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discover the future

**RAMPF** ADVANCED POLYMERS

# RAKU® TOOL

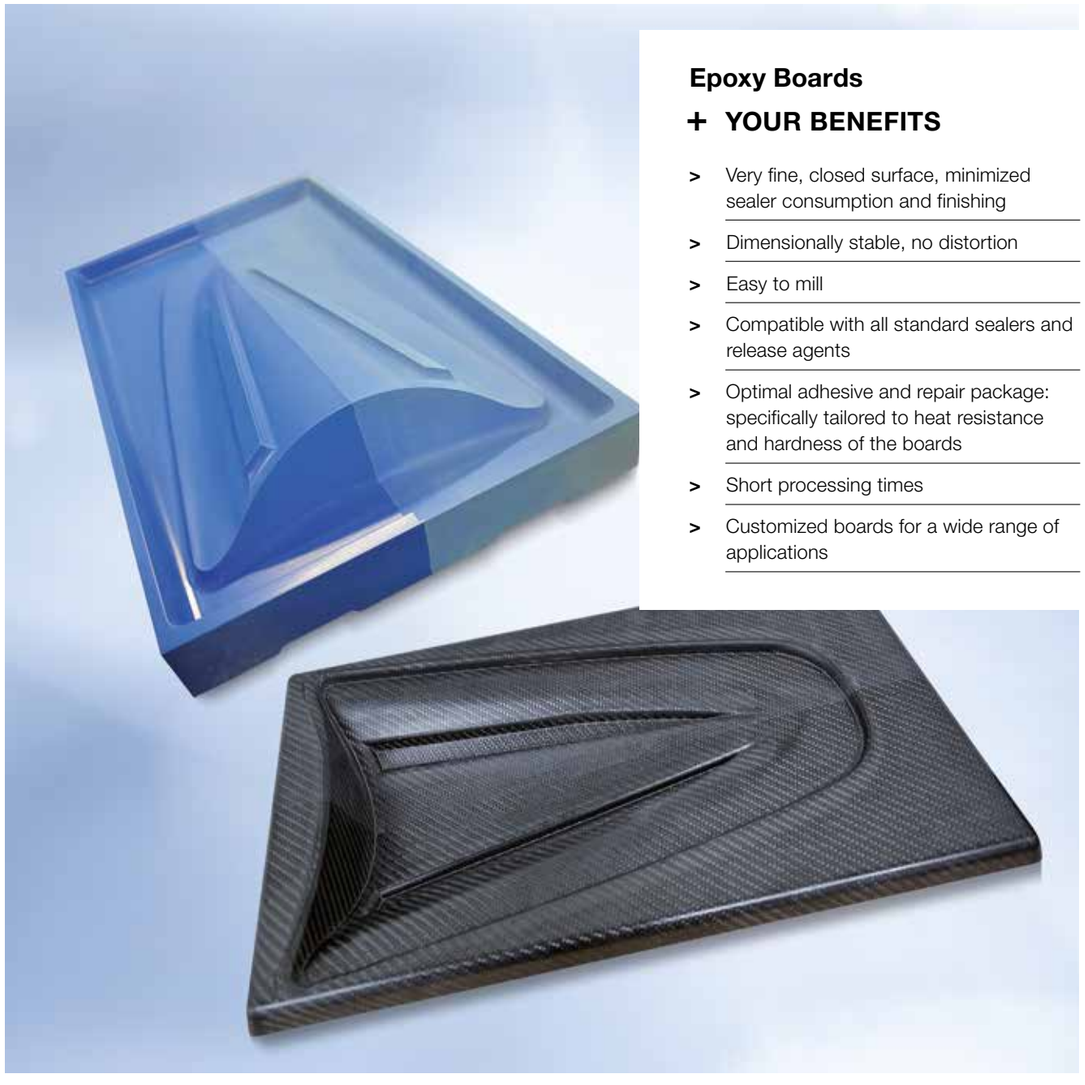
## Trend-setting systems for the composites industry

EN

# RAKU® TOOL
# Board Materials

## Optimizing processes and efficiency

Model and mold engineering materials are essential in the composite industry for manufacturing high-quality components. They enable the precise production of molds and models that serve as negative molds or tools, allowing for the manufacture of final composite parts with complex geometries and excellent surface quality.



