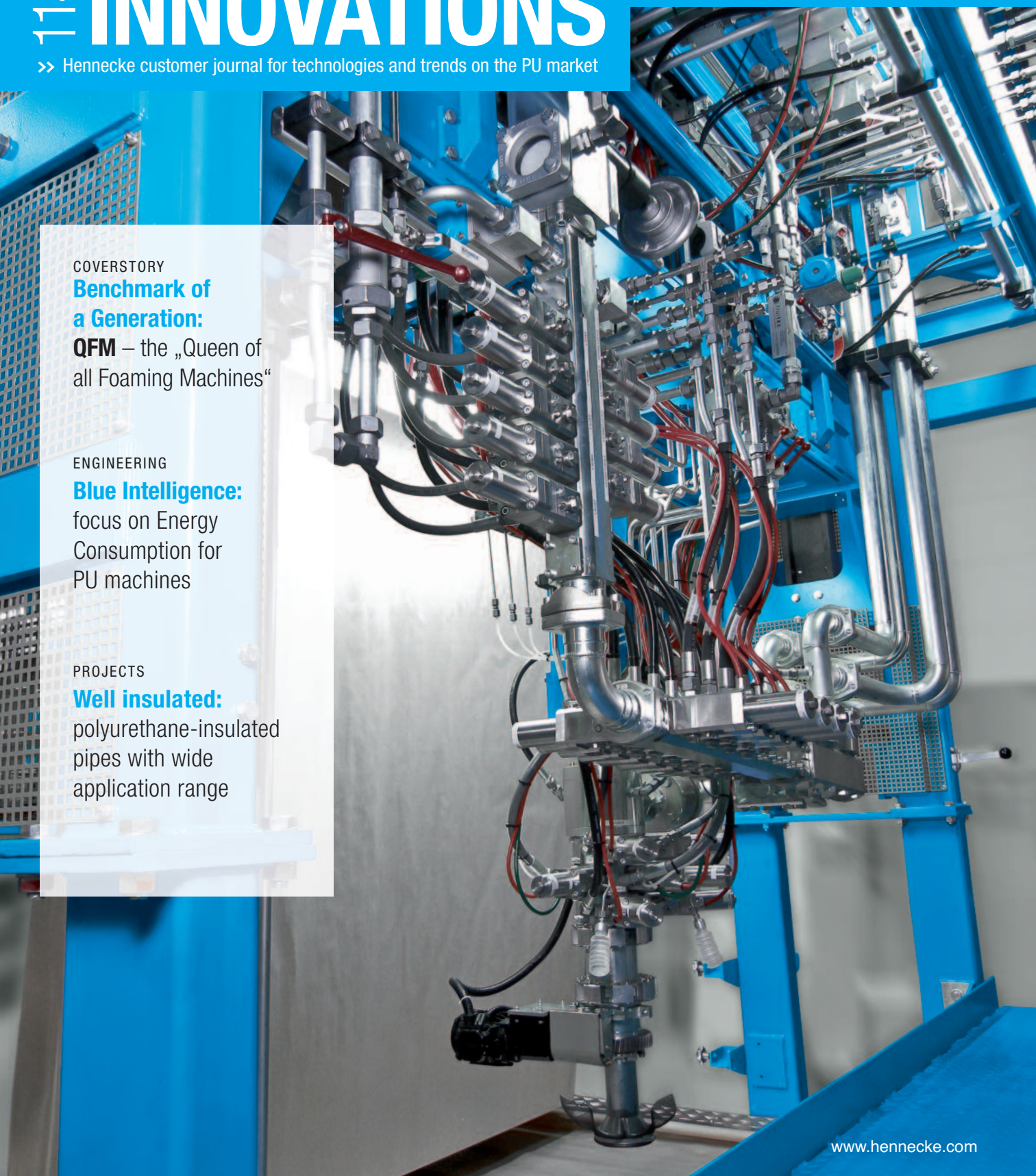
Hennecke
Polyurethane Technology

114 # INNOVATIONS

>> Hennecke customer journal for technologies and trends on the PU market



COVERSTORY

Benchmark of a Generation:
QFM – the „Queen of all Foaming Machines“

ENGINEERING

Blue Intelligence:
focus on Energy Consumption for PU machines

PROJECTS

Well insulated:
polyurethane-insulated pipes with wide application range

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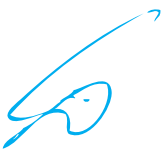
As at September 2014

Dear customers, dear readers,

It is all too often attested and to the same extent undisputed: Germany is a high-price country. As a result, the German mechanical and plant engineering industry in particular has to compete with the sometimes seemingly paradoxical calculation basis of the international competition. At the same time, the sector forms the successful centrepiece of the local export economy and regularly breaks new records. How does this fit together? Or put differently: what justifies higher investment costs from the perspective of our customers around the globe? It is my opinion that the focus is on three elementary components: efficiency, innovation and reliability. Core issues, which traditionally play a central part at Hennecke over the entire value added chain.

In this edition of INNOVATIONS, you can convince yourself of the passion with which Hennecke follows these aims. The perfect example for this are the high-pressure mixheads of the MT series, which are increasingly leaving the competition behind due to their impressive performance and stability (s. page 09). In terms of efficiency, our newest generation of high-pressure metering machines, which are already equipped with the "BLUE INTELLIGENCE" energy saving technology as standard, are setting new benchmarks (s. page 07).

But Hennecke is also taking the lead in the further development of processing technology with enormous investments in research and development. Often in close cooperation with customers and users, as proven by, for example, the realisation of extremely resistant surfaces (s. page 22) or the first series production worldwide of extremely light GFRP leaf springs (s. page 19). The current generation of our slabstock flagship "QFM" shows that we don't lose sight of the optimisation of long-standing plant technology (s. page 04). As you can see, Hennecke has enough expertise in every regard to achieve the added value in various areas of application demanded by the customer. With this in mind, I hope you enjoy reading our customer magazine.



Alois Schmid
Managing Director Technology

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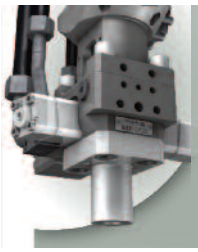

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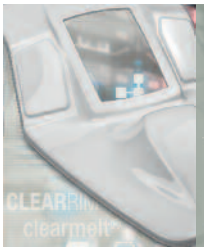

Extremely resistant surfaces

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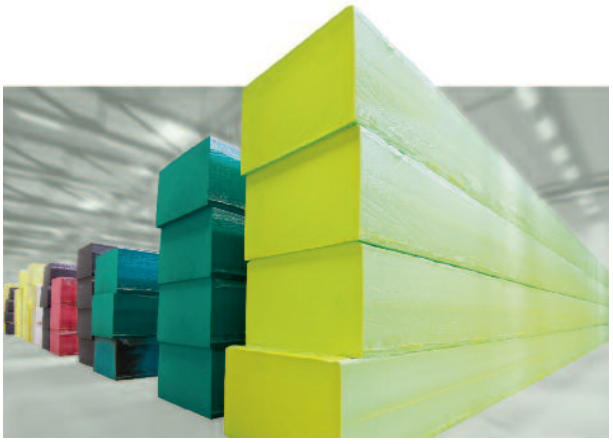
Benchmark of a Generation:

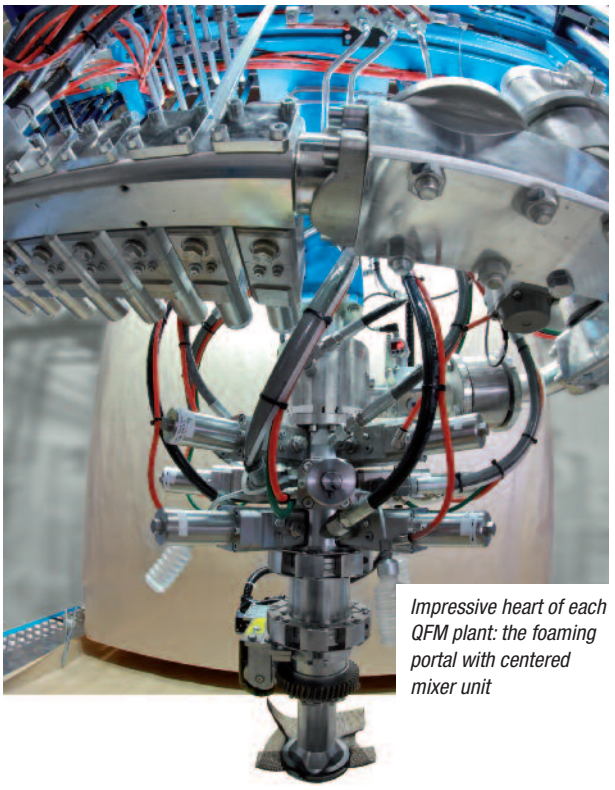
QFM – the „Queen of all Foaming Machines“

Among experts all over the world, the QFM from Hennecke GmbH has long since been the „Queen of all Foaming Machines“, that is to say the queen of all continuous slabstock lines. Even if the abbreviation QFM will also stand for the QUADROFOAMAT in the future: The flagship from the world market leader in systems engineering for the production of slabstock foams has deservedly earned a royal title over the past twenty-five years. Again and again, there have been minor adjustments and optimizations to the plant. Now it's time to present the latest generation of the high-tech product.

