

# RAKU<sup>®</sup> TOOL | Trend-setting systems for the composites industry



# Innovative solutions for model, mold, and tool making

## RAMPF Group

The international RAMPF Group stands for **engineering and chemical solutions** and caters to the economic and ecological needs of industry.

Our range of competencies includes:

- > Production and recycling of **materials** for modeling, lightweight construction, bonding, and protection
- > **Technical production systems** for precise, dynamic positioning and automation, as well as technologies for complex composite parts production
- > **A comprehensive range of solutions and services**, particularly for innovative and customer-specific requirements

This know-how helps our customers achieve profitable and sustainable growth.

Trusting relationships are of utmost importance to RAMPF. They are a vital part of the family-owned company's success story which now spans over 35 years.

RAMPF thinks globally and acts locally. The company has production facilities strategically located in Germany, the United States, Canada, China, and Japan.

## RAMPF Tooling Solutions

The company based in Grafenberg (near Stuttgart), Germany, is the world's largest producer of high-performance, high-quality styling, modeling, and working board materials.

Services and products such as Close Contour Pastes, Close Contour Casting, including large-volume casting, 1:1 casting, and Close Contour Blocks ensure the manufacture of outstanding Close Contour models and molds.

The company develops pioneering systems for the composites industry that cover a wide variety of production processes and a broad range of temperatures.

The very latest production processes and facilities, combined with expert advice and customer-specific service, ensure that our products are manufactured cost effectively and environmentally friendly, and conform to the highest quality standard – worldwide.



