

Wittmann

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innovations

Techniques – Markets – Trends

Volume 14 – 1/2020

*Follow
the thread
of our
new story!*

In this issue:
We begin our series
on key aspects
of plasticizing screw
technology

Battenfeld



WITTMANN innovations (Volume 14 – 1/2020)

Quarterly magazine of the WITTMANN Group. The magazine appears to meet the informational demands of staff and customers.

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Issue 2/2020 of “WITTMANN innovations” will appear at the beginning of the second quarter 2020. – www.wittmann-group.com



Michael Wittmann

Dear Reader,

2020 – quo vadis? A few weeks ago, I had the opportunity to view and listen to a presentation by an economic research institute. Needless to say, this was about the current economic development and the outlook for 2020. An eye-opener for me was the statement by the managing director of the institute that President Trump's morning tweets would be as crucial as the statistical data collected in the course of the research institute's business activities, on which forecasts would normally be based.

We have now become very familiar with President Trump's erratic outbursts of anger, so this can only mean that "everything is possible, and nothing is fixed".

An additional factor in Europe is the Greta Thunberg effect: a young girl in need of protection dedicates her life very effectively in terms of publicity to an issue which affects us all. This creates an emotionally charged situation, in which intelligent and fact-based discussion and decision-making have become virtually impossible.

And how does this all affect our industry? – In 2019, the growth of mechanical engineering for the plastics industry put on the brakes and fell back to the order intake level of 2012. This downturn was largely due to new trade barriers and the many uncertainties for consumers, which have induced them to postpone their purchasing decisions. But since it is not possible for them to postpone their purchases indefinitely, we are starting the new year with optimism. We have already made use of the last year to continue working at full steam on our product development. Innumerable new product launches at the K 2019 have demonstrated very impressively our innovative strength in all business areas.

At the WITTMANN Group, these areas also include injection molding process technology, so we are presenting to you in this issue of our quarterly *innovations* magazine the first part of a three-part series of articles about the correct design and dimensioning of plasticizing screw geometries.

This year, we will also work intensively on circular economy, digitization and CO₂ neutrality. There will certainly be a range of exciting topics to provide a lot of interesting reading material and food for discussion.

I would like to take this opportunity to thank all our employees and business partners very much for their loyalty and dedication, and I wish us all a successful and healthy New Year.

Yours cordially, Michael Wittmann

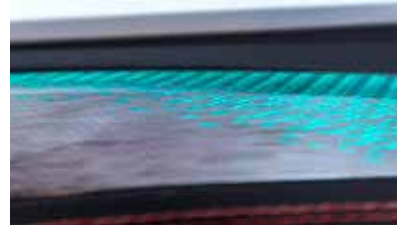
Injection Molding

All about plasticizing screws



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The all-time biggest robot



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All about plasticizing screws

Part 1 of the series

The first part of this three-part series of articles discusses the basic design of a plasticizing unit and the correct choice of injection unit. It shows how the required screw diameter can be ascertained on the basis of the shot volume. The formula for the average residence time can be used to estimate the degree of utilization and the thermal load on the material (which should be kept low in the interest of high product quality). Last but not least, the maximum injection pressure and the available screw torque are key variables for successful injection molding production. – Basic principles for the selection of a barrel-and-screw combination, and the starting point for further optimization.

Filipp Pühringer

Designing an injection molding machine is actually a highly complex task. To ensure that no wrong choice is made when selecting the machine, a large number of key parameters must first be identified and included in the calculation.

Particular attention must be paid to the plasticizing unit, since it is a vital success factor in manufacturing high-quality products. The requirements these aggregates have to meet are extremely complex, but by carefully balancing the different aspects already at the stage of designing the equipment, it is possible to eliminate conflicts of objectives. For example, the demand for the highest possible throughput conflicts with the requirements for material homogeneity, melt quality, conveying stability and wear resistance. The wear resistance does not depend exclusively on the type of material processed, but is rather an attribute resulting from the systemic interplay between the geometry and the correct choice of materials.

The discussion presented here focuses on what needs to be considered in planning the basic design of the plasticizing unit and the injection unit. The definition of the basic design of the plasticizing unit and the injection unit provides the prerequisites for the next step, that is, the choice of the screw geometry. In the next issue of innovations, the development of a new screw geometry will be explained in more detail. (The limiting factors in



Various shapes of plasticizing screws.

developing new screw geometries are the loads on the material processed and on the machine, such as pressure, temperature, dosing torque, etc.)

Basic design of the plasticizing unit

Shot volume

Depending on the material to be processed, the optimal operating range of a plasticizing unit is a screw stroke roughly between 1 and 3 screw diameters (D). If a dosing stroke of more than 4 D is selected for loading the injection unit, maximum process stability can no longer be ensured. The possible consequences would be dosing

time fluctuations, air induction and accelerated wear of the unit. The reason is that the effective screw length is reduced by an increased dosing stroke. Thus, the length of the channel is shortened to compression level, which means that the material has less time to absorb sufficient heat for melting. The result would be rising pressures inside the channel, which would strain both the material and the machine. The shot volume V_{SCH} is calculated as follows:

$$V_{SCH} = \frac{m_T}{\rho_m} + f_{HK} \cdot V_{HK} + V_{MP}$$

For hot runner tools, the compression of the melt inside the hot runner must be taken into account – depending on whether the hot runner needs to be cyclically unloaded (e.g. in the case of open hot runners with easy-flowing materials). The higher the melt compressibility and the higher the injection pressure, the higher the factor f_{HK} for the hot runner. Typical values for f_{HK} lie between 0.1 and 0.3. Thus,

The screw diameter can be derived from the calculated shot volume. As already stated, the metering stroke can be defined as a distance equal to the length of 1 to 3 screw diameters. Accordingly, the following limit diameters apply to the screw:

