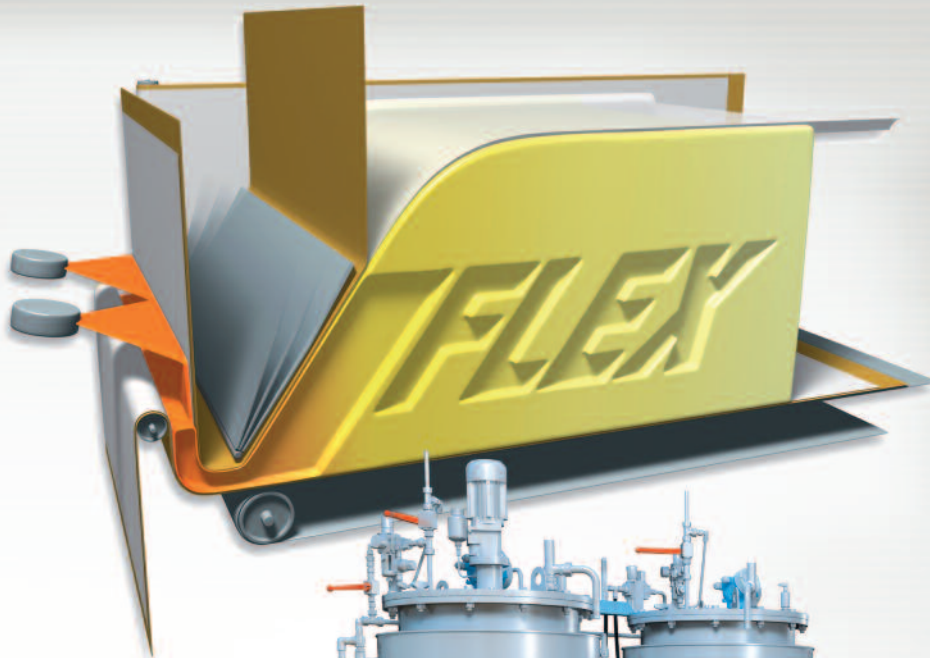


113 INNOVATIONS

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



COVER

JFLEX and HIGHLINE

Real innovations in Hennecke's product portfolio

ENGINEERING

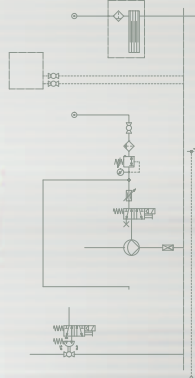
Definitely lightweight!

Production of fibre composite bonnets

HENNECKE GROUP

Hennecke Group expands

Integration of a roll forming technology specialist





Dear customers,
dear readers,

The K show has been a firm date in Hennecke's trade fair calendar for decades, offering an excellent opportunity to demonstrate our technological leadership within the industry. At this year's „K“, we are aiming to be successful in several respects because following the motto „Fascination PUR“, our trade fair appearance will be packed with innovative topics. For example, product innovations such as the compact high-pressure metering machine HIGHLINE for an extremely broad range of applications (s. page 08) and the new JFLEX slabstock line enabling the continuous production of slabstock in a very small space (s. page 04) will be presented. In the field of process technology, Hennecke is also well-prepared, especially when it comes to the forward-looking issue of lightweight construction. The current focus is on functional automotive components with specific properties that again extend the boundaries of the possible (s. page 11 and 14). Moreover, there is some important news about the Hennecke Group: With the Hennecke Profiliertechnik GmbH as the latest member of the corporate group, we have taken a major step to further advance our overall systems competence in the field of steel sandwich panels (s. page 17). As you can see, we are working in a focused manner to be able to offer you optimal solutions in the different application areas of polyurethane processing. Therefore, I am pleased to invite you to experience Hennecke's way of „Fascination PUR“, either at the K show in Düsseldorf or by reading the latest issue of our customer journal INNOVATIONS. I hope you will enjoy the magazine and find some interesting news about the fascinating world of Hennecke PUR.

Rolf Trippler
Managing Director Sales

Dates

PUTECH EURASIA

Istanbul
14.11. - 16.11.2013

INTERPLASTICA

Moscow
28.01. - 31.01.2014

BIG FIVE

Jeddah
09.03. - 12.03.2014

JEC

Paris
11.03. - 13.03.2014

PUTECH INDIA

New Dehli
02.03. - 14.03.2014

UTECH

Carolina
04.06. - 05.06.2014

As at October 2013

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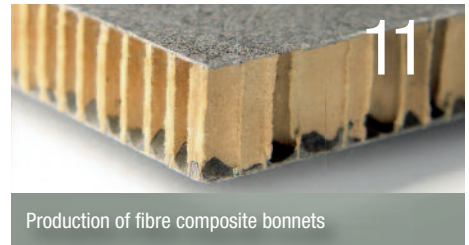
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The new JFLEX:
Bridging the worlds of discontinuous and continuous slabstock lines



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The new HIGHLINE:
Extremely diversified in terms of users and applications



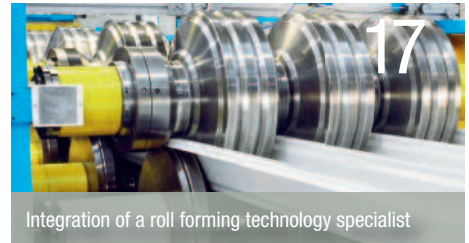
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The new JFLEX:

bridging the worlds of discontinuous
and continuous slabstock lines



As the leader in slabstock production, Hennecke's QFM and MULTIFLEX slabstock lines enjoy an excellent reputation worldwide. Especially major foam manufacturers use Hennecke's proven systems technology because of its high quality and efficiency. Now, a new slabstock line also offers users with medium production volumes all the advantages of continuous production.