Machine Systems



Production Systems



Composite Solutions



Eco Solutions



Polymer Solutions



Tooling Solutions

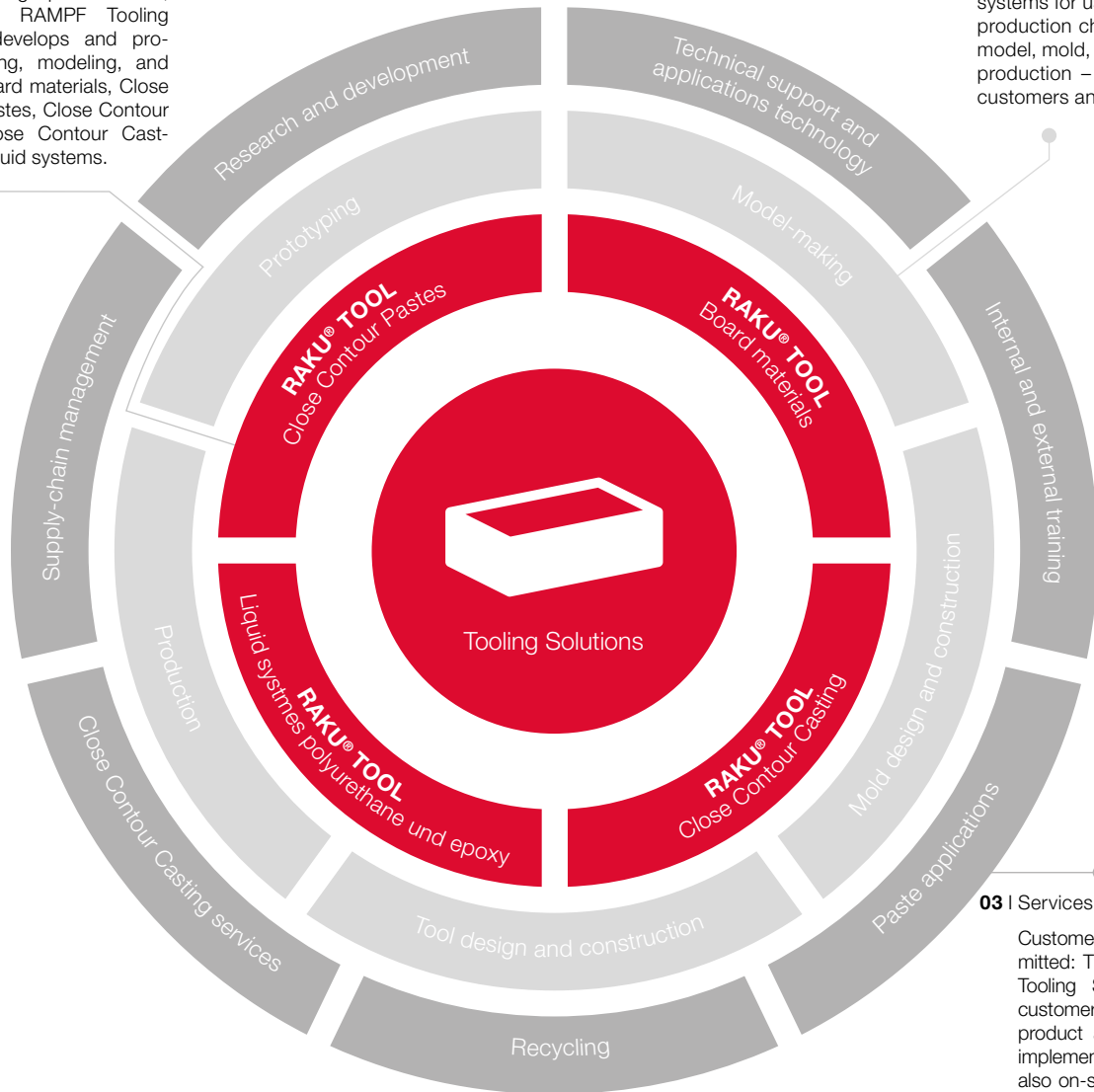
# Range of products and services

## 01 | Materials

Creative, high-performance, sustainable: RAMPF Tooling Solutions develops and produces styling, modeling, and working board materials, Close Contour Pastes, Close Contour Blocks, Close Contour Castings, and liquid systems.

## 02 | Production systems

Customized, high-tech, professional: RAMPF Tooling Solutions develops systems for use throughout the entire production chain – from prototyping, model, mold, and tool construction to production – for existing and future customers and market requirements.



## 03 | Services

Customer-oriented, skilled, committed: The experts from RAMPF Tooling Solutions support their customers in technology and product applications, and in the implementation of their ideas – also on-site. They also offer training courses in which the products and solutions are presented using practical demonstrations.

» Fiber-reinforced thermoset plastics are increasingly being used whenever low weight and mechanical resilience are needed. RAMPF Tooling Solutions offers a comprehensive, future-oriented range of liquid, paste, and board materials specifically designed for modeling and mold engineering. This includes epoxy and polyurethane systems and covers a wide range of temperatures. These new plastics and technologies offer the greatest possible benefits for lightweight construction using composites. «

Advantages



# RAKU® TOOL | Composites

First-class materials, first-class service

## Services

- > **Ready-to-mill castings** for laminating molds and galvanobath models save time and ensure consistent product quality with outstanding mechanical end properties. No need for large equipment investments, and the cost of processing chemical products is eliminated.
- > **Paste application onto your supporting structure:** You can focus completely on your core competences (e.g. milling).
- > **Customized board sizes**, specially cut to size to meet your application, to reduce bonding time and to improve the surface quality through fewer bonding lines.

## Consulting

Our experienced technical team is able to provide tailored advice on using the products and can answer any questions you might have.

- > **Practical product guidance and advice** in the RAMPF Technology Center in Grafenberg
- > **Internal and external training courses**

## Deliveries

- > Rapid, flexible, on time

## Environment

- > Environmentally friendly production – one of RAMPF's guiding principles. Own residual materials are partially reintegrated into production, thereby fulfilling the highest demands in terms of quality and ecology.



## Your benefits

- > **Product quality:** Outstanding physical and mechanical properties, such as impregnation of fibers, room temperature curing, and excellent mechanical end properties
- > **Creative, innovative products and technologies** (e.g. Close Contour Casting, new Close Contour Pastes for direct tooling, epoxy systems for resin infusion with excellent room temperature curing)
- > **Guarantee of consistently high quality, DIN EN ISO 9001 certification**



Industries



# Your industry | Your application

RAMPF Tooling Solutions offers quality, progress and performance for the manufacture of models, molds, tools, and parts in various industrial sectors.