The QFM has retained its almost legendary strengths: Developed for high-performance applications, the QFM has an annual output of more than 25,000 tons of high-quality foam in the heavy-duty sector – of any desired length, a width of up to 2,500 mm and a height of up to 1,500 mm.



The configuration of the plant is based solely on the requirements of the individual customer. For QFM machines come "tailor-made" as standard: Thanks to their modular design and the numerous features geared to meet the individual requirements, the systems are tailor-made for a long production life. Various configuration levels allow exacting customer requirements to be met not only during the planning phase, but even a long time after the production has started.

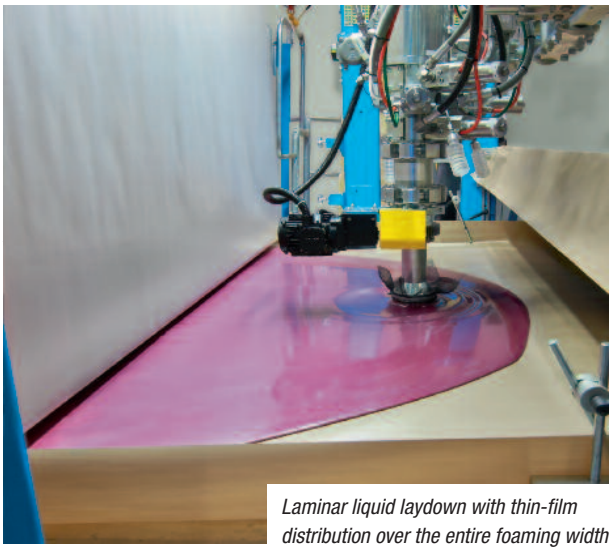


Impressive heart of each QFM plant: the foaming portal with centered mixer unit

Supreme discipline: Metering under high pressure

There is no queen without a crown, no royal palace without a portal: The impressive heart of each QFM plant is its foaming portal. Its centre is dominated by the mixer unit which ensures homogeneous mixing of all necessary components under high pressure. When it comes to the number of components used, there is virtually no upper limit. The configuration is solely determined by the customer's requirements. High-precision metering of all reactive components and additives is one of the prerequisites for focused cell control of high-quality slabstock foams. For this purpose, the QFM uses hydraulically and pneumatically controlled multifunctional injectors. They continue to operate flawlessly even when the production or formulations are changed. Avoidable and unpleasant production downtimes are thus reduced to a technically feasible and

reasonable minimum. At the latest, however, when the mixture is finally poured, the QFM demonstrates its royal elegance. For even in heavy-duty production environments, style and grace count when the highly mobile multi-axis portal seems to be dancing over the bottom sheet in accordance with the formulation, ensuring a very precise and uniform liquid laydown (Liquid Laydown process). The result is perfect foam quality that is almost free from pinholes.



Laminar liquid laydown with thin-film distribution over the entire foaming width

Interaction of the components

The extremely high-precision metering of all components in combination with a focused control of the mixing chamber pressure and the stirrer speed accounts for the versatile and reliable use of the QFM and is the basis of its reputation. It is in fact this congenial interaction of the technical components that enables the QFM to operate almost independently from varying external influences such as high temperature changes or humidity fluctuations. And what starts in the metering system, is carried on in the fall-plate section. For the fall-plate system can also be adjusted individually and with high precision, and this without any effort because the relevant parameters with the corresponding formulations are already stored in the central control unit. As a result, the QFM is also capable of producing sophisticated Ester foams as demanded by the automotive industry, for instance.

Avoiding waste

It is the many details that turn the QFM into a premium product. One of them is the variable passage length which, in the true sense of the word, allows the plant to be adjusted to local production conditions. Another detail is to be found in the curing section, for the flat top system considerably contributes to the reduction of raw material losses by preventing the formation of a dome and the development of a so-called top crust. Moreover, the conveyorized side walls can be precisely tilted what may be useful for foam products with high density in the bottom zone. This means that buckling is compensated in such cases, waste is avoided and the raw material is efficiently used.

Rectangular and plane-parallel: production chain-oriented slabstock foams with minimum waste

Control at the touch of a button

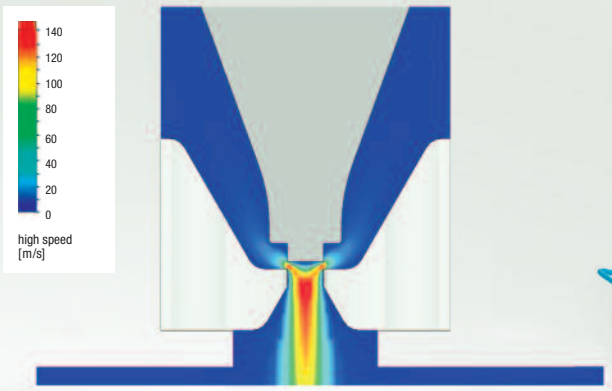
In spite of its complexity: Thanks to its high degree of automation, the QFM can be controlled conveniently - no matter whether the aim is to change the complete formulation or just to control the brakes of the paper guiding system, for instance. Due to its integration into the network, the central process control system is not only designed for intuitive operation, but also for remote access and maintenance from the Hennecke service desk. The QFM can rightly be referred to as a queen – but it is definitely no diva. It does what it is supposed to do, reliably and solidly. For 25 years, the machine has ennobled the high-quality slabstock foams of exacting customers all over the world.

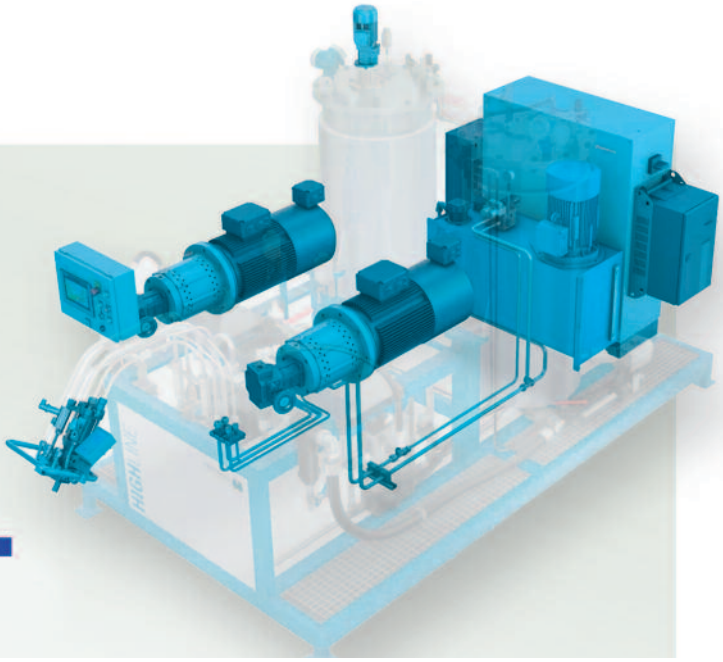
Blue Intelligence:
focus on Energy Consumption for PU machines

Under the label “Blue Intelligence” Hennecke has brought together the measures required for energy saving and reducing CO_2 emissions for foaming machines. The focus is on the optimised management of machine readiness and state-of-the-art injector technology with a high level of efficiency. In combination, these result in a clear reduction of energy costs. At many companies, the production processes and infrastructure have been "trimmed" to ensure energy efficiency. The avoidance and reduction of greenhouse gas emissions are not only crucial for global climate protection, but also for companies themselves. Fewer emissions through reduced energy consumption also means lower costs.

In their search for potential energy savings in their production processes, many companies overlook the machines and plants used in polyurethane technology, since these are often not applied in continuous operation in mass production. Among polyurethane processors the focus is typically on a high level of machine up-time, high quality of the parts produced and low consumption of the raw material components. During production the PU parts are manufactured in groups which are often irregular, with intermittent production interruptions. During these semi-automated applications, interruptions occur due to the removal of parts, cleaning and the spraying of a release agent or during a mould change. However, if one considers this mode of operation for PU machines in detail, one finds great potential for saving energy based on the typical mode of action and operation of these machines. The reaction components used have to be held ready by the machine during the waiting times in an optimum condition in terms of temperature, pressure and homogeneity. For the direct triggering of a pouring process, it is also necessary for the main units, such as the metering pumps and mixhead hydraulic unit, to continue to be operated in a low-pressure circuit. In this condition, machines with an average output still need a significant 30 per cent of their nominal energy requirement.

