
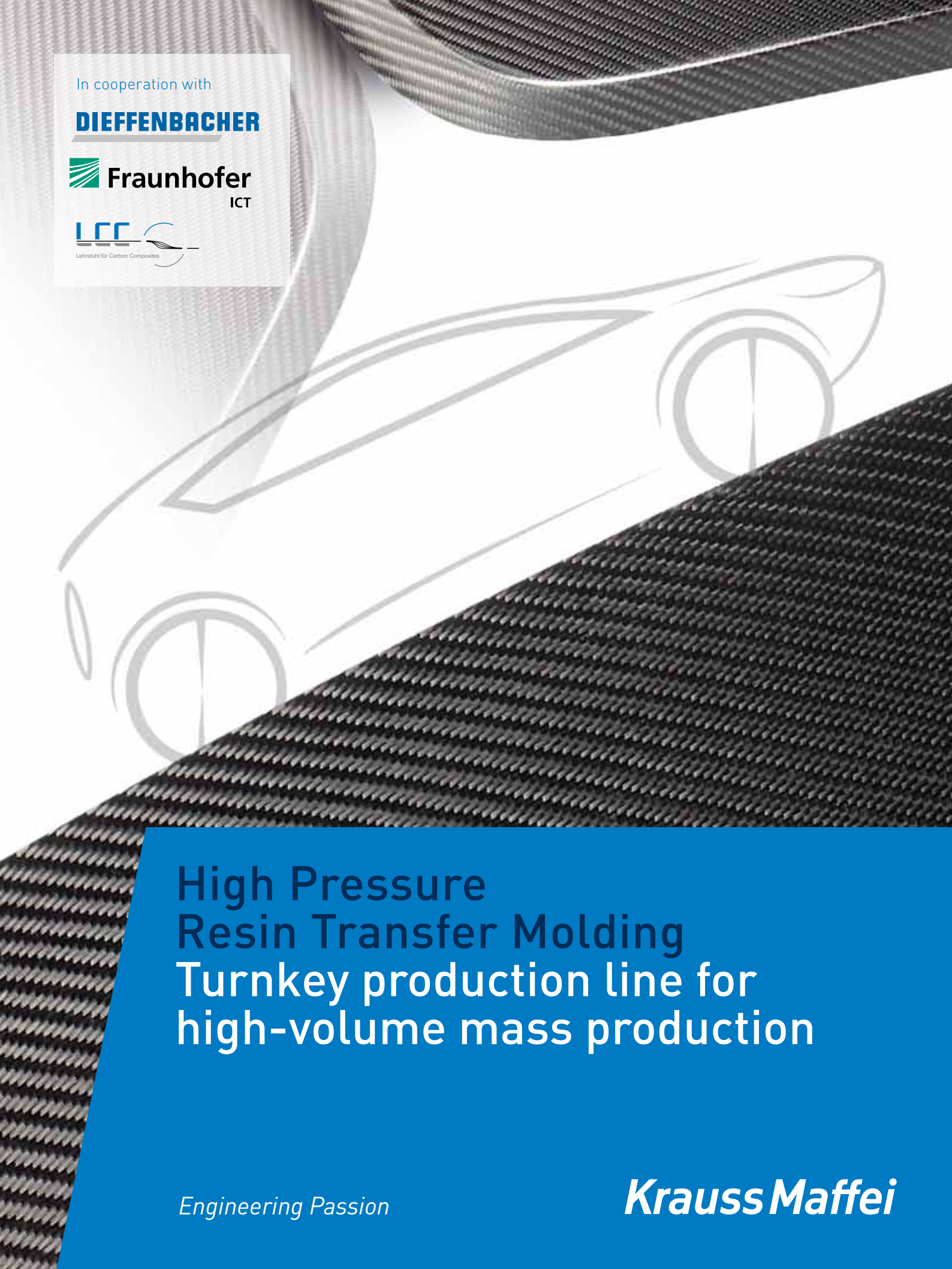


In cooperation with

DIEFFENBACHER

 **Fraunhofer**
ICT

 **LCC**
Lehrstuhl für Carbon Composites



High Pressure Resin Transfer Molding Turnkey production line for high-volume mass production

