Hennecke
Polyurethane Technology

115 **INNOVATIONS**

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

COVERSTORY

HP-RTM technology:
shorter curing times in the production of extremely light high-performance components

PROJECTS

A car park for doors:
flexible production line for refrigerator and freezer doors

ENGINEERING

All from a single source:
complete production lines for sandwich construction elements

Dates

INTERZUM
Cologne
05.05. - 08.05.2015

ELMIA
Jönköping
21.04. - 24.04.2015

CHINAPLAS
Shanghai
20.05. - 23.05.2015

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16.09. - 17.09.2015

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Stuttgart
22.09. - 24.09.2015

FAKUMA
Friedrichshafen
13.10. - 17.10.2015

As at April 2015

Dear customers, dear readers,

Having the courage to break new ground always means that the status quo has to be challenged. We at Hennecke believe that real progress would not be possible without this conviction. This is why our approach is a lived reality in the new and further development of our product and process portfolio. The new edition of our customer magazine INNOVATIONS clearly indicates that this philosophy works.

You will discover, for example, how the largest manufacturer of home appliances in Europe successfully uses a completely new concept for the production of refrigerator door elements (see pg. 07). But this is not the only innovation presented to you in the area of refrigeration plant technology: With the door foaming line ROTAMAT EM, a significant further development of a proven plant concept for use in growth markets has been achieved by our Chinese subsidiary Hennecke Machinery Shanghai (see pg. 18). The key factor for our customers, of course, is what the continuous further development of our machine and plant technology means for their product ideas. For example, when it comes to finding a substitution for tried-and-tested production methods. In this issue, you will find out more about two revolutionary products with a surprisingly similar range of application: a wheel-tyre combination that uses PU elastomer spokes instead of air (see pg. 10) and a passenger car rim made from fibre-reinforced plastic that is implemented by means of Hennecke's HP-RTM technology (see pg. 04).

I hope you will enjoy reading the current issue of INNOVATIONS and discover many more exciting topics. If this encourages you to break new ground in your production, we will be pleased to convince you personally of the benefits of our products.

Rolf Trippler
Managing Director Sales

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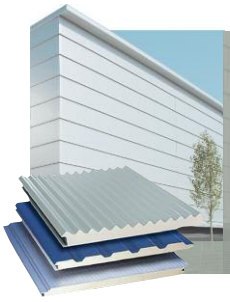

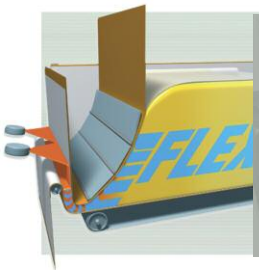

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HP-RTM technology in Hennecke style:

shorter curing times in the production of extremely light high-performance components

The demand for High Pressure RTM (HP-RTM) in the field of lightweight automotive construction has been increasingly growing. Hennecke GmbH is already in an excellent technological position with the STREAMLINE high-pressure metering system for HP-RTM applications as is proven by its impressive automotive serial applications. Nevertheless, the Hennecke process experts are pushing the envelope of what is feasible step by step. The reduction of the specific cycle time plays a decisive role in this as it already did in the course of the process-related combination of high-pressure technology and the traditional RTM process. With the VARIOCAST technology the lightweight construction specialists of Hennecke GmbH are now able to further reduce the demould times for HP-RTM components. This especially meets the demands of users within the field of series production.

Due to increasing requirements for efficiency and ecology interest in lightweight solutions, especially for the automotive industry, has been growing in recent years. The main focus is on components that until now have been realized using the resin injection process in closed moulds. Today, a combination of high-pressure technology and the conventional RTM process is increasingly being used in the production of such high-tech components. With the High-Pressure-RTM process (HP-RTM), Hennecke has broken new ground in polyurethane processing technology. In addition to various already existing carbon structural components for car body applications, developers are increasingly focused on automotive accessories. The best example of this is a high-performance rim manufactured as a carbon-aluminium hybrid design or a pure carbon product. Apart from a high-end surface structure, such rims offer an enormous weight reduction of between 25 and 30 percent over conventional rims made of forged aluminium. The result is not only lower consumption, but also noticeably improved driving dynamics. Besides, developers do not need to worry about the stability of these safety-relevant components because damages do not affect the structure and the rims can easily be repaired by using special resins.

Because of the great amount of manual work and the comparatively long process times involved, it is hardly conceivable that such high-performance parts could be mass-produced by the traditional RTM method. With the HP-RTM process, its degree of automation and the specific cycle time, the Hennecke specialists have created a tool that offers considerable advantages in terms of efficiency and product quality, especially when it comes to producing large volumes economically. In the process, Hennecke can draw on decades of experience in high pressure metering and mass production applications. The result is increased performance – not only in the end product:

- High-pressure injection of the reactive mixture into the mould within a few seconds
- Accelerated reaction and extremely short curing times thanks to high-pressure mixing and highly reactive resin systems
- Specially adapted systems with a variable range of properties due to close cooperation with raw material suppliers

Suitable machine systems of the STREAMLINE series have long been permanent fixtures on the market for lightweight applications based on fibre-reinforced structural components. A reason for this are the high-quality components and equipment features that are even part of the basic configuration of the state-of-the-art processing systems.