## Automotive and vehicle construction

Modeling  
Prototypes (parts)  
Lay-up tools  
Galvano bath models



## Electrical industry

Components



## Aerospace

Lay-up tools  
Galvano bath models  
Stretch forming tools and shaping dies



## Mechanical engineering

Modeling  
Molds  
Machine components



## Medical technology

Modeling  
Molds



## Marine

Master models  
Lay-up tools  
Laminating molds



## Sports and leisure

Modeling  
Lay-up tools for small-scale series



## Wind energy

Master models  
Lay-up tools (RTM/resin infusion)  
Laminating molds



Selection  
criteria



# Selection criteria | Qualitative and economic

## Various production processes – first-class products

The following information is based on our experience with plastic molds and tools. The processes/methods/unit volumes can vary in practice.

Production processes	Hand/wet lay-up	Vacuum bagging / wet lay-up	Resin infusion	Vacuum bagging / prepreg (out of autoclave)	Autoclave process	Wet compression molding	RTM
<b>Qualitative selection criteria</b>							
<b>Possible geometry</b>	Complex	Complex	Complex large and thick parts	Complex, size limited by autoclave/ circulating air oven	Complex, size limited by autoclave/ circulating air oven	Complex, size limited by molding press	Complex, size limited by fixing equipment
<b>Surface finish</b>	moderate	good	good	good	good	good	good
<b>Design</b>	one-sided	one-sided	one-sided	one-sided	one-sided	double-sided	double-sided
<b>Part quality</b>	semi-moderate	moderate	high	very high	very high	high	high
<b>Part thickness variance</b>	very high	high	low	very low	very low	very low	very low
<b>Typical fiber volume content</b>	approx. 35% fabricator dependent	approx. 40–45%	approx. 50–55%	approx. 55–60%	approx. 66–70%	approx. 50–55%	approx. 50–55%
<b>Mechanical properties</b>	low	moderate	very high	very high	very high	high	high
<b>Structural changes</b>	easy	easy	easy	easy to moderate	moderate to difficult	moderate to difficult	moderate to difficult
<b>Process reliability and reproducibility</b>	moderate	moderate	good	very good	very good, controlled process parameters	very good, controlled process parameters	very good, controlled process parameters
<b>Economic selection criteria</b>							
<b>Series volume</b>	<50	<50	<50	<50	< 100	< 100	< 100
<b>Cycle times</b>	long	long	long	moderate	moderate	short	short
<b>Equipment costs</b>	low	low	low	high	very high	high	high
<b>Mold production costs</b>	low	low	low to moderate	moderate	very high	very high	very high
<b>Open or closed mold</b>	open	open	open	open	open	closed	closed
<b>Labor costs</b>	high	high	high	moderate	moderate	moderate	moderate
<b>Material costs</b>	low	moderate	moderate	high	high	low	low
<b>Work hygiene</b>	problematic	problematic	noncritical	noncritical	noncritical	problematic	noncritical
<b>Residue impact through production process</b>	low	high	high	high	high	low	low
<b>Special features</b>	wet processing, inserts possible	wet processing, inserts possible	dry processing, sandwich construction	limited shelf life of prepregs	limited shelf life of prepregs	wet processing, inserts possible	dry processing, sandwich construction

