move towards internet connectivity. In our personal lives, many of us have become accustomed to computers. Today, we expect the same rapidity of information reporting from manufacturing equipment.

Everybody involved in production wants to know whether the equipment is working or not. The newest generation of controls can easily be connected to the internet to provide this crucial information.

Everything from e-mail alerts, to being able to remotely access information is fast becoming the norm in robot controls. When a robot goes down, a user should be able to have the robot manufacturer connect remotely to the equipment to get the robot back up and running in an instant.

WITTMANN BATTENFELD is already implementing Industry 4.0 features, offering a fully integrated molding-cell solution. The robot and auxiliary equipment can be integrated into the molding machine control. This offers the same advantages previously discussed, but for the entire molding cell, not just the robot. It also allows operating the machine via the robot control. ♦

*The trend toward Industry 4.0 connectivity (or WITTMANN 4.0 in the WITTMANN Group's implementation) encourages integration of robots and other molding-cell auxiliaries with the molding machine control.*

*Picture left: Only one example of WITTMANN 4.0 implementation is the company's QuickLook app for mobile devices, which shows the color-coded status of all machines and robots in a plant. (Green = automatic operation; Blue = non-automatic operation; Red = safety criteria out of compliance) Picture right: WITTMANN's R9 robot control viewed on the company's B8 injection molding machine control.*

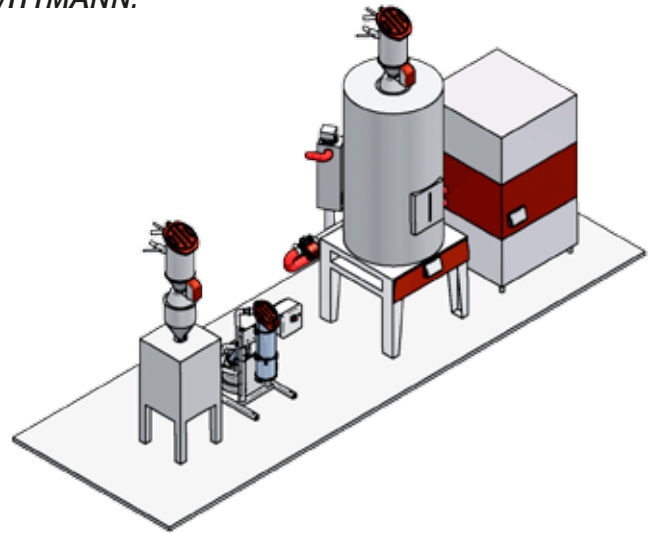
**Jason Cornell** is the WITTMANN BATTENFELD Western Regional Manager of the Robots & Automation Division, based in the company's West Coast Tech Center in Placentia, California, USA.

# Drying system for an integrated production cell

*Cornaglia is one of the best-known suppliers to the automotive industry. To meet the highest demands in the field of plastics processing, the company uses a drying and conveying system from WITTMANN.*

**Paolo Girola**

*Photograph and schematic representation: partial view of the WITTMANN drying and conveying system at Cornaglia in Turin, Italy.*



The Cornaglia Group is an Italian company, founded in 1916 in Turin, the famous “Motortown” of northern Italy. More than 50 years ago, Cornaglia had entered into the automotive industry, with a particular specialization in air ducts, filtering systems and exhaust systems for cars and trucks. Besides the four Cornaglia factories in Italy, several production sites have been established in Eastern Europe, Turkey, India, Canada, USA and Brazil. Recently, a new production cell was installed in the Turin headquarter of Cornaglia, producing oil pans for truck engines.

Only a few years ago, oil pans used in endothermic engines were manufactured from metal, but during the last decade, engineering plastics have step by step replaced the metal formerly used in this field – thanks to several advantages: less weight, higher mechanical strength, better flexibility when it comes to assembling all related components (oil ducts, filters, etc).