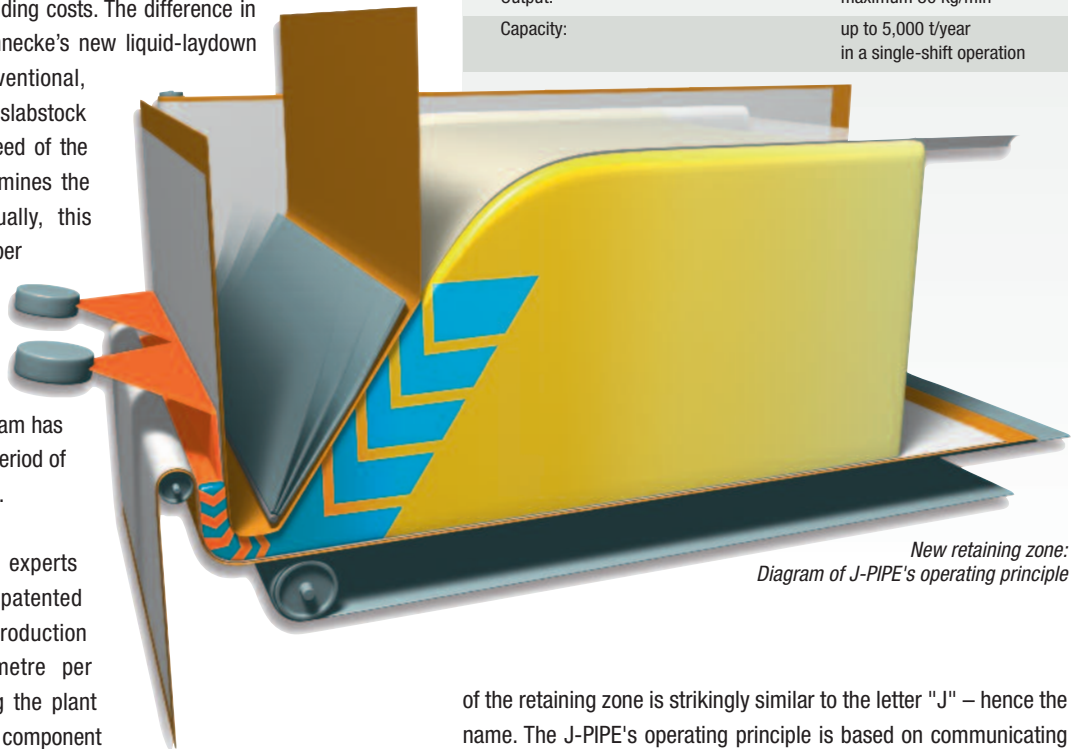


If the production volume of a foam manufacturer is too large to be economically manageable with a discontinuous plant, the manufacturer often faces a dilemma: In order to achieve higher capacities, he needs to make a relatively big investment in a continuous slabstock line, which, however, is usually oversized for his needs because of the high output rate. The full capacity of these slabstock lines of approx. 150 tons per working day can only be used to a limited extent due to various processing limitations. Therefore, in the worst case, the machine is not in operation most of the time. For rather small production volumes, discontinuous slabstock lines are typically used. However, the large amount of cuttings and labour-intensive production are clear disadvantages of this production method. So far, the market gap lying between discontinuous and continuous slabstock lines has not been covered yet. Hennecke is targeting at foam manufacturers who want to achieve a better quality and higher raw-material yield than with discontinuous plants but are unwilling to make the high investment in conventional continuous lines. These may be, for instance, furniture and mattress manufacturers who no longer want to purchase foam but would like to produce it themselves to meet their own requirements. The new JFLEX slabstock line from Hennecke GmbH has been developed exactly to cover this medium production volume. It is very compact, significantly more cost-effective than conventional continuous production systems and convinces to the last detail due to its usual Hennecke quality.



Hennecke JFLEX lines are operated at one-fifth of the usual production speed of traditional continuous plants and still manufacture the same block size. Thus, the machine is only approx. twelve metres long. A great benefit, considering that conventional slabstock lines, with up to 50 metres, are more than four times as long. Due to the small footprint, the user saves precious space or can considerably reduce building costs. The difference in length results from Hennecke's new liquid-laydown technology. For conventional, continuously operating slabstock lines, the expansion speed of the polyurethane mix determines the production speed. Usually, this is approx. five metres per minute. Thus, the specified speed also determines the length of the entire plant, since the foam has to mature for a certain period of time before it can be cut.

Now, Hennecke's PUR experts have developed a patented process enabling a production speed of only one metre per minute, thus shortening the plant length accordingly. Main component of the new technology is the retaining zone of the new JFLEX: the so-called J-PIPE. Here, the liquid mix is poured on one side by distribution nozzles. Now, the expanding polyurethane escapes on the other side, without pressing back into the liquid. The cross section



*New retaining zone:
Diagram of J-PIPE's operating principle*

Technical Specifications:

Plant length:	approx. 12 m
Plant width:	approx. 4.5 m
Plant height:	approx. 3 m
Production speed:	approx. 1 m/min
Output:	maximum 80 kg/min
Capacity:	up to 5,000 t/year in a single-shift operation

of the retaining zone is strikingly similar to the letter "J" – hence the name. The J-PIPE's operating principle is based on communicating vessels. The model shows that these are vessels open at the top, but connected by pipes at the bottom. Even for completely different shapes and sizes, a liquid in communicating vessels is always at the same level because the gravity and air pressure are constant.