Industry



# Process | From the idea to the finished product

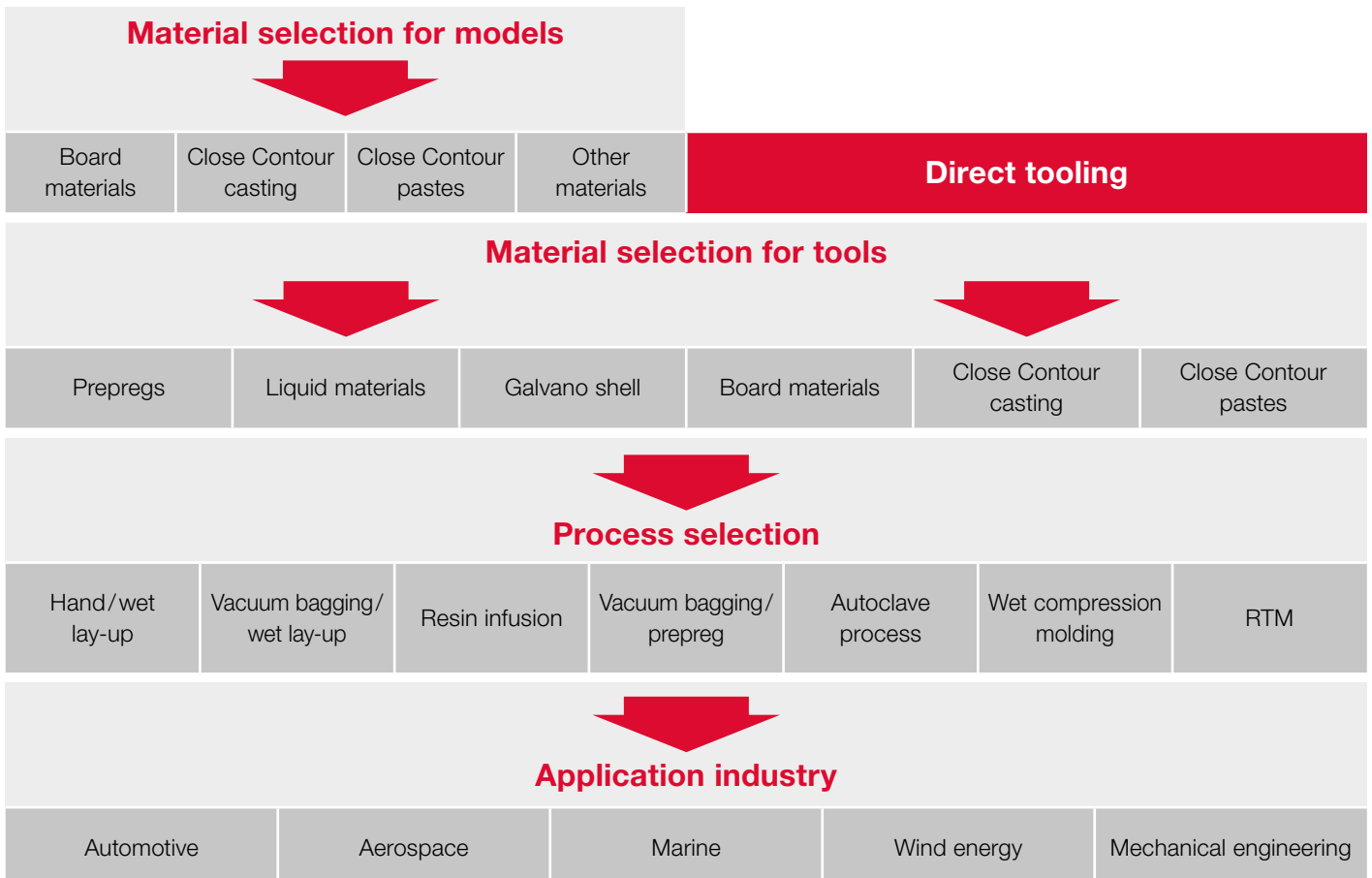
Material and process diversity: Creative materials for your applications

Many routes lead to a finished lightweight component. The starting point involves selecting the appropriate material for the production model. This can be based on the area of application, existing process infrastructure, and desired product characteristics. RAMPF has the perfect material for your requirements.