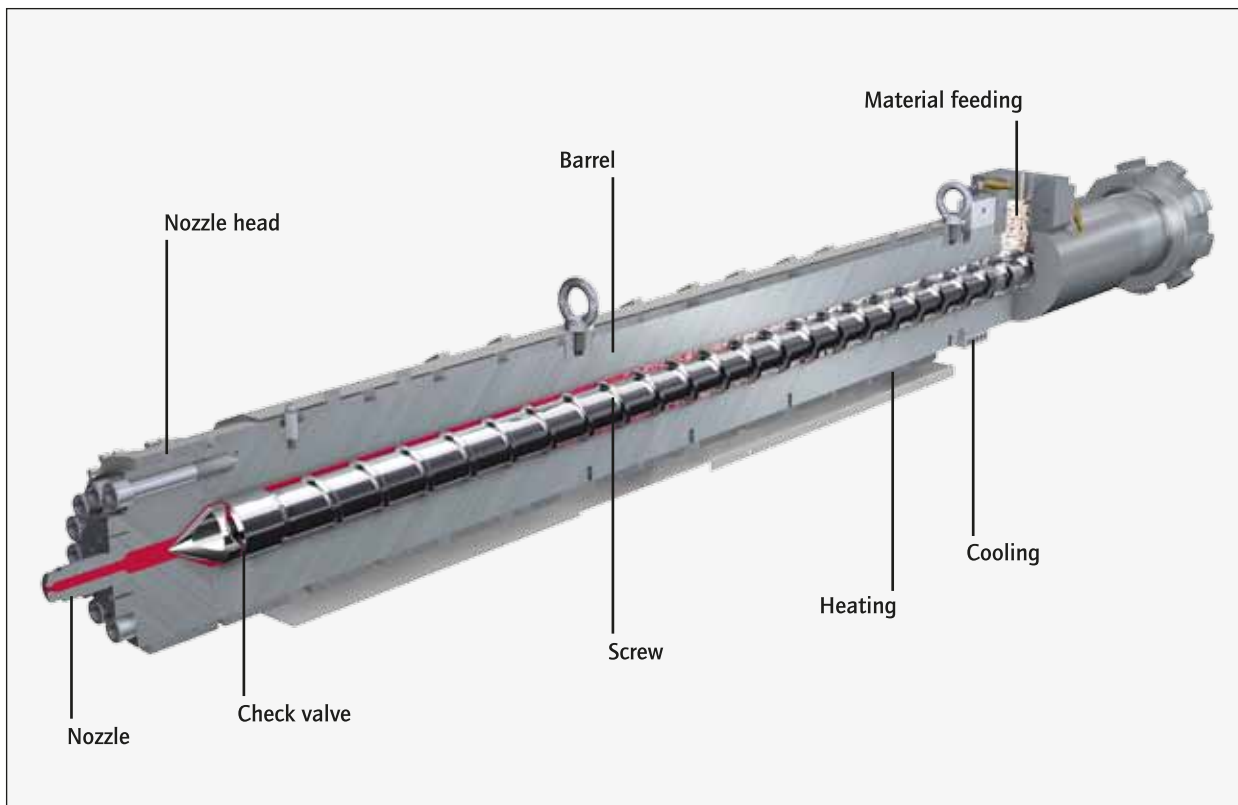
$$D_{min} = \sqrt[3]{\frac{4 \cdot V_{SCH}}{\pi \cdot 3}} \quad \text{and} \quad D_{max} = \sqrt[3]{\frac{4 \cdot V_{SCH}}{\pi \cdot 1}}$$

In the final choice of the screw diameter, the characteristics of all products to be manufactured must be taken into account. Following careful consideration of the calculated diameter ranges, the actual screw diameter is selected.

Residence time

Residence time is the length of time spent by a given plastic particle inside the barrel. Due to the complex flow processes inside the barrel, however, there is no preci-

Effective screw length:
The length of screw lying between the front edge of the filling hole and the screw tip inside the working area of the barrel. It is decisive for material conveyance and pressure build-up.



Schematic diagram of the plasticizing system.

even with relatively small part weights m_T , the required stroke volume may be doubled! For tooling with solidifying sprue, the factor f_{HK} tends towards zero. It is important to note that the weight of the solidifying sprue system is then included in the part weight m_T and taken into account accordingly. The volume of the residual melt cushion V_{MP} should change in relation to the screw diameter D . As a general rule, a screw stroke of 0.1 to 0.3 D should be found inside the barrel at the end of the holding pressure phase. Consequently, the volume of the melt cushion V_{MP} must be calculated as follows:

$$V_{MP} = 0,3 \cdot \frac{D^3}{4} \cdot \pi$$

sely defined time span which applies equally to all melt fractions, but a certain residence time distribution. This depends on factors such as the channel volume, the total cycle time, the material bulk density, the melt density and process parameters such as back pressure and screw speed.

The residence time distribution provides information about the material quality concerning homogeneity and sufficient plasticization. The wider the residence time distribution, the higher the homogenizing effect. Calculating the residence time distribution is a complex mathematical task. In practice, however, a simplified formula for the mean residence time t_v is often sufficient for an assessment. The mean residence time is the amount of >>

- V_{SCH} Shot volume
- m_T Part weight
- ρ_m Melt density
- f_{HK} Hot runner factor
- V_{HK} Hot runner volume
- V_{MP} Volume of residual melt cushion
- D Screw diameter
- D_{min} Smallest recommended screw diameter
- D_{max} Largest recommended screw diameter
- t_v Mean residence time
- t_{zykl} Total cycle time
- V_K Screw channel volume
- f_{MAT} Density correction factor

time a plastic particle spends on average inside the barrel. The mean residence time serves as a first indicator of thermal damage to the material.

$$\bar{t}_V = f_{MAT} \cdot \frac{V_K}{V_{SCH}} \cdot t_{zykl}$$

The factor f_{MAT} takes into account the varying material densities. For instance, the density of solid material is higher than that of the melt, which again is higher than the bulk material density to be found in granulated raw material. Experiments have shown that this factor generally lies between 0.8 and 0.9.

Thus, the calculated residence time is reduced by the empty spaces between the granulate grains in the feed zone of the screw.

For common types of plastics, an optimal time window ranging from 2 min to about 8 min is to be expected.

The residence time should not fall below at least 1 min. It should also be mentioned that, depending on the types of additives and base polymers, there are large differences in the thermal stability of plastics. So some special types of material – for example for lens production – can easily withstand residence times of more than 30 min, while in plastics with medical ingredients degradation processes may already set in after only 2 min.

At the stage of developing a specific screw geometry, the exact channel volume is of course not yet known. Here, the volume of the existing standard 3-zone screw can be used for preliminary orientation. In the case of screws operating according to the same principle, the volumes usually deviate only slightly from the standard value.

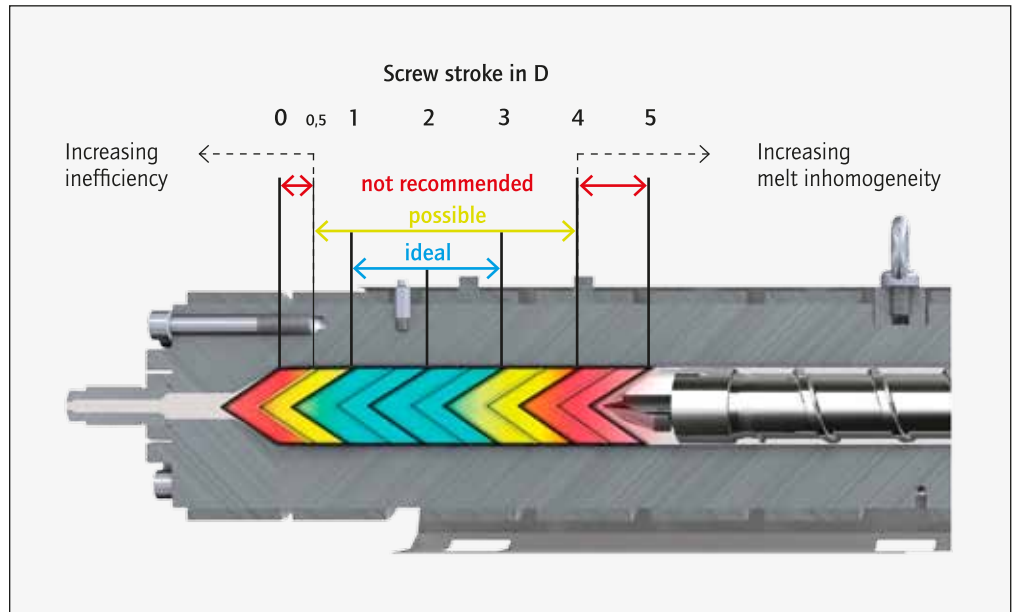
In principle, calculation of the residence time can provide a first reference value for the total length of the screw. Screws are lengthened for extremely short dwell times and shortened for extremely long dwell times.