Perfect mixing through the combination of injection- and stirrer principle: the JFLEX stirrer mixer

In the J-PIPE of the slabstock line, the shorter front leg receiving the reactive liquid mix "communicates" with the longer rear leg, in which the foam rises within the rising zone. To this end, the J-PIPE uses the specific density change so that, thanks to a density of approx. $1,000 \text{ kg/m}^3$, the short leg with the liquid is able to compensate the long leg with the rising foam, whose density is approx. 25 kg/m^3 . Thus, pressures caused by the expanding foam and the liquid are compensated and due to this balance, the plant can be operated at a production speed of only about one metre per minute. In addition to the low production speed, only very short start and

end blocks occur with very little waste as consequence. Hence, the plant can also be used for small production lengths. For example, to produce various foam grades. In addition, the low conveyor speed simplifies the removal of cut blocks, generating fewer requirements on the downstream infrastructure. The plant can be assembled and taken into operation quickly. Furthermore, all JFLEX assemblies are preassembled so that they only have to be connected locally according to the plug-and-play principle. With JFLEX, Hennecke has expanded its product range of continuous slabstock lines successfully, at the same time building a bridge between discontinuous and continuous slabstock lines.

High-pressure polyurethane metering with efficient raw material yield

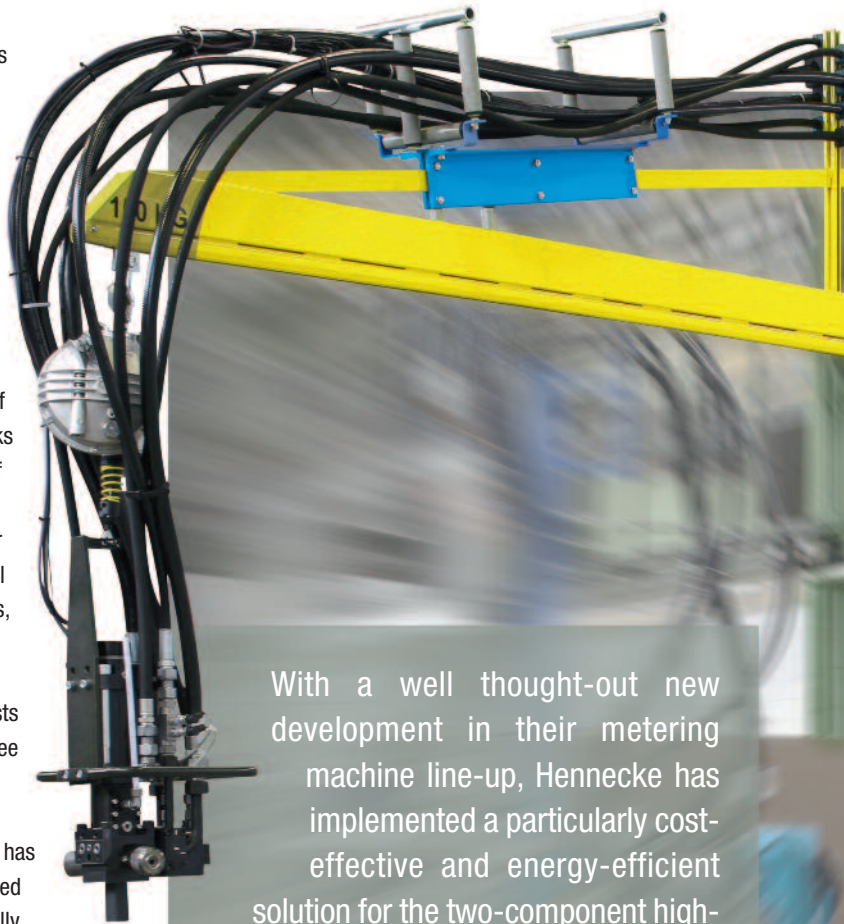


The new **HIGHLINE**: Extremely diversified in terms of users and applications

In the development of high-pressure metering machines for processing polyurethane, Hennecke counts among the most experienced suppliers in the world. This is demonstrated by many thousands of machines that reliably perform their work every day. With the new HIGHLINE, the machine manufacturer from the Rhineland now offers an interesting complete package for two-component applications that impresses users at first glance with its attractive price-performance ratio.

A novelty in the market is the extremely wide range of applications that can be served by HIGHLINE machines. Thanks to the comparatively low purchase price, and the choice of top-quality components and useful additional equipment, investing in HIGHLINE machine technology is worthwhile for countless possible applications. Whether you want to make small series production, perform various hand-operated applications, or incorporate it into highly automated processes.

The cost advantage is achieved by the polyurethane specialists in the Hennecke GmbH through a comparatively high degree of standardisation in the machines. The HIGHLINE has been consistently designed and built as a series product. The manufacturing process in Hennecke's factory workshop has therefore been optimised down to the last detail. A synchronised flow assembly system makes it possible to have substantially shorter delivery times, but at the same high quality standards that Hennecke customers have appreciated so much since the development of the first high-pressure metering machines at the start of the 1950s.



With a well thought-out new development in their metering machine line-up, Hennecke has implemented a particularly cost-effective and energy-efficient solution for the two-component high-pressure processing of polyurethane, without any reduction in metering accuracy, adherence to the formulation, or precise compliance with the desired part weights.





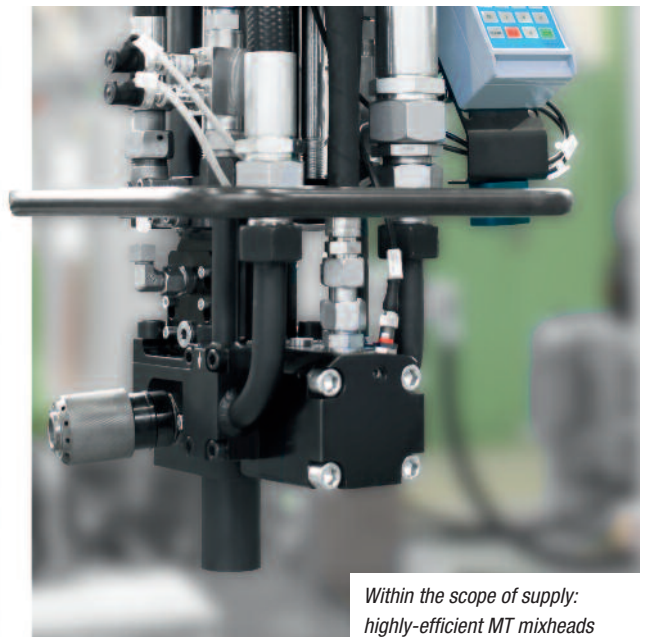
The operating concept has also been redeveloped from scratch, as have major components of the machine automation. In the HIGHLINE, an intelligent energy management system is included for instance, which can reduce power consumption under typical production conditions by up to 50 percent. The intuitive operation and user-friendly menu navigation of the integrated SIMATIC touchscreen are always fitted as standard on Hennecke machines.



