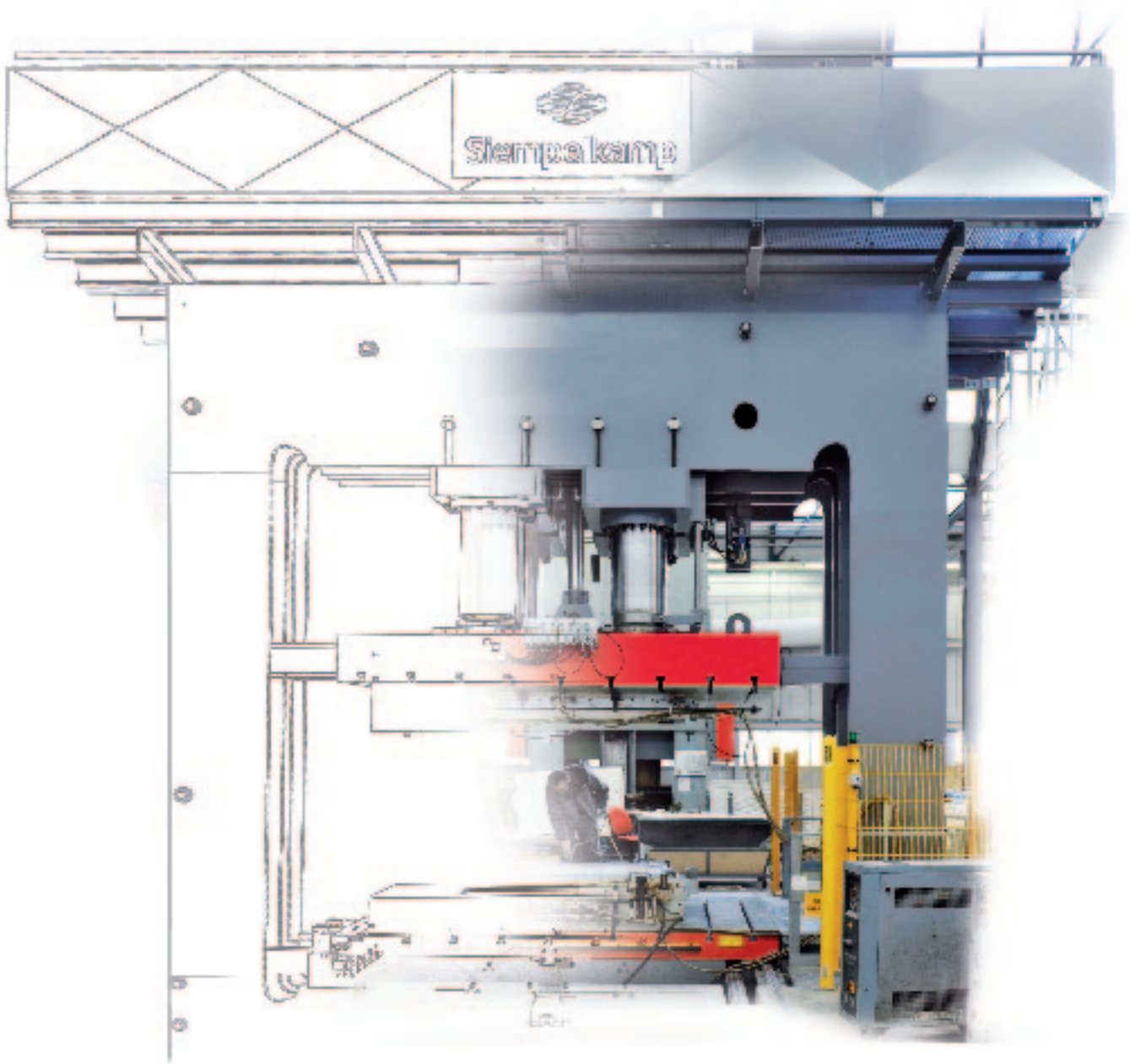




Siempelkamp



Systems solutions

for composite production



Press and plant engineering for composites

Unique system solutions



“We have more than 130 years of experience in metal forming. However, the production of composite materials is more multifaceted in many respects. That is why we started with a white sheet of paper during the design concept of the presses”

Carsten Daub
Sales Manager Composites

Siempelkamp’s composite solutions follow a concept that is specifically tailored to the requirements of the fiber reinforced composite materials – not only during actual pressing but in all phases of the production process, from the raw material to the finished component.

It is suitable for all composite applications – for SMC, PCM, RTM and Thermoplast forming.

Well thought out from scratch

Nowadays every customer has to meet unique requirements. That is why we tailor each system individually to the specific needs of the customer – not just the actual press with mechanics, hydraulics, drives and control, but the whole system including the upstream and downstream processes.

THE RESULT:

Final parts with uniform thickness and excellent surface quality.



With the precision of a machine tool

With an extremely precise closed loop control of the ram plate, especially developed for the composite presses, we achieve the highest precision in every process phase – with fast closing as well as with the actual pressing or forming process.