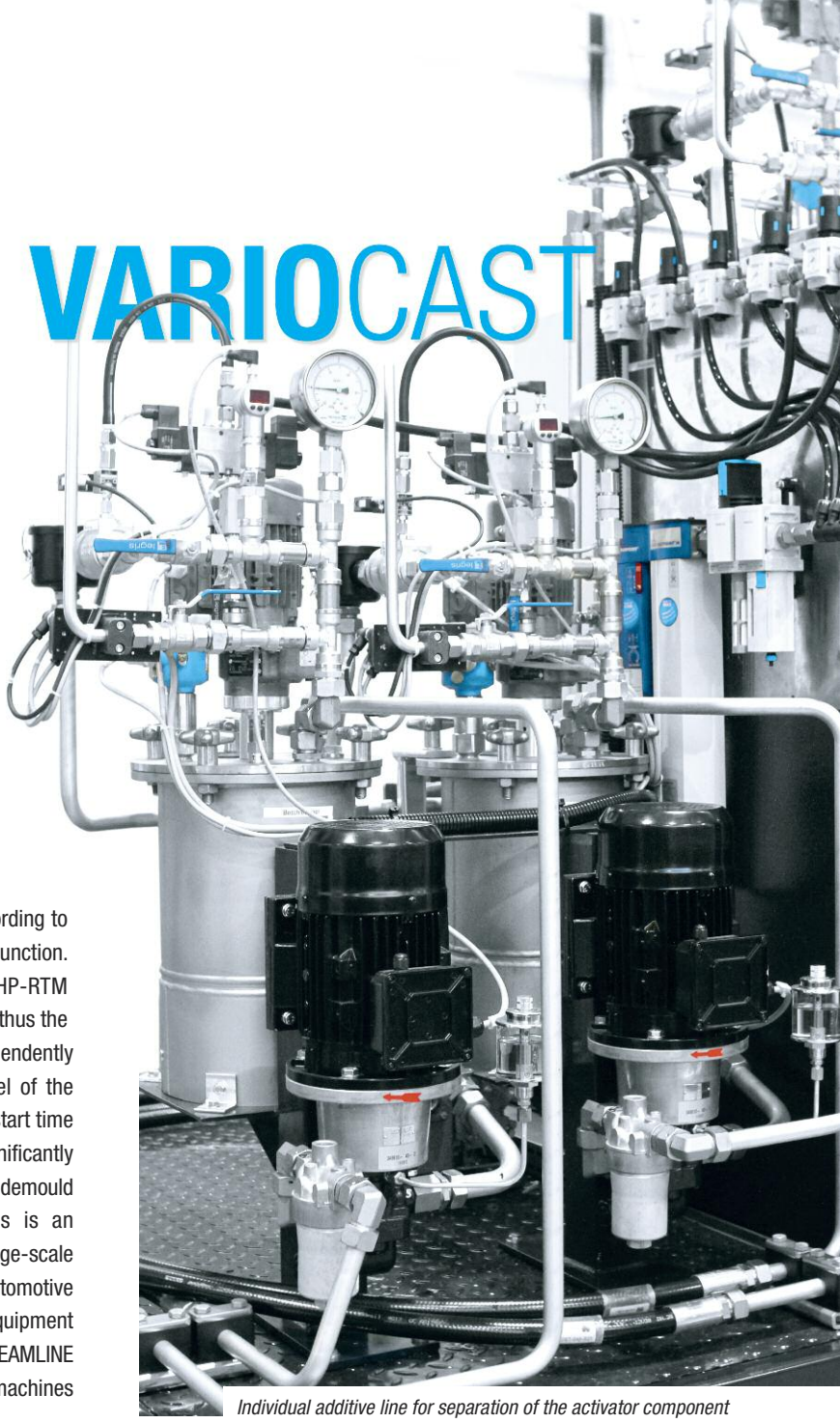
The flow metering system, for instance, is density-independent and thus allows for an exact metering process. This is complemented by a highly efficient heating concept with a component temperature control of up to 130 °C and the effective evacuation of the raw materials in the day tanks.

VARIOCAST

Not by chance Hennecke distinguishes itself as an experienced partner in the field of raw material processing. While "traditional" polyurethane metering machines only process a few pre-formulated components, particularly large-scale Hennecke plants often meter more than 50 individual components with extreme mixing ratios and integral formulations, e.g. during the production of foam products or sandwich panels. Exactly this expertise now forms the basis for adding a useful additional function to the metering machines of the STREAMLINE series: the separation of the activator components by means of an individual additive line (VARIOCAST technology).

Here, the STREAMLINE does not perform the metering according to a defined output but in accordance with a time-dependent function. But why is this function particularly interesting for HP-RTM applications? In order to further reduce the curing time and thus the associated demould time, the injected mix can be time-dependently controlled. The advantage is that, depending on the level of the additional activation, the basic raw material has a specific start time and an individual curing time related hereto, which is significantly shorter compared to a fixed activation. Thanks to VARIOCAST, demould times can be reduced for long shot sequences. This is an indispensable advantage particularly in the framework of large-scale production of lightweight components, for instance, in the automotive industry. As of now, Hennecke customers can include the equipment feature VARIOCAST as an option during the purchase of a STREAMLINE metering machine or they can retrofit their STREAMLINE machines with this feature.

In addition, Hennecke offers extensive support for newcomers to this technology, also addressing fundamental questions such as: How do you build a mould? Where do you position the mixhead? And where do you properly vent using the specifically developed evacuation module? A team of experts will be by your side to get the process started as easy as possible. Even after the start of production, Hennecke STREAMLINE customers will continue to benefit from an extremely extensive support. The online upgrade, for example, allows future control developments to be integrated on demand into the control system. For this purpose the full control of all functions – up to online operating support via menu-guided process input - is available.



Individual additive line for separation of the activator component

A car park for doors:

flexible production line for refrigerator and freezer doors from BSH Hausgeräte GmbH in Giengen begins operation

Ergonomic workstations as well as networked and energy-efficient systems - the new production line for refrigerators and freezers at the BSH site in Giengen meets all the requirements of a modern and eco-friendly production. Part of the production line consists of the new highly automated KTT foaming plant from Hennecke for the production of refrigerator and freezer doors with an insulating polyurethane core. The novelty here is an innovative car park concept for the mould carriers, which enables a mixed production with various curing times but a largely consistent cycle.

BSH Hausgeräte GmbH has invested several million euros in the renewal of the production line, which came on stream in January 2015. An integral part of the production line is the new KTT foaming plant from Hennecke, jointly developed with BSH. The requirements of BSH for this project were clearly defined: a significantly higher degree of automation in the mixed production of various types of doors and a better ergonomic construction than in conventional manufacturing systems.

A refrigerator or freezer door is always built on the same principle. There is an inner side made of plastic and an outer side made of sheet metal. Polyurethane is poured in between these two elements, which cures as a foam and forms a firm connection with the door elements. In addition to the insulating effect of the foam, the door simultaneously obtains its stability.

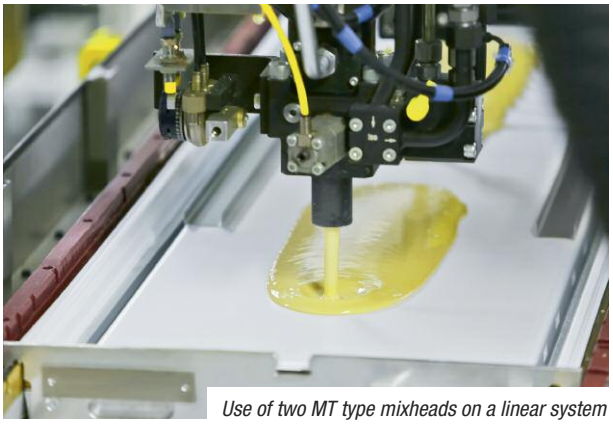
In conventional door manufacturing, for example with the tried and tested ROTAMAT systems from Hennecke, the foam in the door cures in a drum system. Here, the mould carrier rotates in a clocked rotating movement around a horizontal axis. With this type of manufacture, the operator always has the same workflow at a single station. Removing the finished door from the open mould, inserting the plastic inner side as well as the sheet metal outer side into the mould, and as the final step, automatic filling with polyurethane takes place. This operator workflow determines the cycle time of the entire plant.