Ergonomic and user-friendly: the HIGHLINE operator panel

The machine layout is extremely efficient. The HIGHLINE has a compact design, as the tanks and hydraulic system are mounted on a support frame. This not only saves space in the production facility, but also simplifies the installation of the machine, which is uncomplicated to move with a stacker, and which provides additional flexibility in the daily production process. The start-up of the machine is very simple and can be completed in a few easy steps as it is based on Hennecke's typical plug-and-play principle. The basic version has day tanks with a volume of 250 litres each. For laboratory or technical center applications, the HIGHLINE can also be fitted with 60-litre day tanks. The total output range depends on the axial piston pumps used, and varies between 25-2,500 g/s at 50Hz mains supply frequency, and up to 3,000 g/s at 60Hz supply frequency. The quality of the foam products and economical production are not only determined by the metering machine, however. The mixhead used also plays a central role here. Compared with its competitors,

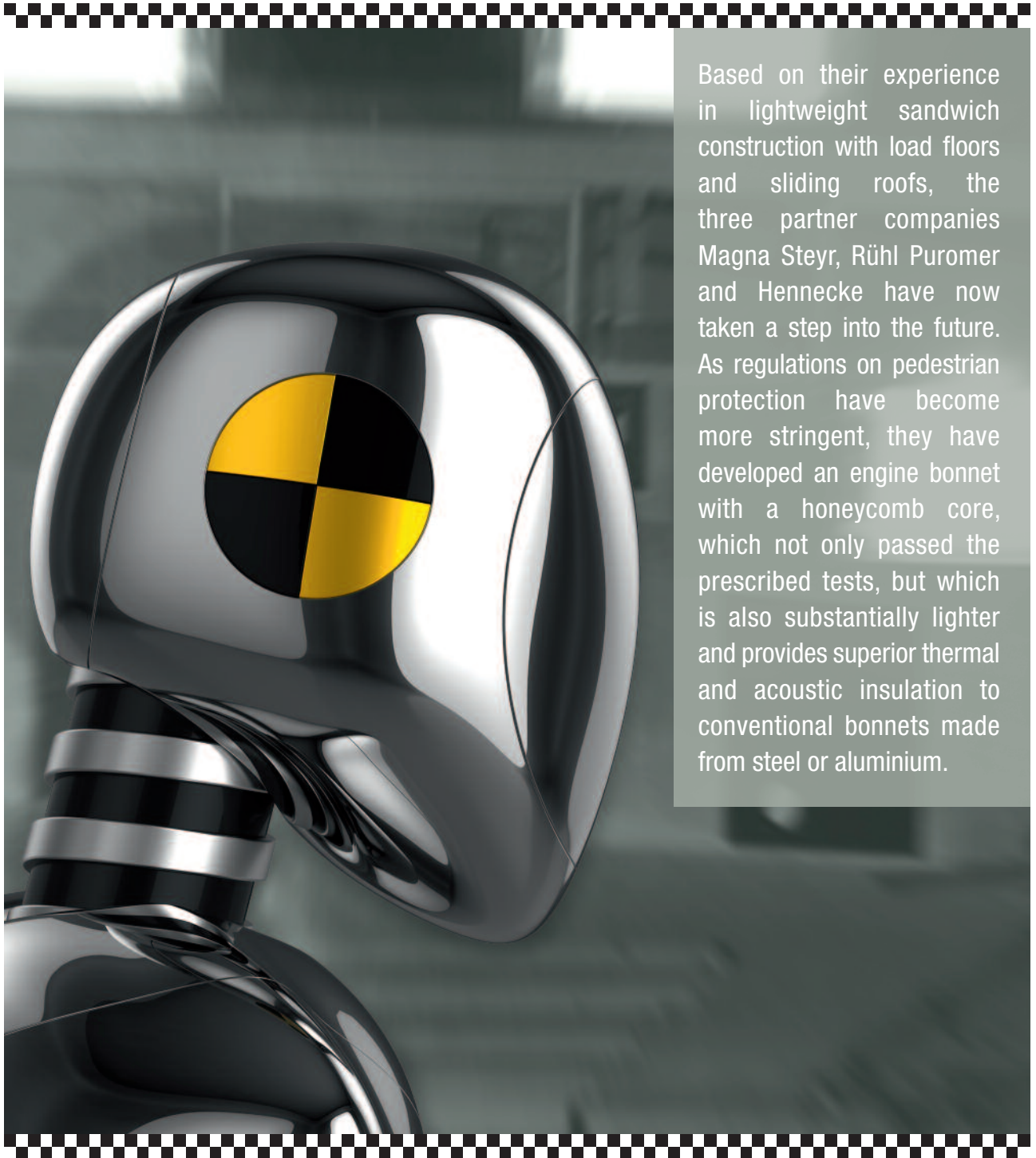
Hennecke makes no compromises when it comes to the mixhead types available: Based on the application spectrum, the HIGHLINE series can be fitted with the best mixheads currently available on the market. Piston-cleaned MT mixheads and the air-cleaned MXL variant ensure perfect mixing results for optimal product quality. All types are manufactured 100 percent at the Hennecke site in Sankt Augustin, in accordance with the state-of-the-art knowledge in polyurethane processing. Here, too, the user benefits from the company's expertise and many years of experience – precisely as one would expect of the HIGHLINE, as Hennecke specialists believe.