Maximum screw torque

Every injection unit has a maximum screw drive torque. It is fixed by the installed drive system. Injection molding machines from WITTMANN BATTENFELD are available with different equipment variants to provide higher drive torques. In this context, the mechanical strength of the driven screw must also be taken into account. Here, the thinnest cross-section is the limiting factor.

Accordingly, the drive torque is adapted to the strength of each type of screw to prevent screw breaks. For determining the required torque, the previously defined variables such as stroke utilization and residence time, as well as the viscosity of the material to be processed, are decisive.

In addition to using precise calculation tools, WITTMANN BATTENFELD can draw on extensive experience from countless systems previously installed to make the correct choice in each particular case.



Schematic diagram: recommended stroke utilization.

Maximum injection pressure

The maximum possible injection pressure must be ascertained in every single case. There is a choice of barrels in different dimensions for every size of injection unit. Especially in the case of large barrels, the maximum injection pressure must be observed. Due to the larger cross-sectional area of the screw, a lower specific injection pressure can be set to obtain the same injection force.

Another important point: the smaller the screw diameter, the higher the transmission ratio of the specific injection pressure to injection force will become, which has an effect on control accuracy. This is ultimately the reason why no small barrels can be installed in large aggregates of any size.

In practice, the required injection pressures are derived from empirical values or determined by calculation (e.g. by filling simulations). Nevertheless, the mechanical engineering design should be laid out to provide a sufficient reserve.

Basic parameters for decision-making

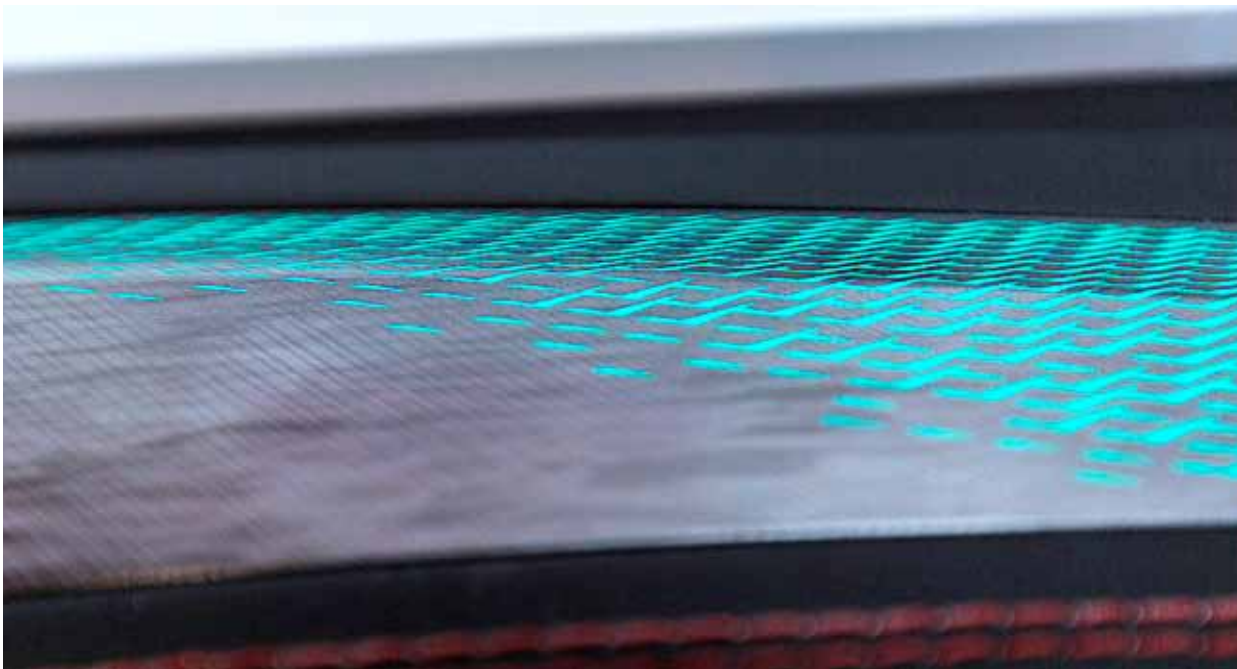
Shot volume, residence time, maximum screw torque and maximum injection pressure: the clarification of these central parameters should make it possible to determine the size of the screw and to choose the right injection unit to match it – or at least strongly limit the choice for both decisions. ♦

Filipp Pühringer is Head of the Process Engineering Development Department at WITTMANN BATTENFELD in Kottlingbrunn, Lower Austria.

From the roll to the third dimension

LEONHARD KURZ Stiftung & Co. KG headquartered in Fürth develops and produces decorative and functional coatings for a great variety of plastics applications which are transferred to plastic parts by means of carrier foil during injection molding. An essential objective is technology and process development as well as the further development of 3D modeling on corners and along the contours of plastic parts. For this purpose, LEONHARD KURZ operates an extensive injection molding technology center. Its equipment includes two production cells based on servo-hydraulic SmartPower injection molding machines from WITTMANN BATTENFELD with 1,200 and 2,100 kN clamping force.

Reinhard Bauer



Decorative and functional coatings, such as those developed and produced at LEONHARD KURZ in Nuremberg/Fürth, enable efficient implementation of new design concepts, shown here, for example on a car door panel with variable and dimmable back-lighting.

*Photo:
LEONHARD
KURZ Stiftung
& Co. KG*

For many of us, the car has become like a second living room, where we tend to spend more and more of our time, thanks to the increasing traffic density. But instead of being able to relax there, we are exposed to a number of stress factors. In order to counteract this, car manufacturers have increasingly invested in recent years in ergonomic improvements and assistance systems, but also in a more comfortable environment for the driver, especially through improving the surrounding surfaces. This includes coating of hard cladding parts with soft-touch elastomers, as well as painting and printing effects or combining structural parts with surface decorations. The latter, in particular, has turned out to be the method with the greatest potential for innovation, thanks to the advancement in foil technology, which is proved by significant growth rates.