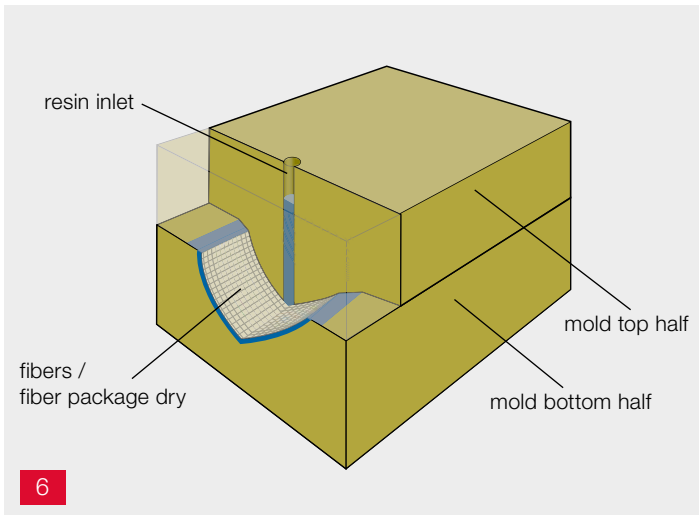
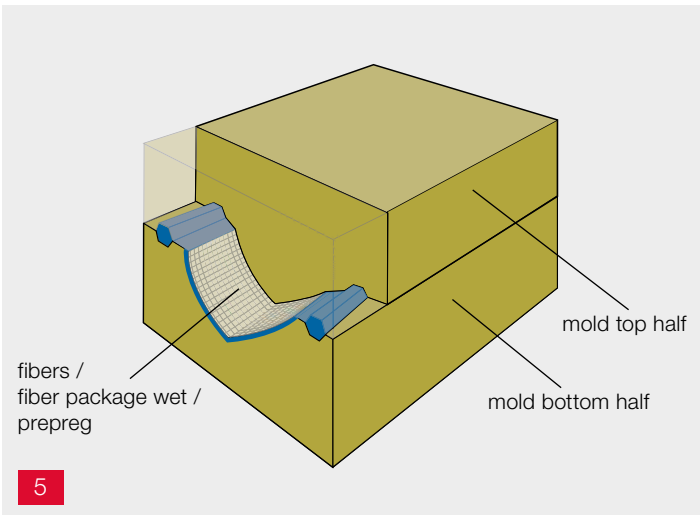
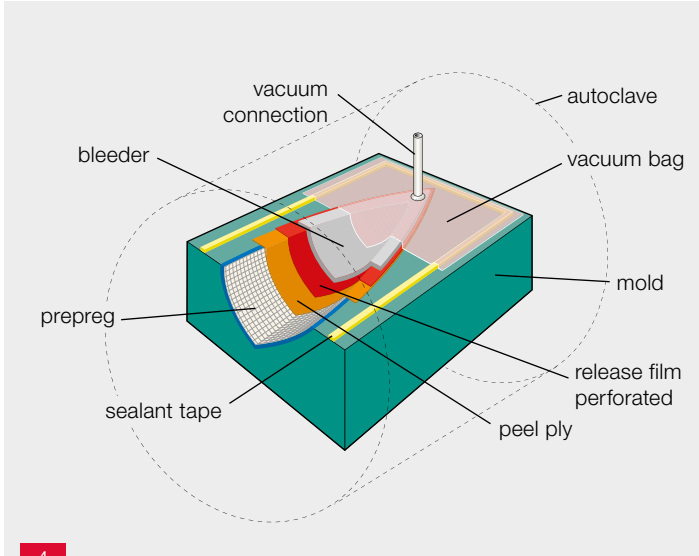
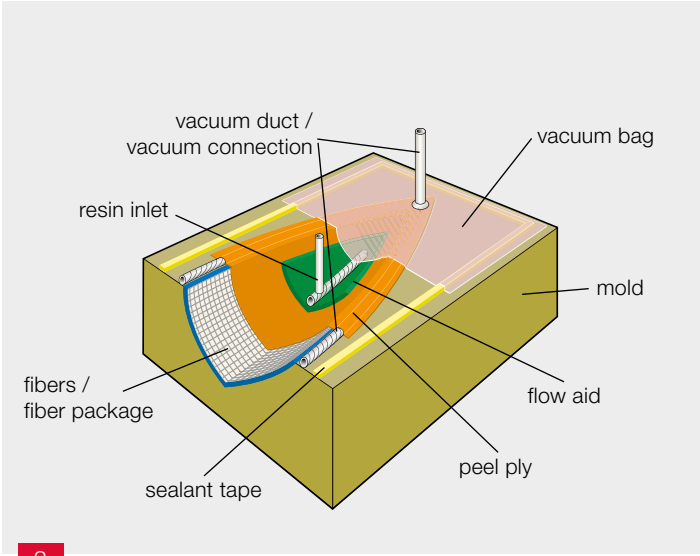
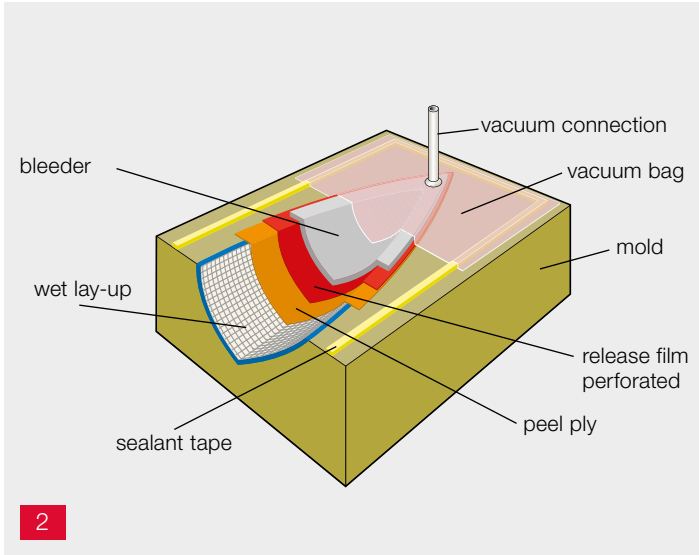
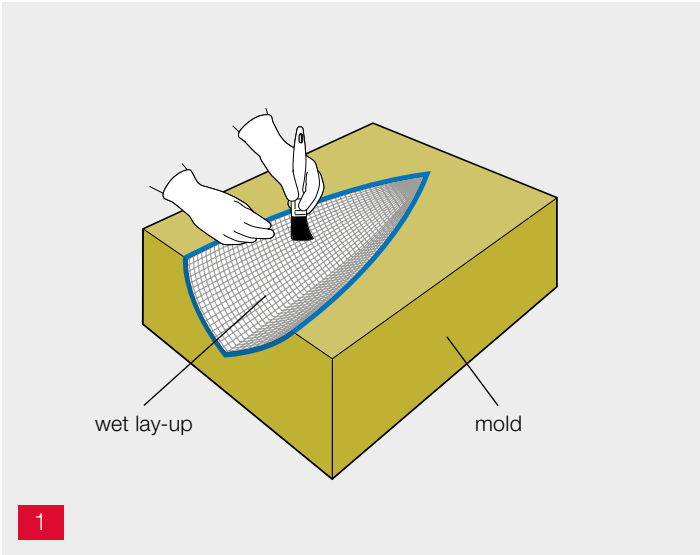