## **A challenging material**

For the oil pan, PA66-GF35 is used, a reinforced polyamide plastic. Being a highly hygroscopic material, there is an absolute need for a deep dehydration process before



the material is melted and injected into the mold. Otherwise, the water molecules bonded inside the polymeric chains of the polyamide would, during the melting process, evaporate within the injection barrel, thus leading to structural weakness of the molded part. In order to assure the most reliable results, no compromise could be accepted with regard to the drying of this particular PA-polymer. Usually, PA66-GF is given a dryer residence time of

three hours at a temperature of 80 °C. Based on Cornaglia’s experience in handling the polyamide polymers for similar applications, this standard drying time was considered not being long enough.

Therefore, a much safer margin of five hours was calculated for the material, assuring enough time for the dehydrating process. With this safety margin, even a highly water-saturated polymer could be dried down to the very low level of residual moisture required for the injection molding process.

With a shot weight of about 5.8 kg for the molded part, and a cycle time of about 120 seconds, the drying system had to be sized for the processing of 175 kg/hr. According to the bulk density of the PA66-GF polymer, a 1,200 ltr SILMAX-based solution from WITTMANN could achieve the requested five hours of residence time.



### **No overheating and degradation of the material**

The technical department of Cornaglia was obviously concerned that an excessive residence time could lead to stress and degradation of the molecular chains of the polymer, finally leading to structural weakness of the molded part. Here, the "Material Saver Function", a standard feature of all WITTMANN SILMAX drying hoppers, brought relief to Cornaglia's worries.

With this function, the drying hopper's inlet and outlet temperature is constantly monitored, and if the difference between these two values falls below a certain level (which means, the moisture content of the granulate being very low), the temperature of the process air is automatically reduced, thus avoiding overheating the polymer and the degradation of the molecular chains.

In addition to that, in view of the air flow parameters, there was also a demand for the best equipment performance. Although a flow rate of 300 m<sup>3</sup>/hr of dry air would have been enough for processing 175 kg of PA66-GF per hour, Cornaglia decided for a 50% higher air flow rate, so a WITTMANN DRYMAX E450 battery dryer was chosen.

Within the dryer, a dew point sensor was installed, offering two important benefits. The first of these – and the most important – is the continuous monitoring of the quality of the drying process. Whatever the

cause may be: if the dew point raises above a certain safety limit, an alarm is given, and the process undergoes an immediate monitoring, according to the strict rule: "quality first!". The second benefit is that the switchover of one desiccant bed to another is not executed using fixed intervals.

A switchover only takes place when the quality of the dry air (its "dryness") is worse compared to the set safety limit. This feature delays the coming regeneration phase of the saturated cartridge, avoiding unnecessary regeneration cycles, saving energy and extending the life time of the molecular sieves.

The conveying of the granulate to both the drying hopper and the injection molding machine, is executed by WITTMANN FEEDMAX material loaders that are connected to a central material conveying system, also from WITTMANN. A centralized vacuum station with a double-stage 4.3 kW side channel blower is sufficient to convey 175 kg of granulate per hour from the storage bin to the SILMAX hopper, and then 175 kg from the SILMAX to the injection molding machine. The complete dedusting of the material is achieved by means of the FEEDMAX loader's sieve filters. A centralized filter station collects the dust extracted from the granulate.

Using a WITTMANN drying system, the Cornaglia Group has achieved the best possible performance and quality in its material handling system. Cornaglia views this as fundamental for best quality and for real technical innovation in the automotive sector. ♦

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## WITTMANN screenless granulators with feeding shafts

*WITTMANN screenless granulators with built-in feeding shafts offer many advantages. A feeding shaft helps to avoid bridging, especially in case of "X-shaped", "H-shaped" or nested runners and flat parts.*

**Denis Metral**

Compared to conventional blade granulators, screenless granulators provide a number of benefits such as energy efficiency, less noise, clean and uniform regrind from hard, brittle plastics such as, ABS, PC, ABS+PC, PA, glass-fiber-reinforced plastics, as well as mineral-filled and talc-filled engineering materials. These granulators run smoothly at a low speed (27 to 32 rpm) without stalling, and they are suited for cutting thicker sprues and/or parts to a pellet size from 4 to 10 mm. Thick-walled parts and/or runners can be processed even using small motor sizes because of the high torque these granulators provide. In short, this type of granulator comes as a solution tailored to the specific needs of those regrinding tough materials. These units make the processor's job much easier, more productive, and more profitable – as the key to efficient and effective plastics processing, in terms of drying, blending and melting, is a uniform regrind.