### Epoxy Boards

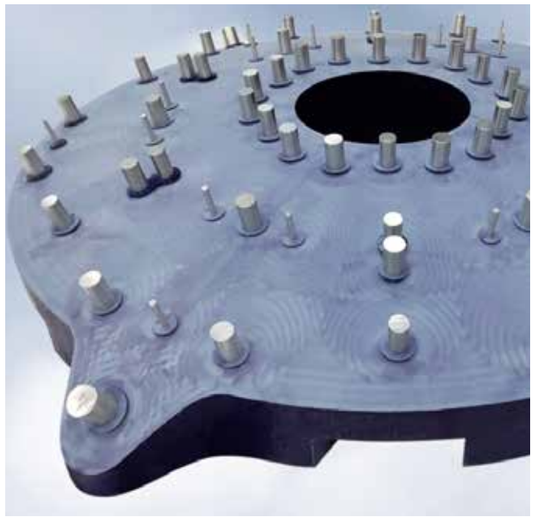
### + YOUR BENEFITS

- > Very fine, closed surface, minimized sealer consumption and finishing
- > Dimensionally stable, no distortion
- > Easy to mill
- > Compatible with all standard sealers and release agents
- > Optimal adhesive and repair package: specifically tailored to heat resistance and hardness of the boards
- > Short processing times
- > Customized boards for a wide range of applications

# RAKU® TOOL
# Close Contour Casting & Blocks

### + YOUR BENEFITS

- > Ready to mill, customized castings
- > Monolithic, seamless part without bonding lines
- > Fine and homogeneous surface quality with perfect surface roughness
- > Excellent dimensional stability
- > Reduction of milling waste
- > Savings in production time and costs: reduced milling time and less pre-processing of models



# Close Contour Pastes

## Dimensionally stable, seamless models and molds

### + YOUR BENEFITS

- > Very fine, homogeneous, and seamless surface quality for all component sizes
- > Cost-efficient model construction thanks to low-cost substructure
- > Easy and fast milling with less waste due to close contour shape
- > Good dimensional stability
- > Heat resistant
- > Easy processing, paste application by hand or CNC machine
- > Can be applied without slump on vertical surfaces
- > Low exotherm, machinable after 9-14 hours room temperature cure
- > Suitable for large components

# Infusion and Laminating Systems

## Light and strong – High-strength, durable parts

### Epoxy Gelcoat Systems

### + YOUR BENEFITS

- > Sandable and polishable
- > Abrasion and chemical resistant
- > Polishable to a high gloss
- > Suitable for high-temperature applications

### Epoxy Laminating Systems

### + YOUR BENEFITS

- > High mechanical properties with room temperature curing
- > Excellent wetting properties
- > Pot life and curing times adjustable via hardeners
- > Outstanding compatibility with fibers, fabrics, and fillers
- > Good strength
- > Solvent-free

### Epoxy Infusion & RTM Systems

### + YOUR BENEFITS

- > Low viscosity
- > No degassing under vacuum
- > Excellent wetting and flow properties
- > Suitable for high-temperature applications