With the new Hennecke KTT foaming plant, the removal, loading and foaming steps are now divided into three downstream stations. This division considerably reduces the cycle time. In order to increase the flexibility of the system, the doors no longer cure in a drum system, but in a type of "multi-storey car park".

In the first station, a six-axis robot removes the finished door from the open mould with a vacuum gripper. The flat vacuum gripper is designed so that it can transport all model variants of the refrigerator doors - one or two-door in various sizes. At the second station, the operator inserts the inner and outer sides. BSH and Hennecke have paid particular attention to the ergonomic design of this workstation. When placing the door elements into the open mould of a conventional plant, the operator inserts one part into the lower mould half and the other part at the top into the open mould lid. For the insertion into the lid, the operator must really stretch. To avoid this, Hennecke has simplified the insertion. The operator places the inner and outer parts only into the lower mould half. When transferring the mould carrier to the third station for filling,

the mould closes and opens again immediately. In doing so, the sheet metal outer part is taken into the upper mould half.

Two mixheads on a linear system pour the polyurethane into the mould. With a small door only one mixhead is at work, with large or two-piece doors both mixheads are used so that the mould can close again quickly. For each door type, a special foaming programme and the necessary curing time is stored in the control system.



Use of two MT type mixheads on a linear system

This "car park system" gives BSH the opportunity to run a mixed production of different types of doors. No matter how long a door needs to cure, the cycle ofthe plant remains largely the same. An infeed and outfeed station for the mould carriers enables the moulds to be changed during production without causing an interruption. Therefore each mould carrier is designed self-sufficiently. It is equipped with a motor to open the mould, a compressed air reservoir for the air cushion to execute a parallel stroke during opening and closing, and an electric temperature control to provide the desired temperature during curing.

Handling of up to ten mould carriers: KTT's central lift

The BSH site in Giengen focuses consistently on the topic of industry 4.0. The entire production line is interconnected. This enables, not lastly, perfect coordination with the cooling device assembly line, where the refrigerator and freezer doors must be made available in a timed manner. The devices manufactured by the company are not just for the German and European markets; they are also sent from Giengen to the entire world.

B/S/H/

BSH Hausgeräte GmbH is the largest home appliance manufacturer in Europe and one of the world's leading companies in the industry. Today, BSH has 42 factories in 13 countries in Europe, USA, Latin America and Asia. Together with a network of sales and customer service companies, there are over 80 companies in 47 countries with approximately 50,000 employees working for BSH, more than 70 percent of which are in Europe. In the brands portfolio the top brands are Bosch and Siemens. With eight specialty brands (Gaggenau, Neff, Thermador, Constructa, Viva, Ufesa, Junker and Zelmer) BSH serves individual consumers' wishes. Four regional brands (Balay, Pitsos, Profilo and Coldex) provide a broad presence in their respective home markets. The company employs approximately 2,500 employees at the Giengen site and annually produces more than 1.5 million refrigerators and freezers.

Treading new ground:

serial production of a revolutionary wheel-tyre combination with ELASTOLINE low-pressure metering machines.

Can you reinvent the wheel? Yes, Michelin North America can. With the innovative airless wheel concept Tweel®, the tyre specialist proves that with metering machines from Hennecke for processing PU elastomers, you can tread, or rather drive on, completely new ground. Serial production of the new wheel-tyre combination is currently starting for a professional riding mower.

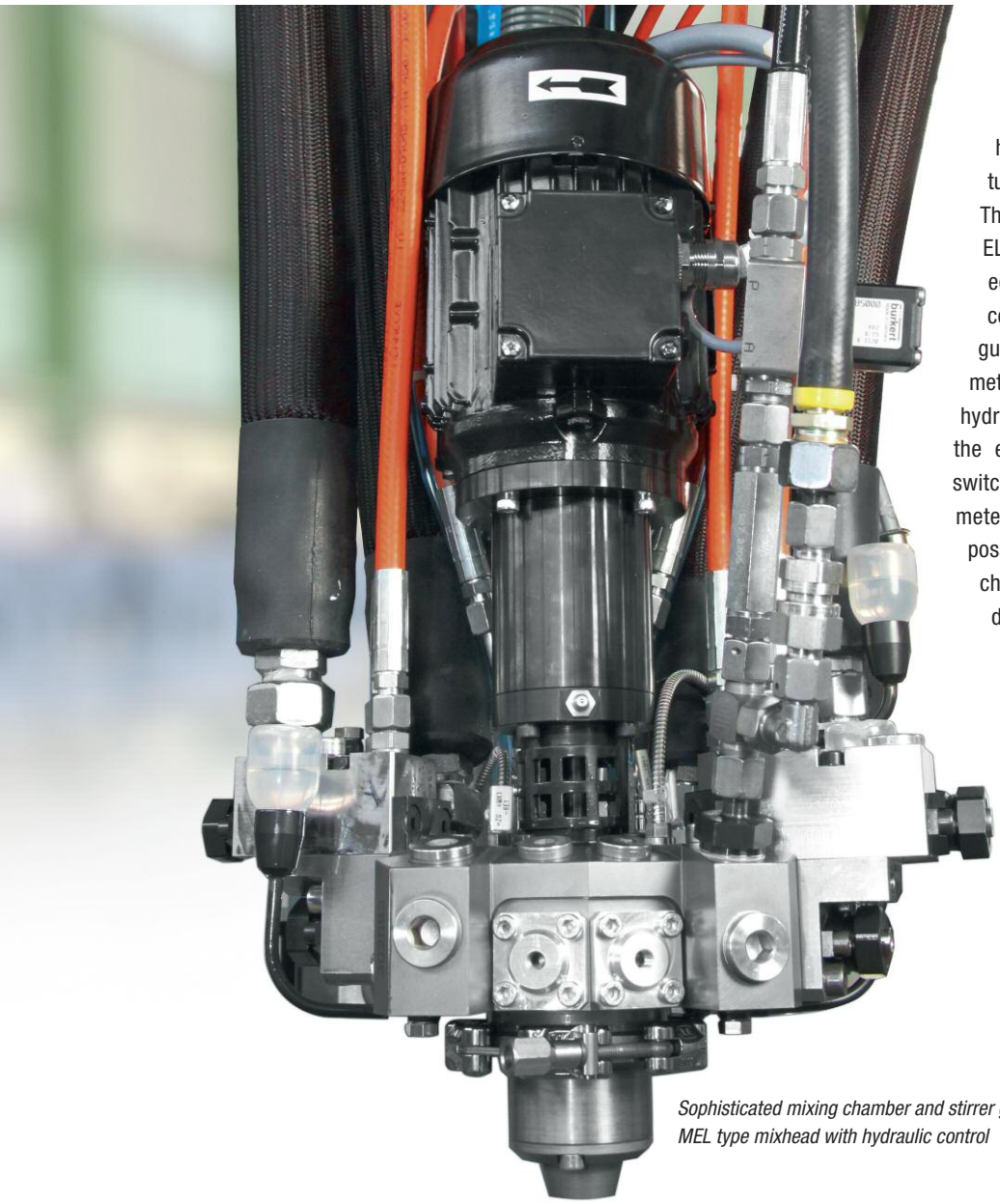
Since the invention of the pneumatic tyre in 1888, there has, in principle, been no change to the combination of a stiff, load-bearing rim surrounded by an elastic rubber tyre filled with pressurised air. From bicycles to lorries, they all depend on this same connecting element between the vehicle and the ground. This is not without good reason: with its suspension and shock absorption properties, the rim wheel system contributes considerably to the driveability and comfort of a vehicle. In spite of further development over the last 127 years, one drawback still remains: if air escapes from the tyres, unrestricted mobility is no longer a possibility.