### **Advantages of feeding shafts**

A feeding shaft keeps large runners/parts in motion, and pre-breaks them, thus helping to avoid bridging or nesting of parts. The shaft also helps to avoid downtime eventually caused by material backing-up or material overflow, and keeps the production process running smoothly.

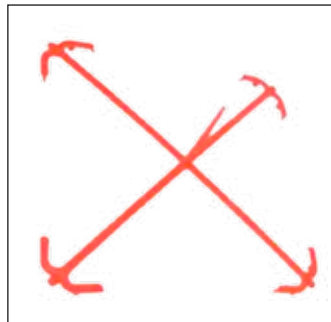
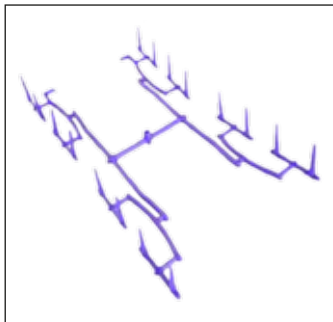
The optional feeding shaft offered by the WITTMANN Group is completely independently driven and it has elongated hooks to pre-cut the plastic parts/runners and push them into the cutting chamber for a subsequent regular grinding.

The feeding shaft therefore reduces the dimensions of the parts before they reach the cutting chamber, and this may allow the use of an altogether smaller type of granulator, possibly saving capital expenditure. >>

View of the JUNIOR DOUBLE cutting chamber with two rotors, cutting large sprues and parts, and with the optional feeding shaft mounted within the opened feed hopper.



Typically problematic shapes of runners: "H" and "X", and a flat part (from left to right). In such cases, ideally a feeding shaft is used.



**Fundamentals of screenless granulation**

The principle of screenless grinding uses rollers with many teeth intermeshing with bed knives, and a few breaker knives. At first, the breaker knives on the rotor push the sprue/part deeper into the cutting chamber and/or pre-break it. Then the roller cutter's teeth grab the particles and reduce them to smaller pieces: to ideally sized consistent and dust-free chips. This approach allows the material to be cut uniformly, so that it can be easily reprocessed by the machine. This is, all in all, an economical operation which is further enhanced by using a helical arrangement of the cutting teeth – for even greater energy savings. The cutting teeth on the rotors are, in view of the rotor axis, not perpendicularly arranged, but are making a staggered cut that needs less energy and is less likely to jam.

Toothed rollers are available with 4, 5, 7, or 10 mm teeth. The granules of the resulting regrind can only reach the size of the distance lying between two teeth. No longs are generated, and no screening of the regrind is necessary.

**ARS Automatic Reversing System**

WITTMANN offers an optional Automatic Reversing System (ARS) to boost the cutting performance under high load conditions. The Automatic Reversing System helps minimize blockages in the cutting chamber and aids the granulation of thick-walled or tougher plastics, such as those heavily reinforced with glass fiber.

This optional Automatic Reversing System enables the granulator to determine if the resistance to the cutting blade is too high. When this should be the case, the rotor reverses, thus repositioning the part, allowing cutting from a different angle.

Finally, screenless granulators from the WITTMANN Group are available with a part feeding hopper that has a large top opening, ideally designed to be fed with sprues manually or with a conveyor. This provides the plastics processor with the possibility of an integrated, closed-loop recycling system while minimizing the regrind's contamination. ♦

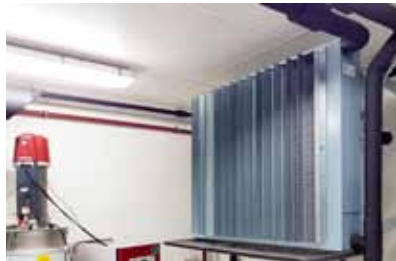
**Denis Metral** is International Product Manager for granulators at WITTMANN BATTENFELD France SAS in Moirans, France.