# Selection Criteria

## 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.

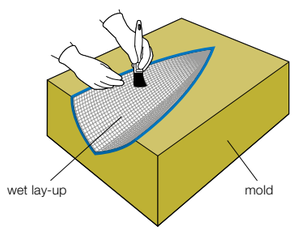
| PRODUCTION PROCESSES | HAND / WET LAY-UP | VACUUM BAGGING / WET LAY-UP | RESIN INFUSION | VACUUM BAGGING / PREPREG (OUT OF AUTOCLAVE) | AUTOCLAVE PROCESS | WET COMPRESSION MOLDING | RTM |
|---|---|---|---|---|---|---|---|
| **ECONOMIC SELECTION CRITERIA** | | | | | | | |
| **Series volume** | < 50 | < 50 | < 50 | < 50 | < 100 | < 100 | < 100 |
| **Cycle times** | long | long | long | moderate | moderate | short | short |
| **Process costs** | low | low | low | high | very high | high | very high |
| **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. 65–70 % | 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 |

# Production Process

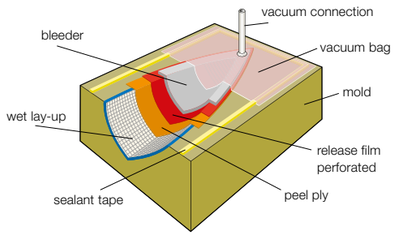
## Quality and efficiency in perfect harmony

The key production processes for **RAKU® TOOL** materials are:

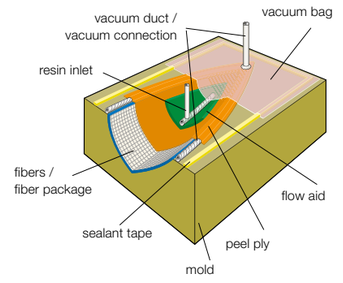
### HAND / WET LAY-UP



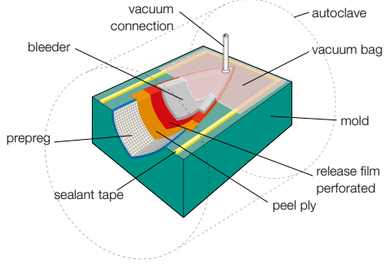

### VACUUM BAGGING WET LAY-UP



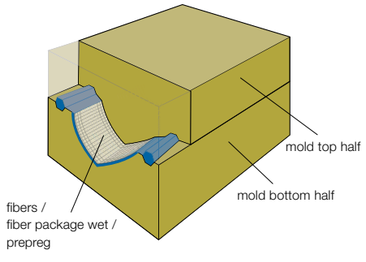

### RESIN INFUSION



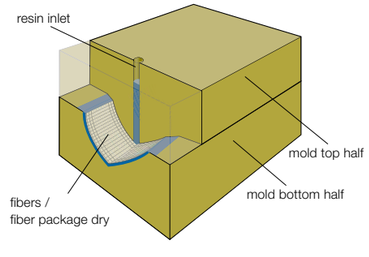

### AUTOCLAVE PROCESS




### WET COMPRESSION MOLDING

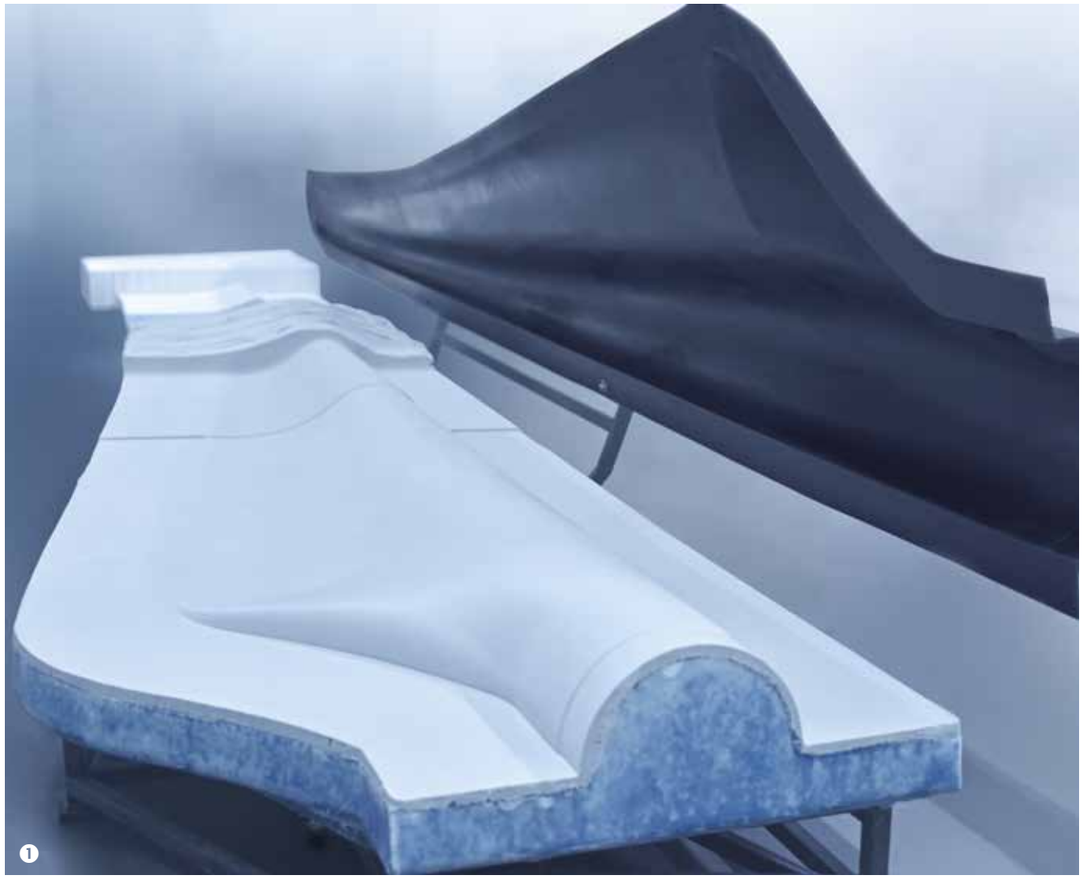


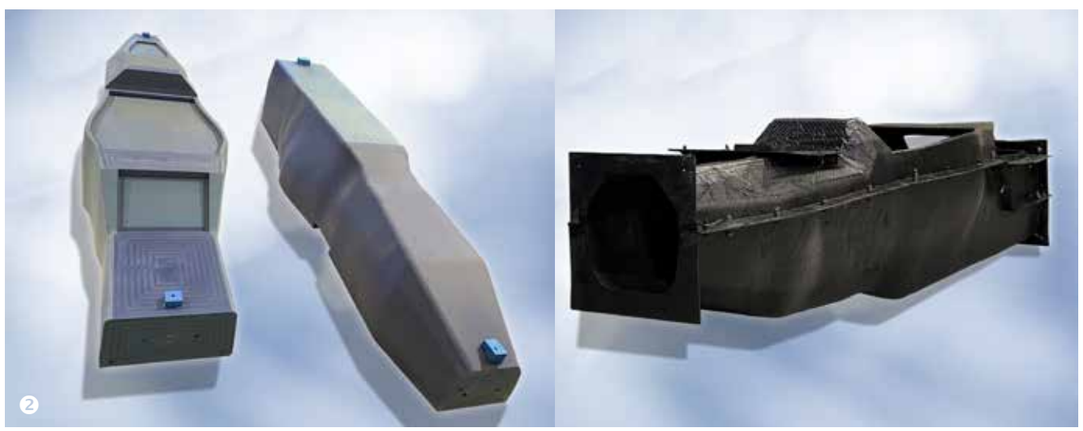

### RTM (RESIN TRANSFER MOLDING)



# **RAKU® TOOL** in action

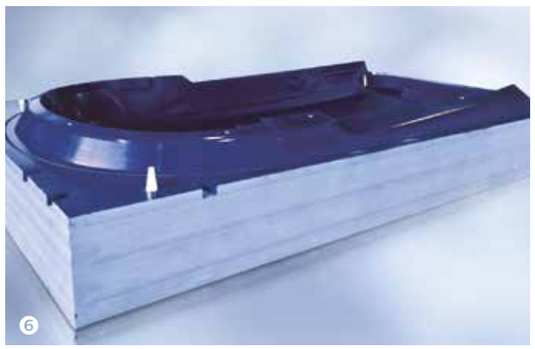
Product and solution examples from the marine, wind energy, automotive, and motorsport industries.