Engineering Passion

Krauss Maffei

A tour round the plant

High Pressure Resin Transfer Molding



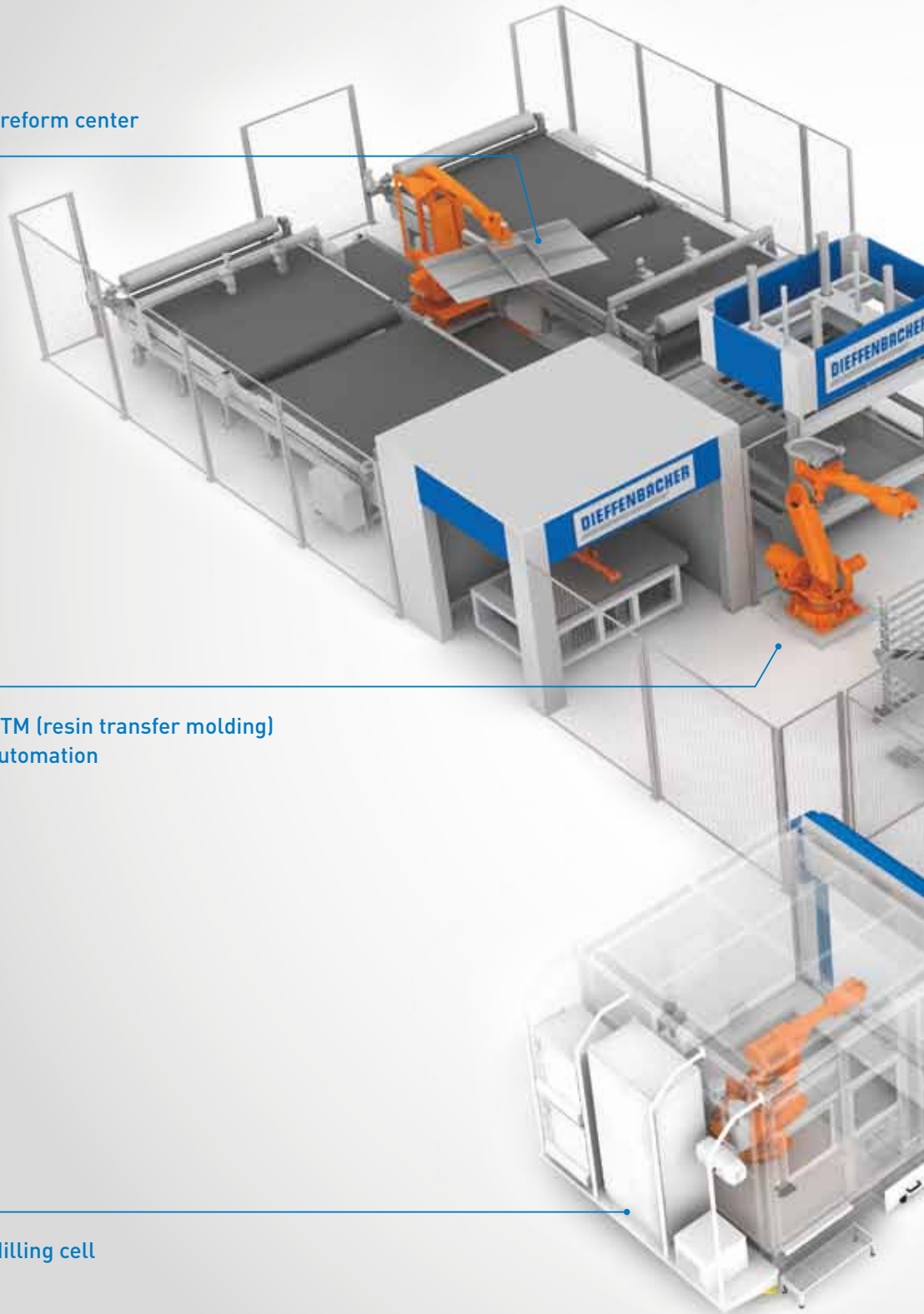
Preform center



RTM (resin transfer molding)
automation



Milling cell



Press center with change table



Metering machine



Expertise throughout the entire process chain from preform through to post-mold processing

Together with our system partners, we offer an integrated, product-oriented process and system concept for the high-pressure resin transfer molding process (HP-RTM). For you, this means process stability at the highest level.

Our integrated concept for the mass production of fiber composite components ranges from the preform center, press peripherals, technology and metering system through to the mold technology and part post-mold processing. Our innovative metering system for processing highly reactive resins permits extremely short cycle times. The systematic interaction between the individual system components, consisting of a press, mold and metering machine, is a critical factor in the manufacture of highly complex components with a fiber volume content of more than 50 per cent.

