THERMOFORMING AND INJECTION MOLDING PERFECTLY COMBINED

DISCOVER FIBERFORM TECHNOLOGY

KraussMaffei

Pioneering Plastics

FACTS & FIGURES

APPLICATION AREAS FOR FIBERFORM TECHNOLOGY

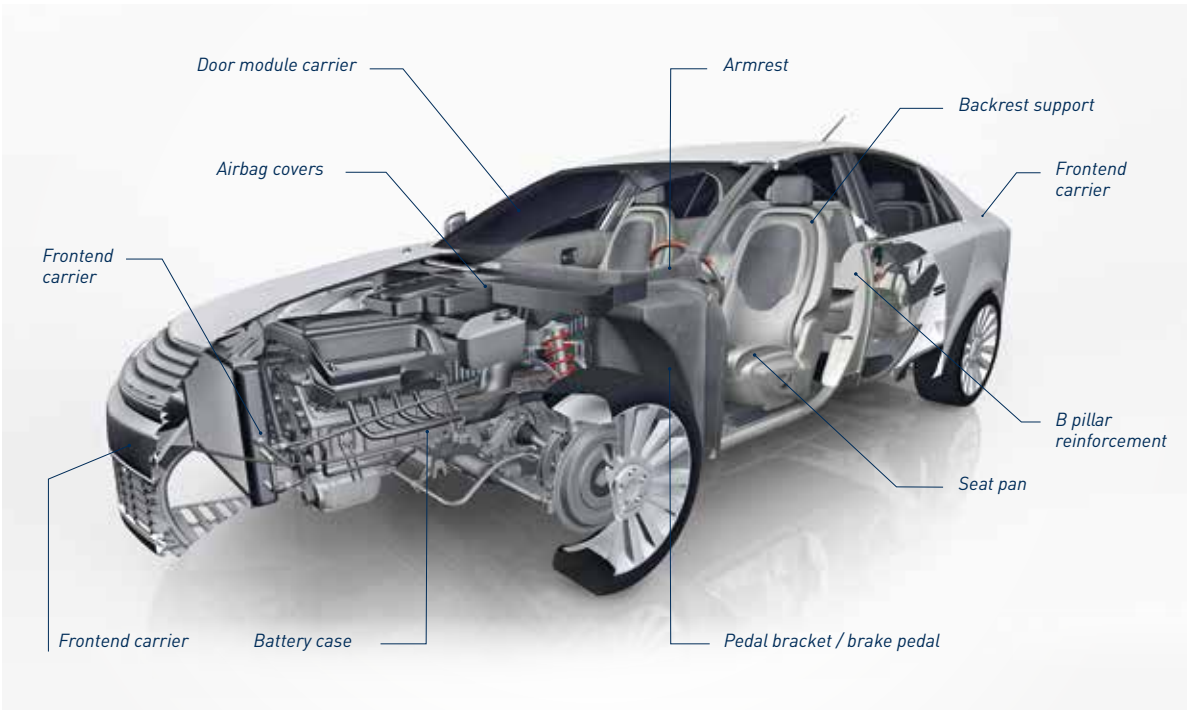
Airbag housing

Ski binding

Hollow profile

Support

FiberForm in automotive manufacturing



LIGHTWEIGHT CONSTRUCTION WITH FIBERFORM
THERMOFORMING AND INJECTION MOLDING PERFECTLY COMBINED

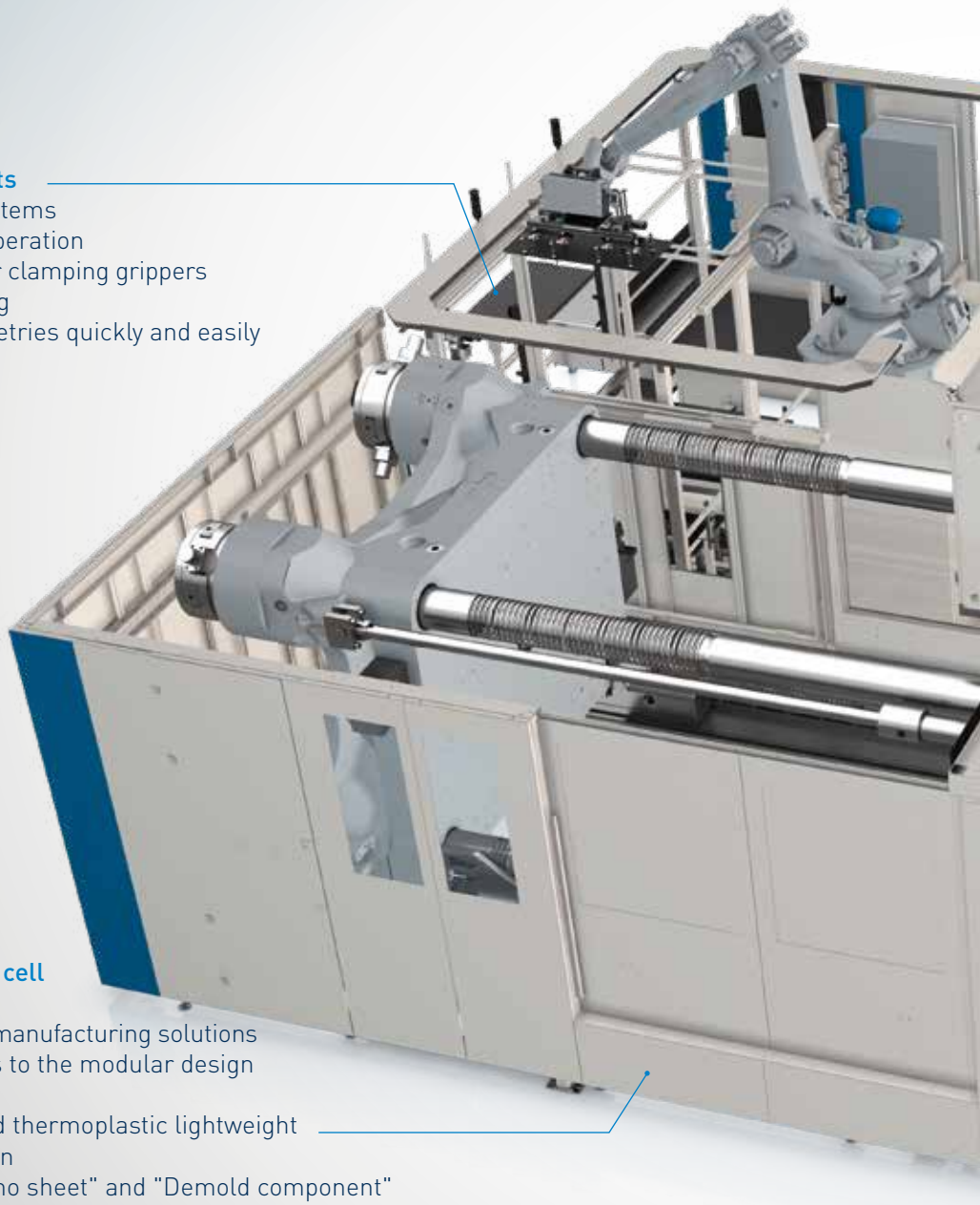
Components made of thermoplastic fiber-reinforced composites are popular these days. They provide high levels of strength at extremely low weights and can be manufactured in short cycle times in large industrial quantities. They are increasingly replacing components made of metal or thick-walled plastic parts.

KraussMaffei uses proven standard injection molding machines for FiberForm technology. The automation concept, infrared heating station and peripherals can be defined regardless of the injection molding machine type – even for retrofitting. In addition, FiberForm systems can be used for standard injection molding processes without any problems. This is why FiberForm systems from KraussMaffei are extremely flexible and have high availability.

Your benefits at a glance:

