

RAKU-TOOL® | Trend-setting systems for the composites industry



Innovative solutions for model, mold, and tool making

RAMPF Group

The RAMPF Group, Germany, 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, bonding, and protection
- > **Technical production systems** for positioning and automation, which can be utilized as a stable basis for achieving precision and dynamics
- > **Comprehensive range of solutions and services**, particularly for innovative customer-specific requirements

Using this know-how, RAMPF helps customers achieve profitable and sustainable growth.

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

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

RAMPF Tooling Solutions

The company is based in Grafenberg (near Stuttgart), and 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 the manufacturing of our tooling products around the world is cost-effective, environmentally friendly, and of consistent high quality.



Machine Systems

System solutions, rump machines, basic machinery, and multi-axis positioning and moving systems based on machine beds made from innovative materials. Precision grinding of mineral casting, steel, hard stone, and ceramics.



Production Systems

Production systems with low-pressure mixing and dispensing systems for the bonding, sealing, foaming, and casting of a wide variety of materials. Wide range of automation skills relating to all aspects of process engineering.



Eco Solutions

Chemical solutions for the production of alternative polyols from PU and PET residues. Conceptual planning and custom-design of PU and PET reprocessing plants and facilities for manufacturing alternative polyols using PET and PA.



Polymer Solutions

Reactive resin systems based on polyurethane, epoxy, and silicone. Liquid and thixotropic sealing systems, electro and engineering casting resins, edge and filter casting resins, and adhesives, as well as comprehensive expertise in application technology.