❶ Wind blade master model made from RAKU® TOOL CP-6060 to produce a lay-up tool for wind blade manufacture

❷ Master model made from RAKU® TOOL CC-6503 Close Contour Casting for student formula racing car – carbon fiber part for monocoque

❸ Master model made from RAKU® TOOL CC-6503 Close Contour Casting to produce a lay-up tool with low-temperature tooling prepregs

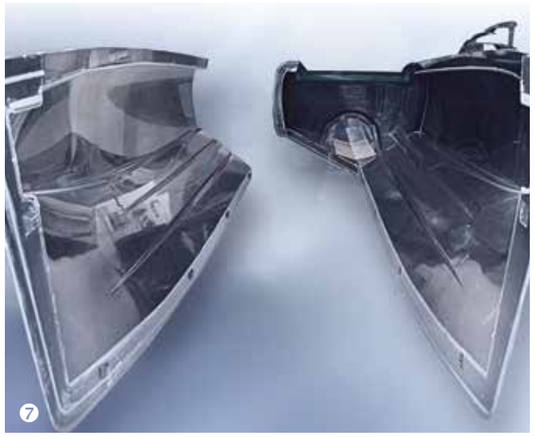
❹ Master model made from RAKU® TOOL CC-6503 Close Contour Casting to produce a prepreg lay-up tool for the manufacture of an airplane silencer

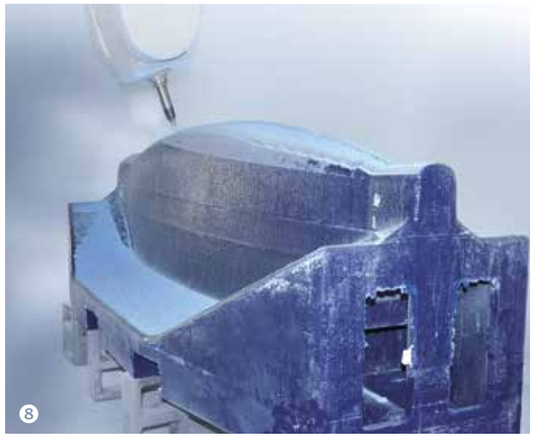
❺ Production mold made from RAKU® TOOL WB-1404 board and fiber reinforced light weight part made from RAKU® TOOL EI-2500 / EH-2970-1 epoxy resin infusion

❻ Mold made from RAKU® TOOL CC-6503 Close Contour Casting for the production of carbon fiber parts via RTM

# **RAKU® TOOL** in action

Product and solution examples from the marine, wind energy, automotive, and motorsport industries.





❼ Production mold for boat hull produced via resin infusion (gelcoat RAKU® TOOL EG-2104 / EH-2950-1 resin infusion EI-2500 / EH-2973)

❽ Milling of master model from RAKU® TOOL CC-6503 Close Contour Casting

❾ Vacuum clamping fixture made from RAKU® TOOL MB-0600 board

# RAMPF #DiscoverTheFuture

We have been developing and manufacturing reactive resin systems based on polyurethane, epoxy, silicone, and silane-modified polymers – for more than four decades.

Our portfolio includes
> Sealing systems, electro and engineering casting resins, edge and filter casting resins, and adhesives
> Board and liquid materials for model and mold engineering
> Chemical solutions for the manufacture of customized recycled polyols based on polyurethane, PET, and PIR residues

Our products and solutions are used globally and in a wide range of industries – from automotive and electromobility, electrics/electronics, and white goods to aerospace, foundry, furniture, and mattresses.