More than just high gloss, decoration and scratch protection

Ever since the 1980s, foils have been playing an increasingly important part in the surface finish of plastic parts. At first, these were mainly used as carrier foils for metal coatings to be transferred onto plastic parts by

hot stamping. This led to the foil gaining an increasing significance as a transfer medium for placing design layers/decorative prints on parts during the injection molding process. Roll-to-roll transfer is used for this purpose (IMD = in-mold-decoration through transfer). A foil feeder specially developed by KURZ pulls the laminated foil web (most frequently consisting of polyester) synchronized with the cycle through the open mold, with the possibility of having continuous designs controlled by path control, and single image decorations by light conductor positioning. The IMD mold-specific clamping frame and vacuum technology then take care of high-precision holding and fitting into the mold cavity. The coating layer is subsequently “overmolded” to form an adhesive bond with the plastic. After the carrier foil has been separated from coating layer during mold opening, the inline-decorated part is demolded normally. This decoration method is also known as a “dry varnish decoration system” (including protective coating).

LEONHARD KURZ based in the Franconian city of Fürth is the market leader in transfer products for surface finishing of plastics parts. In addition to traditional hot stamping foils and IMD foils, Kurz offers a wide range of >>

*PMD insert
combined with a
printed capacitive
PolyIC sensor on
the inside of the
molded part.*

*Photo:
LEONHARD
KURZ Stiftung
& Co. KG*



decoration products with special effects and/or functionalities, such as parts commonly known as PMD (print mold design) foil components. These are crystal-clear polycarbonate foils printed on both sides with a precisely coordinated design.

In this way it is possible to create part decorations with a 3D effect. Because of their relatively high rigidity and relatively high softening temperatures, however, PC foils are not suitable for direct processing on an injection molding machine, but must be cut to size and formed into insert parts outside the machine by thermoforming

and subsequent downstream finishing steps instead. When inserted into the mold and then overmolded, they are transformed into instrument panels of center consoles for automobiles.

Varioform IMD pushes application limits and unit costs

However, neither the IMD roll passage method for processing polyester foils nor the PMD foil insert process are all-purpose solutions for decoration tasks. They differ in terms of both application limits and costs. For instance, the IMD polyester foils processed directly from the roll within one injection molding cycle can only be drawn three-dimensionally within relatively narrow limits.

As a further step towards realizing three-dimensional design transfer, KURZ intelligently combined several methods with each other into a single process and developed the Varioform one-shot roll-to-roll IMD process from there.

Martin Hahn, responsible for Application, Technology & Innovation, explains this as follows: "This additional technological development in application technology opens up a wide range in the choice of foil systems in combination with the injection molding substrate materials (such as PP or ABS-TPU). This leads to new variation options also in part structures, with simultaneous utilization of a diversified design perspective as well as, from an economic point of view, to achieving an even greater 3D moldability in a ONE SHOT roll-to-roll IMD process."

Similar to standard IMD processes, design changes are carried out by simply exchanging the foil roll. It is also possible to process a great variety of single image and continuous decorations as well as functional foils. This, too, enables the realization of extremely high-quality surface designs at reasonable cost. Thus IMD Varioform constitutes a further link in KURZ application technology.

Martin Hahn: "For KURZ, processes and application technology are vital success factors. Accordingly, our technical application lab for injection molding has been extended by adding appropriate trial and testing equipment. Following a comprehensive cost/benefit analysis, we decided to acquire two injection molding cells from WITTMANN BATTENFELD for this purpose. The decisive argument in favor of this choice was their all-in-one concept,

LEONHARD KURZ – Fürth



The company, founded in 1899 by Leonhard Kurz for the production of gold leaf, is known today as the KURZ Group, a global leader in hot stamping and coating technology. KURZ develops and produces decorative and functional coatings applied to carrier foils for a great variety of application areas, such as metalized, pigmented and holographic stamping foils for packaging or print products, surface finishes for electronic appliances or automotive parts, protective and decorative paints for furniture or household appliances, authenticity marks for brand products or magnetic strips for flight tickets or savings bank passbooks, or holographic strips for bank notes. With more than 5,000 employees in 14 production plants in Europe, Asia and the USA, 24 international subsidiaries and a global network of agencies and sales offices, the KURZ Group manufactures and distributes an extensive product portfolio for surface finish, decoration, labeling and forgery protection, rounded off by a wide range of stamping machinery and stamping tools. Furthermore, KURZ invests continuously in new technologies and develops innovative solutions for integrating functions in surfaces.

(Photo: LEONHARD KURZ Stiftung & Co. KG)



which means that all auxiliary components for the injection molding machines, such as handling robots, parts conveyor systems, material loaders, mold tempering devices and the complete clean room housing also come from the WITTMANN Group, are therefore perfectly coordinated with each other and also linked to each other and to the outside via the WITTMANN 4.0 software tools.”

Optimal near-production maturity with SmartPower injection molding machines

To drive the further development of KURZ process technologies with maximum closeness to practice and production maturity, KURZ decided to acquire two machines from the servo-hydraulic *SmartPower* series, namely a *SmartPower* 210/750 (with 2,100 kN clamping force) and a *SmartPower* 120/350 (with 1,200 kN clamping force), each equipped with a W918 robot from WITTMANN and clocked part conveyors. KURZ has fitted the clamping unit of each machine with a roll-to-roll foil feeding unit.

Project Leader Fabian Bürkel from LEONHARD KURZ and Marcus Otto, Sales Engineer for Injection Molding Technology at WITTMANN BATTENFELD/Nuremberg were jointly responsible for the detailed conception of the two systems. Fabian Bürkel comments in retrospect: “The most important point for us was the transferability of the processing parameters established in test runs to the real operation practice of potential users of our foils. Here, we wanted to be as independent as possible of variable influences from production auxiliaries. The WITTMANN BATTENFELD concept of interlinked and coordinated auxiliary devices gives us the chance to concentrate entirely on the coordination of the injection molding process with the corresponding wide range of different foil systems.”

Reaching for three-dimensional heights

The main focus of the new testing capacities lies on increasing the level of three-dimensional foil stretching (through infrared pre-heating and subsequent vacuum forming inside the mold) as an integral part of the injection molding process, as well as systematic optimization of the sprue position to minimize the effect of thrust impact from the plastic melt on the carrier foil’s elasticity.

An important side effect of the current product development program is keeping the corners of molded parts free of wrinkles, as well as process-safe folding of the foil around the contours of the molded part. (Please note: folding in this context means bending a decorative material, e.g. a plastic foil, around the edge of a carrier part by 90° or 180°, with subsequent fastening of the bent edge of the foil to the rear side of the carrier part.)