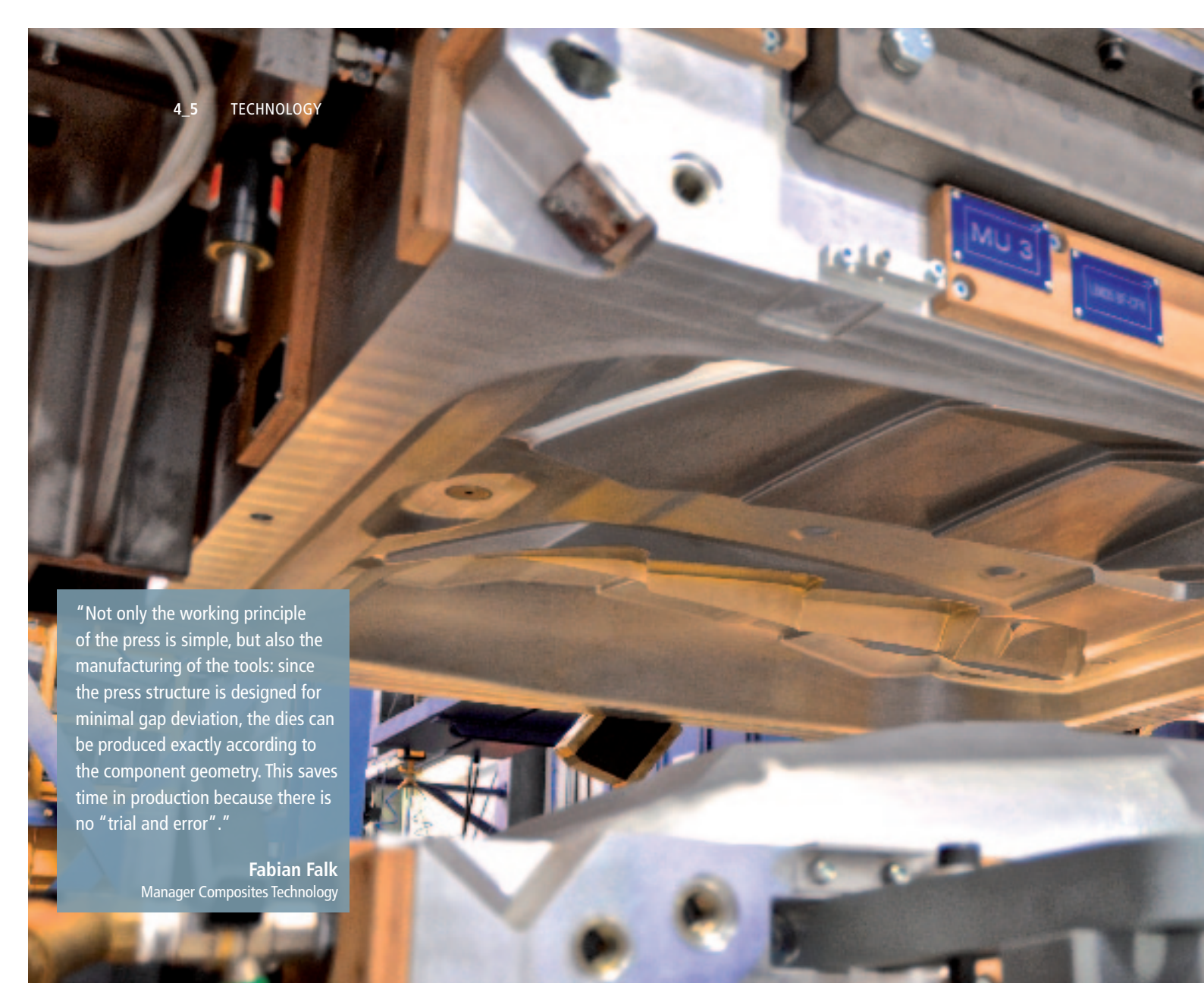
Although the presses apply loads of several thousand tons, they work as accurately as machine tools. One of the reasons is that the control system automatically compensates for all interfering influences.

Complete solutions

More than in other processes, the periphery of the press plays an important role: temperature windows are short, reaction times must be exactly adhered to, material must be quickly fed and removed.

That’s why we deliver complete solutions including peripheral systems. These components are harmoniously coordinated, for example handling, loading and unloading stations as well as post-processing.

As a general contractor, we completely integrate the individual components into a single production line. This means for our customers: a single point of contact for the complete project.



“Not only the working principle of the press is simple, but also the manufacturing of the tools: since the press structure is designed for minimal gap deviation, the dies can be produced exactly according to the component geometry. This saves time in production because there is no “trial and error”.”