In the control version of the HIGHLINE machine type, which was presented for the first time at the K Trade Fair in November 2013 at the Hennecke stand, the foaming machine can now be switched to standby mode. In this version, the main units are completely switched off after a maximum interruption time has been reached, without significantly extending the required lead time until the next pouring process. On the one hand, this is achieved by means of a modified temperature control concept, which also works even if there is no





Effective conversion of high pressure into mixing energy through reduction of the internal fluid friction

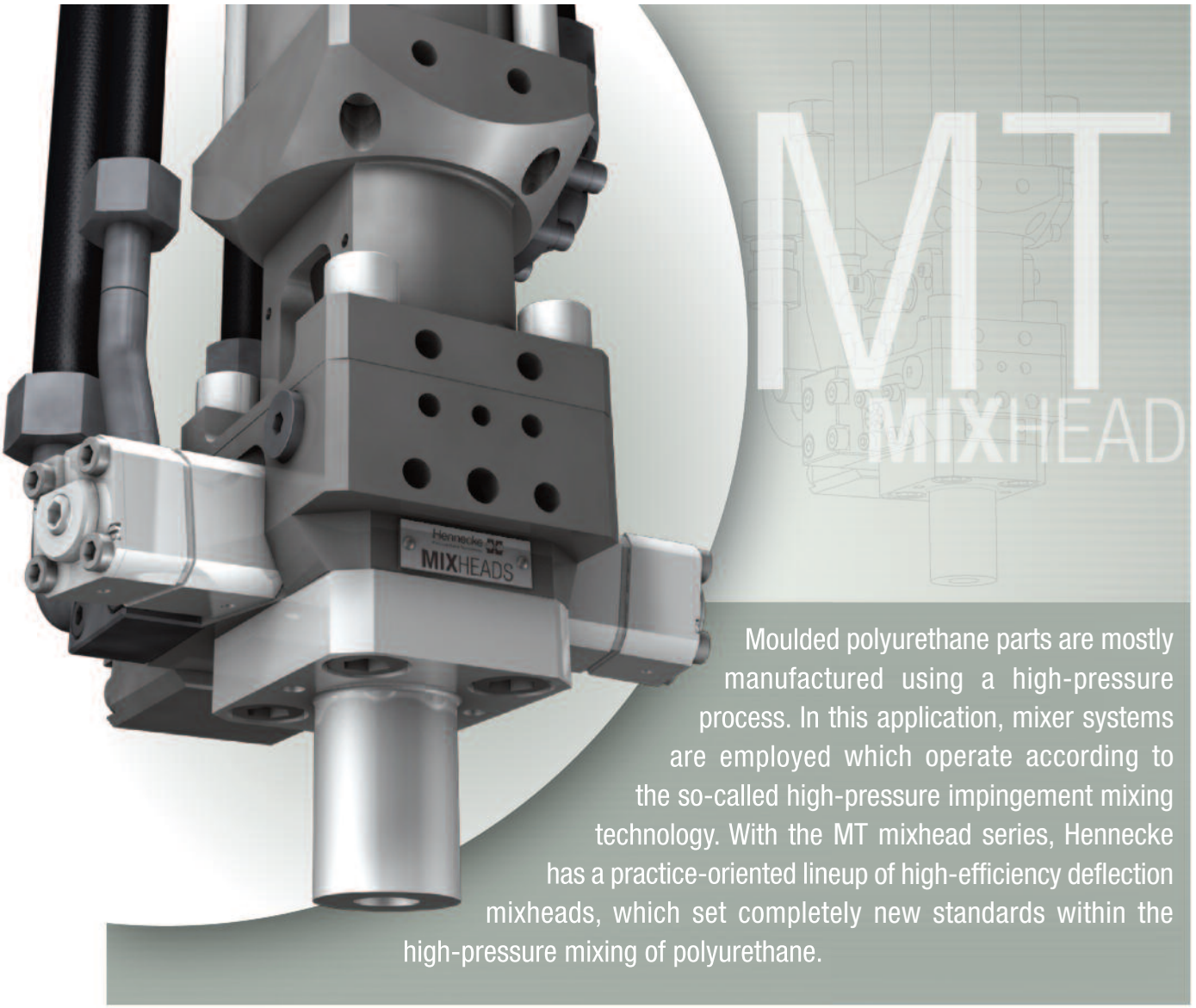
component circuit via the metering pumps and heat exchangers. On the other hand, equipping the machine with constant pressure injectors enables the shortest possible pressure build-up times. With the renewed call for a pouring process it is therefore possible to switch the machine directly to high-pressure circuit mode, not only with respect to the components, but also hydraulically. The time that elapses until the possible triggering of the pouring process only differs insignificantly from a start from the low-pressure circuit with the units already running. The interruption time until the machine is shifted down to standby mode can be freely adjusted and ideally adapted by the machine operator. Depending on the application and installation size of the foaming machines, significant reductions in energy consumption can be achieved. The absolute height can be determined on the basis of a load spectrum for each specific application.

Besides the standby time, Hennecke has also analysed the pouring process thoroughly with regard to its energy savings potential. The result is a clear increase in the efficiency level of the injector. In the case of the high-pressure foaming machines which are mainly used on the market, the energy for mixing the reaction components is generated by means of the atomisation rate, i.e. through a correspondingly high pressure in the mixhead injectors. Here, the efficient transformation of high pressure into mixing energy plays a significant role in determining the amount of energy required. The speeds in the injectors of a mixhead required for sufficient mixing are between 70 and 150 m/s. In order to achieve these speeds for the chemicals, which to some extent are highly viscous, pressures from 80 to 130 bar are needed at the injectors. Computationally, only one third of the practically applied pressure would be required for the friction-free physical conversion of the pressure into speed due to the increase in the pulse current. This clearly shows the great potential available for making improvements in the field of injector technology. By means of more consistent shaping of the injector geometry to achieve optimum flow, it has been possible to significantly improve the efficiency of the conversion process. For this, modern flow simulation tools have been used. Improved efficiency of the foaming machine by changing the level of effectiveness of the injectors is only possible when the machine is running with a high-pressure circuit during the pouring process, thereby showing its effect in particular during series production or in the case of continuous applications.

Conclusion: In addition to the use of state-of-the-art injector technology with high levels of efficiency and an adapted temperature control concept, expedient management of machine readiness achieves a significant reduction in energy consumption. Both measures have been implemented in the new HIGHLINE machine range. The effect of the energy savings is also particularly significant for applications in which small and medium-sized quantities are produced in an irregular sequence.

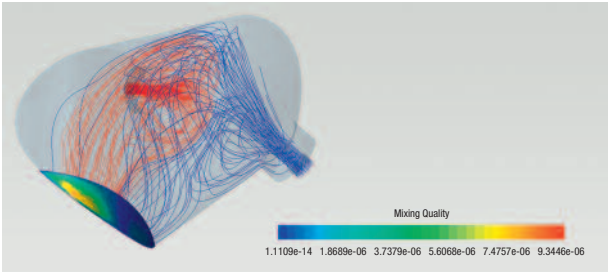
New dimensions for PUR processing with high-pressure mixing technology:

Hennecke's MT mixheads



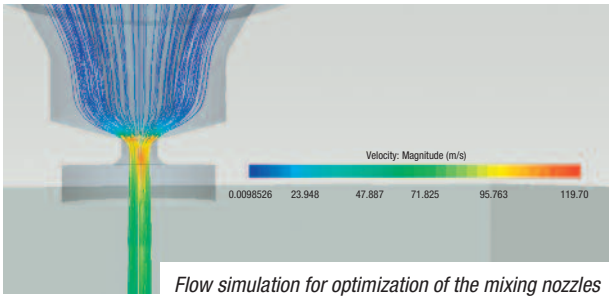
Moulded polyurethane parts are mostly manufactured using a high-pressure process. In this application, mixer systems are employed which operate according to the so-called high-pressure impingement mixing technology. With the MT mixhead series, Hennecke has a practice-oriented lineup of high-efficiency deflection mixheads, which set completely new standards within the high-pressure mixing of polyurethane.