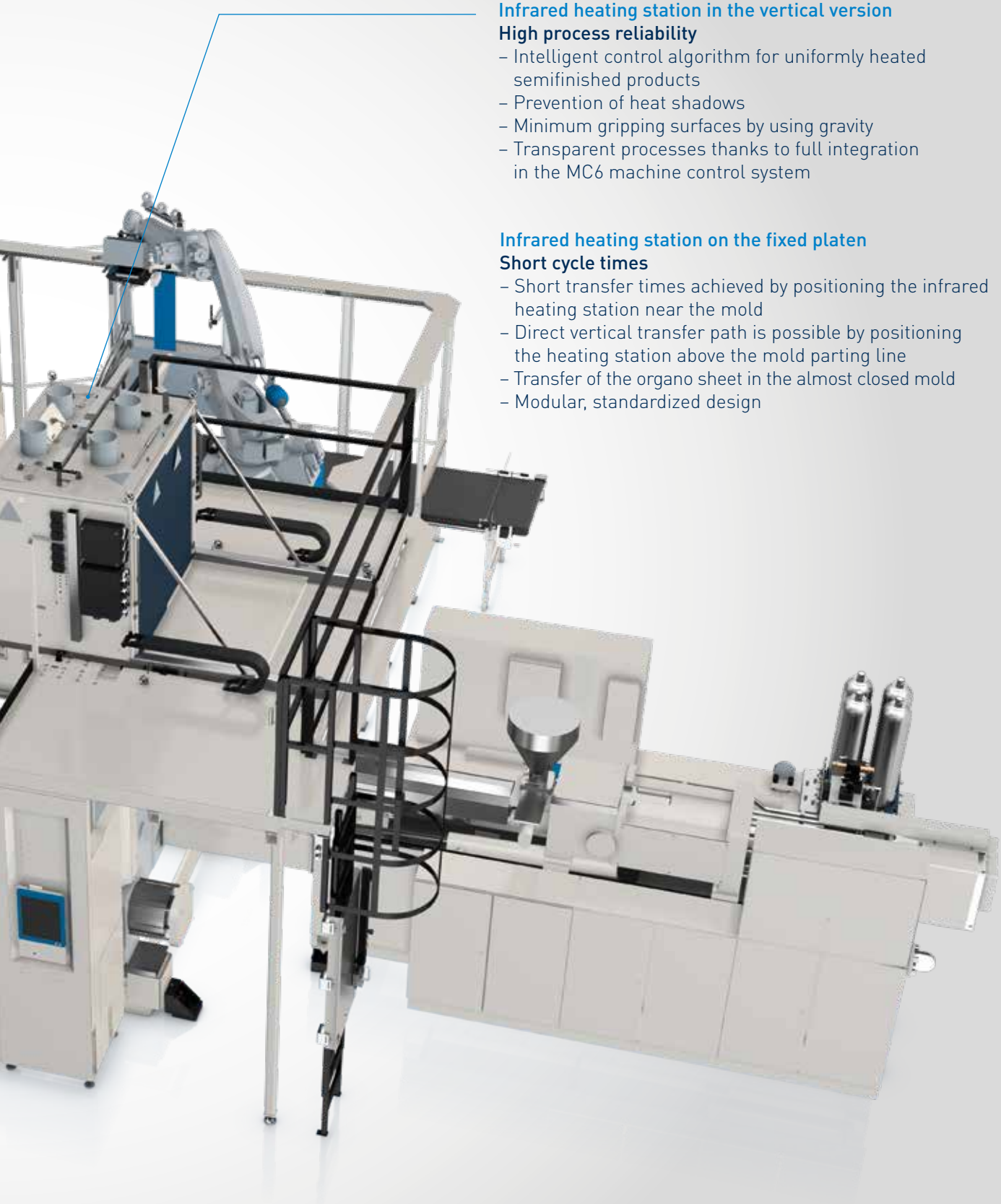
- Low component weight with high stiffness values
- High degree of functional integration
- Short cycle times thanks to fully automated manufacturing
- System and process expertise from a single supplier
- Extensive network of semifinished product suppliers, mold makers and material manufacturers

TRANSPARENT TECHNOLOGY
THE FIBERFORM SYSTEM SOLUTION



Feeding of semifinished products
- Fed by container or drawer systems
- Can be filled during ongoing operation
- Held and handled by vacuum or clamping grippers
- Mechanical or optical centering
- Can be adapted to other geometries quickly and easily

Fully automated manufacturing cell
High level of productivity
- Standardized product-specific manufacturing solutions
- High system availability thanks to the modular design of the manufacturing cell
- Standard injection molding and thermoplastic lightweight construction without conversion
- Decoupling of the "Insert organo sheet" and "Demold component" process steps
- Minimum installation area thanks to intelligently arranged kinematic units
- Easy integration of peripherals and follow-up processes (such as quality assurance measures)