Tooling Solutions

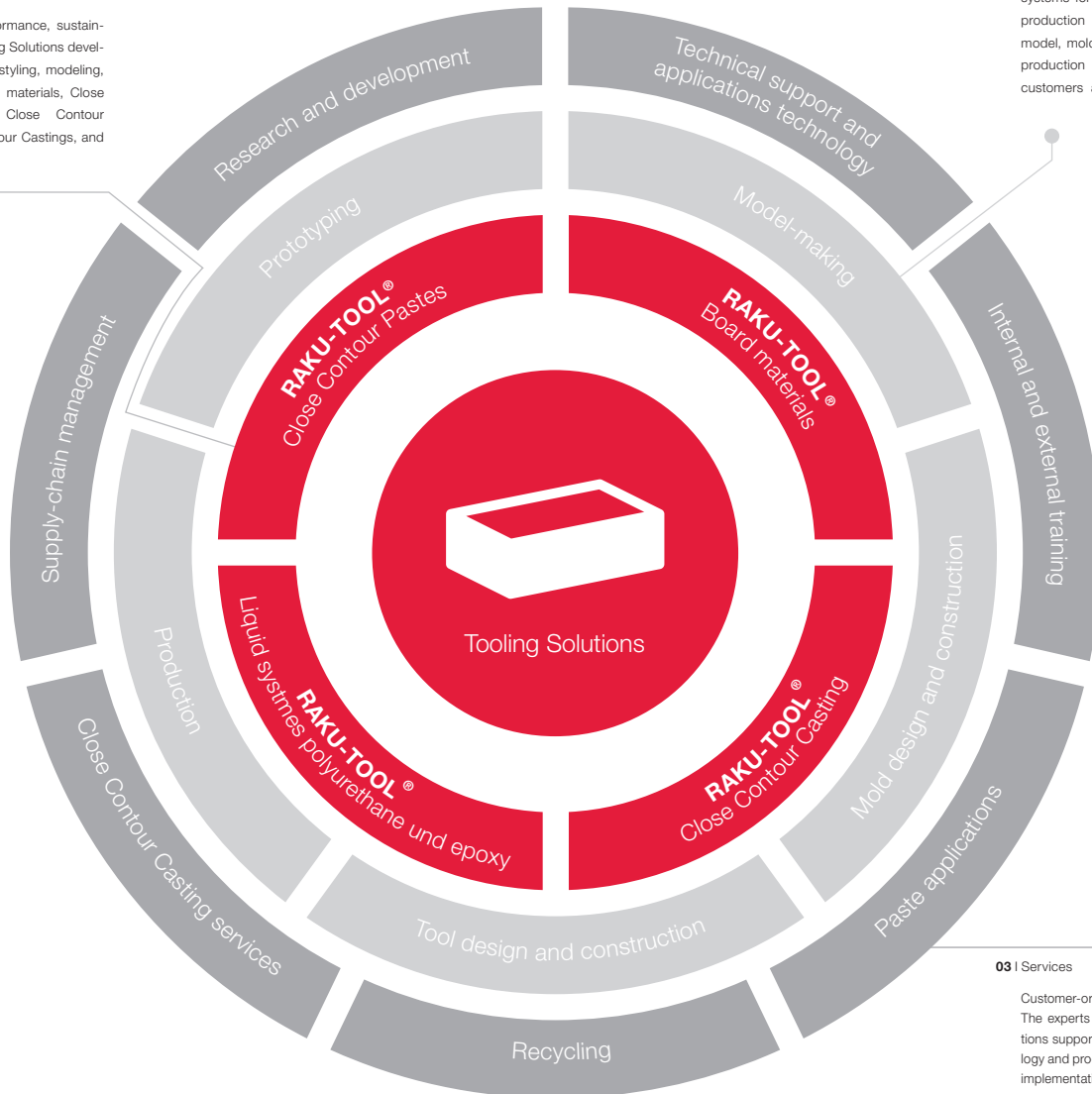
Range of products and services

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 – including on-site when necessary. 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

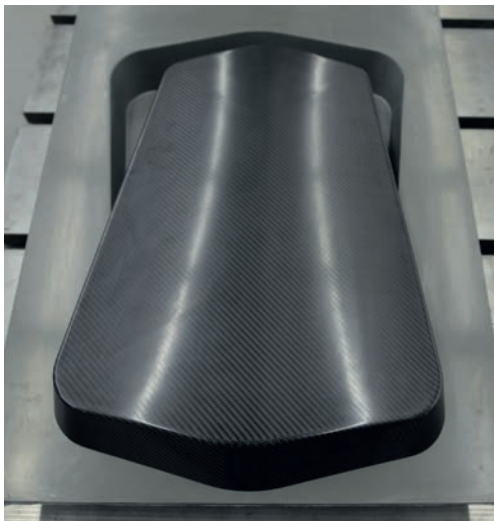
Environment

- > 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



Medical technology

Modeling
Molds



Electrical industry

Components



Marine

Master models
Lay-up tools
Laminating models



Aerospace

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



Sports and leisure

Modeling
Lay-up tools for small-scale series



Mechanical engineering

Modeling
Molds
Machine components



Wind energy

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



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
Qualitative selection criteria							
Possible geometry	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
Surface finish	moderate	good	good	good	good	good	good
Design	one-sided	one-sided	one-sided	one-sided	one-sided	double-sided	double-sided
Part quality	semi-moderate	moderate	high	very high	very high	high	high
Part thickness variance	very high	high	low	very low	very low	very low	very low
Typical fiber volume content	approx. 35 % fabricator dependent	approx. 40–45 %	approx. 50–55 %	approx. 55–60 %	approx. 66–70 %	approx. 50–55 %	approx. 50–55 %
Mechanical properties	low	moderate	very high	very high	very high	high	high
Structural changes	easy	easy	easy	easy to moderate	moderate to difficult	moderate to difficult	moderate to difficult
Process reliability and reproducibility	moderate	moderate	good	very good	very good, controlled process parameters	very good, controlled process parameters	very good, controlled process parameters
Economic selection criteria							
Series volume	<50	<50	<50	<50	<100	<100	<100
Tack times	moderate	moderate	moderate	long	long	short	short
Equipment costs	low	low	low	high	very high	high	high
Mold production costs	low	low	low to moderate	moderate	very high	very high	very high
Open or closed mold	open	open	open	open	open	closed	closed
Labor costs	high	high	high	moderate	moderate	moderate	moderate
Material costs	low	moderate	moderate	high	high	low	low
Work hygiene	problematic	problematic	noncritical	noncritical	noncritical	problematic	noncritical
Residue impact through production process	low	high	high	high	high	low	low
Special features	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