Fabian Falk
Manager Composites Technology

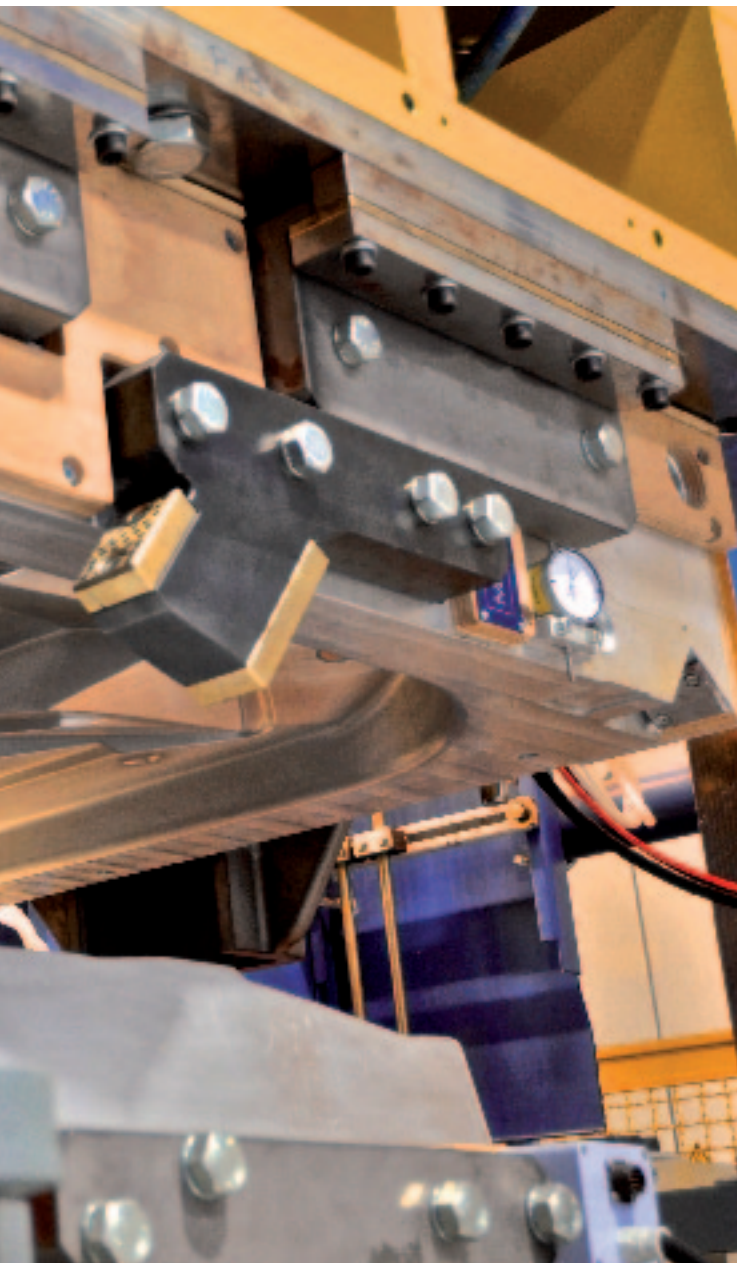
Production of fiber-reinforced composites

System-related precision

With a unique design Siempelkamp's composite presses achieve the high precision required for the production of fiber reinforced composites: the upper tool is guided exclusively by means of one axis with four individually controlled hydraulic cylinders.

Simple concept – impeccable conditions

The hydraulic control actively compensates all external influences from the process to the nearest hundredth of a millimeter. Since the ram plate is decoupled from the machine, other factors – for example, temperature behavior, horizontal forces, or the inevitable deformation of the press frame – do not affect the process. The fixed lower tool is, at all time, the absolute reference for the position and force control in the process.



Drive fast – close precisely

The control makes it possible to first lower the ram plate at a high speed and decelerates just before the final closing. This saves valuable production time during each press stroke.

The precise horizontal alignment of the upper tool ensures the stress-free retraction of the tool halves – jamming is virtually eliminated. This means highest press availability and long tool life.

The four individually controlled cylinders apply the force where it is needed: the thickness profile of the components is precisely maintained even in the case of extreme eccentric loads – a great advantage especially for asymmetrical components.

AT A GLANCE

- Short cycle times
 - Precise thickness distribution
 - High reproducibility
 - High availability
-



EXAMPLE CONFIGURATION

Type	SMC press
Press force	3,000 t
Press speed	8 mm / s
Press stroke	1,000 mm
Opening height	1,700 mm
Table size	4,200 x 2,000 mm
Number of cylinders	8 pieces
Press control	Hydraulic proportional valve technology
Design	metal frame construction

The processes	
SMC	– Sheet Molding compounds with glass or carbon fibers
BMC	– Bulk Molding Compounds
PCM	– Prepreg Compression Molding with short, long or continuous fibers
RTM	– Resin Transfer Molding
IMC	– In-Mold Coating

The SMC presses from Siempelkamp are designed in such a way that they can also be used for the RTM process.



Sheet Molding Compounds

SMC

Short cycle times

Since the SMC process is predominantly used in the production of high quantities, apart from precision, a short cycle time plays a important role. And since the compound material is chemically reactive, the time window for achieving an optimum surface quality is also small. The advantages of the Siempelkamp presses: they apply the force extremely quickly to the product, because they close at a very high speed decelerating just before reaching the end position.

Depending on the level of automation, the tool change is done automatically – just 120 seconds later the next part can be produced!

No stress

The precise positioning of the ram plate ensures that the tools are precisely aligned to each other during the complete press stroke – not just on the last millimeters. Under all operating

conditions the tools remain parallel. In this way the presses achieve high availability and the extensive tools have a long service life. In the In-Mold Coating (IMC) after the actual pressing process, the presses' outstanding feature is the clearance-free suspension of the ram plate: the gap can be opened by a few tenths of a millimeter in a controlled manner.