Within the scope of supply: highly-efficient MT mixheads

Definitely lightweight!

Production of fibre composite bonnets



Based on their experience in lightweight sandwich construction with load floors and sliding roofs, the three partner companies Magna Steyr, Rühl Puromer and Hennecke have now taken a step into the future. As regulations on pedestrian protection have become more stringent, they have developed an engine bonnet with a honeycomb core, which not only passed the prescribed tests, but which is also substantially lighter and provides superior thermal and acoustic insulation to conventional bonnets made from steel or aluminium.

In 2009, the EU published Global Technical Regulation (GTR) no. 9 on pedestrian protection, the implementation of which is being worked on by automotive manufacturers and suppliers around the world. Pedestrian protection is also assuming considerably greater importance in the redefinition of the Euro NCAP ratings, a non-manufacturer-specific crash-test programme. In order to continue receiving the sought-after 4-star or 5-star ratings for their vehicles, the manufacturers must make greater efforts to ensure pedestrian protection in future.

is the high technical and economic expense resulting from the use of sensors, control systems and pyrotechnic triggers, as well as the increased maintenance requirements. Furthermore, these systems in turn require additional space in the front of the vehicle. This inevitably means that compromises have to be made in the design.

Magna Steyr AG & Co KG, from Graz in Austria, is a leading global development and manufacturing partner of automotive manufacturers, independent of any specific brand.

The company decided to transfer its existing expertise in the field of sandwich technology to the development and series production of vehicle exterior parts.

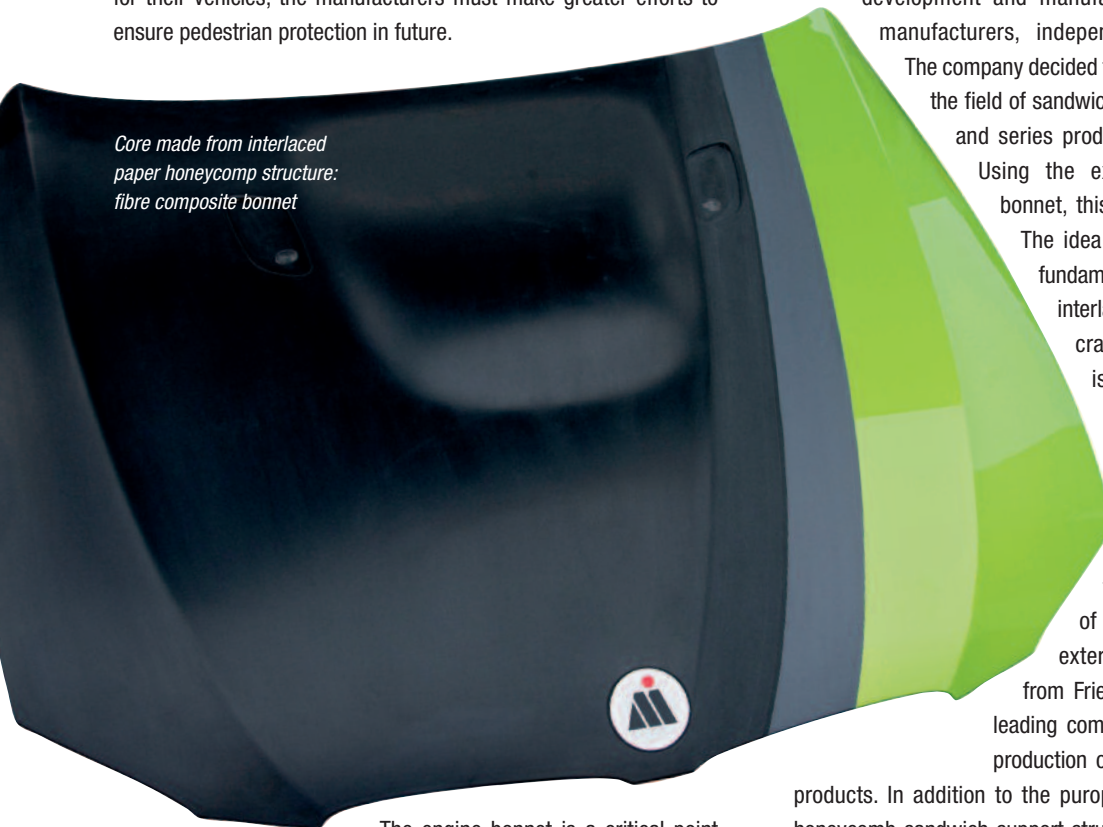
Using the example of a fibre composite bonnet, this is now impressively exhibited.

The idea was to utilise one of the most fundamental mechanical properties of the interlaced paper honeycomb structure: crash protection. In principle, this is the same effect utilised e.g. by stuntmen, when they use stacked cardboard boxes to absorb kinetic energy.

A particular challenge here was the paintable class-A surface of the engine bonnet, required for exterior parts. Rühl Puromer GmbH from Friedrichsdorf is one of the world's leading companies for the development and production of PUR systems and GRP special products. In addition to the puroreg® system for manufacturing honeycomb sandwich support structures, adapted specially for the application, these specialists have also developed a purorim® system based on PUR that uses the Reaction Injection Moulding (RIM) process to ensure the required surface quality and hence successfully solve the task.