## Your benefits

- > Comprehensive product portfolio
- > Systems with varying temperature resistances (RT – 190 °C)
- > Rapidly available



# Production process



# Production process | With RAKU® TOOL

Bringing quality and efficiency into perfect harmony

There are different composite production processes, depending on the required component properties, the component quality, and the operational circumstances.

Qualitative criteria – e.g. surface finish, design, part quality, process reliability – and economic criteria – e.g. series volume, equipment costs, etc. – are significant for process selection.

The key production processes for RAKU® TOOL materials are illustrated here.



## Additional information

**Image 1:** Hand / wet lay-up: Manual impregnation and lay-up of fibers.

**Image 2:** Vacuum bagging / wet lay-up: Manual impregnation and lay-up of fibers. Peel ply and bleeder to be put in place. Build-up of vacuum bag. The vacuum bag film enables the build-up of vacuum pressure, to remove excess thermosetting resin during the liquid stage. Afterwards cure of wet laminate under vacuum.

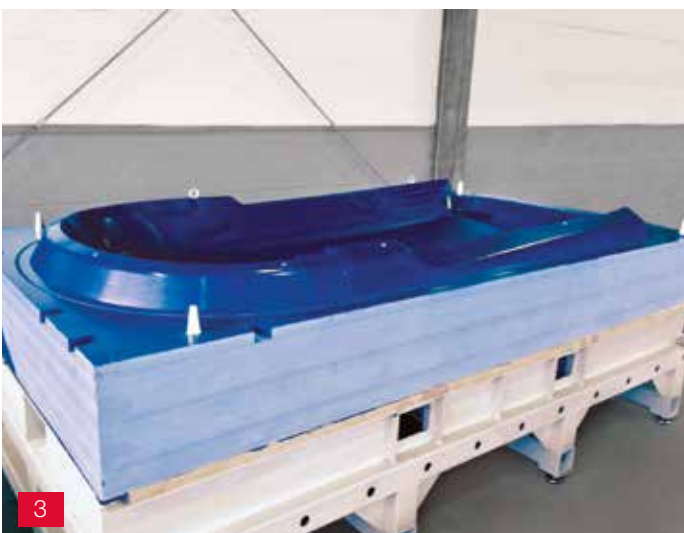
**Image 3:** Resin infusion: Lay-up of dry fibers / fiber package. Peel ply, flow mesh, resin flow and vacuum channels to be put in place. Build-up of vacuum bag. Impregnation of composite package through injection of thermosetting resin via drop of pressure generated through vacuum.