Complete production plants

For the SMC process, Siempelkamp supplies complete solutions with harmoniously coordinated equipment:

- Uncoiling and cutting to size
- Weighing and feeding
- Pressing and removing
- Cooling
- Edge trimming and joining

THE RESULT:

Components of uniform thickness over the entire area.



EXAMPLE CONFIGURATION

Type	RTM press
Press force	800 t
Press speed	8 mm / s
Press stroke	400 mm
Opening height	1,200 mm
Table size	1,500 x 2,000 mm
Number of cylinders	4
Tool change / Setup	via Tool Shuttle System

The processes

RTM – Resin injection method as C-RTM and HP-RTM
SMC – Sheet Molding compounds with glass or carbon fibers
IMC – In-Mold Coating

All Siempelkamp RTM presses are designed in such a way that they can also be used for the SMC process.



Resin Transfer Molding

RTM

Pressure and counterpressure

In the RTM process, the press has to manage other tasks than in sheet molding: first the upper tool has to drive exactly into a defined gap position. When the resin is injected, it is important to maintain the gap width and adjust as needed.

The backlash-free suspension of the ram plate ensures that the thickness profile of the components is precisely maintained, even when high pressure is built up during injection.

Well-directed flow of resin

The individual closed loop control of the four cylinders has great advantages, especially for surface and structural components with complex geometries: the upper tool can be tilted in a targeted manner. Thus, the resin flows in a closed front, creating a smooth surface.

The control is so flexible that the upper tool can be tilted up and closed in an "inclined position". Even during coating with the IMC process, where the gap is opened by a few tenths of a millimeter, the clearance-free control of the gap width is proven.

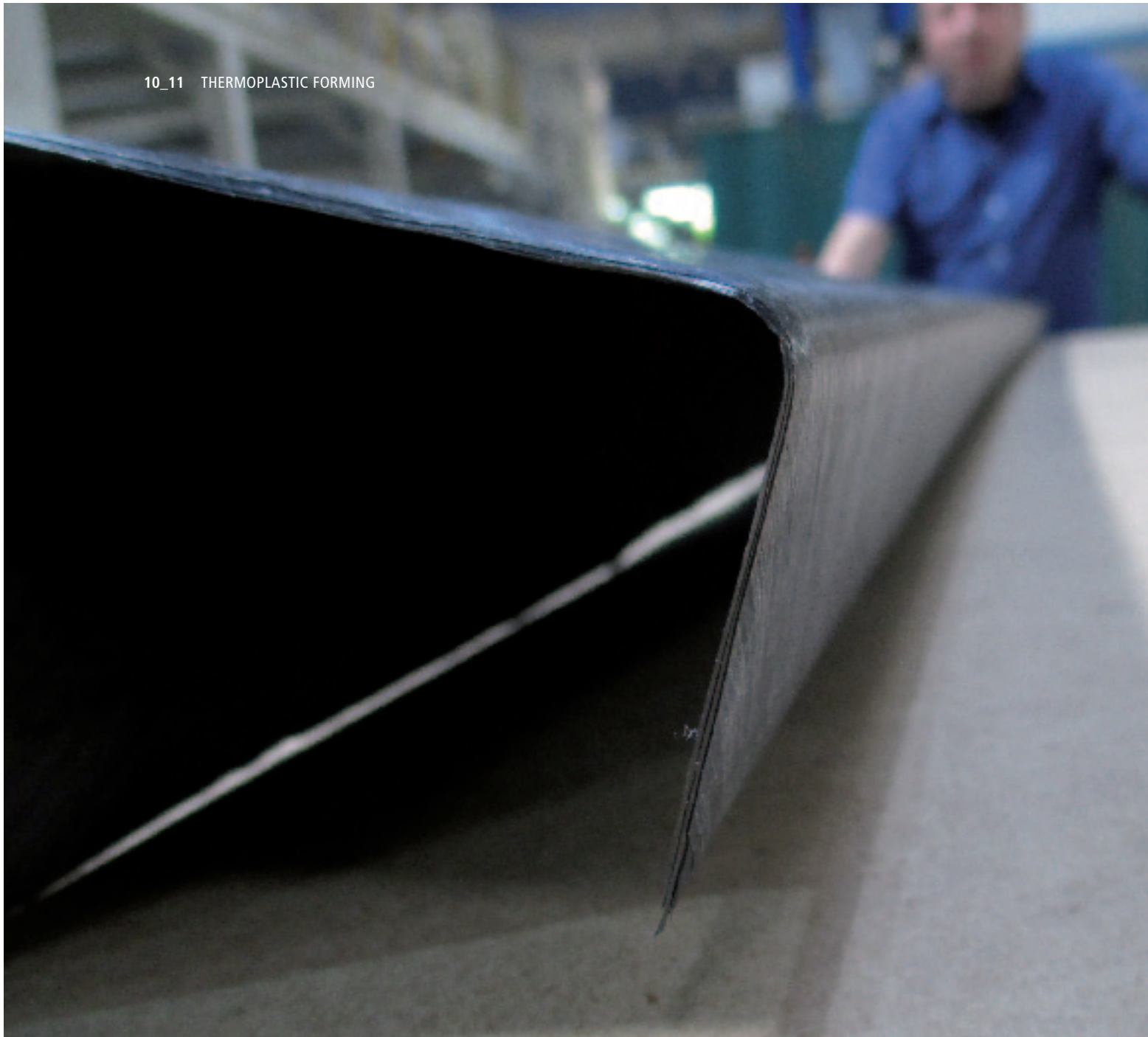
Complete production plants

The system solutions from Siempelkamp covers all process steps from unrolling the fabrics through the finished, stored parts:

- Cutting fabrics to size
- Preform production with draping, binding, preforming
- Loading
- Pressing, injecting
- Unloading, inspection
- Deburring, edge trimming
- Joining

Siempelkamp supplies integrated shuttle systems for material feeding and tool change:

- Sliding table for manual tool change
- One-way shuttle for the lower tool
- Two-sided shuttle for the parallel handling during pressing
- Fully automatic tool changing systems



Fast and gentle transfer

Thermoplastic Forming

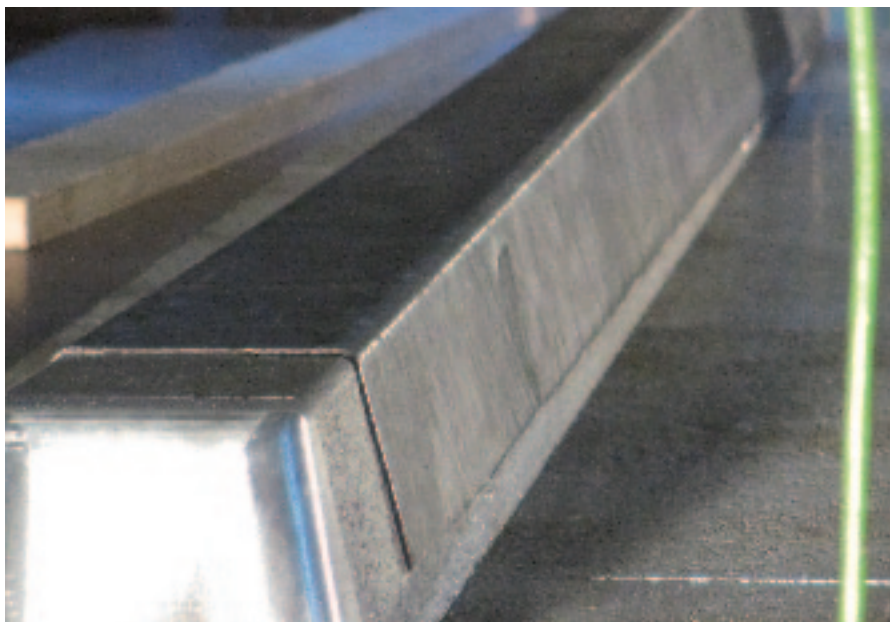
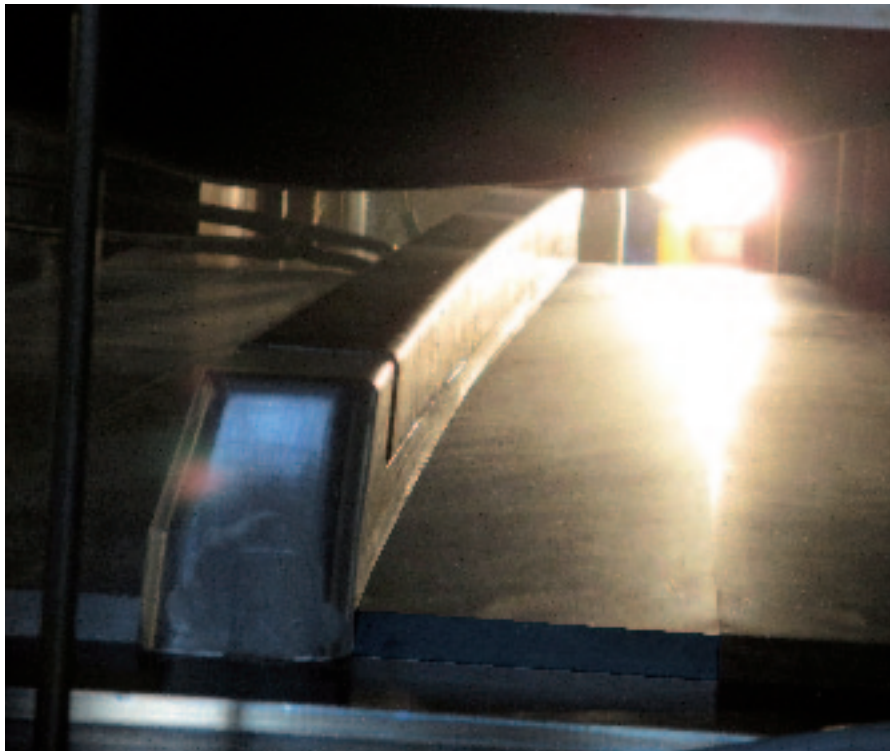
Every tenth of a second counts

Even more than in the SMC process, the thermoplastic molding process has a short overall process time because the organic sheets heated outside the press cool down by up to 3 K every second.

Here, Siempelkamp offers tailored solutions for fast handling. The basic idea: short distances and linear movements.

Reliable handling

The hot – and thus flexible – semifinished products requires unique demands from the material handling. With in-house expertise in feed systems and in cooperation with industrial partners, Siempelkamp realizes the fast and gentle transfer from heating through reliable feeding up to the defined removing of the finished parts.