Michelin tackled this problem and the result is an airless concept which combines the tyres and rim in one component, hence the name Tweel® – created by combining the words tyre and wheel. Combined, a hub made from metal, flexible elastomer spokes, and a tread made from conventional tyre rubber create a maintenance-free and almost failsafe wheel concept, whose suspension and shock absorption properties do not just match up to its air-filled counterpart, but in fact even surpass it in several requirement areas. In addition, the wheel-tyre combination is designed so that the tread ensures low and even distribution of contact pressure. The Tweel® is therefore perfectly suited for terrain that is heavy or damaging to tyres as well as for uses in which the ground surface should be protected, as is the case with lawn surfaces, for example.

It is not for nothing that Michelin North America are currently concentrating the Tweel® production spectrum on land cultivation, gardening and earth moving machines. At the end of 2014, the company opened a new production site for Tweel® manufacture in Peidmont in the US state of South Carolina. Serial production of the new wheel tyres as an original equipment option for professional riding mowers also started at this site.

During production, the metal hub for the lawn mower's wheel is laid into a mould for the spokes and this is filled with cast elastomer. Here Michelin focused its attention on achieving extremely high metering accuracy, reproducibility of the specific formulation, homogeneous component mixing as well as bubble-free filling. After casting, the spokes cure in the oven, forming an almost inseparable bond with the hub. In the last production step, the rubber tread is attached.

With the production of Tweel® the tyre specialist trusts in Hennecke's decades of expertise in the area of low-pressure processing of cast elastomers. The company uses ELASTOLINE F low-pressure metering machines from Hennecke in the production of the elastomer spokes. The machines are suitable for processing up to four principal and four auxiliary components and provide the user with the option of structuring the metering lines in a modular construction. The consistent use of high-quality materials and reliable machine components ensures the best possible production results over the long term. For example, through the use of highly precise gear pumps, which guarantee reliable metering even with extreme mixing ratios.



In addition, product containers with tempered circulating air and stirrers, which are installed in insulated individual cabins, ensure homogeneous and precise temperature conditioning of the raw materials. The mixhead technology of the ELASTOLINE type series is already equipped ex works with a hydraulic control: a special feature which guarantees the processor a superior metering quality. The mixhead nozzles' hydraulic control is responsible for the extremely short and synchronised switching cycles, without which precise metering of this quality would not be possible. The sophisticated mixing chamber and stirrer geometry was developed in elaborate flow simulation procedures, and was further improved through lengthy test series in Hennecke's technical centre. This ensures the best possible mixing quality even with hard to mix raw materials. For particularly high durability and precision, Hennecke produces the mixhead and stirrer in a special alloy.

Sophisticated mixing chamber and stirrer geometry: MEL type mixhead with hydraulic control

The Tweel® production spectrum currently focuses on land cultivation, gardening and earth moving machines

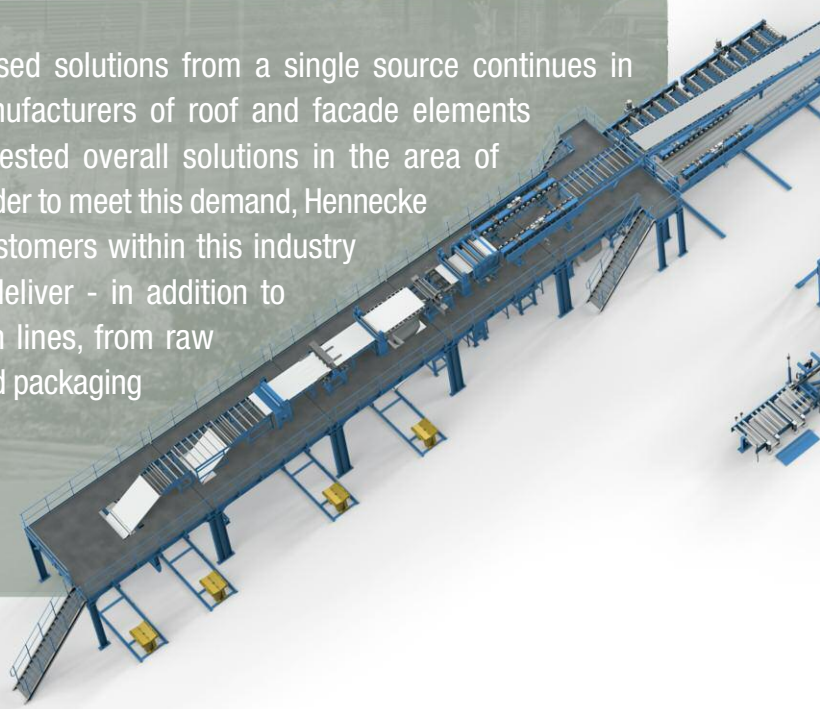
The metering machine's and mixhead's extremely high-end technology, perfected right down to the smallest detail, reflects Hennecke's decades of experience. Spanning different disciplines, the machine manufacturer's specialists work to create the best possible technology for their customers.

Michelin also aims to further develop the Tweel® concept and make an entirely new connection to the road possible for other vehicles in the future. Tests are already being carried out for conventional vehicles. Perhaps the next revolution is already rolling up to us for equipping passenger cars with the innovative wheel-tyre combination.