Your benefits:

- Machine, mold and process innovations from a single source
- Highly efficient system of the HP-RTM machine
- Fully automated processes
- Lightweight components, approx. 50% lighter than metals
- Visible parts with high-quality carbon surface aesthetics

1. Preform center

Customized manufacture of dimensionally stable preforms from dry fabrics/scrim made of carbon, glass or aramid fibers.

Features:

- CNC cutting program without additional consumables
- Reliable handling of an extremely wide variety of textile semifinished products
- Binding agent application system for the selective application of binding agent
- Automated draping process for manufacturing complex preform geometries
- Trimming station for edge trimming the preform after forming

2. Press peripherals

Use of proven individual components for rationalizing production sequences improves the efficiency of the HP-RTM production line and ensures repeatability.

Features:

- Robot and gripper technology for loading and unloading
- Gripper change systems
- Automated mold cleaning
- Component charge carrier systems
- Mold temperature control systems
- Vacuum systems

3. Press technology

Advanced and flexible press concepts for high-volume mass production.

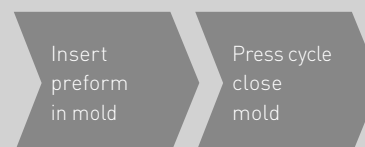
Features:

- High-precision and fast parallel motion control
- Bending line with precise overlap
- Change tables for higher productivity
- Special press operating programs for RTM and IMC
- Interfaces for line automation and metering system integration
- All-round accessibility
- Energy-efficient presses

Preform manufacture



RTM





KraussMaffei fiber composites center



Innovative metering system

4. Metering system

Innovative metering system for highly reactive resins.

Features:

Special vacuum-aided storage tank system

Steady, highly accurate temperature control with constant operating point

Energy-efficient heating concept

Optimized pumps, suitable for even corrosive media

Direct heating of machine components which carry material

Metering system for all available resins (EPOXY, PU, PA)

5. Mold development

From simulation through to the component.

Features:

Mold temperature control

Special HP-RTM sealing systems

Integrated vacuum system

Integrated sensor system for monitoring mold filling

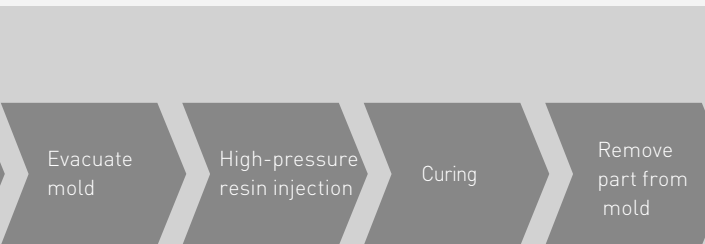
Simulation-aided mold design

Resin injection at up to 100 bar cavity pressure

Closed-loop control of resin injection for optimum mold filling

Highly accurate/repeatable admixing of internal release agents on the high-pressure mixing head