Infrared heating station in the vertical version

High process reliability

- Intelligent control algorithm for uniformly heated semifinished products
- Prevention of heat shadows
- Minimum gripping surfaces by using gravity
- Transparent processes thanks to full integration in the MC6 machine control system

Infrared heating station on the fixed platen

Short cycle times

- Short transfer times achieved by positioning the infrared heating station near the mold
- Direct vertical transfer path is possible by positioning the heating station above the mold parting line
- Transfer of the organo sheet in the almost closed mold
- Modular, standardized design

FIBERFORM SYSTEM CONCEPTS
SYSTEM AND PROCESS EXPERTISE FROM A SINGLE SUPPLIER

To heat up the semifinished products using infrared heating technology, we have developed our own intelligent hardware and software solutions. They ensure fast, synchronous and uniform heating, and very short transfer times as the basis for efficient manufacturing of components in large series.

A manufacturing concept that is ready for large series production

All FiberForm concepts from KraussMaffei are characterized by the infrared heating station positioned directly on the fixed platen. This produces the shortest transfer paths for inserting the heated semifinished product into the mold.

Infrared heating technology

Infrared technology is used for heating. The advantages of this are the lower investment costs and the higher heating capacity compared with convection systems. Shorter heat-up times can therefore be achieved. Depending on the thickness of the semifinished products and the required cycle time, heating is done on one side or both sides. The infrared heating surface depends on the size of the semifinished product and can be individually adapted to your needs.

Intelligent thermal management

KraussMaffei has developed its own patent-pending infrared heating technology (hardware and software) with a highly dynamic closed-loop control system and intelligent thermal management. Compared with conventional systems, it stops the semifinished product surface from overheating. Furthermore, fast and uniform heating of the organo sheets and a static energy state of the system are reliably attained before and during series production. Process conditions can be reproduced.

YOUR BENEFITS:

- **Low cooling of the semifinished products thanks to short transfer times**
- **Heating of semifinished products that is uniform and fast while also being gentle**
- **Central control of the processes and uniform operating concept thanks to the MC6 control system**

Two robots decouple heating of the organo sheet and demolding of the finished part – for short cycle times.

Easy mold changing and free access to the clamping zone thanks to horizontally moving heating station.

High capacity utilization

The infrared heating station is easy to move horizontally. The position between the production position and mold changing can thus be changed faster. This contributes significantly to the high system availability and makes it easy to use for standard injection molding tasks.

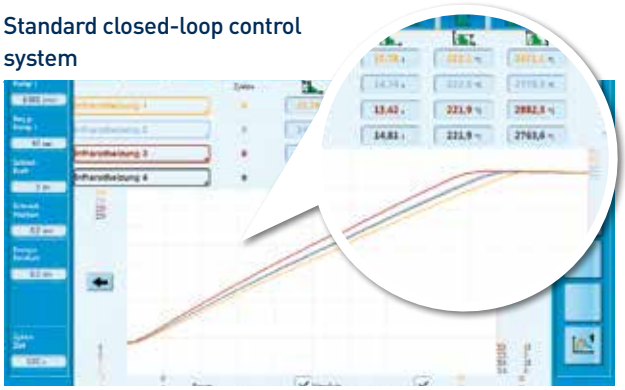
Uniform operating concept thanks to MC6 control system

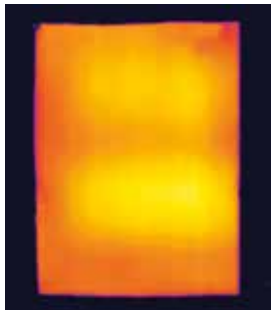
The control system of the infrared heating station is integrated in the MC6 machine control system. That makes it possible for an operator with a uniform operating concept to edit all oven and injection molding parameters at a central location.