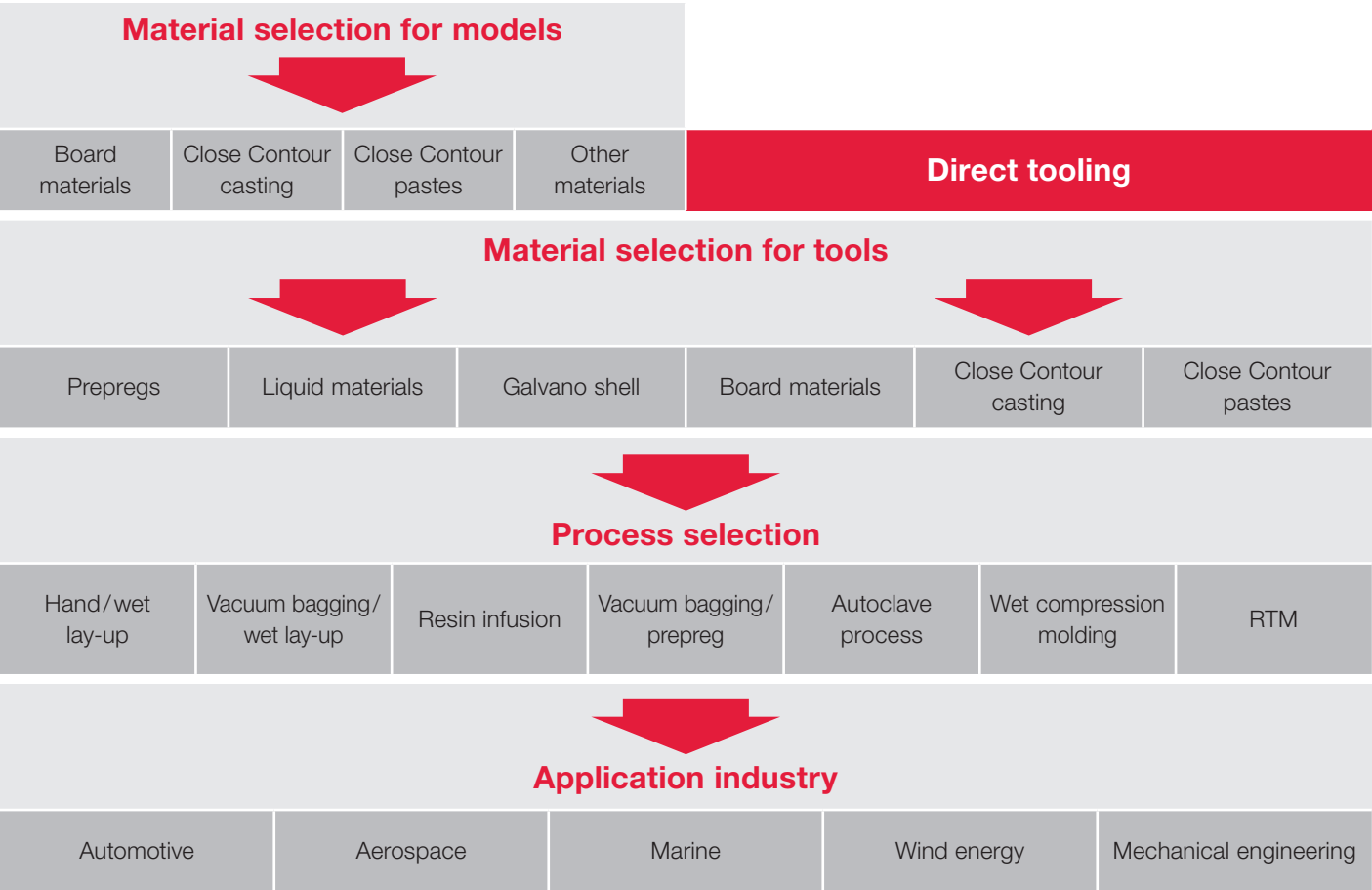
Material and process diversity: Creative materials for your applications

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.