An award-winning application for a car door inside panel demonstrates the potential inherent in KURZ application processes. Here, a partly translucent decorative foil/IMD single image system is combined by means of IML technology with a printed capacitive PolyIC sensor on the inside of the molded part. Both of these are overmolded within just one injection molding cycle. The sensor enables touch operation of the light switch and the dimming function, by which the color of the LED light source can also be varied. ♦

KURZ has increased its application/technology capacity by the acquisition of two “all-in-one” production cells based on SmartPower injection molding machines with 2,100 and 1,200 kN clamping force.

Photos: R. Bauer

Both injection molding machines are equipped with roll-to-roll foil feeding units. The robots carry a foil heating panel and on the opposite side a suction gripper for finished parts removal.

The production cells were designed by Project Leader Fabian Bürkel, LEONHARD KURZ, and Marcus Otto, Sales Engineer for Injection Molding at WITTMANN BATTENFELD/Nuremberg.

Examples from the current testing program at LEONHARD KURZ to extend the thermoforming dimensions and potentials for forming corners and radii with various foils.

IMD technology on the visible side of a door panel. In addition, a PolyIC foil component is placed on the rear side, equipped with a printed-on sensor structure to integrate functions.



AIRMOULD® at WITTE in Ostrov: 300

The production plant of the German WITTE Automotive group, newly opened in Ostrov/ Northern Bohemia in 2016, specializes in the production of car door handles and locking modules in cooperation with the Nejdeč plant 20 km away. Its current annual production amounts to approximately 3.5 million units. For this purpose, 14 WITTMANN BATTENFELD injection molding cells are running at WITTE Automotive in Ostrov. About one million of the handles produced are manufactured as hollow parts, using WITTMANN BATTENFELD AIRMOULD® gas injection technology.

Reinhard Bauer

Xhe diversity of shapes, colors and functionalities of the external door handles and locking units manufactured at WITTE Automotive in Ostrov, which must also comply with stringent crash safety regulations, is impressive. Yet the product portfolio of the WITTE Automotive group goes far beyond external door handles; it also includes strikers, internal door operating systems, locks and keys, closing aids, door-stays, door brakes and motorized door drive systems.

Focus on surface quality

Since the door and flap handles of a car are seen and felt by its user, their shapes and touch contribute substantially to a car's appearance of quality. To produce them, a new injection molding plant was built in Ostrov near Karlovy Vary in 2016, with 14 injection molding machines from WITTMANN BATTENFELD with clamping forces ranging from 1,800 to 5,500 kN as its basic equipment, combined with WITTMANN linear robots and peripherals for automatic downstream finishing of the injection-molded door handles. An expansion of the facility to 20 production cells is under way since last year.

The handles are manufactured from PA6-GF30 (with 30 per cent fiberglass reinforcement), the covers from a PC/ABS blend, the structural components behind them from PP-GF 30. The requirements for consistently high quality of the molded parts with optimal energy efficiency are fully met by the hybrid *MacroPower E 500/2100* machines equipped with an all-electric injection unit and a servo-hydraulic 2-platen clamping unit.

"Depending on customers' specifications, we produce three different types of door handles", explains Pavel Karas, Department Manager Injection Molding at the Ostrov facility during a tour of the production hall. Then he adds: "Handles with incorporated sensors and appropriate electronic devices require an installation space with smooth walls. For this purpose, we produce handles where mechanical sliders inside the mold push out to create the necessary space. The alternative are handles consisting of two or more



housing shells held together by snap couplings and screws. The handles without integrated sensor electronics are one-piece hollow parts produced with gas injection technology", and he emphasizes that "this is the most effective method to reduce the plastic wall thickness and consequently the necessary cooling time and material consumption without elaborate mechanisms inside the mold."

This process seems simple, but it requires high-precision process control for optimal results. The first step is to completely fill the cavity and solidify of the outer layers by cooling them on the cavity wall. Then a controlled dose of nitrogen is blown into the plastic melt through injector nozzles under a pressure of up to 300 bar. There, the pressurized gas acts like a piston and displaces the still liquid plastic melt from the core area into an overflow cavity via a mechanically opened channel. Depending on the handle model, the quantity of plastic pushed out is about 25 to 30 percent of the total volume. The gas pressure inside the now hollow part subsequently counteracts shrinkage through cooling, thus eliminating potential sink marks on the outer surface. At the end of the cooling time, the molded part and content of the overflow cavity are removed, and the contents of the overflow cavity are cut off and recycled for re-use together with virgin material. The cycle time is reduced to about 45 to 50 seconds, depending on the handle model, and is thus roughly equal to that of the process using a slide.

The focus of the WITTE Automotive production plant, opened at Ostrov in Northern Bohemia in 2016, is on car door handles and the locking mechanisms behind them.

Photos: R. Bauer

bar pressurized nitrogen under control



The central nitrogen supply and processing unit is located outside the corporate building. A central liquid nitrogen tank is combined with two gas compressor/vaporizer units. Via a gas bottle aggregate for pressure balancing, they feed nitrogen under a system pressure of 300 bar into the pipeline system of the machine hall.

System integration for easy operation

On the injection molding machines, the pressurized gas is distributed to several individual supply pipelines leading to the injection nozzles inside the mold. Each of these injection pipelines passes through its own pressure regulator, which is controlled by a separate AIR-MOULD® control unit. This is an independent device which can be used flexibly on several machines as required. The core of the mobile control unit is a UNI-LOG B6 control system able to address up to eight pressure control modules and eight core pulls. Its communication with the injection molding machine takes place via the standardized EUROMAP 62 interface specially

14 WITTMANN BATTENFELD injection molding machines at WITTE Ostrov, with clamping forces ranging from 1,800 to 5,500 kN, producing about 3.5 million door handle assemblies for automobiles per annum.



Central pressurized nitrogen network for all machines

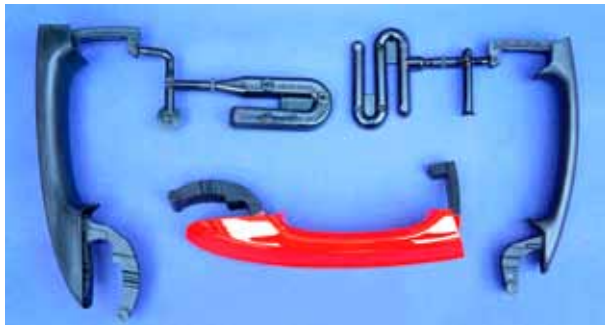
When the new plant was constructed, all of the infrastructure components for injection molding production were laid out not only for centralized machine charging and operation, but also for future modular extension. This equally applies to the power connections, the material drying and loading system and the nitrogen supply.

designed for the integration of fluid injection equipment. On the 15" TFT color touch-screen of the AIRMOULD® control unit, pressure profiles can be entered with nominal curves and up to nine freely programmable positions. It is also possible to have actual value pressure curves displayed simultaneously for up to eight pressure control modules. A multi-channel pressure monitoring system and an impulse program for automatic purging of the injection nozzles are >>

Michal Slaba, Managing Director of WITTMANN BATTENFELD CZ and Pavel Karas, Production Manager of Injection Molding at WITTE Ostrov, looking back on many years of successful cooperation.