## Development work on dryers in the climate chamber

The WITTMANN materialhandling technology plant (including sheet metal production) has been located in Wolkersdorf, Lower Austria since 2015. WITTMANN dry air dryers, which are sold worldwide, are among the products developed there. These are exposed to extreme conditions in the climate chamber on site, to make sure that the appliances show the reliability promised by the name WITTMANN at every place in the world. Right next to the showroom in Wolkersdorf, on an area of some 35 m<sup>2</sup>, heart of the material handling technology's R&D department is situated, the climate chamber. Of course access to it is prohibited while tests are in progress, yet numerous interested visitors to the showroom still take the opportunity to have a look through the viewing window into the interior of the chamber.

The climatic conditions prevailing in Austria and Central Europe certainly vary a lot, but on the whole are not so extreme that they would present a real challenge to dry air dryers. However, it is indispensable to test appliances which operate with the ambient air under extreme conditions as well. After all, WITTMANN dryers operate in all conceivable areas of the world, and so they must cope everywhere with the local ambient temperature and air humidity. Right from the plan-



ning stage of the Wolkersdorf production plant, the climate chamber installed there was included in the design. It offers a room completely insulated from the outside world and equipped with an ultra-modern air conditioning system, which is able to simulate an extremely wide range of ambient climatic conditions.

The dimensions of the chamber are laid out to accommodate not only mobile and battery dryers for test purposes, but also entire drying systems. This makes it possible to specify at an early stage the necessary adaptations to specific requirements on various local markets.

All dryers are exposed to a great variety of ambient conditions. The test results are recorded using the OPC protocol and included in relevant documentations, from which the locally required adaptations can be derived in each case.

For example, if a dryer operating in Europe or North America is able to reach an excellent dew point value with standard equipment and in standard operation, specific adaptations still need to be made to reach a comparable result under tropical conditions. It goes without saying that one of the most recently developed new products in the area of drying technology, the ATON segmented wheel dryer from the WITTMANN Group, was optimized in terms of drying performance and energy efficiency with the help of tests carried out in the climate chamber.

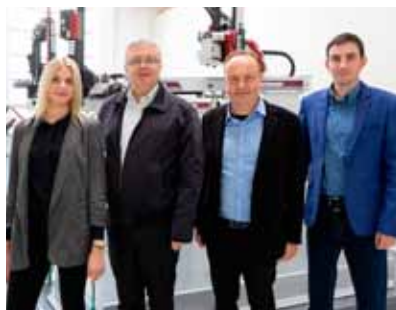
WITTMANN dryers score with the option to have the actual dew point shown on their display – unlike various products from competitors, which only display the set target value. ♦

*Inside views of the climate chamber at the Wolkersdorf production plant of the WITTMANN Group.*

*Hermetically sealed from the outside, the climatic conditions currently prevailing inside the chamber can be retrieved by using a touch terminal.*

## New agent of the WITTMANN Group in the Ukraine

WIBA TOV, established in Kiev in summer 2018, is the new representative office of the WITTMANN Group in the Ukraine. So WITTMANN BATTENFELD injection molding machines and auxiliary appliances from WITTMANN are now also available in this rapidly growing market. Peter Kreytzi and his team rely on the WITTMANN BATTENFELD brand, which is also well-known in the Ukraine and stands for high quality standards, energy efficiency and service. For him and his team, personal contacts with the local plastics processors



are vital, since they may ultimately develop into long-standing partnerships. So far, Western European brands have not really been present in the Ukraine, so that primarily

Chinese manufacturers are currently offering their products in that country. Changing the market situation in this respect is the goal of WIBA TOV. Plastic products have already been strongly in demand in the Ukraine for a considerable time, and 1,400 injection molding companies have been established there so far. A growing industry with many interesting customers for WIBA TOV. Most recently, the economy of the Ukraine has grown by 3.6%, which certainly contributes to a positive outlook on the development of its local market. ♦

*From the left: Kateryna Dubovyk (Managing Director/Area Sales Manager), Ivan Vishchak (Area Sales Manager), Peter Kreytzi (CEO), Serhii Bakhmat (Service Group Leader).*

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