Everything from a single source:

complete production lines for sandwich construction elements

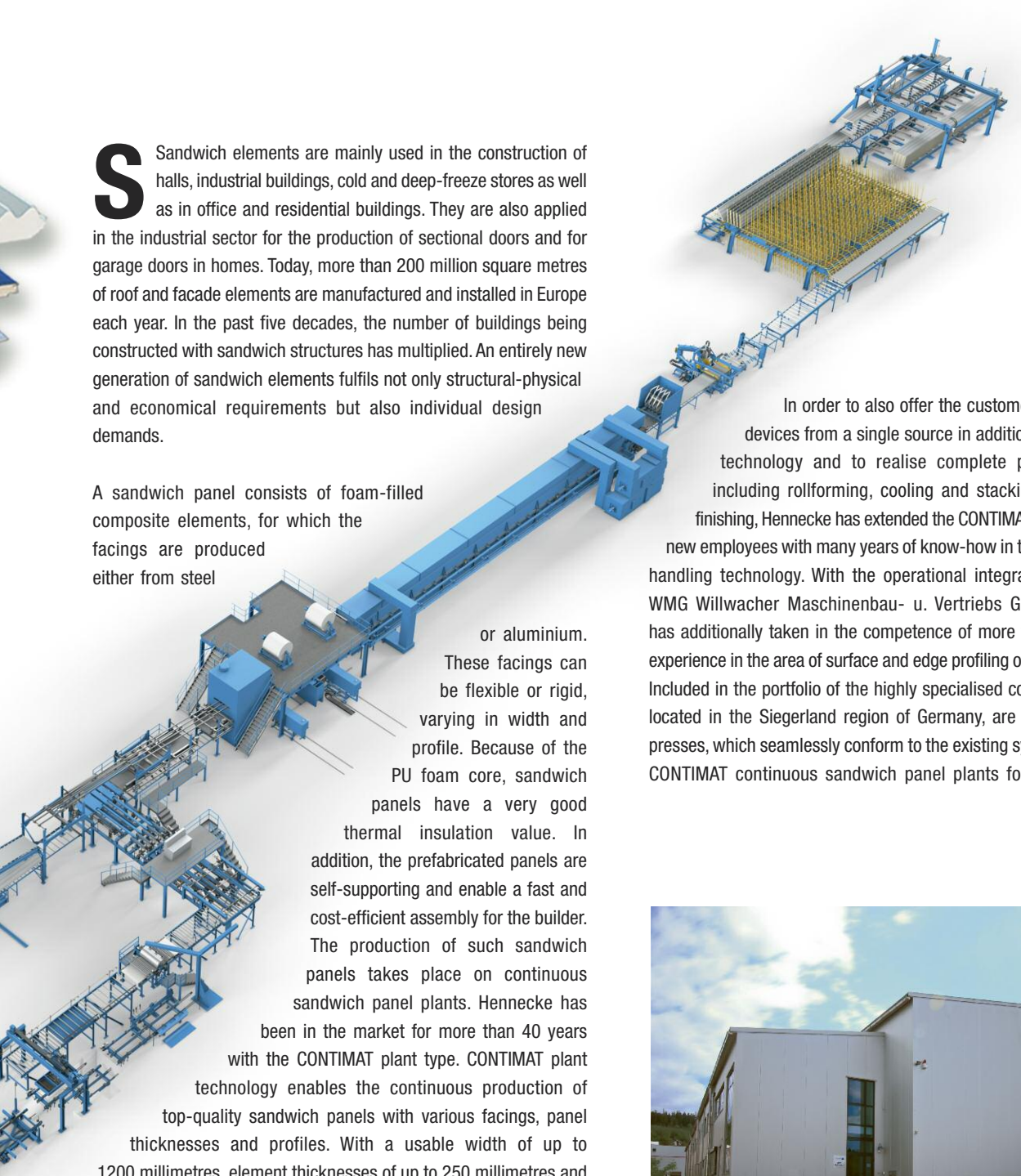
The trend of obtaining complete customised solutions from a single source continues in almost all areas of production. Even manufacturers of roof and facade elements have in the past years increasingly requested overall solutions in the area of continuous sandwich panel production. In order to meet this demand, Hennecke has broadened its product portfolio for customers within this industry sector. The PU specialist is now able to deliver - in addition to reaction technology - complete production lines, from raw material storage to rollforming machines and packaging equipment.



Sandwich elements are mainly used in the construction of halls, industrial buildings, cold and deep-freeze stores as well as in office and residential buildings. They are also applied in the industrial sector for the production of sectional doors and for garage doors in homes. Today, more than 200 million square metres of roof and facade elements are manufactured and installed in Europe each year. In the past five decades, the number of buildings being constructed with sandwich structures has multiplied. An entirely new generation of sandwich elements fulfils not only structural-physical and economical requirements but also individual design demands.

A sandwich panel consists of foam-filled composite elements, for which the facings are produced either from steel or aluminium. These facings can be flexible or rigid, varying in width and profile. Because of the PU foam core, sandwich panels have a very good thermal insulation value. In addition, the prefabricated panels are self-supporting and enable a fast and cost-efficient assembly for the builder.

The production of such sandwich panels takes place on continuous sandwich panel plants. Hennecke has been in the market for more than 40 years with the CONTIMAT plant type. CONTIMAT plant technology enables the continuous production of top-quality sandwich panels with various facings, panel thicknesses and profiles. With a usable width of up to 1200 millimetres, element thicknesses of up to 250 millimetres and a production capacity of up to two million square metres per year, the modern system concept covers an extremely wide range of applications.



In order to also offer the customers all peripheral devices from a single source in addition to the reaction technology and to realise complete production lines including rollforming, cooling and stacking systems and finishing, Hennecke has extended the CONTIMAT team to include new employees with many years of know-how in the area of panel-handling technology. With the operational integration of parts of WMG Willwacher Maschinenbau- u. Vertriebs GmbH, Hennecke has additionally taken in the competence of more than 40 years of experience in the area of surface and edge profiling of metal elements. Included in the portfolio of the highly specialised company, which is located in the Siegerland region of Germany, are rollformers and presses, which seamlessly conform to the existing system concept of CONTIMAT continuous sandwich panel plants for metal facings.

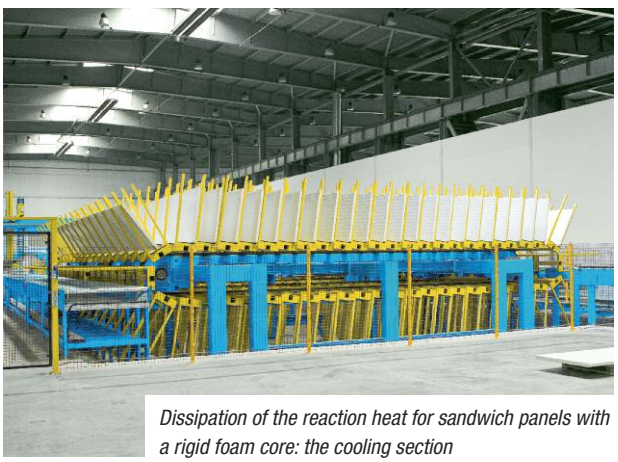
Production facility of Hennecke Profiliertechnik in Kreuztal

Good accessibility and short profile changing times: profiling of the facings for sectional door elements

With these measures, the company is in an optimal and comprehensive position to cover all the major areas of continuous panel production:

- Production technology for sandwich panels with a core made of PUR/PIR rigid foam and/or mineral wool with steel facings in all varieties and designs for wall and roof
- Plants for foamed sectional doors
- Complete production lines for insulation panels with PUR/PIR rigid foam core and flexible facings including complete finishing
- Complete production plants for Structural Insulated Panels (SIP) with a PUR/PIR rigid foam core and rigid facings made of, for example, wood materials or inorganic panels
- Efficient and economic production of special products, such as, e.g. foamed doors, trailer walls and prefabricated house components

Hennecke has successfully demonstrated its technological leadership and the sustainable performance of the CONTIMAT plants in many projects. The newly gained complete system capacity is accepted very well in the market.