When selecting the appropriate mixing and metering systems for PUR processing, the decision was easy to make. Magna Steyr relies on PUR-CSM processing systems. On the one hand, this is because

Core made from interlaced paper honeycomb structure: fibre composite bonnet



The engine bonnet is a critical point for pedestrian protection. It should be designed in such a way that it absorbs as much energy as possible in the event of a collision with the body. This requires free space underneath the bonnet. In current motor vehicles, however, every last cubic centimetre of space in the engine compartment is filled. As a result, various manufacturers have developed quick-acting systems that raise the bonnet in the event of a collision, in some cases fitted with additional airbags, in order to achieve the prescribed values. The disadvantage of these systems



Hennecke is the undisputed market leader for large-scale production systems for manufacturing lightweight PREG composites, and on the other hand, when it comes to processing polyurethane, the automotive supplier has already been relying on the PUR specialists from Hennecke for many years.

After the development period, series production of the bonnet is now imminent. In principle, the sandwich structure of the bonnet resembles the design of a PREG load floor for luggage compartment systems. A honeycomb core is used for the production of the bonnet, with glass fibre reinforcement applied from above and below. In order to achieve the different compression hardnesses and stability required in the bonnet, e.g. for hinges, the honeycomb core is designed as a reinforced structure at the relevant points. Afterwards, the PUR matrix is applied using the PUR-CSM spraying process. In this patented spray-up approach, the semi-finished fibre products are wetted on both sides with a thermally activated PUR system. This makes it possible to apply a thicker layer of material in specific, targeted areas of the component. The part is then compressed and cured inside the mould. In the next stage, the RIM process is used on the outside and around the outer edge of the bonnet to produce the paintable class-A surface.

The polyurethane spray coat creates an optimal and durable connection between the glass fibre and the honeycomb core. This ensures extremely high stability and torsional rigidity. The thickness and structure of the honeycomb core allows the crash performance of the bonnet to be adjusted in a defined manner. If the bonnet is designed in such a way that it extends down to the radiator grille at the front, this area then also corresponds to the regulations for

pedestrian protection, and allows the designers almost total freedom to design the front section of a vehicle. The structural design also includes other positive effects. In addition to the substantially lower weight, the bonnet has excellent insulating properties thanks to its honeycomb core. For example, it requires no noise-absorbent mat, which is almost inevitable in conventional bonnets. But it not only exhibits excellent insulating properties in terms of noise, it also provides thermal insulation. This generates advantages when it comes to CO₂ emissions, because the motor cools down significantly more slowly, and under ideal circumstances cold starts can be avoided more often.

The engine bonnet has passed all of the comprehensive approval tests for use in the automotive industry - and naturally also the new requirements for pedestrian protection. This new design will be extended to many other exterior parts in future, such as tailgates, doors and roofs – a further important step on the road to a complete lightweight car body.

Innovative lightweight solutions

Engel Austria and Hennecke form a development alliance

When analyzing the basic elements and requirements for „forward-looking lightweight construction in the automotive industry“, the following features are indispensable:

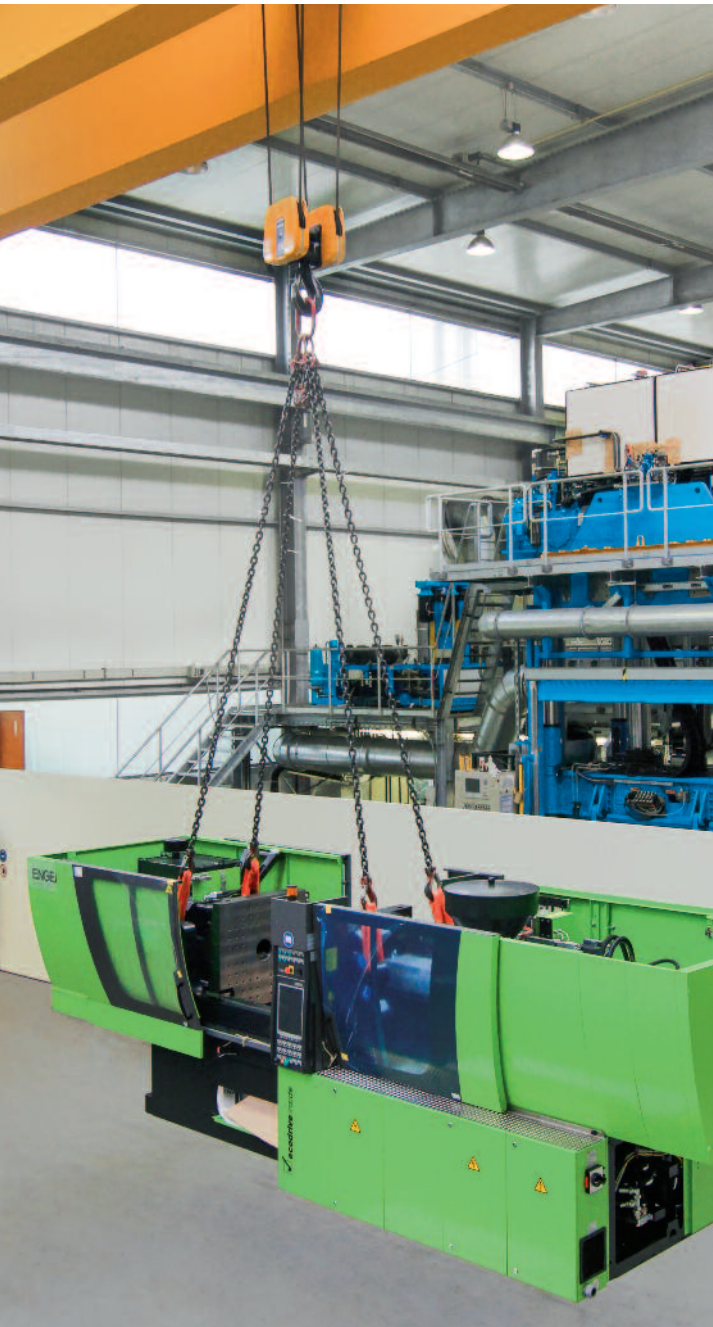
- Fibre composites tailored to requirements
- Mass production capability
- Cost optimization