We conserve resources and protect our environment, both in the development of our chemical products and in their manufacture and recycling. Together with our customers and partners, we are working towards a successful and sustainable future.

**Chemical and Engineering Solutions**

Advanced Polymers | Composite Solutions | Machine Systems | Production Systems

**RAMPF** Advanced Polymers is a company of the international RAMPF Group.

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## RAKU® TOOL Composite Product Recommendations

| Resin | Hardener | Pot life at 25 °C (min) | ISO 75 (°C) | Key Properties | hand/ wet lay-up | vacuum bagging/ wet lay-up | resin infusion | vacuum bagging/ prepreg (out of autoclave) | autoclave process | wet com-pression molding | RTM | galvano bath models |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 60 min / 180 min / 360 min | | | | | | | | | | |
| **RAKU® TOOL Epoxy Gelcoat Systems (250 ml)** | | | | | | | | | | | | |
| EG-2100 | EH-2901-2 | 15–20 min | 60–65 °C | can be sanded and polished | | | | | | | | |
| | EH-2950-1 | 30–35 min | 95–100 °C | can be sanded and polished, good interlayer adhesion, even with gelation over night | | | | | | | | |
| EG-2101 | EH-2901-2 | 30–35 min | 55–60 °C | can be sanded and polished, good covering power, good machinability | | | | | | | | |
| | EH-2950-1 | 50–60 min | 88–93 °C | | | | | | | | | |
| EG-2102 | EH-2901-2 | 25–30 min | 60–65 °C | abrasion and chemical resistant | | | | | | | | |
| | EH-2950-1 | 50–60 min | 95–100 °C | | | | | | | | | |
| EG-2104 | EH-2950-1 | 35–45 min | 100–105 °C | can be polished to a high gloss | | | | | | | | |
| EG-2105 | EH-2950-1 | 40–50 min | 125–130 °C | excellent styrene resistance, can be polished to a high gloss | | | | | | | | |
| EG-2107 | EH-2950-1 | 70–90 min | 180–190 °C | high temperature applications | | | | | | | | |
| **RAKU® TOOL Epoxy Coupling Layer (500 ml)** | | | | | | | | | | | | |
| EL-2209-2 | EH-2950-1 | 20–30 min | 100–105 °C | ready-made coupling layer, excellent interlayer adhesion | | | | | | | | |
| **RAKU® TOOL Epoxy Laminating Systems (500 ml)** | | | | | | | | | | | | |
| EL-2200 | EH-2900 | 70–90 min | 48–53 °C | viscosity 1000–1300 mPa·s, multipurpose, laminating and back filling resin | | | | | | | | |
| EL-2201 | EH-2904-1 | 25–30 min | 55–60 °C | viscosity 700–1100 mPa·s, high mechanical properties at room temperature cure | | | | | | | | |
| | EH-2905-1 | 60–70 min | 53–58 °C | | | | | | | | | |
| | EH-2906-1 | 120–140 min | 50–55 °C | | | | | | | | | |
| EL-2203 | EH-2952-1 | 50–60 min | 115–120 °C | viscosity 400–700 mPa·s, low-viscosity, excellent wetting properties, good gelation at room temperature | | | | | | | | |
| | EH-2953-1 | 70–80 min | 115–120 °C | | | | | | | | | |
| **RAKU® TOOL Epoxy Casting Systems (1000 ml)** | | | | | | | | | | | | |
| EC-2404 | EH-2952-1 | 100–120 min | 115–120 °C | high temperature resistance, easy to cast | | | | | | | | |