About 1 million handles are produced in Ostrov from PA6-GF 30. – Two models with the core material displaced by the nitrogen into the overflow cavity. In the middle a high-gloss painted part.



Picture left: The central gas supply system. Picture right: AIRMOULD® control system able to address up to eight pressure control modules. The control system communicates with the machine via the EUROMAP 62 interface.



Since, with only few exceptions, the handles are produced with 4-cavity molds, the gas flow to the machine is divided into four individual streams passing through four separate pressure control units.



Close-up view of a 4-cavity mold to produce handles with gas injection technology.



Reinhard Bauer is a freelance journalist and communications consultant specializing in plastics technology.

also available. The AIRMOULD® control system includes the same basic functions as the machine's control system, such as access authorization via a USB stick or password, and a storage facility for process data, either externally via a USB port or via a network connection.

The gas pressure in the individual nozzle pipelines is controlled by highly dynamic servo valves inside the upstream pressure control units. To keep the controlled section short and to minimize potential losses of gas, the pressure control units inside the machine are positioned as close as possible to the mold, ideally directly on the mold platen. Since, with few exceptions, the handles are manufactured with 4-cavity molds, the gas flow there is divided into four individual streams. The control modules are designed with the focus on high-precision regulation and monitoring of the gas pressure for both large and small volumes of gas. To ensure consistent gas quality, the control modules are equipped with inlet and outlet filters for the gas stream. The cavities of the mold are connected with their respective control units by individual gas pipes.

Conclusion

WITTMANN BATTENFELD has been supplying equipment for the mass production of thick-walled, one-piece parts with perfectly smooth surfaces free of sink marks for more than 30 years. Thanks to its strategic reliance on in-house development, the company is able to offer integrated system solutions proven in 24/7/365 operation.

WITTE's Production Manager Pavel Karas draws his own positive conclusion in this matter: "Due to our position in the just-in-time supply chain of the automobile manufacturers, we are absolutely dependant on permanently reliable production equipment. Here we have always been able to bank on WITTMANN BATTENFELD injection molding technology." ♦

WITTE Automotive – Ostrov



WITTE Automotive with its corporate headquarters in Velbert/North Rhine-Westphalia ranks among the technology leaders in the area of closing and locking systems for automobiles. These can be found on doors, flaps and seats in cars of all major brands. Production takes place in Europe, at four locations in Germany, as well as in Sweden, the Czech Republic and Bulgaria. 5,200 employees realized more than 670 million EUR in sales in 2017. WITTE Automotive shows a global presence in the USA, Mexico, Brazil, India, China, Japan and Korea as a member of VAST, the Vehicle Access Systems Technology Alliance. With about 12,000 employees and about 1,700 million USD in sales, VAST ranks among the globally leading suppliers in this product segment. By opening its second facility in the Czech Republic in 2016, WITTE Automotive has set new benchmarks with the most modern production plant worldwide for painted external door handles in Ostrov. (Photo: R. Bauer)

"Manufacturing safety": Productos Climax and WITTMANN BATTENFELD

Productos Climax is Spain's leading manufacturer of personal protective equipment. The business has a very wide product range ensuring safety for all working areas in very many different sectors.

WITTMANN BATTENFELD Spain



Interior view of the Productos Climax production plant.

Established in 1984, Productos Climax has been growing steadily and regularly, thanks to dedication, experience and know-how acquired in the course of 34 years of progress and business development. On the one hand, the company's professionalism has allowed them to offer a perfectly adapted product that answers the needs of the customers on the national market – on the other hand, to face and overcome the enormous complexities that exist on the different international markets in regard to the different standards of workplace hazard prevention.

Following the slogan "We work for your safety", Productos Climax applies its business culture to each of its manufacturing processes, offering equipment that guarantees maximum safety and user comfort. Complying with the technical requirements demanded by the European CE regulation, the company strictly respects the requirements established by the laws of each country where its products are in use. Climax's Research & Development & Innovation Department designs and develops all Climax components, depending on the special needs of each activity. All components are manufactured under strict quality control and verified twice in Climax's own laboratories as

well as at official approval centers, thus obtaining the necessary certification. And, after more than 30 years, Productos Climax has become a benchmark in the world of personal protective equipment, being active in more than 70 countries worldwide.

Productos Climax and WITTMANN BATTENFELD

At its injection molding plant in Parets del Vallès (Barcelona), Productos Climax has entrusted its plastics technology needs to the WITTMANN Group for years. The factory contains a considerable array of WITTMANN BATTENFELD machines, always accompanied by the best WITTMANN automation systems. This Spanish company's production center not only relies upon the award-winning WITTMANN W8 robots, but also on the latest generations of peripheral equipment from the same manufacturer. Among other things, Climax uses FEEDMAX loaders, DOSIMAX dosing equipment and DRYMAX dryers. Only last year Productos Climax successfully commissioned two *SmartPower* 300-ton servo-hydraulic injection molding machines and a large *MacroPower* 650-ton machine, >>

Picture left: Climax products – face protective mask (1), respirator mask (2), safety glasses (3), protective glasses for welding work (4). Picture right: Productos Climax plant in Parets del Vallès (Barcelona).



Francisco Recio, Climax Production Manager, Carlos Duard, Area Salesman of WITTMANN BATTENFELD Spain, and Yoel Vaca, WITTMANN BATTENFELD Spain Sales Manager.



together with several robots, customized automation and diverse auxiliary equipment – thus showing total confidence in WITTMANN Group technology.

Ismael García, the Productos Climax Sales Manager, says that this partnership has helped to “achieve a real improvement in terms of productivity, significantly reducing the number of defective injection molded parts.” He expresses his total satisfaction with the technical and customer service offered by the WITTMANN Group’s Spanish subsidiary, WITTMANN BATTENFELD Spain. He adds that all his expectations have been met, and all problems had been solved that occur when installing new injection molding equipment and automation. WITTMANN BATTENFELD Spain is proud and grateful to receive such a satisfactory testimonial from such a prominent customer as Productos Climax. Especially when the manufacturing process requires the very best in terms of precision, quality and reliability.

Written by the Marketing Team of WITTMANN BATTENFELD SPAIN S.L. in La Pobla de Claramunt near Barcelona.

Productos Climax and WITTMANN BATTENFELD Spain form a strong team, with both companies producing the best technology. Together, they have achieved a great success and solid loyalty from their customers. Climax is not limited to personal protective equipment for the working environment. It also produces a complete range of products focused on the world of today’s sport, helmets, climbing harnesses, ribbons, ropes, and so on – the best products on the market for safe sporting activities.