Dissipation of the reaction heat for sandwich panels with a rigid foam core: the cooling section

This is also reflected in investments in new plants. In the last year and a half alone, Hennecke was able to supply Eastern Europe and Asia with complete production plants including profiling, cooling, stacking and packaging for the production of garage doors, insulating panels, cold store panels and even for special products like floor heating panels. This also includes a highly flexible system concept that allows various products to be processed on a single plant.

However, the excellent market acceptance is no reason to sit back and rest. Through continuous further development of the CONTIMAT plant technology, Hennecke wants to continue to offer its customers tailor-made solutions for every conceivable application. For that, productivity, plant availability, flexibility and a long lifespan are decisive criteria. With its longtime application experience and market presence in combination with innovative orientation, Hennecke does not set the technology standard in the area of sandwich plants for nothing, and is increasingly becoming the contact worldwide when it comes to efficient production of sandwich elements.

Program-controlled stacking of the sandwich panels

Foam pouring under high speed, mixhead and dispensing systems for the fast-running CONTIMAT

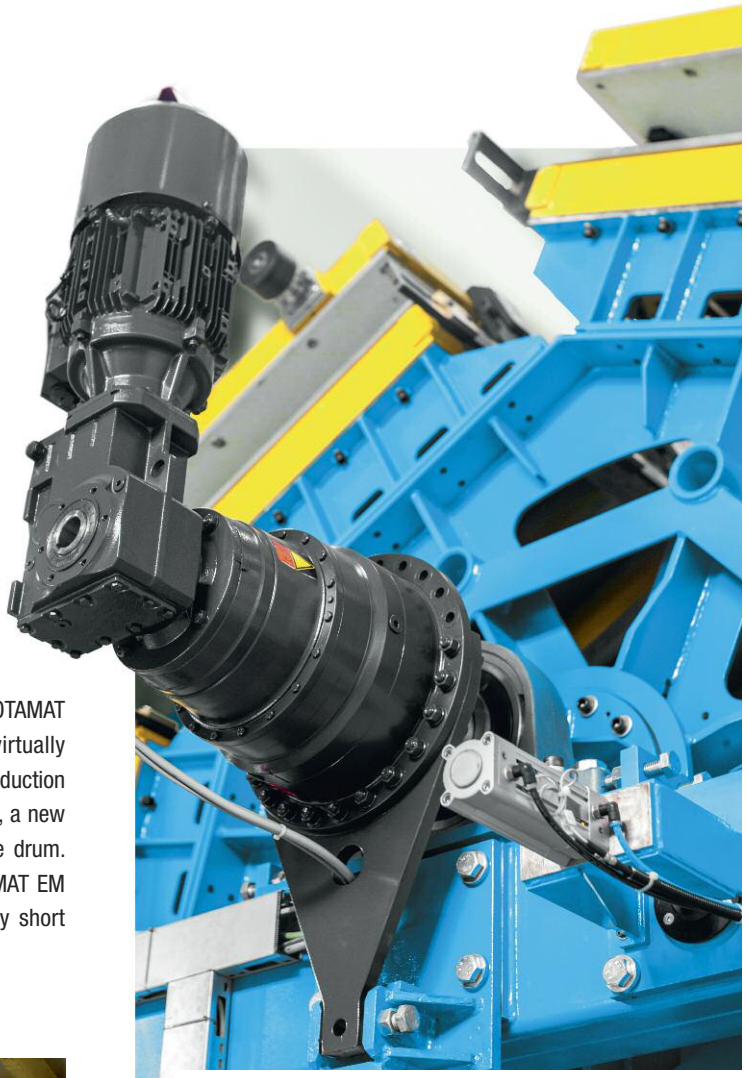
In the production of sandwich panels with flexible facings, often highly reactive PIR systems are used in conjunction with high conveyor speeds. Therefore Hennecke extensively modified the CONTIMAT reaction mixhead. Special recirculation mixheads are used which are equipped with a circulation control so that the material can circulate directly in the mixing chamber via the injectors and recirculation grooves of the control piston. Thanks to hydraulically controlled pistons, the special type of mixhead is also self-cleaning. To ensure optimum mixing quality, the individual injectors are specifically adjusted and designed as constant pressure injectors. The mixing pressure is thus automatically kept at a constant level throughout the entire operating range. At the same time, output changes can be made over wide ranges without having to adjust or replace the injectors, for example when changing to different insulation thicknesses. The entirely new so-called multiple nozzle system allows the processor an optimal surface distribution over the entire foaming width and simultaneously ensures that the reaction mixture has the same age at every location over the foaming width. An optimal foam quality is thus ensured, with homogeneous thickness distribution and without any voids which often arise from the usual overlaps of foam.

Efficient, fast and compact:
the new ROTAMAT EM

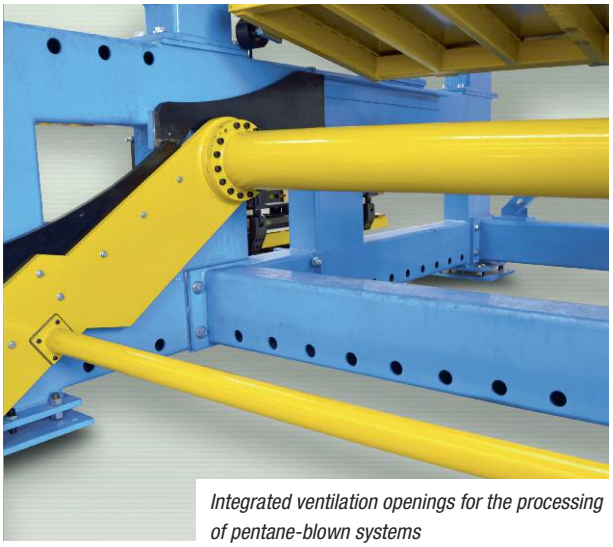
ROTAMAT polyurethane foaming lines are the consistent implementation of the industry's demands on a largely automated, discontinuous production of door elements with an insulating layer made of rigid polyurethane foam. Hennecke's new ROTAMAT EM complements the series with a modular version that is driven exclusively by electric motors.