= mold = model = part

**Temperature resistance**

| 50–80 °C | 80–120 °C | 120–160 °C | 160–200 °C |
|---|---|---|---|

## RAKU® TOOL Composite Product Recommendations

| Resin | Hardener | Pot life at 25 °C (min) | ISO 75 (°C) | Key Properties | hand/ wet lay-up | vacuum bagging/ wet lay-up | resin infusion | vacuum bagging/ prepreg (out of autoclave) | autoclave process | wet compression molding | RTM | galvano bath models |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 60 min / 180 min / 360 min | | | | | | | | | | |
| **RAKU® TOOL Epoxy Infusion Systems (500 ml)** | | | | | | | | | | | | |
| EL-2203 | EH-2970-1 | 50–60 min | 115–120 °C | low-viscosity 400–600 mPa·s, no out gassing under vacuum, excellent wetting and flow properties, good cure at room temperature | | | ■ ▲ | ■ | ■ | ▲ | ▲ | |
| EI-2500 | EH-2953-1 | 60–80 min | 110–115 °C | RTM injection system for medium to large parts | | ■ ▲ | ■ ▲ | | | | ▲ | |
| EI-2500 | EH-2970-1 | 50–60 min | 110–115 °C | low-viscosity 500–1000 mPa·s, no out gassing under vacuum, excellent wetting and flow properties | | ■ ▲ | ■ ▲ | ■ | ■ | | ■ ▲ | |
| EI-2500 | EH-2971 | 70–80 min | 100–110 °C | low-viscosity 300–700 mPa·s, no out gassing under vacuum, excellent wetting and flow properties | | ■ ▲ | ■ ▲ | ■ | ■ | | ■ ▲ | |
| EI-2500 | EH-2973 | 70–80 min | 133–138 °C | Medium temperature applications, low viscosity 300–700 mPa·s, no out gassing under vacuum, excellent wetting and flow properties | | ■ ▲ | ■ ▲ | ■ | ■ | | ▲ | |
| EI-2504 | EH-2974 | 210–270 min | 160–165 °C | viscosity 550–750 mPa·s, high temperature applications, prepreg lay-up tools | | | ■ ▲ | ■ | ■ | | | |
| **RAKU® TOOL Epoxy Laminating Paste Systems (500 ml)** | | | | | | | | | | | | |
| EL-2207-3 | EH-2907-3 | 30–35 min | 60–65 °C | laminating paste, layer thickness 15 mm | ■ | ■ | | | | | | ■ |
| EL-2207-3 | EH-2912 | 80–100 min | 58–63 °C | laminating paste, layer thickness 15 mm and lower exothermic than with EH-2907-3 | ■ | ■ | | | | | | ■ |
| **RAKU® TOOL Epoxy Close Contour Pastes (machine applied) (1000 ml)** | | | | | | | | | | | | |
| CP-6060 R | CP-6060 H | 30–40 min | 60–65 °C | ca. 0.6 g/cm³, gray, modeling paste, specially suited for large parts | ■ | ■ | ■ | ■ | ■ | | | |
| CP-6070 R | CP-6070 H | 30–40 min | 70–75 °C | ca. 0.75 g/cm³, brown, modeling paste | ■ ■ | ■ ■ | ■ ■ | ■ | ■ | | | |
| CP-6070 R | CP-6072 H | 50–60 min | 60–65 °C | ca. 0.75 g/cm³, brown, modeling paste, less shrinkage than with CP-6070 hardener | | | | | | | | |
| CP-6083 R | CP-6083 H | 50–60 min | 80–85 °C | ca. 0,85 g/cm³, gray, dimensionally stable models and molds with a fine, homogeneous and seamless surface for all part sizes. | ■ ■ | ■ ■ | ■ ■ | ■ | ■ | | | |
| CP-6083 R | CP-6084 H | 60–70 min | 85–90 °C | ca. 0,85 g/cm³, gray, dimensionally stable models and molds with a fine, homogeneous and seamless surface for all part sizes, less shrinkage than with CP-6083 hardener. | | | | | | | | |