High-pressure impingement mixing systems were already developed in the early sixties of the past century. The operating principle has been kept almost the same. The high-pressure mixers most often used today are deflection mixheads, which contain a cylindrical mixing chamber with an outlet pipe that is arranged at a right angle. Contrary to stirrer or static mixers, the high-pressure impingement mixing technology provides the option of using self-cleaning mixers. This is a major advantage, as neither raw material is lost, nor is solvent required for cleaning. The self-cleaning of the mixers is achieved by the relatively simple geometric design of the mixing chamber and all the areas that are wetted out with reaction mixture. This is to ensure that they can be cleaned mechanically using a simple piston rod. The downside of the relatively simple cylindrical geometry: the design options for optimizing the flow of the mixing chamber are very limited. That is precisely what Hennecke's development engineers have set as their task. They have consequently questioned the entire concept of the proven high-pressure impingement mixing technology in order to develop a new deflection mixhead which significantly improves the mixing efficiency while keeping the same self-cleaning ability. The result of this is the Hennecke MT mixhead series with sizes which can process reaction mixtures from 5 g/s to 5000 g/s and are available to the customer in two-, four- and six- component versions. The core focus of the development process was to identify and significantly optimize the remaining geometrical degrees of freedom for a mixing chamber with a mostly fixed geometry. For example,



Flow simulation for optimization of the mixing chamber

the target was to optimize the parameters such as the relation between the diameter and height of the mixing chamber as well as the position and angularity of the mixing nozzles. This task was solved with numerous model experiments and flow simulation calculations. With participation of the Fraunhofer Institute for Algorithms and Scientific Computing (SCAI) the parameters were ultimately varied until the ideal setting was found. The prototypes were elaborately tested with representative polyurethane systems under real production conditions in the laboratory of Hennecke GmbH. The result can indeed be seen as a quantum leap in high-pressure mixing technology. The total efficiency of the new mixhead generation was significantly improved, which benefits the end user in several respects. The required energy for the production of moulded foam parts is significantly lower. Considering that a normal metering system for the manufacture of, for example, car seat cushions requires the power of approx. 15 KW simply for executing the mixing task, it is understandable how the efficient mixing technology can substantially affect the unit costs of a seat cushion. Even without the energy costs being a primary factor, the efficiency improvement results in



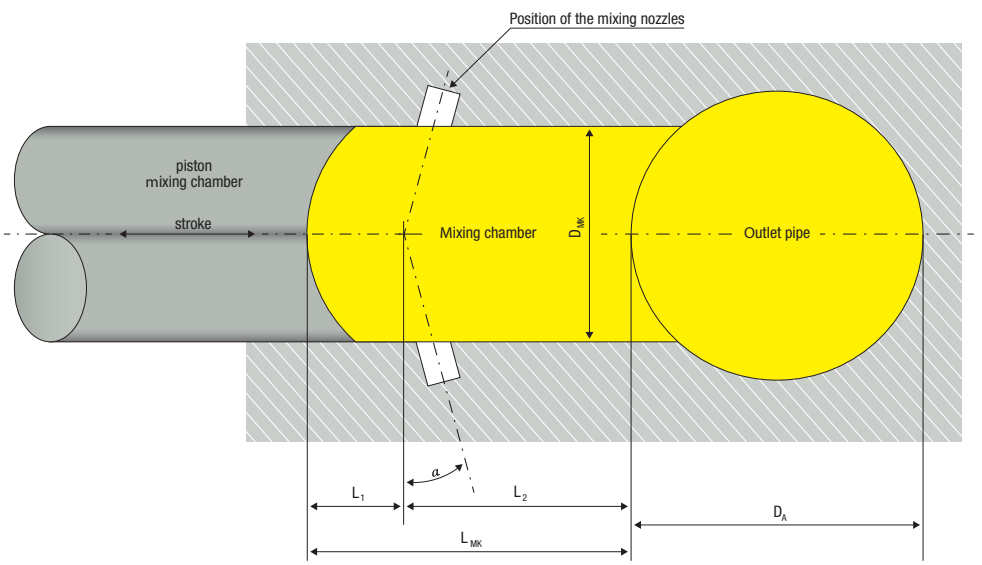
Flow simulation for optimization of the mixing nozzles

a considerably wider process window, in which a large range of products can be manufactured reliably and at the highest quality with the scrap rate also decreasing significantly. The MT series now provides users with a mixer system, which reflects the current state of the art.

A modern mixhead must, of course, not only be optimized in terms of process technology. It is not without reason that the mixhead is considered the "heart piece" in a polyurethane plant. If the mixhead stops working, the production is at a standstill. This becomes particularly evident within the automotive supplier industry where production systems for seat manufacturing are operated, for example, in three shift operation. The system produces a finished seat in less than 15 seconds, which consists of at least three foam areas. It is usual that mixheads in such systems have to perform several million individual metering operations each year.

This means that the mixhead design, the selection of the materials and their treatment as well as the manufacturing quality are particularly challenged. For the design, the Hennecke engineers followed a simple formula: few individual components which only need to be finely machined in the functional areas, resulting in a robust, durable design with low error possibilities and an extremely attractive life

cycle costing. It was possible to reduce the number of individual parts for the new design by about a third, with the complexity of each individual part kept simple. The core is formed by the mixhead housing with its high-precision bores for the mixing chamber, the mixture outlet and the mixing nozzles. This housing, in which the function sliders move in the hardened reaction mixture, is subject to the highest stress and thus forms the major wear areas. The application of extremely high-strength materials, combined with a special surface hardening and wear-resistant coating, enables MT mixheads to achieve several million "shots" in many applications. Specifically for the manufacture of these mixhead housings, Hennecke has invested in a new machining center to ensure that the high quality requirements are met and the manufacturing quality is secured in the long term. In addition to the mixing chamber, the mixing nozzles have to be taken into consideration in order to be able to effectively mix polyurethane systems using the high-pressure impingement mixing technology at the highest possible efficiency level. The mixing nozzles have the task of converting the pressure with which the reactive components are metered into speed. An ideal mixing nozzle should therefore accelerate the reaction component during the material passage with a low pressure difference to a maximum high speed. This means that the liquid stream threads of the reaction components have to cover a long distance in the mixing chamber and come into contact with the reaction partner. With the new development of the mixing nozzles for the MT mixhead series, the efficiency rate, thus the conversion of pressure into speed, was increased by approx. 30 percent. An infinite adjustment of the mixing nozzle opening allows the MT mixheads to be operated over a wide output range. The transition from a small output to a significantly higher output takes place at an almost constant pressure level, which is why quantity or formulation changes (mixing ratio alterations) can be carried out extremely quickly. The output or formulation change is performed during the cleaning stroke for the outlet pipe in less than one second.