In ROTAMAT systems, the mould carriers rotate around the horizontal axis in a cyclical turning motion. In the operating station, the mould carrier is opened via a rocker after it has been unlocked. The operator removes the foamed door and inserts the new sheet metal door and inliner. Before starting the foaming operation, the lower part of the mould carrier is swung back into the horizontal position. After the fully automatic foam filling has been completed, the ROTAMAT indexes to the next position and closes the mould carrier during the turning movement. With a successful track record of over 20 years in the worldwide production of door elements for refrigeration appliances and in the manufacture of insulated polyurethane panels for varied applications, the ROTAMAT principle has become a fixture in the market.

With the new „EM“ type, Hennecke adds a version to the ROTAMAT series that is driven exclusively by low-noise and virtually maintenance-free electric motors, thus providing efficient production at an excellent price-performance ratio. Among other things, a new construction for the first time enables a direct drive of the drum. With the high acceleration of the electric drives, the ROTAMAT EM is also suitable for foaming systems with a comparatively short reaction time.



Quiet-running and virtually maintenance-free: electromotive direct drive for drum and swivel arm movement



Integrated ventilation openings for the processing of pentane-blown systems

ROTAMAT EM systems are available for seven or eight mould carriers with external diameters of up to 2,500 mm in length, 900 mm in depth and 240 mm in height. The integrated mixhead manipulator can optionally be fitted with up to 3 axes in a biaxial variant and/or with two mixheads. The processing of pentane-blown systems is also possible with the EM type. The construction for this includes integrated ventilation openings already mounted at the factory, which only need to be connected to an external exhaust air system via a flange at the top of the main frame. As an option, a ventilation system can be supplied by Hennecke. Users of the ROTAMAT EM naturally also benefit from the design advantages of the system.

ROTAMAT EM mould carrier equipped with parallel stroke (available on request)

The systems technology is not only extremely space-saving but thanks to the comparatively large opening angle of the mould carrier, it can also score points from an ergonomic perspective. Moreover, the new plant version demonstrates its high efficiency even before it is put into operation. The delivery of the plant consists of several preassembled units which not only significantly facilitate and reduce the assembly effort on site, but also make shipping very easy because the preassembled units perfectly fit into standardized sea containers.

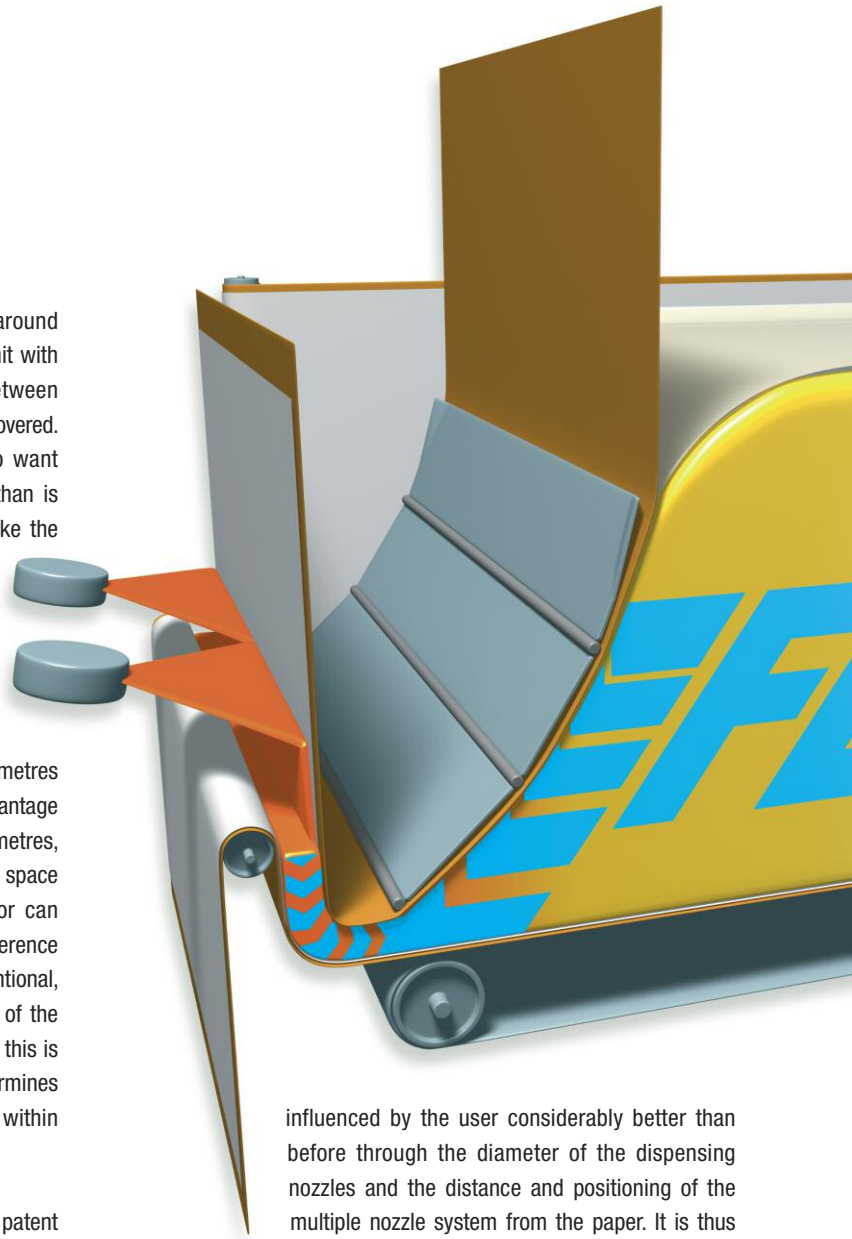
ROTAMAT EF:
highly automated and raw-material efficient

Tailored to meet your individual production requirements, ROTAMAT EF systems are equipped with five, six, seven or eight mould carrier places. The major drives of the EF version are also driven by electric motor. A suitably dimensioned toothed ring for achieving high acceleration rates allows the rotation time to be reduced down to approx. three seconds in ROTAMAT EF systems. For a cycle time of 45 seconds, the EF type produces around 80 door sets per hour with eight mould carrier places. To reduce the operating costs, the ROTAMAT EF can be equipped with automatic door removal devices that move along the x-axis of the filling manipulator. The cured doors are picked up by vacuum suction cups after the mould carrier has been opened and conveyed to a depository next to the ROTAMAT. For very frequent mould changes, automatic mould change is also recommended. Pouring into the closed mould, for example when using low-boiling blowing agents, is also possible. Thanks to the use of Pentane Process Technology (PPT), the ROTAMAT not only meets economic requirements, but also lives up to the highest ecological standards.