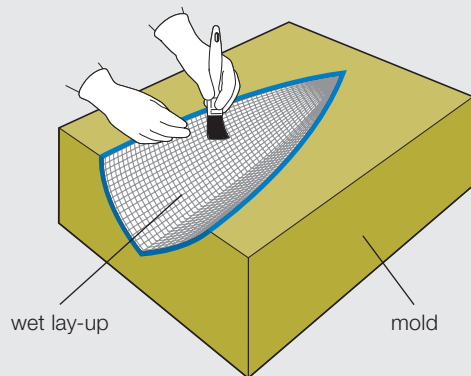


Your benefits

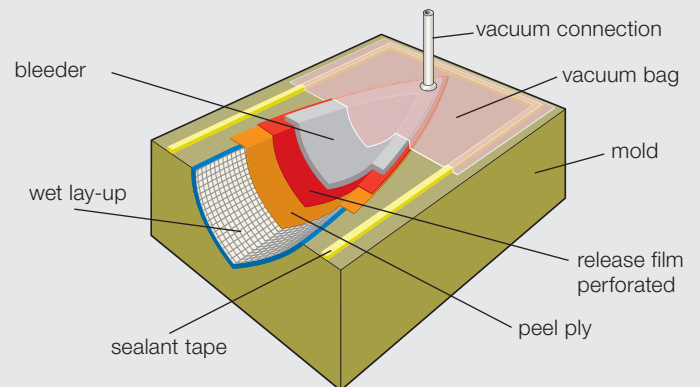
- > Comprehensive product portfolio
- > Systems with varying temperature resistances (RT – 170 °C)
- > Rapidly available



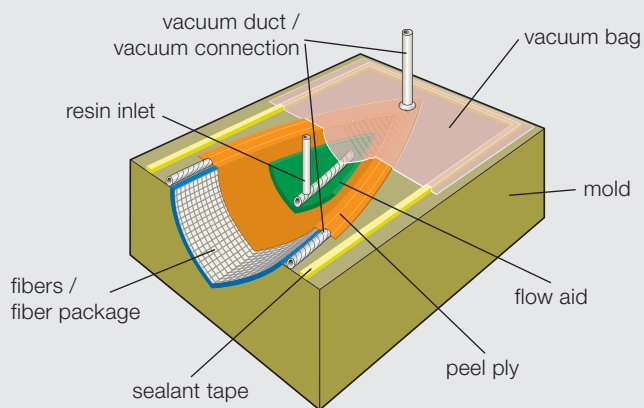
Production process



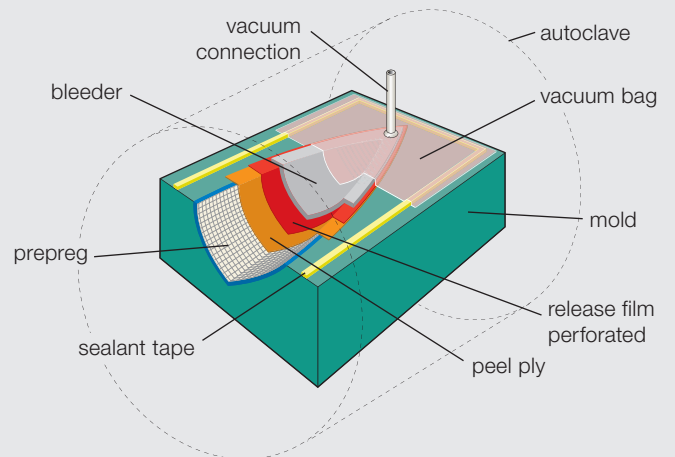
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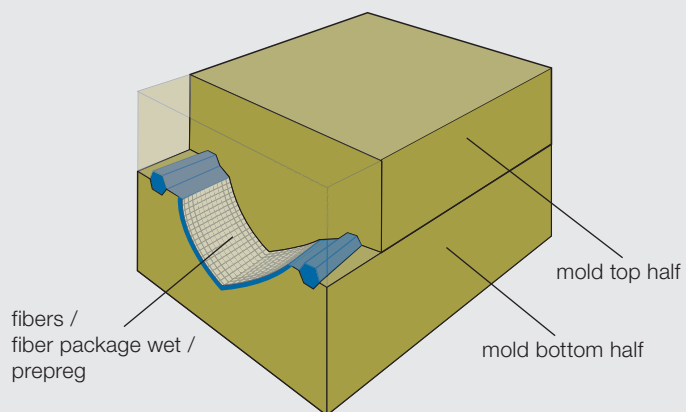
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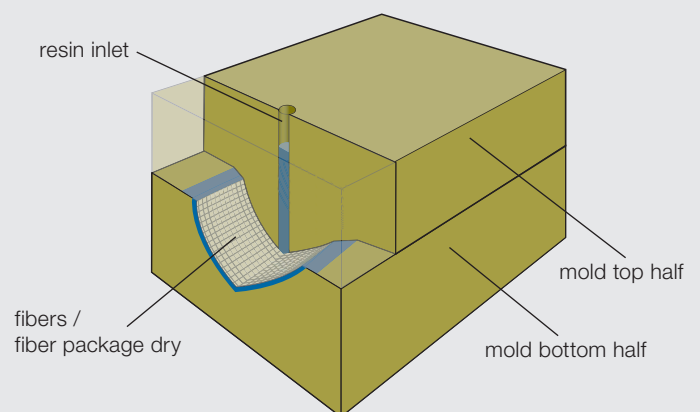
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5