Complete production equipment

- Cut to size
- Heating
- Loading
- Forming
- Machining / Post-processing

THE RESULT:

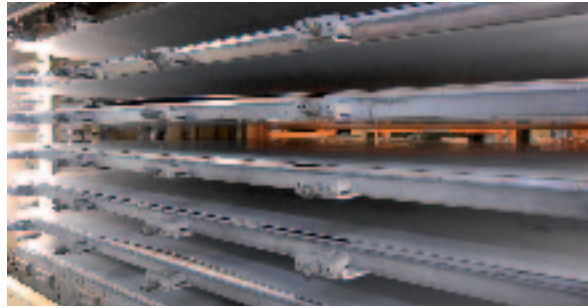
The semifinished products are formed into shape at the right process parameters. Thus, the components exactly comply with the product specifications.



EXAMPLE CONFIGURATION

Type	Multi-daylight press
Number of daylight	6
Press force	780 T
Dimensions of the panels	3,000 x 2,000 mm
Process temperature	180 °C
Temperature control	+/- 2 K over the panel area and all floors
Heating and cooling rate	7.5 K / min

The process
Thermoplastic consolidation



AT A GLANCE:

- Uniform pressure and temperature distribution
- Short cycle and idle times
- Complete documentation of production logs

Board components for special applications

Multi-daylight Presses

For sophisticated lightweight construction

Multi-daylight presses for composites produce amongst others, sandwich panels for the aerospace industry. Here the highest requirements are demanded on the processing of the resins and fiber material in the cover layers. The resulting weight saving thus is on the cutting edge of what is technically feasible nowadays.

Due to the uniform distribution of pressure and temperature they achieve a homogeneous consolidation of the material. This applies not only to each individual plate, but also to each batch: the boards of all floors have the same high quality.

Short cycle times

A special feature of Siempelkamp's multi-daylight presses: the two-row charging trolley feeds and empties all the floors of the press synchronously.

Complete documentation

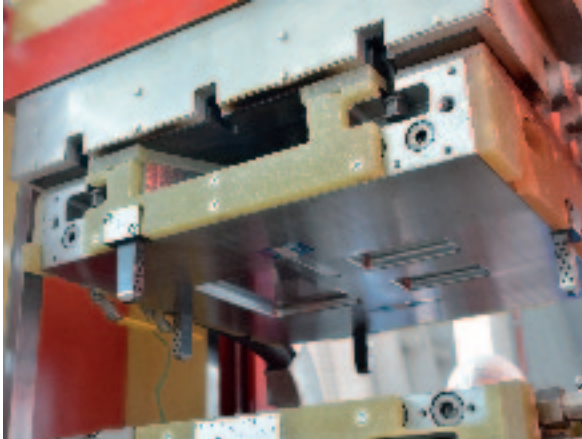
Especially for products for the aviation industry, the complete documentation of the production data is required. The control technology of the press system records, manages and transfers the production data to the customer IT systems.

Complete production systems

- High-rack storage for raw material / finished products
- Shelf operating device
- Loading and unloading with two-row charging trolley
- Heating / cooling systems with temperature control
- Exhaust air extraction

Type **Universal laboratory press**

Press force	150 t
Press table area	700 x 700 mm
Press opening height	500 mm
Press stroke	500 mm
Position accuracy	+/- 0.1 mm