Important operating functions

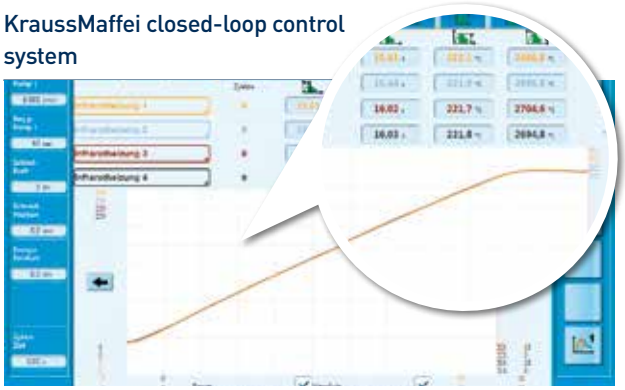
- Assign heating zones / infrared emitters to various pyrometers
- Specify target temperatures of the semifinished product surfaces in the specified heating zones
- Monitor the actual temperatures of the semifinished product surface measured by the pyrometer
- Change mode of individual infrared emitters

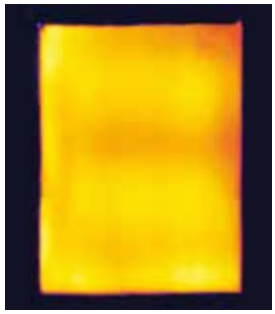
Standard closed-loop control system





KraussMaffei closed-loop control system





The KraussMaffei closed-loop control system ensures uniform heating in all heating zones.

PRODUCT-ORIENTED AUTOMATION SOLUTIONS
INDIVIDUAL SYSTEMS COMPRISING STANDARDIZED MODULES

FiberForm technology from KraussMaffei combines thermoforming of thermoplastic semifinished products with injection molding. All FiberForm production systems from KraussMaffei have a modular design. Product-oriented automation solutions ensure efficient manufacturing.

Standardized concepts

KraussMaffei has developed three standardized, product-specific concepts for automation. Depending on the application and component size, they combine heating technology, the position of the heating station and the automation system into one sophisticated system concept. You can therefore produce long-fiber-reinforced thermoplastic components in large numbers of pieces and with very short cycle times. We work from these standards to develop the optimum production solution for each of our customers according to their individual needs.

Decoupled working steps

For each of our manufacturing solutions, we use two independently acting robots. The necessary freedom of movement and payload determine which robot model is chosen. Two linear robots or two articulated-arm robots are used. Heating of the organo sheet, feeding of the semifinished product and demolding of the component can therefore be decoupled from each other in terms of time. This ensures short transfer times.

YOUR BENEFITS:

- A manufacturing concept that is ready for large series production
- System solutions: Modular and highly productive
- Short cycles thanks to decoupled process steps
- Transparent processes thanks to higher-level process control

Turnkey production solutions as the basis for production to start smoothly.

1. Fully automated feeding of semifinished products
- Fed by container or drawer systems
- Mechanical or optical centering is possible
- Held and handled by vacuum or clamping grippers

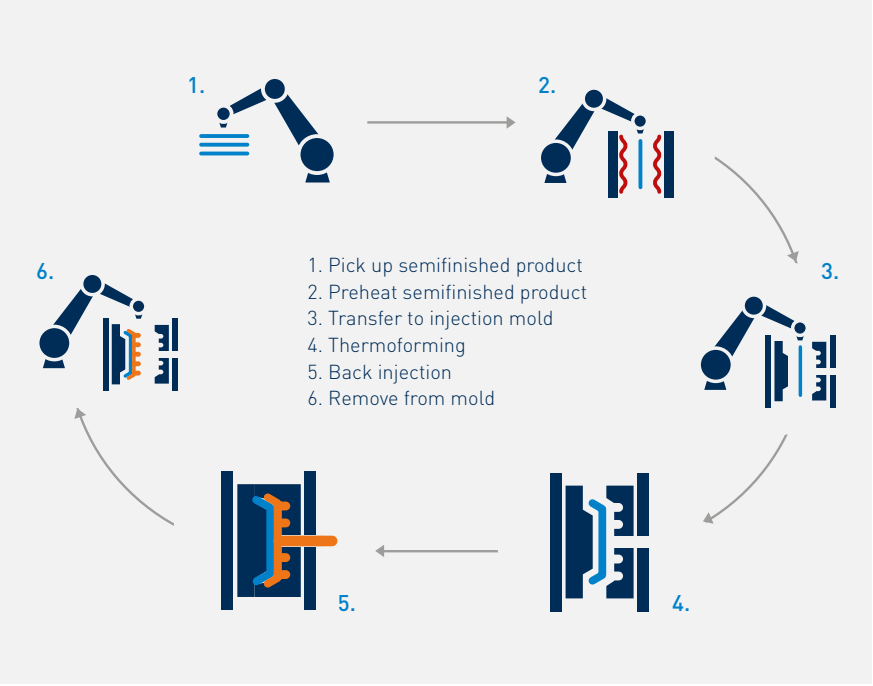
2. Heating of semifinished products
- Vertical feed
- Infrared heating technology
- Heating on one side or both sides (optional)