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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.

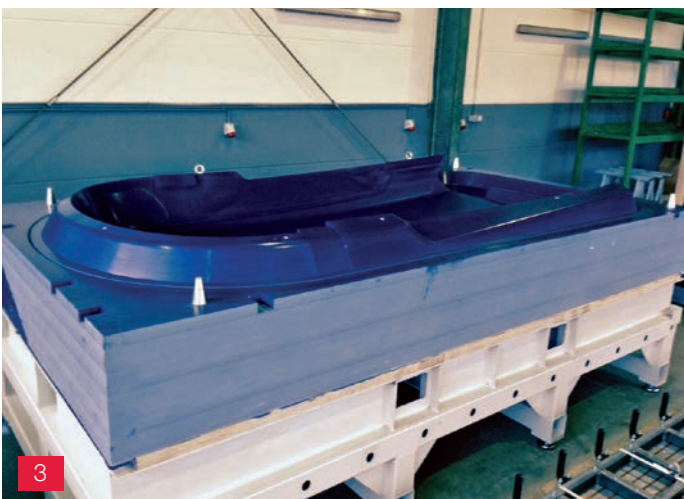
Image 3: Resin infusion: Lay-up of dry fibers/fiber package. Peel ply, flow mesh, resin flow and vacuum channels to be put in place. Build-up of vacuum bag. Impregnation of composite package through injection of thermosetting resin via drop of pressure generated through vacuum.

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: Original model of a wind turbine blade for resin infusion (RIF) mold made from epoxy resin.

Product: Close Contour Paste RAKU-TOOL® CP-6100-1

Advantages:

- > Heat-resistant, since the exothermic reaction of the RIF epoxy resin can reach 60 °C
- > Low coefficient of thermal expansion
- > High flexural and compressive modulus

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.

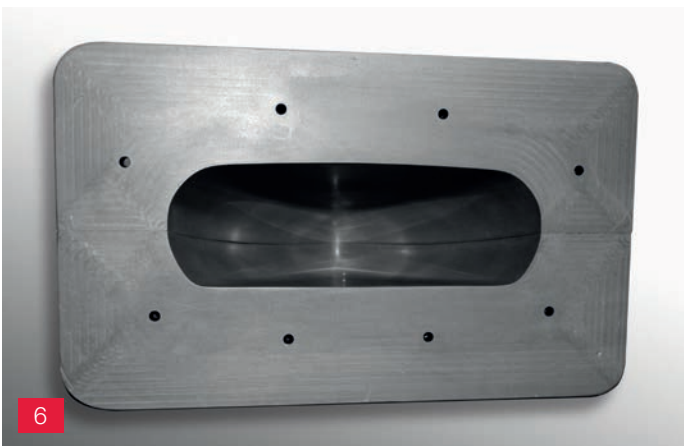
Product: Close Contour Casting RAKU-TOOL® CC-6503

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: Production of monocoque molds for manufacturing lightweight carbon-fiber components for a GP3 racecar

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. 5: 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