Easy to get started

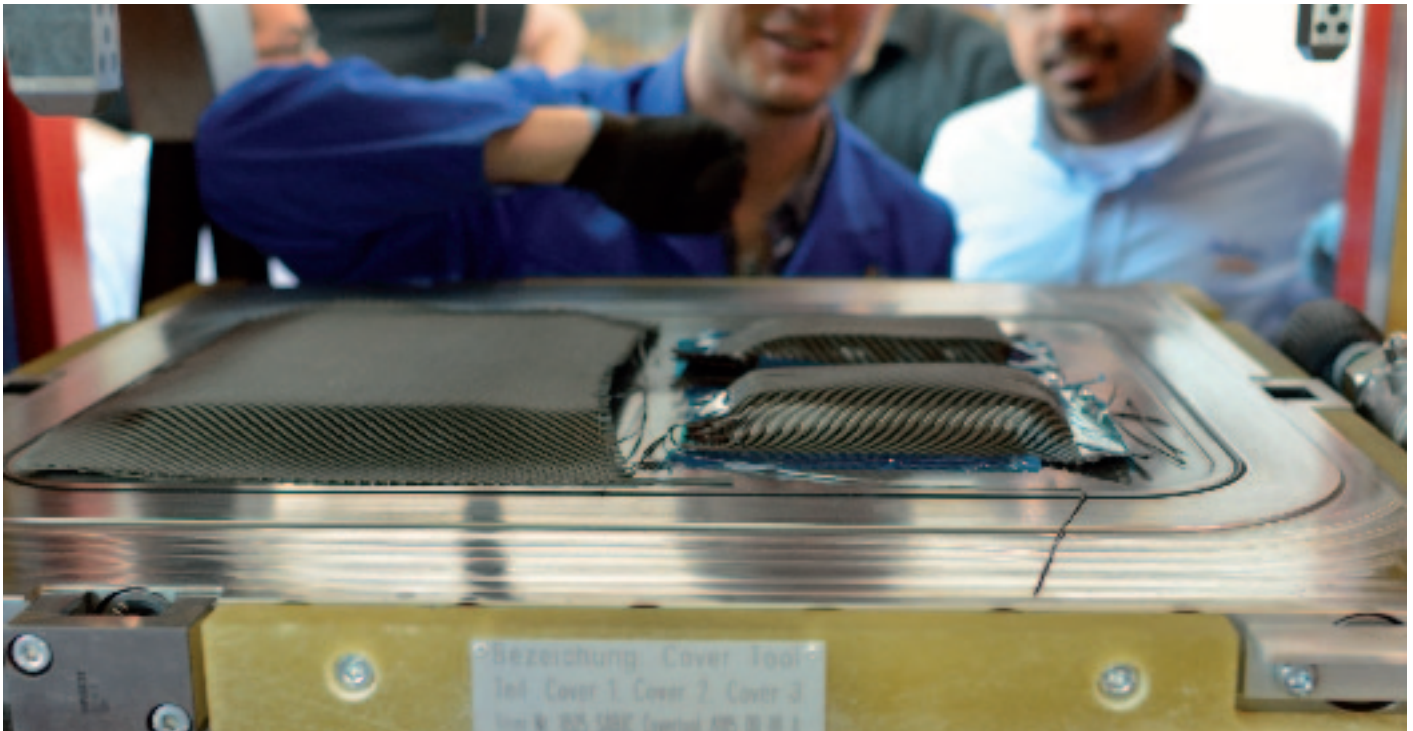
Laboratory Pressing Systems

A press for all processes

Beside the pressing systems for industrial production, Siempelkamp manufactures laboratory press systems – both “try-out” presses for laboratory-scale tests with a starting pressing force of 150 t as well as presses for “full-scale testing”. The laboratory press systems are designed for maximum flexibility. With it, all processes of composite production can be investigated. For example, it can be investigated whether press technology is an economic alternative for “autoclave” processes.

All processes

- SMC with glass fiber or carbon fiber
- RTM
- PCM
- Organo-sheet consolidation
- Thermoplast forming
- Hybrid forming
- Integrated molding and joining of hybrid materials



All control methods

- Force control with position monitoring
- Position control with force monitoring

Each process step can be individually defined and programmed:

- All relevant process data are recorded and displayed.
- The process can be followed step by step.
- The included software enables easy analysis of the production data, thanks to the intuitive HMI.

Start immediately

The laboratory press can be delivered as a turnkey package with all periphery devices from cutting the fabrics until placing of the finished product.

This means for our customers: you do not need to procure individual components, but you get a system that is immediately ready for operation and offers high flexibility. In contrast to traditional laboratory presses, it has all the features of their big brothers in the industry, for example the clearance-free positioning.

The scope of supply

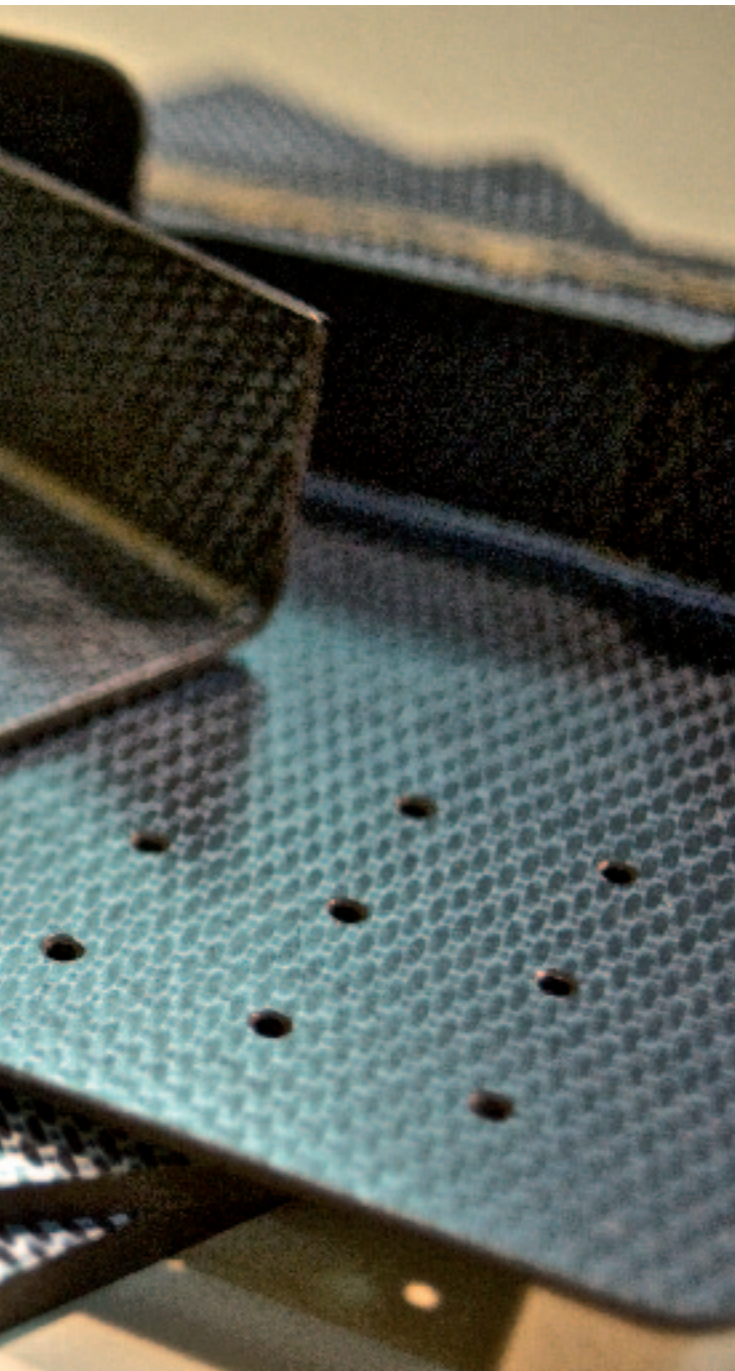
- Cutting devices
- Press with a pressing force of 150 t
- Heating and cooling system up to 400 ° C
- Tool heating up to 180 ° C
- Dosing and injection system for RTM
- Oven for thermal aftertreatment
- Post-processing / Trimming / Machining