Self-cleaning mixing head system

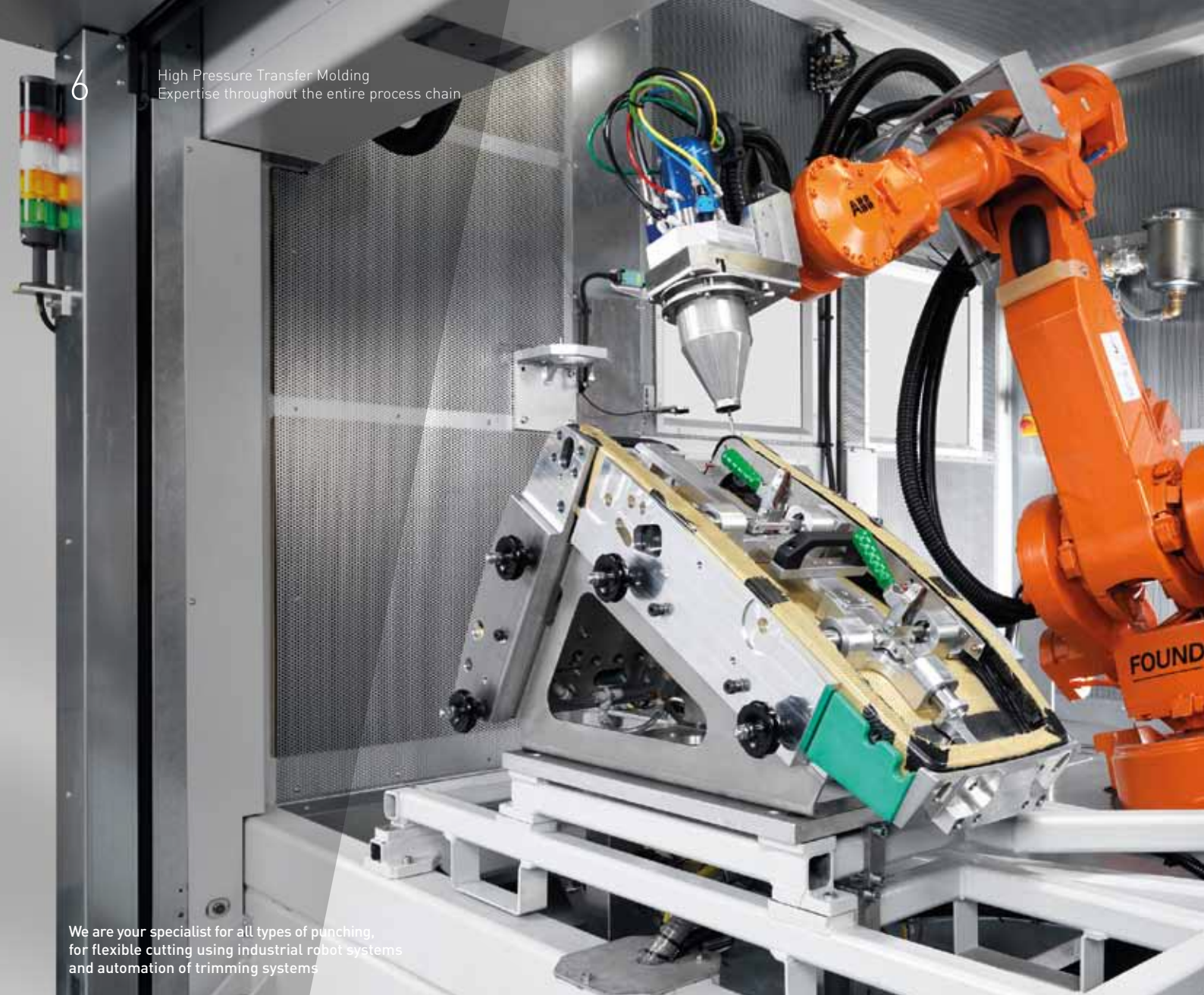


Dimensionally stable preform



Finished part

Post-mold processing



We are your specialist for all types of punching, for flexible cutting using industrial robot systems and automation of trimming systems

6. Final processing

Flexible machining of the final product with high cutting accuracy.

Features:

Machining guided by industrial robots

Machining in a closed booth with sound insulation enclosure

Mobile, robust machining cell

Compact construction with optimized use of space

Dynamic process management (short cycle times)

Long tool life (matched tools and stress-resistant process)

Machining possible with geometrically defined and undefined cutting edges

High repeatability of machining results

Simple modification of machining task

Program modification based on automatic product identification

Monitoring of machining operations as early as the offline simulation stage

Dust and swarf extraction (extraction directly from tool combined with booth extraction)

Internal tool cooling using compressed air

Automatic tool change system with tool measurement and breakage monitoring system

Tool change magazine can be loaded without interrupting the process

Encapsulated supply and control units

Special vacuum technology for fiber composite machining

Modular system structure (vertical turntable, sliding table, tilting table, receiving table)