Much of this company’s success is based on in-house production. From Productos Climax’ point of view, “Made in Spain” is a real hallmark, which perfectly illustrates their efforts to ensure perfect identification as a manufacturer with each of their products. Climax exercises a total and integral end-to-end traceability of the production process. And to get to this quality standard Climax has invested over the years in the very best machinery and equipment. ♦

The biggest WITTMANN Group robot yet belongs to BELLI, France

BELLI was founded in 1957. The family business is managed by Eric Chanal. The company is located in Bellignat in the department of Ain, in the heart of the French "plastics valley". Recently, BELLI purchased a W873XL robot, the biggest robot the WITTMANN Group has built so far.

Julie Filliere

The BELLI production workshop has more than 22,000 m² of floor space and houses 24 injection molding machines with clamping forces from 60 to 3,500 tons. BELLI processes more than 7,000 tons of plastic material (ABS, PP, PE and PA) per year. The company is active in many different industry sectors: food, agriculture, construction, electrics, toys, shipping, childcare, security, and others.

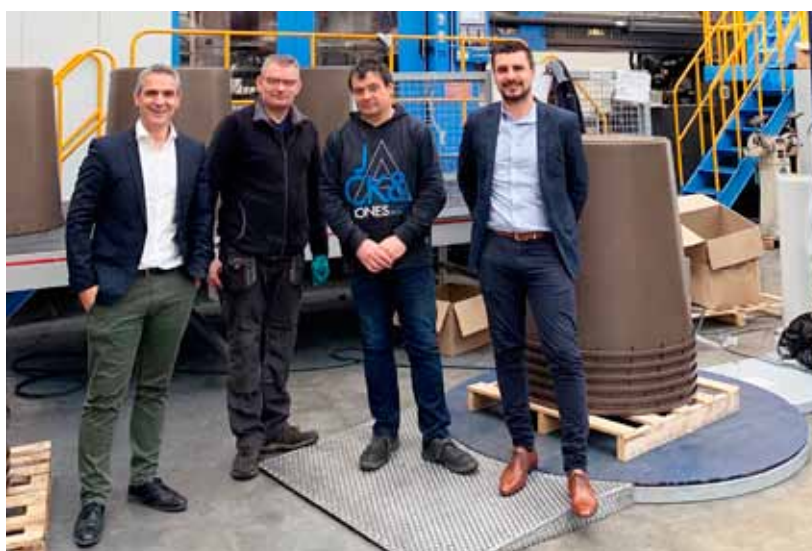
With the purchase of the W873XL robot, BELLI now owns the biggest WITTMANN robot ever. When asked about the reasons for buying, Eric Chanal highlights the robot's X-stroke of 3 m and its ability to handle parts weighing up to 100 kg. Chanal says that "with this application, we produce hollow plastic containers. These are increasingly-complex garbage and water treatment containers that get a lot of usage in practice, and therefore are of considerable wall thickness. With a demolding stroke of 3 m, we don't have to work with only partial mold openings, and we can also take advantage of much more floor space for palletizing. Another striking advantage is that this robot allows the installation of grippers able to handle large parts in less extraction time. And last but not least, are we really fond of the WITTMANN TeachBox console, because of its usability, making faultless robot programming so easy."

A fruitful partnership

The fruitful commercial relationship between BELLI and the WITTMANN Group is now over fifteen years old. WITTMANN was delighted to receive this latest order from BELLI, showing the high level of trust the company has in WITTMANN automation solutions. During a preliminary visit at the WITTMANN Group's headquarters in Vienna, Eric Chanal learnt about various possible solutions and their



WITTMANN W873XL robot, photographed during the installation phase at BELLI in Bellignat, France.



From left to right: WITTMANN BATTENFELD France CEO Fabien Chambon, BELLI Injection Workshop Manager Eddy Serre, BELLI General Manager Eric Chanal, WITTMANN BATTENFELD France Commercial Manager Robots Gregory Maron.

availability. The WITTMANN technicians clearly affirmed the feasibility of this project: adapting the design of a WITTMANN W873 robot to the special needs of BELLI. Finally, Dr. Werner Wittmann and Michael Wittmann themselves decided to produce this exceptional robot for BELLI.

Eric Chanal is absolutely satisfied with the performance of this WITTMANN robot. A 6-axis-robot was used for this application previously. This type of robot had major difficulties during the production and removal phases. Eric Chanal says that "I was happy to be able to demonstrate the new robot to my own customer who agreed immediately that this solution developed jointly by BELLI and the WITTMANN Group was the most suitable."

BELLI is so happy with this acquisition that the company plans to order an even bigger robot. It is with pleasure that the WITTMANN Group will accompany BELLI in the course of setting this new record! ♦

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

MEGATECH Industries and the WITTMANN Group – evolving together

MEGATECH Industries is an international business that specializes in plastics injection molding for the world's leading automotive companies. It relies on WITTMANN Group technology for the automation of many of its manufacturing processes.

WITTMANN BATTENFELD Spain

Views of the central material drying and conveying system from WITTMANN at the MEGATECH Industries Amurrio, S.L. (MIA) plant in Amurrio, Spain: DRYMAX E battery dryers, ...

The prestigious Austrian-owned MEGATECH group began its journey in plastics in Spain.

The year was 1957 and coincided with the first official industrial fair of the country.

In the subsequent years, the company continued its expansion with the foundation of a plant in the Czech Republic, the construction of a factory in Amurrio, Spain (1982), and a technical center at the same location the following year.

In 1999, the company has started business in the Americas with the opening of a plant in Brazil, and in 2003, the new factory in Orense, Spain, was inaugurated, opening also a new technical center in Bucharest, where the new projects of the corporation are developed. Six years later, the trade delegations in Germany and France were already a reality, coinciding with the change of name to MEGATECH Industries.

In the following years, the group continued to expand, acquired a plant in Portugal, founded a plant in India, built the plant in Brno (Czech Republic) and acquired five more plants: three in Germany, one in Poland, and the last also in the Czech Republic, consolidating itself as a large industrial group with global projection.

From the outset MEGATECH Industries has specialized in the development and production of vehicle components. From modules and components for the interior, to aesthetic elements of the exterior, passing through the innovative technical parts located under the hood. Its product range focuses on: consoles, electronic boxes, interior columns, exterior parts, components for door panels, ceilings, baggage compartments and dashboard elements. It is an interna-



... SILMAX drying hoppers with FEEDMAX material loaders, ...

tional supplier to the car manufacturers such as: Citroën, Peugeot, Seat, BMW, Volkswagen, Audi, Mercedes, Porsche, Bentley and others. It also supplies components to other leading suppliers in the automotive sector, such as Bosch or Schneider Electric.