Cross section of a high-pressure deflection mixhead

MT26 with constant pressure injectors in two-component version

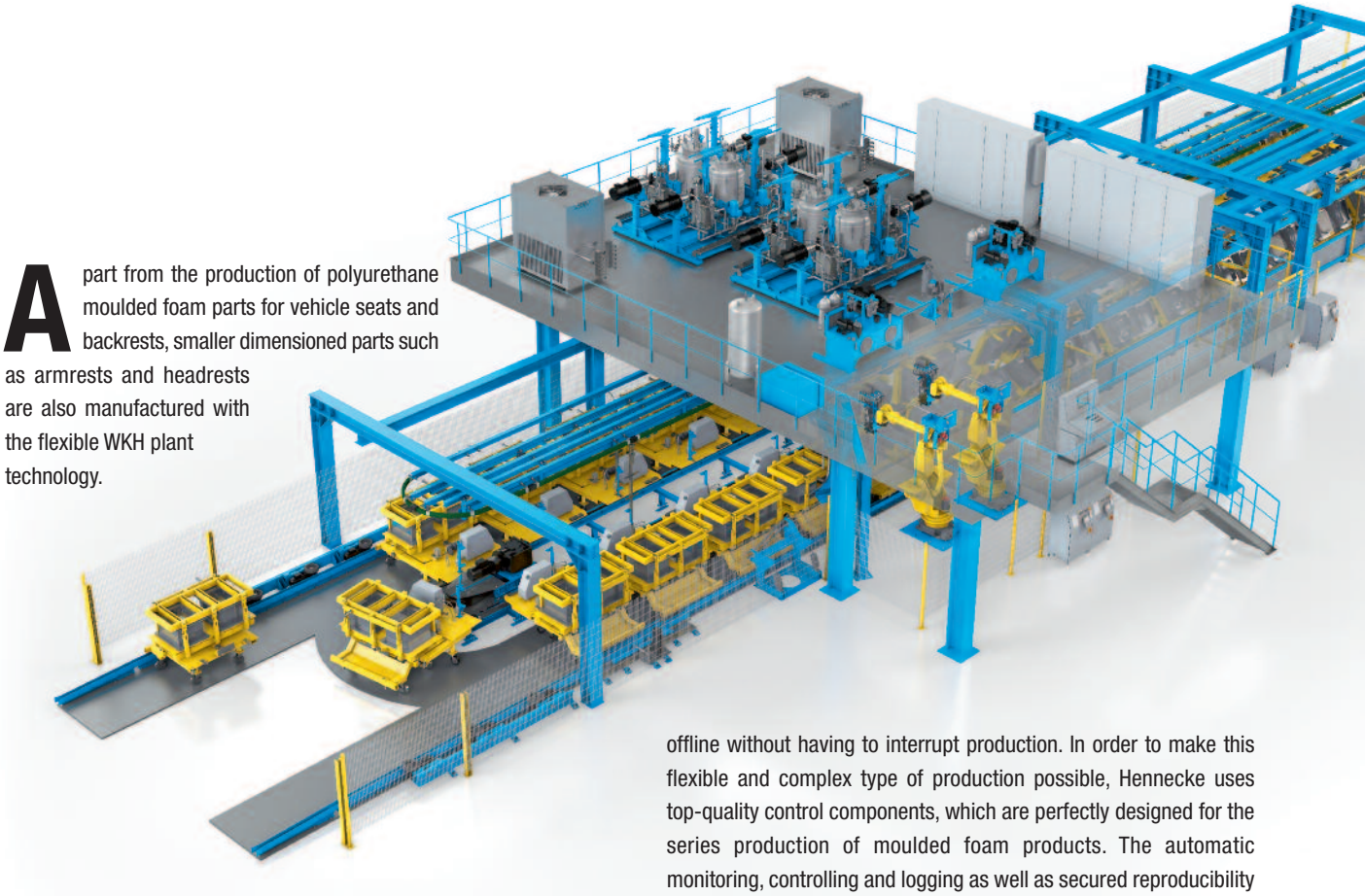
This results in the possibility for the user to produce a wide range of products with only one mixhead at high efficiency. In the case of the four- or six-component mixheads, there is a further possibility of selecting or deselecting individual reaction components or other additives between the shots. The variation of products and product properties is therefore almost limitless with Hennecke's MT mixing system. Even if the user only has one production line.

The number of advantages when using the MT series can also be confirmed by Hennecke customers: the MT mixhead was the clear winner of a professionally designed comparison test of high-pressure mixheads used for the manufacture of refrigeration appliances. As part of the test operation, two-component mixheads from different manufacturers were closely examined under exactly the same conditions over a period of six months in production. Here, the Hennecke MT mixhead received the top mark for all significant assessment criteria (laminar discharge, mixing quality, leak-tightness as well as susceptibility to faults).

Keeping the production in sight:

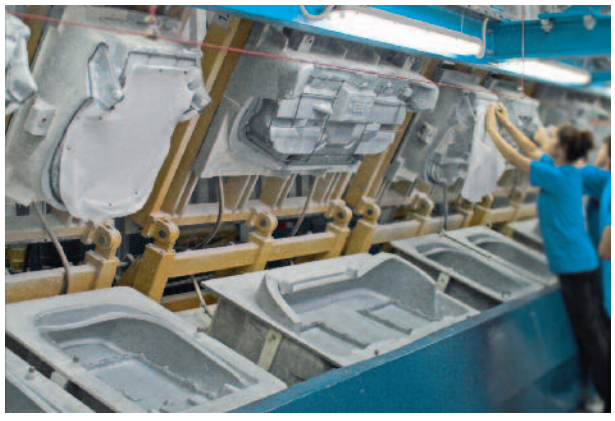
PURTRONIC ensures intuitive control during the manufacturing of moulded foam products

Hennecke's WKH oval conveyor systems offer the ideal solutions for the requirements of an economical production of polyurethane foam parts for vehicle seats and backrests. High flexibility, mould change without downtime and an outstanding and constant product quality characterize this plant. Hennecke does not make any compromises with the interface between human and machine so that the user can fully exploit the potential of the WKH plant technology: The plant visualization PURTRONIC allows intuitive and efficient operation and offers users ideal support in the daily production process.



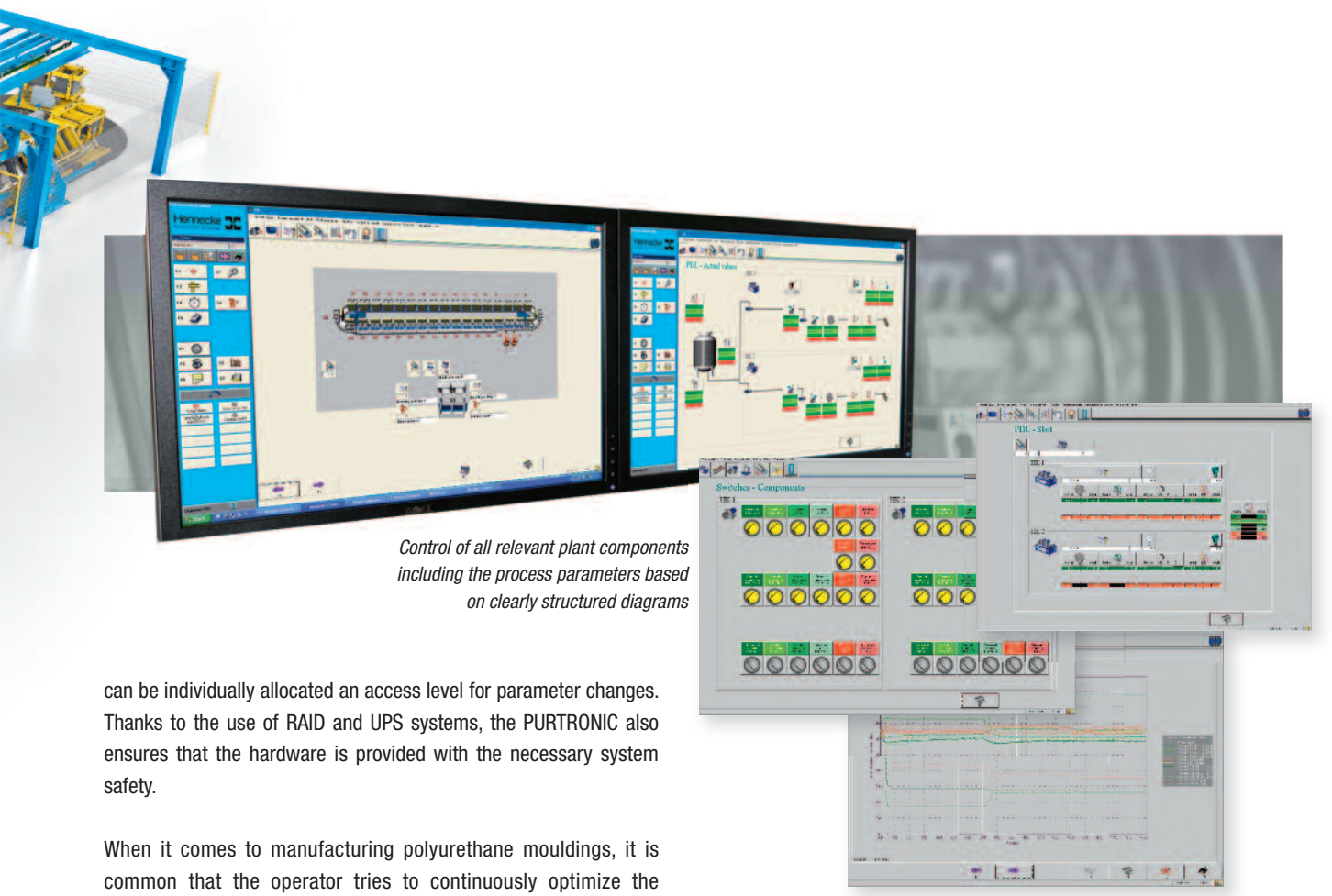
Apart from the production of polyurethane moulded foam parts for vehicle seats and backrests, smaller dimensioned parts such as armrests and headrests are also manufactured with the flexible WKH plant technology.

Because the users are often confronted with the requirement to realize products for different manufacturers and vehicle types with various formulations and because the total amount of seat types is increasingly rising, it is often necessary to carry out a mould change.



For this application, Hennecke offers its oval conveyor plant concepts with an automatic in- and outfeed station QCD (Quick-Connect-Disconnect), which allow the exchange of mould carriers during running production and at a conveyor speed of up to 15 m/min. This makes it possible to retrofit, prepare and maintain the mould carriers offline without having to interrupt production. In order to make this flexible and complex type of production possible, Hennecke uses top-quality control components, which are perfectly designed for the series production of moulded foam products. The automatic monitoring, controlling and logging as well as secured reproducibility of all relevant process parameters provide the polyurethane processors with an outstanding and constant product quality at all times – even at high production rates. The plant operators are optimally supported by the intuitive visualization PURTRONIC, which is based on industrial computer components and relies on Windows®-OS software. Production is profoundly supported and accelerated by the complex, software-technical data acquisition and processing.