**Image 4:** Autoclave process: Prepregs to be put into the mold. Peel ply / release film (perforated) and bleeder to be put in place. Build-up of vacuum bag. Prepregs are cured under pressure and vacuum in the autoclave in connection with temperature.

**Image 5:** Wet compression molding: Fibers / fiber package wet / prepreg to be put into multipart mold. Close mold

**Image 6:** RTM (Resin Transfer Molding): Dry fibers / fiber package to be put into multipart mold. Close mold. Thermosetting resin is injected via low pressure.

## Applications



### Additional information

**Fig. 1:** Production mold for boat hull produced via resin infusion.

Products: Gelcoat RAKU® TOOL EG-2104 / EH-2950-1 and Resin Infusion System RAKU® TOOL EI-2500/EH-2973

Advantages:

- > Large, complex molds are easy to produce via resin infusion.
- > Post-cure can take place at lower temperatures.

**Fig. 2:** Production of a racecar monocoque for the GP3 series. A Close Contour Casting was used for the master models, which were then used for the manufacture of the lay-up tool using low-temperature tooling prepregs.

Product: Close Contour Casting RAKU® TOOL CC/CB-6503

Advantages:

- > Monolithic shell casting with a consistent wall thickness
- > Excellent surface of prepreg lay-up tool, no bonding lines
- > Reduction of milling time through close contour shape

**Fig. 3:** Production of several large molds for the manufacture of carbon fiber parts using the RTM process.

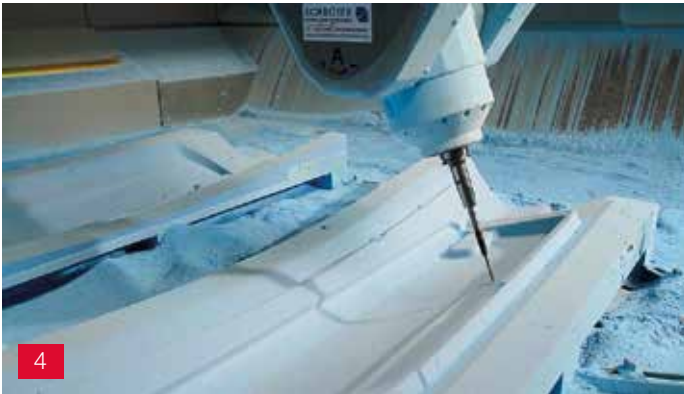
Product: Close Contour Casting RAKU® TOOL CC-6503

Advantages:

- > Very dense, homogeneous, fine surface, no bonding lines
- > Quick machining, since casting is supplied as a three dimensional shape which is already a close contour of the customer's final model/ mold/tool
- > Temperature resistant up to 80 °C
- > The RTM process (with a plastic tool) is generally used for series sizes <100
- > Through the use of a closed tool in RTM both part surfaces are of a high quality

# RAKU® TOOL | In use

Product and application examples from the wind energy, automotive, and motorsport industries



## Additional information

**Fig. 4 + 5:** Production of molds for the manufacture of composite carbon fiber parts

Product: RAKU® TOOL WB-0691 board material

Advantages:

- > Extremely fine surface structure
- > Very easy to mill
- > Excellent dimensional stability
- > Heat resistant up to 110 °C

**Fig. 6:** Manufacture of a production mold for creating wind turbine blades using the composite construction method.

Product: Close Contour Paste RAKU® TOOL CP-6060

Advantages:

- > Easy to process, quick application without slump, even on vertical surfaces
- > High temperature resistance of up to 70 °C
- > Very fine homogeneous surface
- > Good dimensional stability
- > Close contour shape
- > Faster milling, less waste
- > Economical manufacturing of large models and molds

**Fig. 7:** Production mold and fiber reinforced light-weight part for ADAC GT Masters racing car.

Products: board material RAKU® TOOL WB-1404 and epoxy resin infusion RAKU® TOOL EI-2500 / EH-2970-1

Advantages:

- > Excellent surface quality of resin infusion parts
- > No damage to molds during demolding
- > Accuracy of fit for parts

# RAMPF Group | Locations