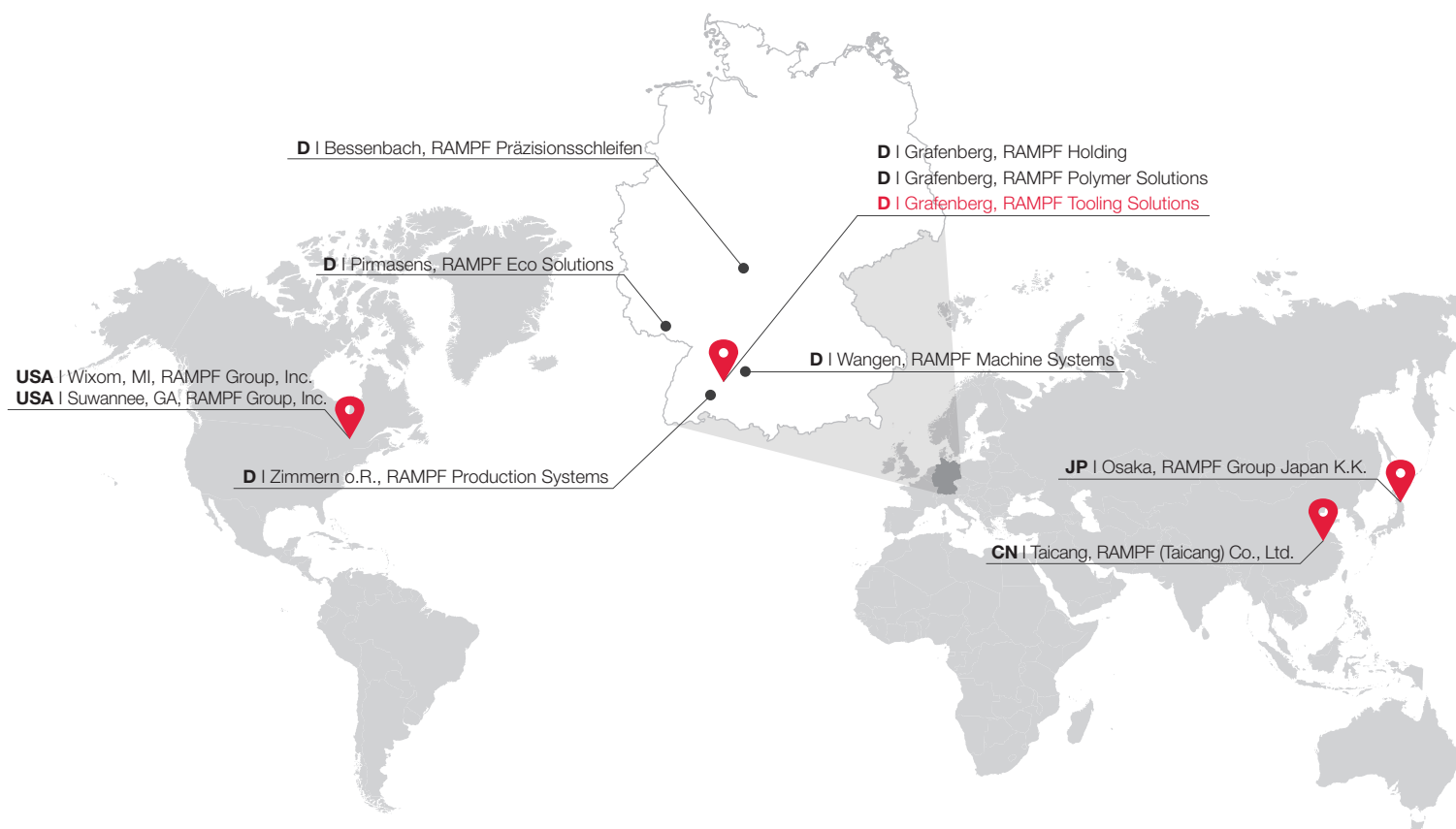
Fig. 6 + 7: Production of GP3 series racecar monocoque nose in composite using Close Contour Paste for medium temperature prepreg lay-up tools.

Product: Close Contour Paste RAKU-TOOL® CP-6131

Advantages:

- > The tool can be used with medium temperature prepreps
- > Quick and even heat distribution within the shell tool, which enables fast autoclave cycle times and even post-cure profile
- > Direct tooling, no need to create a master model
- > No sealing necessary; dense, void-free, homogeneous, seamless, and fine surface
- > Savings resulting from lower material consumption
- > Faster milling through close contour shape

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