In the present case, these keywords form the basis of a development alliance between the injection moulding expert Engel and the HP-RTM-specialist Hennecke. Fibre composites that are tailored to meet individual requirements are a classic product which is processed by the RTM method. With the development of the HP-RTM process, Hennecke has been able to significantly optimize the cycle time of a common production process by using reactive plastic systems. The HP-RTM method focuses on a task that is well-known and tried and tested in the area of PU processing: the high-pressure injection of a reactive mix into a mould within a few seconds. Combined with the suitable raw material system, the HP-RTM process allows an accelerated reaction and extremely short curing times to be achieved. On top of this, Hennecke GmbH's decades of experience in high-pressure metering are apparent. For example, in a process-optimized mixhead series for HP-RTM applications that delivers top-quality and reproducible results at all times. Moreover, the use of Hennecke's patented constant pressure injector ensures a stable homogeneous injection pressure. The extremely innovative filling process in a closed control loop and all other tasks of this new production method are implemented by Hennecke's STREAMLINE machine series.

Now Hennecke addresses the issue of mass-producing fibre composite parts together with Engel. For it is not always necessary to manufacture parts in complete fibre fabric structure. Within a part, the fibre fabric is often only required at places where forces actually have to be absorbed. Afterwards, the final moulding process can take place completely by thermoplastic injection moulding and in high-quality design, also when the parts are demoulded without being processed further.







Delivery of the injection moulding machine for the expansion of Hennecke's tech center

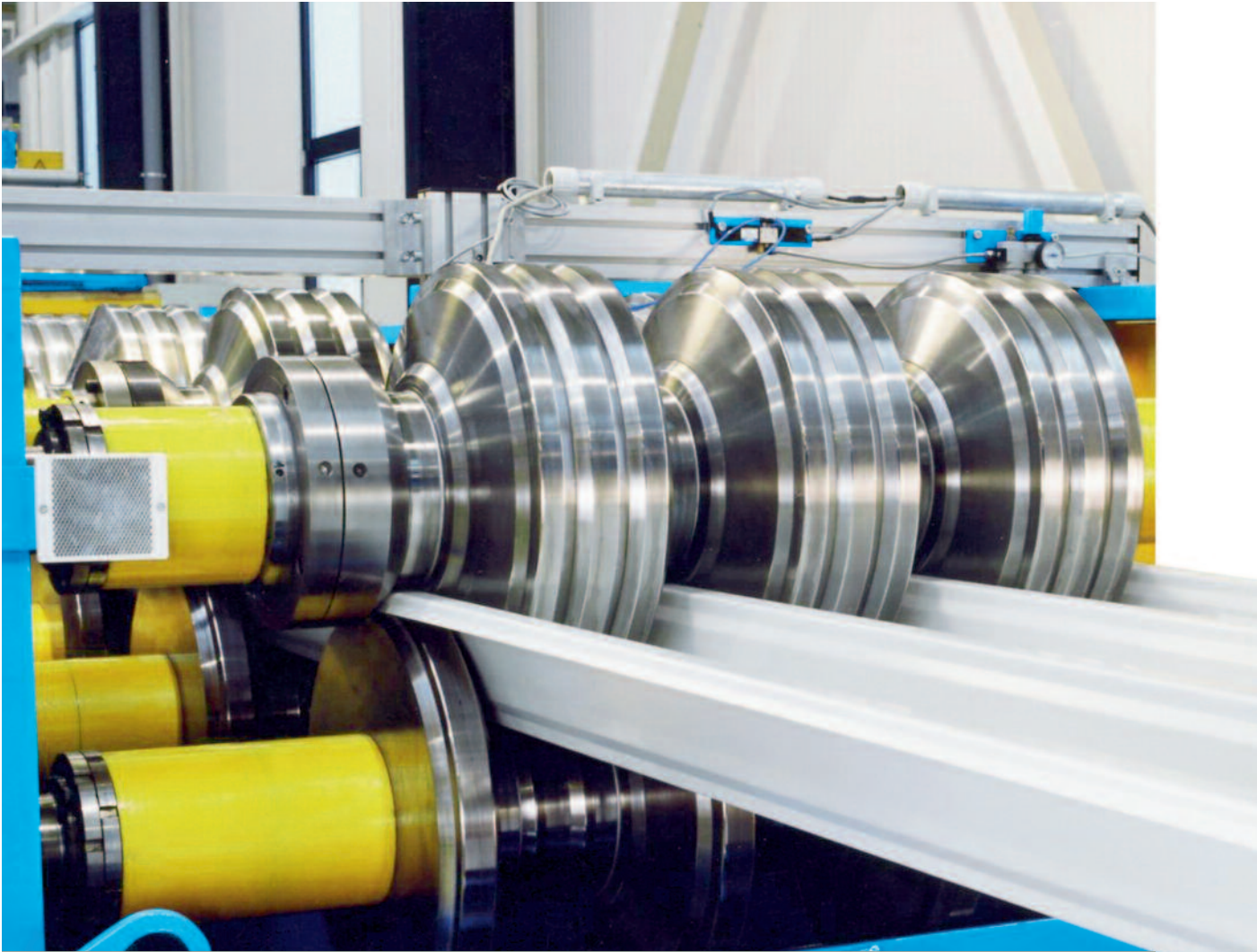
Recognizing this, both companies have decided to cooperate on developing possible technology combinations and to expand their technical centers for lightweight applications. „In composite products, various types of materials are coupled to bring out the positive properties. For the manufacturing process, this ideally has to start with mechanical engineering“, says Jens Winiarz, Head of Sales of CSM and New Technologies at Hennecke GmbH. Both Engel´s site in Sankt Valentin (Austria) with its Technology Center for lightweight composites and Hennecke's site in Sankt Augustin (Germany) with its well-known PUR-CSM Center are equipped with the relevant injection moulding and HP-RTM technology. Each of the two companies installs state-of-the-art machine technology at the other location to make sure that development work, future customer trials, pre-series sampling and raw material optimization can be carried out there. „The basic condition for successful lightweight solutions is to ensure that material, design and processing interact perfectly. This is why cooperating with partners along the value-added chain is particularly important for this topic of the future. Our long-standing, close partnership with Hennecke allows development processes to be accelerated, especially when it comes to new challenges“, explains Peter Egger, Head of the Technology Center for lightweight composites of Engel Austria.