The pursuit of excellence and the continuous improvement of manufacturing processes are some of the advantages that enable this company to lead its sector. Business has grown through the decades without ever losing sight



standards. The relationship between MEGATECH Industries and WITTMANN in Spain began decades ago, with the incorporation of multiple robots and other peripheral equipment such as temperature controllers into production at the company's Amurrio plant.

In 2016, the relationship further strengthened with new projects – this time installing WITTMANN central material handling systems. The first installation for 5 machines in the Alava plant, for example, consisted of a DRYMAX dryer with a capacity of 1.200 m³/h, 5 SILMAX drying hoppers and more than 10 material loaders from the WITTMANN FEEDMAX series.

A few months later in Galicia, WITTMANN then built up a central material handling installation for all the new machines in the extension of MEGATECH's Orense plant. This system – equipped with the latest WITTMANN FEEDMAX loader technology – again fulfilled the efficiency and quality objectives demanded by MEGATECH. This particular project was specially designed and configured by WITTMANN engineers in order to process the most advanced engineering polymers. Pinpoint accuracy in raw material supply had to be achieved – with the highest repeatability. For this purpose, 2 centralized WITTMANN DRYMAX battery dryers were installed, used together with 6 SILMAX drying hoppers, 3 blower stations with automatic filter cleaning, several FEEDMAX material loaders and a coded coupling station. All equipment was centrally controlled by the WITTMANN M7.3 control system, allowing the proper management of drying and loading processes and further optimizing highly efficient production.

... central filter stations, ...



Success breeds success

The results that were achieved with WITTMANN as a partner at the Amurrio and Orense plants, convinced MEGATECH to work with WITTMANN on yet further projects: WITTMANN BATTENFELD Spain, the Spanish subsidiary of the WITTMANN Group – working hand in hand with its local Portuguese partner and distributor TECNOFRIAS –, subsequently commissioned and installed a new centralized conveying system for about 30 machines at the large MEGATECH plant in Marinha Grande, Portugal. This installation incorporates two central DRYMAX dryers of 900 m³/h capacity, 3 SILMAX drying hoppers, several external SILMAX Compact material storage silos of capacities of 100 l and 150 l, plus more than 45 loaders from the FEEDMAX series – everything fully and seamlessly integrated into the plant's new injection molding floor via the WITTMANN M7.3 control system.

Customizing and optimizing the WITTMANN design and technology for the use in the three Spanish and Portuguese plants was only made possible through the intense collaboration of the two companies involved.

The introduction of continuous improvements in the Spanish and Portuguese MEGATECH plants by the WITTMANN Group continues to help optimize the MEGATECH production day-to-day – maintaining the highest levels in production output and quality.

MEGATECH Industries and the WITTMANN Group are constantly evolving together – both businesses looking towards a very promising future. ♦

... CODEMAX coupling station with piping system.

of optimal quality in all products. The group currently has a workforce of some 3,800 employees spread around the world.

MEGATECH and WITTMANN

The implementation of cutting edge technology in the company's plants is a constant theme. The WITTMANN Group is able to continuously service this theme – helping evolve various processes within the company's demanding

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SMARTINDUS: a Moroccan success story

SMARTINDUS has been selling WITTMANN and WITTMANN BATTENFELD products in Morocco for more than three years now. The company is an essential presence for the WITTMANN Group in a region where the plastics industry is growing year after year, mainly in the automotive and packaging sectors.

*Picture left: The SMARTINDUS facility in Tangier, Morocco.
Picture right: Abderrahim Oukha, SMARTINDUS Technical Sales Manager (left), and Abdelouahed Moutaie, Production Manager of the chemical source company ONI.*



SMARTINDUS, with many years of experience in the plastics market in Morocco, has enabled the WITTMANN Group to develop effectively in the Moroccan area. Based in Tangier, in the northern part of the country, SMARTINDUS' geographical location close to the Morocco's two largest free-trade areas is ideal for the sale and servicing of WITTMANN Group products. Youssef Hassani, is the Director of SMARTINDUS and his team is composed of three people dedicated to the sale of WITTMANN Group equipment.

Lahcen Abouhnd, SMARTINDUS technician, installing an IML cell at the ONI company.



*Picture left: Lahcen Abouhnd and Hicham Mimouni, SMARTINDUS, installing two W818 robots from WITTMANN at the FUJIKURA Automotives Group.
Picture right: Youssef HASSANI, SMARTINDUS Director (left), with Zakaria Guelzim, Director of the FATER Spa Maroc Procter & Gamble factory.*

Two technicians provide after-sales service and the start-up of equipment for customers – covering the entire Moroccan territory. Since 2016, the agency has enabled the WITTMANN Group to carry out many projects in the automotive industry, but also in regard to packaging applications. Complete production cells have been installed successfully in the region: from medium to large injection molding machines including robots – even for IML applications – and all sorts of peripheral equipment. Counting as a record, more than 130 WITTMANN temperature controllers were sold to one single customer.

Know-how and technical support are crucial for manufacturers in the Moroccan marketplace. The combination of SMARTINDUS' expertise and



the quality of the WITTMANN Group's products has brought about a high degree of trust. Moroccan customers include VARROC, SOGEFI, SOURCE CHEMICALS, PROINSUR, ARAYMOND,

VALEO, SCHLEMMER, EUROSTYLES GMD, NOVAERUM, INOTECHA, and many others. Technical projects and customer names continue to steadily grow. ♦

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 - Finland 4/2008+1/2012
 - France 2/2007, 3/2008, 4/2015, 2/2017, 4/2018
 - Germany 1/2007, 3/2012, 4/2013, 3/2014, 1/2018, 2/2019, 4/2019
 - Great Britain 2/2009, 2/2010, 3/2017, 4/2019
 - Greece 2/2014
 - Guatemala 1/2013
 - Hungary 1/2008, 4/2015
 - India 2/2008, 3/2010, 2/2012, 3/2018
 - Israel 1/2012
 - Italy 4/2008, 1/2010, 4/2011
 - Mexico 3/2007, 3/2009, 1+2/2011, 3/2018
 - Morocco, 1/2017
 - Poland 2/2013, 3/2013, 4/2015, 3/2016, 3/2017
 - Russia 4/2012
 - Serbia/Kosovo/Albania 1/2017, 4/2019
 - Slovenia/Croatia 1/2010
 - South Africa 1/2016
 - Southeast Asia 2/2007
 - South Korea 3/2010, 2/2017
 - Spain 3/2007, 1/2017, 1/2018
 - Sweden 2/2009, 4/2018
 - Switzerland 1/2008, 2/2012
 - Taiwan 4/2009, 4/2015
 - Turkey 2/2008, 2+4/2011
 - Ukraine 1/2019
 - USA 2/2008, 3/2009, 1/2011, 4/2013, 4/2014, 2/2016, 4/2016, 4/2017
 - Vietnam 4/2015

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