Further development of JFLEX:

Good, made even better

With JFLEX Hennecke has successfully expanded their continuous slabstock plant product family and at the same time bridged the gap between discontinuous and continuous slabstock plants. JFLEX offers users with medium-sized production volumes all the advantages of a continuous production process. Since its introduction at the K trade fair 2013 Hennecke was able to place the JFLEX very successfully within the market. The current generation now benefits from various improvements that have been gradually integrated in the context of expanded market requirements.



The positive reactions of slabstock processors around the world have shown that Hennecke has scored a hit with the new JFLEX. So far, the market gap lying between discontinuous and continuous slabstock lines has not yet been covered. The target groups of JFLEX are foam manufacturers who want to achieve a better quality and higher raw-material yield than is possible with discontinuous plants, but are unwilling to make the high investment in conventional continuous lines. JFLEX offers companies with medium-sized production volumes all the advantages of a continuous production process.

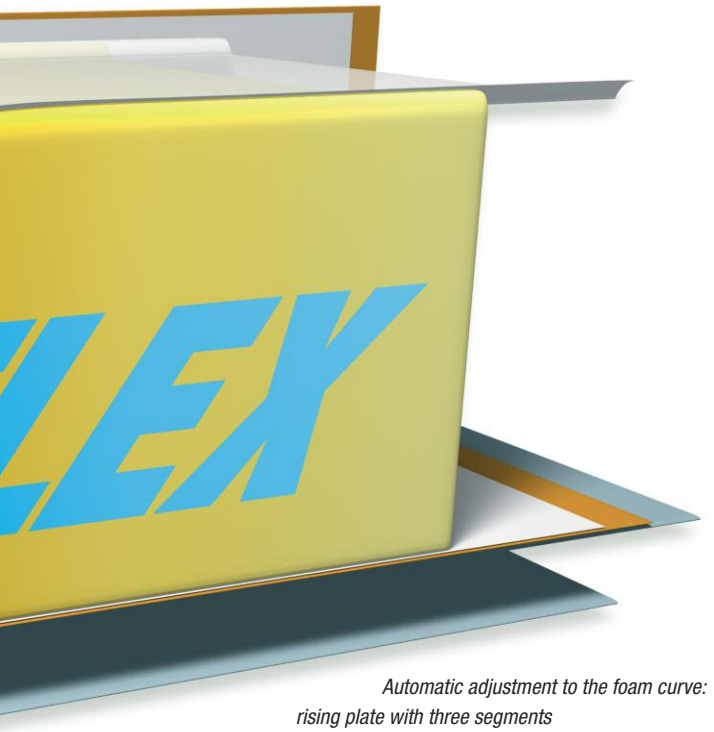
JFLEX lines are operated at one-fifth of the usual production speed of traditional continuous plants and still manufacture similar block sizes. Thus, the machine is only approx. twelve metres long. This extremely compact design provides a significant advantage over conventional slabstock plants, which measure up to 50 metres, making them more than four times as long. Due to the small space requirement, the user saves precious production space or can significantly reduce building costs. Hennecke enables this difference in length with a new liquid-laydown technology. For conventional, continuously operating slabstock lines, the expansion speed of the polyurethane mix determines the production speed. Typically, this is about five metres per minute. The specified speed also determines the length of the entire plant, as the foam must mature within a defined period of time before it can be cut.

The PU specialists at Hennecke have developed a method – patent pending – by which it is possible to operate with a production speed of one metre per minute, and thus to shorten the plant length accordingly. The main component of the new technology is the JFLEX retaining and rising zone: the so-called J-PIPE. Here, the liquid polyurethane mixture is poured on one side using a dispensing system. The expanding polyurethane foam exits on the other side without being able to press back into the liquid and thus expands along a rising plate. The system hereby takes advantage of the density difference between the reactive fluid on one side and the lighter foam on the other side.

This JFLEX process has been further optimised by Hennecke specialists using the experience gained in everyday production. With the further developed "Multiple Nozzle System", various foaming widths in the range of 1000 to 2300 millimetres can now be implemented very flexibly. The raw material distribution can be influenced by the user considerably better than before through the diameter of the dispensing nozzles and the distance and positioning of the multiple nozzle system from the paper. It is thus ensured that the mixture has the same age at every location over the entire width distribution. Meanwhile the multiple nozzle system of the JFLEX also demonstrates its capabilities in further PU applications, in which a uniform rising profile of the foam is the focus.

The second optimisation of the JFLEX process occurred in the area of the rising plate. By dividing into three segments instead of a single rigid element, the geometry can be better adjusted to the foam curve. Additionally, this geometry can now be adjusted motorised during the foaming process. Automatic adjustment is also possible via the control system of the plant depending on the formulation.

But Hennecke has perfected the plant not only with regard to the JFLEX process. It has also optimised the operation and the technical design of the flat top device.

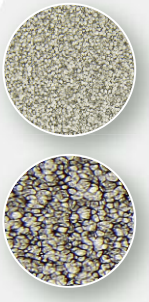


Automatic adjustment to the foam curve: rising plate with three segments

The raw material efficiency is further increased through improved block geometry. The skins of the block are very thin and thus help to minimise the cutting loss. Hennecke technicians also scrutinised the setup times and were able to reduce them further. For example, the side paper is no longer removed after production, it instead remains in the tunnel and is thus ready for the next production. It has also been shown that during production with JFLEX the finished foam exits the tunnel after just seven metres of production and can then be immediately examined by the operator. Necessary formulation adjustments can therefore be achieved without any notable material losses. Conventional systems produce more than 20 metres within this period of time.

With these optimisations and new experiences, JFLEX is further matured and can be deployed reliably in slabstock production. Thus, the new plant type fits seamlessly into the Hennecke QFM and MULTIFLEX slabstock lines. As market leaders in the field of slabstock production, the tried and tested plants enjoy an excellent reputation worldwide.

Typical JFLEX production range



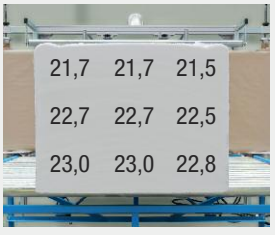
- **Standard foam with a density of 15 to 45 kg/m³**
- Use of fillers of up to 50 parts to 100 parts polyol and
- Possible cell sizes from approx. 25 up to 50 ppi

An even finer cell structure can be achieved through an additional high pressure gassing of isocyanate with nitrogen. Likewise an even coarser cell structure is possible through degassing of isocyanate.

- **Viscoelastic foam, MDI-based and with a density of 50 to 100 kg/m³**
- **HR foam with a density of 25 to 50 kg/m³**

Examples of density and hardness distribution

Typical density distribution
(standard foam without fillers, 22 kg/m³)



In kg/m³

Typical hardness distribution
(40% compression set)

In kPa

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