The process control center (PCC), which is visible on every PURTRONIC screen display, provides the operator with a simple and clear system and user data management. This makes working with the plant more intuitive and efficient. From here the operator can control all relevant plant components including the process parameters, which can be visualized for all components in clearly structured diagrams. The PCC also provides access to the process monitoring and documentation systems through pre-configured tables and graphical displays, which are specifically adapted to the respective application. For example, the overview of the entire running production including all mould carriers can be displayed. A parallel presentation of all wet part data gives the user a clear overview thanks to the holistic display. Despite the extensive and complex process data density, all screen displays remain clear and easy to read for the user. The Easy User Management system ensures safety during production. Every user



Control of all relevant plant components including the process parameters based on clearly structured diagrams

can be individually allocated an access level for parameter changes. Thanks to the use of RAID and UPS systems, the PURTRONIC also ensures that the hardware is provided with the necessary system safety.

When it comes to manufacturing polyurethane mouldings, it is common that the operator tries to continuously optimize the production and foam parts by fine tuning all parameters. The menu item "Touch & Find" makes it easy for the user to monitor and, if appropriate, adjust the pressures, parameters, values and times of the plant. The overviews were optimized with this in mind and display very detailed facts to the operator. When entering metering packages the user can choose to enter them either in proportions (percent) or individual quantities (gram). The plausibility of all entered values is thereby checked automatically.

The extensive data memory on an SQL server is helpful during the optimization of production. Here, the PUR processor finds relevant information in tables and graphical displays with the option of exporting them into common file formats (such as MS Excel). These prepared production data give the plant operator the best possible foundation to further increase the efficiency of the plant.

The Hennecke software developers considered it particularly important that the operator is provided with a user interface which allows him to adapt the visualization to his own needs. For example, three configurable hot keys of the PCC serve the purpose of selectively loading frequently used submodules and returning to the previous screen. The numerous integrated shortcut tags in the respective visualizations help the user to quickly reach the desired screen. If problems still develop, the operator can directly access the 360°SERVICE portal by Hennecke via the PURTRONIC, in order to find a solution as quickly as possible using the online support, for example.

Well insulated:

polyurethane-insulated pipes with wide application range

Hennecke has been a renowned supplier of systems and process technology for the manufacturing of polyurethane-insulated pipes for more than two decades. A long-term customer of Hennecke is the world leader in the production of pre-insulated pipes LOGSTOR A/S. Together with LOGSTOR A/S Hennecke has repeatedly developed new innovative systems for pipe insulation over the years. As part of the latest pipeline project of the Danish district heating and pipeline specialist, hot bitumen sand is to be transported in Canada.

LOGSTOR

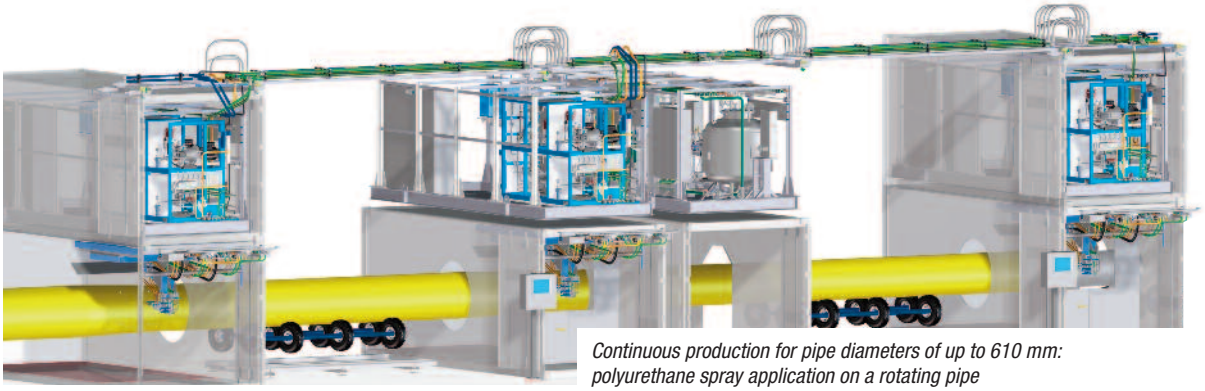
Manufactures pre-insulated pipe systems in ten factories across six countries.

Apart from being used in district heating technology, they are also deployed in on and offshore applications for transporting oil and gas products, in the process industry as well as in shipbuilding. Many of the pipes are manufactured continuously rather than individually by means of Hennecke's continuous process. As a first step in this process, the inner pipes are fixed continuously. At the same time, a vapordeposited PE foil is pre-formed into a U-shape. In the next step a mixhead pours the polyurethane foam onto the foil, which is subsequently closed so that it envelopes the inner pipe. Afterwards, the pipe, foil and rising foam pass through a calibrating unit for curing. The foam-insulated pipe is then run through an extruder in which the polyethylene outer pipe jacket is applied. The pipe is drawn uniformly during the entire manufacturing process. The polyurethane foam only has to rise, as opposed to the traditional process, which requires a flow path over the length of the pipe. As a result, an even density distribution and insulation is achieved. After the cooling and curing process is completed, the continuous pipe can be cut to the desired lengths.

The insulated pipes from LOGSTOR are not only used for transporting gas and oil, but also for bitumen sand. Rising oil prices and technological progress are making the extraction of crude oil from bitumen sand increasingly viable. The energy company was contracted by TransCanada Pipelines for the Northern Courier Pipeline Project in Canada. The 24 inch pipeline for the project is 90 kilometers long and its purpose is the transport of bitumen sand between the Fort Hills Mine and the East Tank Farm, located north of Fort McMurray, Alberta. In order to make the bitumen sand ready for transport, it must be heated. This makes an insulation of the pipeline mandatory in order to prevent the mixture from cooling down too much.

Contrary to the standardized pipes for district heating applications, individual specifications must be met for each order in the case of oil pipelines. In order to be able to compete for the contract in Canada multiple specification pipes were required. As Hennecke's own technical center can only produce pipes at a length of six meters, LOGSTOR manufactured various specification pipes at a length of 21 meters each using existing Hennecke system technology, which were checked and approved by TransCanada Pipelines.

Hennecke now supplies LOGSTOR with two continuous systems specifically designed for the pipeline specification, which make it possible to continuously apply an up to 120 millimeters thick insulation layer onto a rotating pipe. The maximum length of the manufactured pipes is up to 24 meters and the diameter is up to 610 millimeters.