The two companies are convinced that their alliance will provide great added value to the customer. Especially because the interaction of fibre composites tailored to requirements on the one hand and process optimization on the other hand are the key to large-scale production with short cycle times in the trend towards lightweight construction.



Hennecke Profiliertechnik GmbH

A roll forming technology specialist



With its CONTIMAT lines for the continuous production of high-quality sandwich composite elements, Hennecke has made a name for itself in the global market. In order to further advance its overall systems competence to meet customer demand in the application of sandwich panels with metal facings, Hennecke has integrated an established systems technology specialist in the profiling of metal elements, Willwacher Maschinenbau- und Vertriebs GmbH (WMG).



The operational integration of parts of Willwacher Maschinenbau- und Vertriebs GmbH (WMG) into the Hennecke Group is taking place as of 31 August 2013. With effect from 1 September, the new company will be trading under the name "Hennecke Profiliertechnik GmbH". WMG has over 40 years of experience in manufacturing roll forming machinery. The portfolio of the highly specialised company, which is registered in the Siegerland region of Germany, includes amongst other things roll-forming machines and presses for manufacturing sectional shutter profiles and cut-to-length lines, as well as high-performance

trapezoidal sheet roll forming systems. The latter fit perfectly into the existing plant concept for Hennecke's CONTIMAT continuous sandwich panel lines. In addition to this, Hennecke Profiliertechnik GmbH will naturally also continue to successfully produce the rest of WMG's product range. For Hennecke's managing director Rolf Trippler, this operational integration an important step towards being able to satisfy almost all customer requirements for the production of sandwich panels from a single source by the globally established Hennecke Group: "WMG has extensive expertise and an experienced and well rehearsed team. Within Hennecke Profiliertechnik GmbH, we will

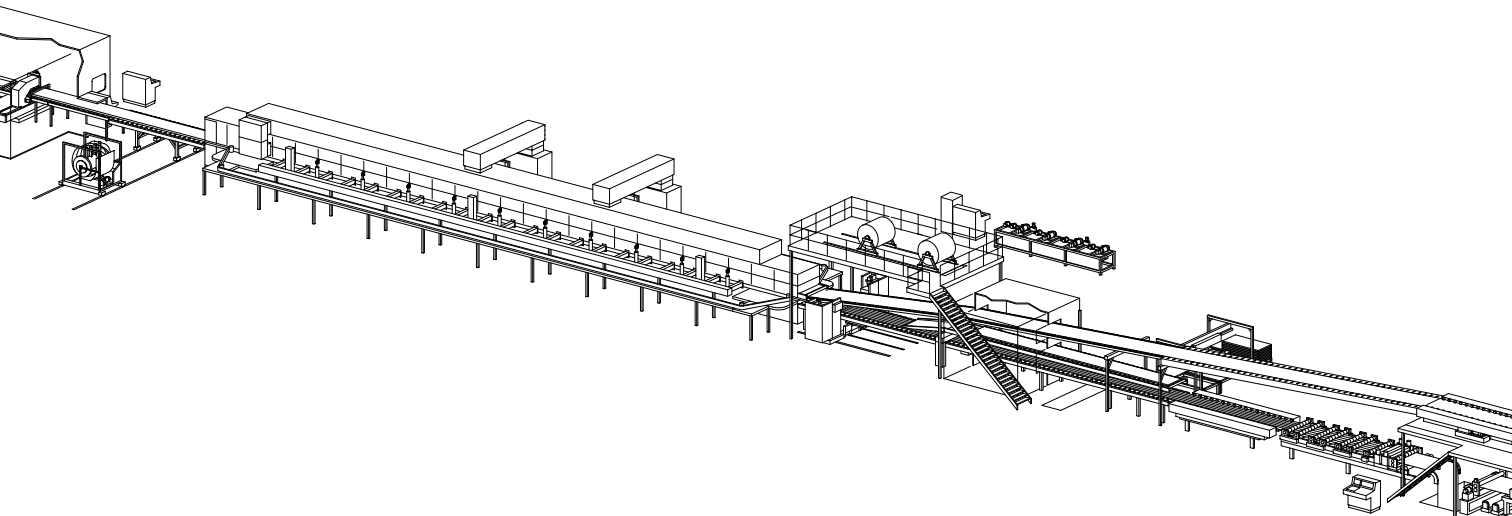


Hennecke
 Roll Forming Technology
 Roll Forming Technology

Production facility of Hennecke Profiliertechnik in Kreuztal

utilise this expertise in the interest of our customers by integrating a high-quality trapezoidal sheet forming system that makes the CONTIMAT plant technology even more attractive compared to the competition. The entire Hennecke Group will benefit from this." Jürgen Willwacher is of the same opinion. The founder and managing partner of WMG appreciates the opportunities provided by the entry of a world market leader in the field of polyurethane processing: "The entry of the Hennecke Group represents a great opportunity for the further development of our core business. Especially when it comes to international market coverage.

" With effect from 1 September, Mr. Willwacher will be the managing director of Hennecke Profiliertechnik GmbH, and will thus ensure the consistent continuation of successful business operations. The decision to establish Hennecke Profiliertechnik GmbH is not least attributable to the consistent strategy of Hennecke owner ADCURAM Group AG, which aims to steadily strengthen and further develop Hennecke in the field of sandwich panel systems concepts.



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