System can be loaded fully automatically

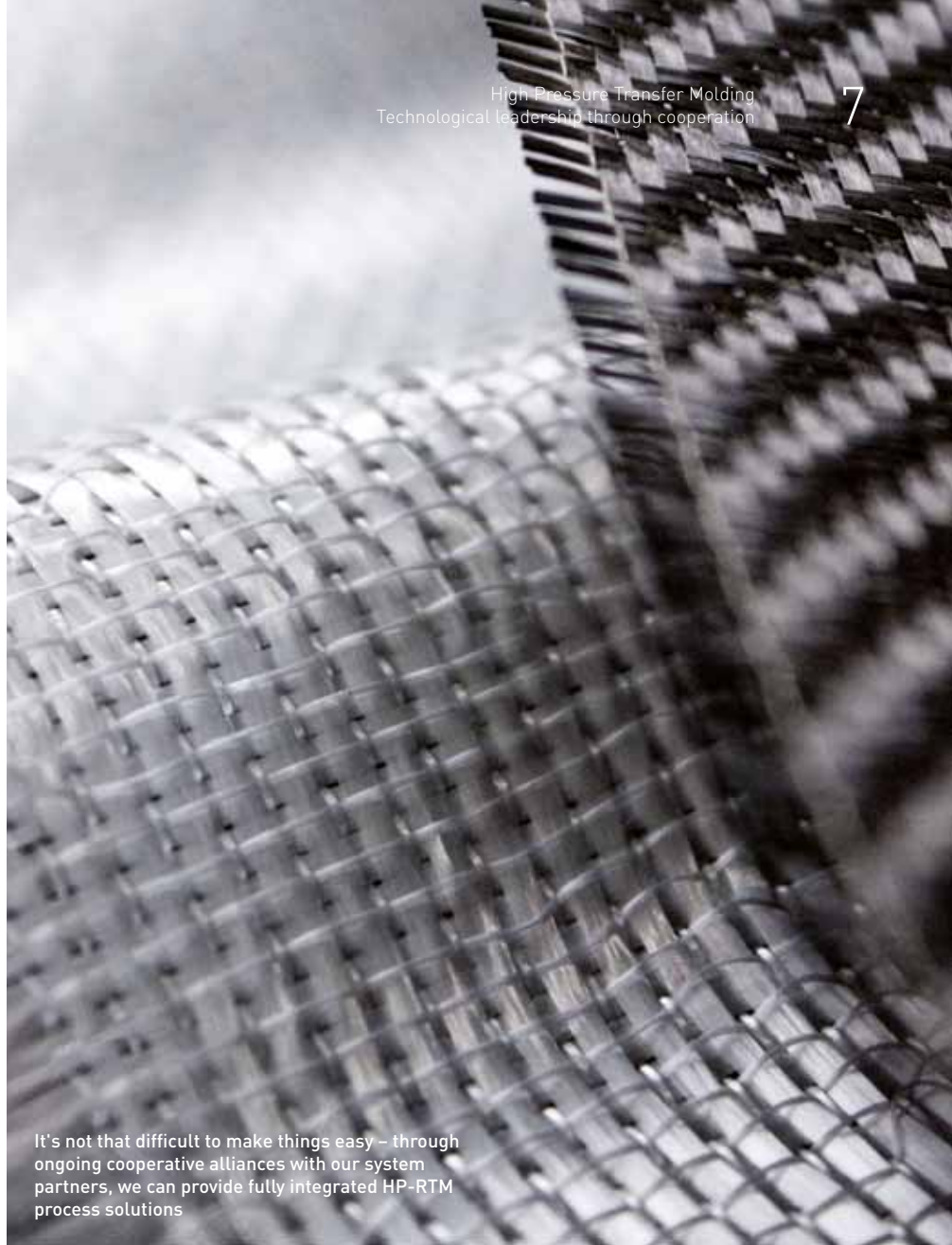
Several systems can be linked together

Process-optimized product holding systems

Quick-change product holders

Optional cross-market component selection possible (for example, robots: ABB, Kuka, Stäubli)

Adaptation to customer's equipment specifications is optional



It's not that difficult to make things easy – through ongoing cooperative alliances with our system partners, we can provide fully integrated HP-RTM process solutions

Technological leadership through cooperation

To develop innovative ideas and systems, KraussMaffei collaborates closely with technology trend-setters.

To ensure that the HP-RTM production chain is optimally organised and designed, we pool our expertise with that of our cooperation partners Dieffenbacher, TU München and the Fraunhofer ICT (Institute for Chemical Technology). We have set ourselves the goal of collaborating on product-oriented developments with a view to globally marketing turnkey machines for the high-pressure resin injection process. Take advantage of the comprehensive expertise provided by our cooperative partnerships and a thorough assessment of press technology compared to alternative technologies.

Your benefits:

- Pooled expertise throughout the entire HP-RTM production chain
 - Independent development center with production capability
 - Process-oriented component design and development
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High Pressure Resin Transfer Molding Turnkey production line for high-volume mass production

Take advantage of machine and process technology from a single source. Together with its partners, KraussMaffei is able to cover all stages of the process chain from unwinding the semifinished textile product (e.g. CFRP fabric) through to final processing of the finished fiber composite component, as turnkey solutions incorporating a high level of system expertise. Production-ready machines have been installed at the Fraunhofer Institute for Chemical Technology. They feature the latest Dieffenbacher press and system technology as well as HP-RTM injection technology from KraussMaffei. Our extensive expertise in materials enables us to take an integrated approach to the development of machine and process technology. In this way, we consolidate and sustain our technological leadership through cooperation.