3. Transfer of the mold
- Form-locked or friction-locked transfer
- Use of standard injection molds
- Different mold concepts are possible

4. Thermoforming of semifinished products
- Shaping by clamping the mold
- Low forming forces required
- Complex shaping can be realized thanks to additional splitters

5. Back injection
- Firmly bonding connection of the semifinished product to the injection molding material
- Functional integration through encapsulation of insertion elements
- Complex design options due to the injection molding process

6. Demolding finished parts
- Demolding with vacuum or clamping grippers
- Downstream quality assurance



FiberForm automation concepts

	Injection molding machine sizes			Heating principle	Position of the heating station	Automation	Semifinished product size (width x height)
	CX	GX	MX				
Concept 1	■			Infrared technology	Above the FP*	Linear unit with two kinematic units (LRX 250 TwinZ)	up to 350 x 350 mm
Concept 2	■	■		Infrared technology	Above the FP*	Linear unit with two kinematic units (LRX 500 TwinZ)	up to 850 x 850 mm
Concept 3		■		Infrared technology	Above the FP*	Two articulated-arm robots	up to 1350 x 850 mm

* Fixed platen

OUR WORLDWIDE EXPERTISE IS YOUR ADVANTAGE
DIGITAL & SERVICE SOLUTIONS

With your KraussMaffei machine, you have chosen a product that delivers the highest levels of productivity and reliability. In addition to our range of machinery, KraussMaffei focuses on comprehensive and future-oriented solutions, innovative business models and an innovative portfolio of digital products.

Customer service at the touch of a button

The process of digital transformation is becoming faster and easier than ever for the customer. Our Digital & Service Solutions unit makes your production chain even more flexible and efficient with future-oriented solutions. KraussMaffei thus globally provides an all-inclusive customer service package and networks machines and processes with each other. Our global support offers a sound basis for your local long-term success.

Individual challenges in mechanical engineering call for intelligent solutions

With our services portfolio, we support you throughout your machine's lifecycle with a strong focus on your specific needs. In order to satisfy your wishes, we offer you a wide range of solutions in order to ensure maximum availability and optimum productivity of your machines.

Technology³ as a unique selling proposition

KraussMaffei is the only supplier in the world with a product range comprising the most important machine technologies for plastic and rubber processing: injection molding machinery, automation, reaction process machinery and extrusion technology. KraussMaffei is represented worldwide with more than 30 subsidiaries and over 10 production plants as well as about 570 commercial and service partners. Working together with our customers and partners, we are thus in a position to offer vast and unique expertise in the industry.

You can find further information at:
www.kraussmaffei.com

KRAUSSMAFFEI – PIONEERING PLASTICS

Extensive expertise from a single supplier

KraussMaffei is one of the world's leading manufacturers of machinery and systems for producing and processing plastics and rubber. Our brand has been synonymous with cutting-edge technology for over 180 years. Our product range includes all technologies in injection molding, extrusion and reaction process machinery. KraussMaffei has a unique selling proposition in the industry as a result. By drawing on our proven innovative capacity, we can guarantee our customers sustained additional value over their entire value-adding chain through our standardized and individual product, process, digital and service solutions. The range of our products and services allows us to serve customers in many sectors including the automotive, packaging, medical and construction industries. We also supply manufacturers of electrical and electronic products and household appliances.

At your service all over the world

KraussMaffei is represented all over the world. Subsidiaries provide you with support in the countries shown in light blue. Our sales and service partners take care of you in the regions shown in white.

You can find all contact information at www.kraussmaffei.com

0.0 WE . 2nd edition 05/21 . IMM 101 BR 09/2013 EN ··· KraussMaffei reserves the right to make technical changes ··· Printed in Federal Republic of Germany.

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