■ = mold ■ = model ▲ = part

**Temperature resistance**

| 50–80 °C | 80–120 °C | 120–160 °C | 160–200 °C |
|---|---|---|---|



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discover the future

## RAKU® TOOL Composite Product Recommendations

| Resin | Hardener | Density (g/cm³) ca. | ISO 75 (°C) | Key Properties | hand/ wet lay-up | vacuum bagging/ wet lay-up | resin infusion | vacuum bagging/ prepreg (out of autoclave) | autoclave process | wet compression molding | RTM | galvano bath models |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RAKU® TOOL Boards** | | | | | | | | | | | | |
| SB-0240 | Apricot | 0.24 g/cm³ | 60–70 °C | very simple molds for laminating | ■ | ■ | | | | | | |
| SB-0351 | Apricot | 0.35 g/cm³ | 65–75 °C | very simple molds for laminating, optimized compressive strength | ■ | ■ | | | | | | |
| SB-0470 | Apricot | 0.47 g/cm³ | 75–80 °C | simple molds for laminating | ■ | ■ | ■ | | | | | |
| MB-0600 | Brown | 0.60 g/cm³ | 70–75 °C | models, molds for laminating | ■ | ■ | ■ | | | ■ | ■ | |
| MB-0670 | Brown | 0.67 g/cm³ | 75–80 °C | models, molds for laminating, low coefficient of thermal expansion | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| MB-0720 | Brown | 0.72 g/cm³ | 75–80 °C | high quality models, molds for laminating, low coefficient of thermal expansion | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| WB-0691 | Blue | 0.69 g/cm³ | 100–110 °C | epoxy board, lay-up tools for low temperature prepreg | | | | ■ | ■ | | | |
| WB-0700 | Light green | 0.70 g/cm³ | 130–140 °C | epoxy board, prepreg lay-up tools, low linear coefficient of thermal expansion | | | | ■ | ■ | | | |
| WB-0890 | Dark blue | 0.89 g/cm³ | 100–110 °C | epoxy board, lay-up tools for low temperature prepregs, very fine surface structure, good dimensional stability | | | | ■ | ■ | | | |
| WB-1404 | Olive | 1.40 g/cm³ | 75–80 °C | can be polished to a high gloss, good impact strength, good styrene resistance | ■ | ■ | ■ | | | ■ | ■ | |
| WB-1700 | Dark gray | 1.70 g/cm³ | 120–125 °C | can be polished to a high gloss, chemical resistant | | | | ■ | ■ | ■ | ■ | |
| **RAKU® TOOL Close Contour Casting (CCC) / Close Contour Blocks (CB)** | | | | | | | | | | | | |
| CC/CB-6010 | Brown | 0.80 g/cm³ | 75–80 °C | models, molds for laminating, high compressive strength | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| CC/CB-6503 | Blue | 1.85 g/cm³ | 80–85 °C | dense structure, galvano bath models | | | ■ | ■ | ■ | | | ■ |
| CC/CB-6506 | Dark gray | 1.90 g/cm³ | 110–115 °C | can be polished to a high gloss, chemical resistant, lay-up tools for low temperature prepreg, linear coefficient of thermal expansion | | | | ■ | ■ | ■ | ■ | |
| CC/CB-6507 | Olive | 1.40 g/cm³ | 75–80 °C | can be polished to a high gloss, good impact strength, good styrene resistance | ■ | ■ | ■ | | | ■ | ■ | |
| CB-6700 | Light green | 0.70 g/cm³ | 130–140 °C | epoxy material, prepreg lay-up tools, low linear coefficient of thermal expansion | | | | ■ | ■ | | | |

The mechanical properties and temperature resistance are only obtained through the post cure according to the recommended cure schedule.

For physical and mechanical properties please refer to the individual product technical data sheets.

■ = mold ■ = model ■ = part

**Temperature resistance**

| 50–80 °C | 80–120 °C | 120–160 °C | 160–200 °C |
|---|---|---|---|

3-3-005/13EN; Sheet 2 of 2. Errors excepted. Subject to change.

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