“Composite materials and processes have been developing dynamically – both in industry and in research. That is why we offer our customers the opportunity to test and optimize new processes in our technical center in Krefeld. ”

Dr. Michael Schöler
Head of Research and Development

Trials create confidence

Technical Center



Open for new ideas

The technical center is equipped with two lab presses, which are available to customers for trials or the design of their processes. They can test and optimize new procedures before they make an investment decision.

- The "400° press" is designed for parts with a length of up to 600 mm.
The press system is equipped with a heating and cooling system for a maximum temperature of 400 ° C.
- The "4 x 8-foot press" is designed for parts up to 2,400 mm in length.
The system is equipped with a heater for temperatures of up to 240 ° C.

Siempelkamp's technical center

- Several lab presses for different applications
- Heating cooling press up to 400 ° C
- R & D projects
- In-house development
- Bilateral customer projects
- Process development / feasibility studies
- Material testing
- Dialogue with universities and research institutions



Type	Multipurpose Press System
Design	4 columns design, full accessibility
Pressing force	2,500 t
Cushion cylinders	integrated in lower crosshead
Fast closing speed	800 mm / s
Pressing speed	350 mm / s
Pressure build-up time	0.5 s
Press stroke	1,800 mm
Opening height	2,550 mm
Press table area	2,500 x 1,800 mm
Hydraulic control	Proportional valve technology
Parallelism and position accuracy	+/- 0.05 mm
Ram plate tilting	+/- 5 °
Tempering system for tools	160 ° C
Tool interfaces	Media supply lines with integrated sensors

Pioneering partnerships

Networking in our industry



Siempelkamp actively contributes to the development of the industrial use of composite components with funding projects, cooperations with universities and industry partners as well as memberships in associations.

Current R&D topics are for example:

- the manufacture of large-area structural components for the aerospace industry,
- the integral construction approach, which combines several functions in one component,
- the further development of thermoplast forming for the industrial process,
- the production of hybrid components made of fiber-reinforced plastic and metal for the automotive industry



OHLF LeichtbauCampus

Through our active cooperation in associations, we are shaping the future of composite production.



CFK VALLEY

As a part of the competence network CFK Valley e.V., we contribute with our experience to the construction of presses for the practical application of fiber composite and other lightweight construction technologies in the aircraft and automotive industry.



Aachen Center

As a member of the Aachen Center for integrative Lightweight Construction, we share our knowledge and deepen our experience in close interdisciplinary cooperation with a strong international network.



As a founding member of the Open Hybrid LabFactory e.V. we have a presence with our own office in Wolfsburg. With our multi-purpose press system in OHLF's pilot plant, members and industry partners are researching to develop new materials and manufacturing processes for the automotive industry.

Well prepared for for the series

For large-scale tests, we supply presses that are used, for example, in the pre-production stage for industrial applications, such as optimizations or also release tests before production starts.

An example:

The 2,500 t press for the OpenHybrid LabFactory e.V. is so strong that it can also be used for the simultaneous forming and joining of carbon and metal hybrid components.



Siempelkamp headquarters and main production facility

Siempelkamp – Plant operators have been trusting in this name for over 130 years.

Our advantage in the market has a long tradition: We plan and design high-precision press systems which set benchmarks in the woodworking, metal forming, rubber, and composite industries. For the composites industry Siempelkamp provides complete systems solutions, enabling our customers to achieve highest quality and cost-effectiveness in their business.



Siempelkamp

Sales representative offices / Production facilities

Australia

Siempelkamp Pty Ltd.

Brazil

Siempelkamp do Brasil Ltda.

China

Siempelkamp (Wuxi)
Machinery Manufacturing Ltd., Beijing

France

Siempelkamp France Sarl

India

Siempelkamp India Pvt. Ltd.

Russia

Siempelkamp Moscow

Belarus

Siempelkamp BEL

Singapore

Siempelkamp Pte Ltd.

Spain

Siempelkamp Barcelona

Turkey

Siempelkamp Istanbul

USA

Siempelkamp L.P.