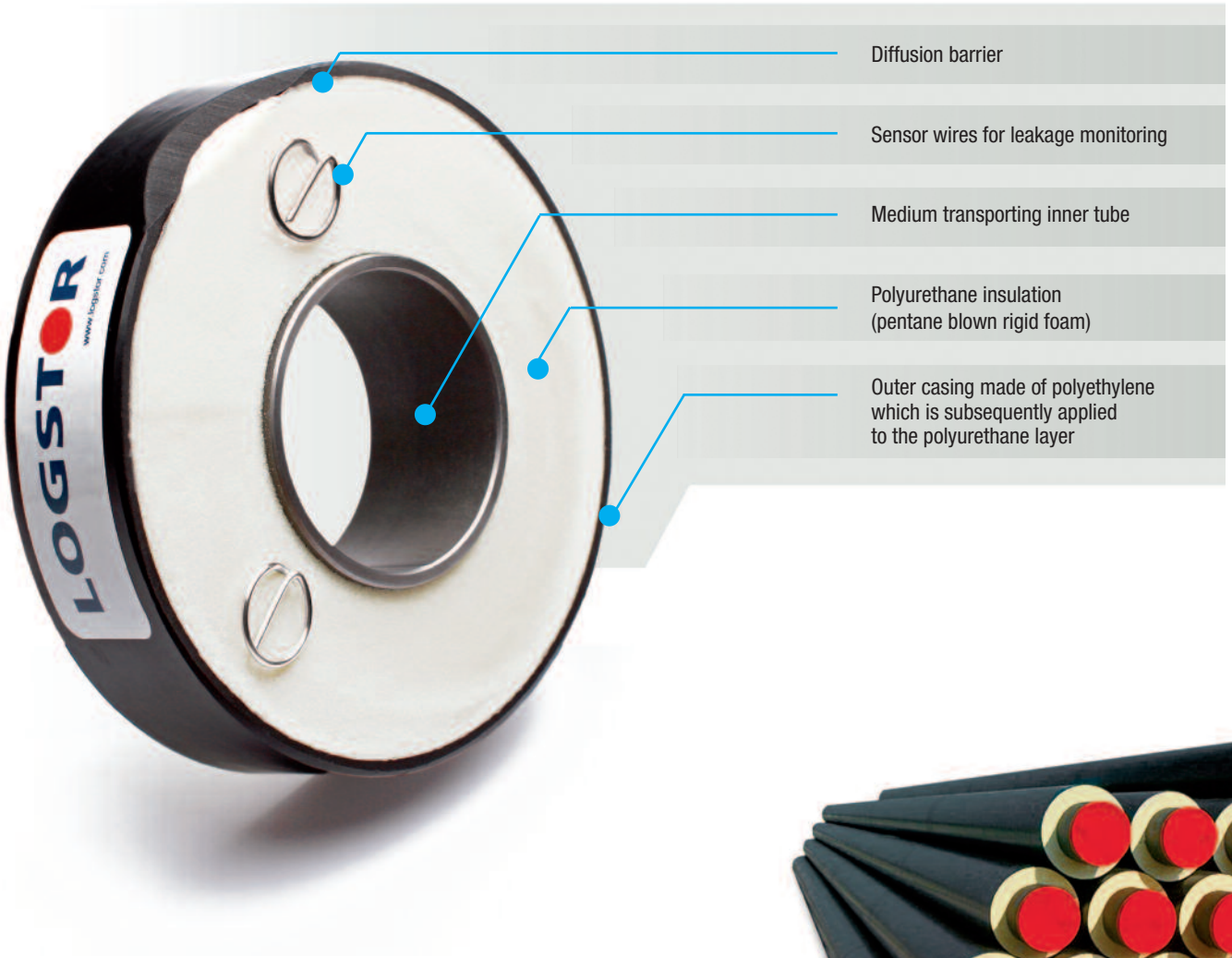


Continuous production for pipe diameters of up to 610 mm: polyurethane spray application on a rotating pipe

Thus, about 450 kilograms of insulating foam is applied to each pipe. In order to adapt the raw material ideally to the ambient conditions, pentane and the activator have to be metered online to the polyol in very small quantities. The focus here is on a homogeneous foam quality over the entire pipe length.

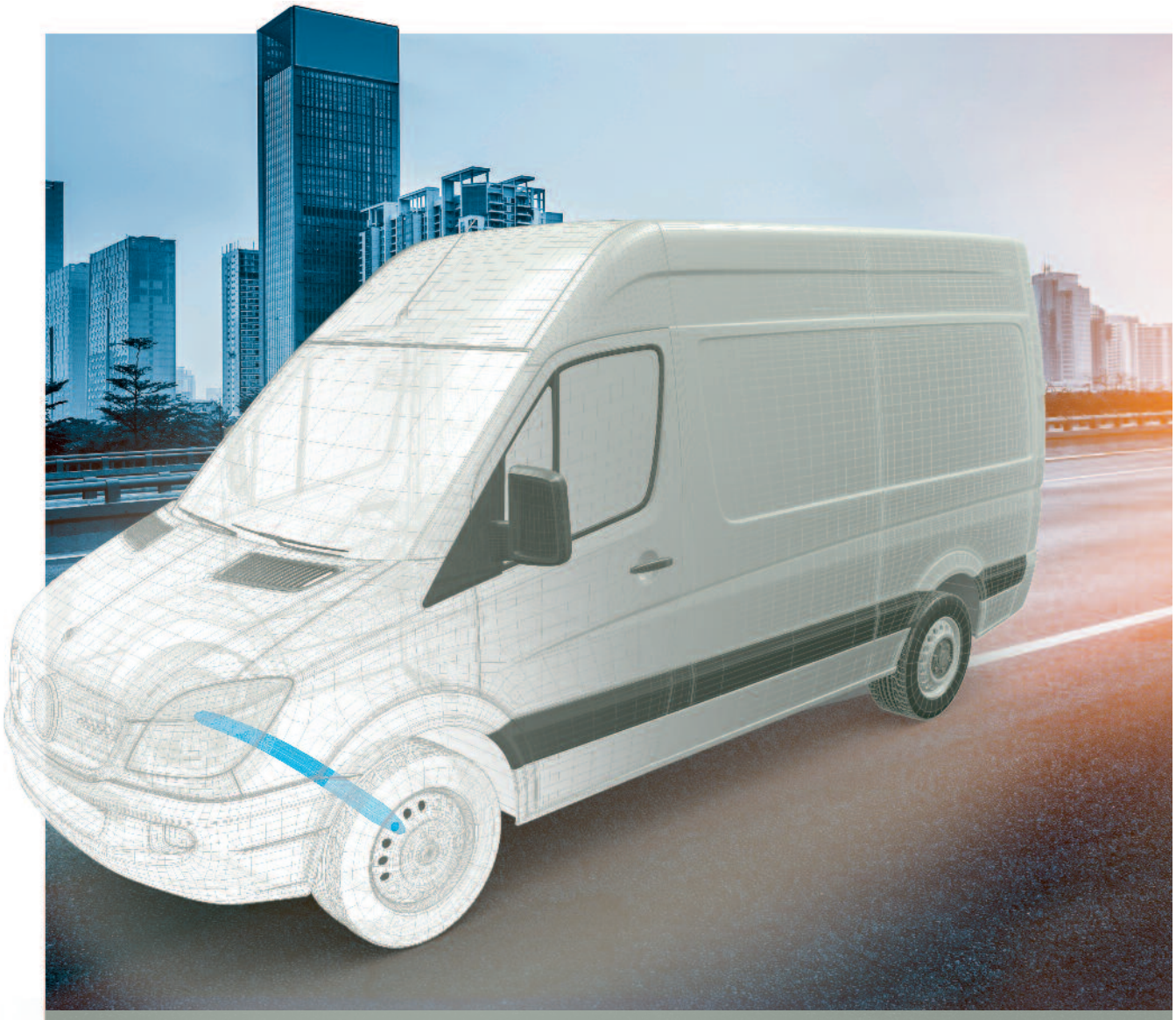
LOGSTOR also uses the Hennecke technology for manufacturing district heating pipes. The energy company's pre-insulated pipe systems with their particularly effective insulation are specifically designed to limit energy loss in district heating and cooling systems to the absolute minimum.

District heating and cooling – especially when based on cogeneration – can contribute to a significant reduction of the CO_2 emission. The expansion of the district heating network in Europe offers a particularly great potential. For example, only about 13 percent of the German population are connected to a district heating network. The technology for economically insulating the pipes for the network is definitely available at Hennecke.



Truly light as a feather:

start of the first HP-RTM series production for GFRP leaf springs worldwide

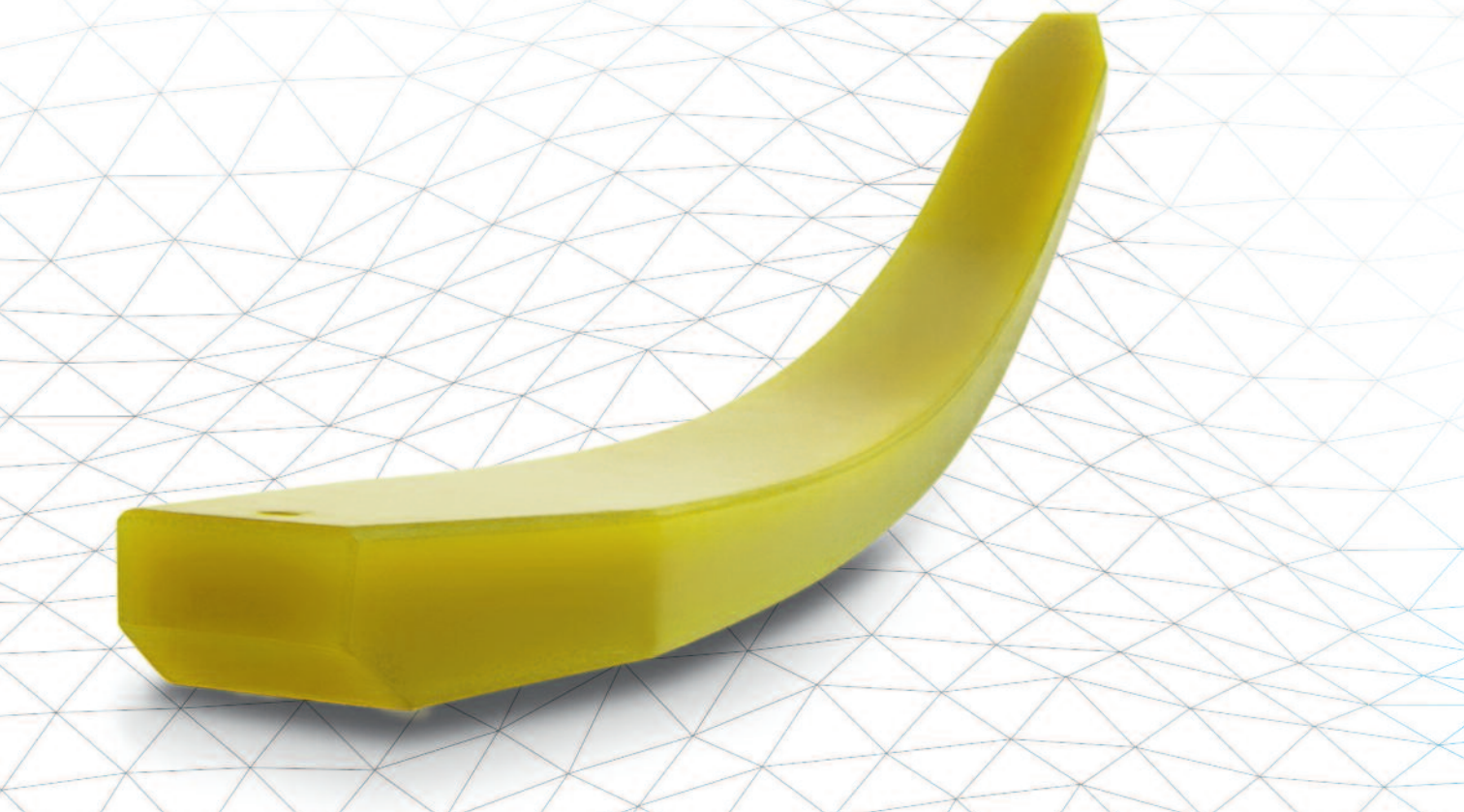


Apart from new drive concepts, reduced vehicle weight is a significant element to ensure more efficiency also in future automotive manufacture. In this respect, the topic of lightweight construction has again placed the focus on almost all vehicle parts. Various components offer particularly good conditions for the ideal implementation of the required weight savings. A perfect example for this are leaf springs, which have always been used in commercial vehicles and pickup trucks with comparatively high axle load.

Replacing conventional steel with glass fibre reinforced plastic results in really convincing weight savings. In the case of leaf springs for commercial vehicles, up to 60 percent weight can be saved compared to the usual variant made of steel. As there are up to two such components in a vehicle, the optimizing potential is significant. A leaf spring made of glass fibre reinforced plastic even outshines its steel equivalent with regard to performance and resistance to weathering. Signs of corrosion are no longer relevant and the use of glass fibre prepregs in the component core additionally allows a targeted control of the range of properties.

The high-tech leaf springs are manufactured by means of the High Pressure RTM process (HP RTM), with which Hennecke has replaced the established polyurethane processing technology with a new approach. The focus of the HP-RTM method is on a task that is well-known as well as tried and tested in PU processing: the high-pressure injection of a reactive mix into a mould within seconds.

In combination with the appropriate raw material system, the HP-RTM process provides for accelerated reaction and extremely short curing times. In addition, Hennecke GmbH's decades of experience of high-pressure metering takes effect. For example, with a customized mixhead series for HP-RTM applications, which delivers high-quality and reproducible results at all times. Thanks to the use of the patented Hennecke constant pressure injector, a permanent homogeneous injection pressure is ensured additionally. The particularly intelligent filling process in the closed control circuit and all other tasks of this new production variant are enabled by Hennecke's STREAMLINE machine series.



With the first RTM production of the GFRP leaf springs worldwide in multiple cavities and cycle times in the minute range, BENTELER SGL, a joint venture of Benteler Automobiltechnik GmbH based in Paderborn and the SGL Group headquartered in Wiesbaden, has now proved the suitability of the HP-RTM technology for mass production. The technological further development of the standard RTM process has proved itself and will continue to establish itself with the practically tested STREAMLINE metering machines.

Customized machine system with especially designed mixheads: the STREAMLINE

"With the HP-RTM process and the suitable machine technology of the type STREAMLINE, we have created a new tool for the RTM sector, in order to significantly optimize production processes with regard to cycle time," says Tobias Jansen, Sales Manager for new technologies at Hennecke GmbH. Customers and raw material partners have the opportunity to find out more about these advantages at Hennecke's headquarters in Sankt Augustin. The Hennecke TECHCENTER not only offers the suitable equipment for trials, developments and test samples by customers and raw material partners, but also the expertise of experienced process engineers.

Significant reduction of cycle times in HP-RTM applications: STREAMLINE metering machines

Hard shell, intelligent core:

with high pressure to impressive surfaces

In automotive engineering in particular there is a growing trend towards touch-sensitive control logic as a cutting-edge interface between man and automobile. Through the combination of a thermoplastic base support, a capacitive sensor foil and a functional coating of polyurethane (PUR), these so-called hybrid products can be of great use to vehicle designers and manufacturers alike. Hennecke GmbH is an expert and exclusive system partner in the creation of extremely resistant surfaces. The latest examples of this are the cooperation with the company ENGEL Austria GmbH and a new collaborative project with the Plastics Institute in Lüdenscheid which focuses on the issue of painting in the mould.

When it comes to processing transparent PUR systems in order to provide a finish for surfaces, Hennecke GmbH has not only the appropriate machine technology at its disposal, but can also take advantage of its many years of expertise in the field of process control for flooding with PUR. With the CLEARRIM process, Hennecke succeeded more than a decade ago in achieving an important breakthrough with respect to the surface sealing of decorative parts. In this process, a thin layer of PUR is introduced under high pressure into the mould cavity in order to effectively finish thermoplastic support elements with natural surfaces within a very short time. The work required for post-processing and the level of emissions are drastically reduced in comparison to painting. This enables users to produce a scratch-resistant, durable and high-quality surface structure for decorative parts in the automotive field, the furniture industry or countless other decorative applications. Through the use of special polyurethane raw material systems it is even possible to create self-healing surfaces, where the focus is not only on the surface feel, but also on functionality.

A further advantage of the CLEARRIM technology is its outstanding ability to be combined with accompanying processing methods. The best example of this is a process-related development resulting from the collaboration between Hennecke and ENGEL Austria GmbH: the clearmelt® technology. In this process, thermoplastic mouldings are combined with decorative film overlays or wooden inserts by means of injection moulding. The actual finishing process using the transparent PUR system is carried out in the same production cell. This economical production method offers almost unlimited opportunities for individual surface design, particularly with regard to the realisation of special surface effects.

With the additional integration of a capacitive foil, an elementary added value has now been incorporated into the product. In the specific example application of a component of the cockpit centre console, the thermoplastic base support is injection-moulded using a turnplate device made of PC/ABS, while at the same time on the second side of the mould the pre-moulded part produced in the previous cycle is coated with polyurethane. The capacitive foil is inserted into the mould before the first component is injected. In this part, the PUR layer fulfils several functions at the same time. The main focus is on protecting the high-class surface against chemical and mechanical attack. One important side effect is the high degree of gloss of the coating and the depth effect that is achievable, which produces the impression of extremely high quality. Overall, this production approach ensures that in the future it will be possible to operate cars as conveniently as smartphones. This is possible due to the fact that simply by touching and interacting with the capacitive electronics, the physical controls in the cockpit of the future can be reduced to a reasonable minimum. This trend not only opens up completely new degrees of freedom for designers, but also makes the production of functional elements significantly less expensive. This means that nothing is standing in the way of the increasing introduction of such controls into the series production of future car generations.

In order to help this new and cutting-edge technology successfully find its way into the market, it is necessary to select the right machine and plant technology, appropriate mould geometries and new raw material systems. As part of a collaborative project with the Plastics Institute in Lüdenscheid (www.kunststoff-institut.de), in which Hennecke acts as a partner for machine technology, interested customers are able to acquire in-depth insights into the innovative coating process. Under the generic term of the "surface treatment of plastic parts", the current focus of the project Painting in the mould deals - amongst other things - with the clearmelt® and CLEARRIM process. Here, participants are informed of the innovative technologies in a practically-relevant manner and with a high degree of technological expertise so that they can use them themselves subsequently for their own products, for example. Interested processors can contact the Plastics Institute in Lüdenscheid at any time for more information about the broad range of possibilities.

Working together in partnership on a promising collaborative project – from left to right: D. Malecha (Plastics Institute in Lüdenscheid), R. Trippler (Managing Director Hennecke GmbH), J. Günther (Plastics Institute in Lüdenscheid), J. Winiarz (Hennecke GmbH)

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