

# Technical Data Sheet

## EPIKOTE™ Resin MGS BPR 135G-Series and EPIKURE™ Curing Agent MGS BPH 134G-137GF

### Application

Adhesive EPIKOTE™ MGS™ BPR 135G-Series is a solvent free epoxy based bonding paste with a wide range of applications. It is suitable for bonding laminates and wood and appropriately metallic and mineral components.

### Specifications

Property	Unit	Resin BPR 135G3	Resin BPR 135G25	Resin BPR 135G2
Colour		yellow	white	white
Density <sup>1)</sup>	g/cm <sup>3</sup>	1,2 – 1,3	1,15 – 1,25	1 – 1,2
Viscosity <sup>3)</sup>	Pa·s	30 – 50	25 – 35	15 – 20

Property	Unit	Curing Agent BPH 1340G	Curing Agent BPH 134G	Curing Agent BPH 1355G
Colour		red	red	red
Density <sup>1)</sup>	g/cm <sup>3</sup>	1,05 – 1,15	1,05 – 1,15	1,05 – 1,15
Viscosity <sup>3)</sup>	Pa·s	10 – 20	10 – 20	10 – 20
Pot life <sup>2)</sup>	Pa·s	15 – 45	10 – 35	25 – 65

Property	Unit	Curing Agent BPH 135G	Curing Agent BPH 136G	Curing Agent BPH 137G	Curing Agent BPH 137GF
Colour		red	blue	blue	blue
Density <sup>1)</sup>	g/cm <sup>3</sup>	1,05 – 1,15	1,05 – 1,15	1,05 – 1,15	1,05 – 1,15
Viscosity <sup>3)</sup>	Pa·s	10 – 20	10 – 20	10 – 20	10 – 20
Pot life <sup>2)</sup>	Pa·s	45 – 90	90 – 160	130 – 200	130 – 210

The pot life measurement is a test to evaluate the quality of a product under constant conditions. Different local factors like humidity, temperature or mass of the applied material, time of exposure to atmosphere (and others) are directly influencing the material properties (processing and mechanical). To operate successfully the production parameters have to be determined individually by the user.

Measuring conditions:

- 1) measured at 25°C
- 2) 100g mixture of BPR 135G3 and particular hardener in water bath at 30°C
- 3) plate-to-plate rheometer, gap 0.5mm, 25°C, shear rate 100 s<sup>-1</sup>

BPR 135G2 with all curing agents

Density<sup>1)</sup> (mixed) 1,05 – 1,15

Density<sup>1)</sup> (cured) 1,10 – 1,20

BPR 135G3 with all curing agents

Density<sup>1)</sup> (mixed) 1,15 – 1,25

Density<sup>1)</sup> (cured) 1,20 – 1,30

Measuring conditions:

- 1) measured at 25°C

### Characteristics

Approval	DNV-GL SE (Germanischer Lloyd) Secondary bonding of FRP to FRP and various materials.
Application	Production of rotor blades for wind energy plants, shipbuilding, sporting goods, moulds and other devices.
Operational temperature	-60°C up to +50°C without heat treatment -60°C up to +80°C with heat treatment
Processing	Generally process temperatures between 10°C – 50°C, depending on individual production conditions.
Features	fills gaps of up to approx. 30 mm without sagging, good sag resistance at elevated temperature
Storage	Shelf life of at least 24 months in originally sealed containers

## Bond lines

Bond line thickness control is important for any structural adhesive joint application to obtain consistent and optimal adhesive joint properties. For larger parts, such as found in boat and wind turbine blade production, bond line thicknesses of 1-10 mm are generally targeted. Due to the glass fibre in the 135G bonding paste system, improved fatigue properties, higher cohesive strengths and lower exotherms, have been observed. In applications where bond line thicknesses may be greater than 10 mm the effects of higher exotherm temperatures and lower adhesive joint properties should be evaluated.

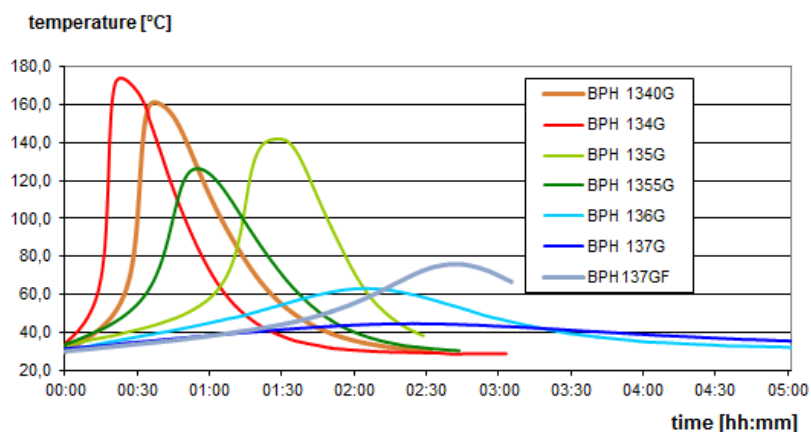
## Bonding Paste Systems

All the bonding paste resins (EPIKOTE™ Resin MGS™ BPR 135G2, 135G25, 135G3) can be processed with the following specially modified curing agents:

EPIKURE™ Curing Agent MGS™ BPH 134G	very fast curing agent
EPIKURE™ Curing Agent MGS™ BPH 1340G	very fast curing agent
EPIKURE™ Curing Agent MGS™ BPH 1355G	fast curing agent
EPIKURE™ Curing Agent MGS™ BPH 135G	medium curing agent
EPIKURE™ Curing Agent MGS™ BPH 136G	slow curing agent
EPIKURE™ Curing Agent MGS™ BPH 137G	very slow curing agent
EPIKURE™ Curing Agent MGS™ BPH 137GF	very slow curing agent with fast Tg-development

## Temperature Development

Development of temperature BPR 135G3



Measuring conditions: measured 100g in a paper cup with a lid isolated in a water bath at 30°C starting at 30°C

EPIKOTE Resin MGS BPR 135G-Series and EPIKURE Curing Agent MGS BPH 134G-137GF  
<https://www.hexion.com/en-US/product/-archive-epikote-resin-mgs-bpr-135g-series-and-epikure-curing-agent-mgs-bph-134g-137gf>

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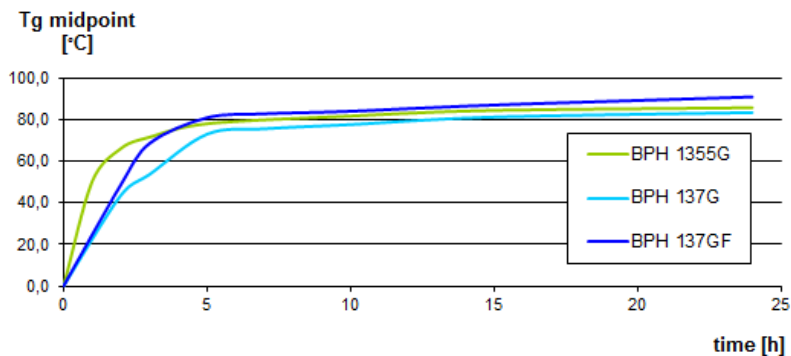
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The optimum processing (mixing) temperature is in the range of 20°C to 30°C. Higher temperatures are possible, but will shorten pot life. A temperature increase of 10°C will halve the pot life. Water (e.g. high humidity or contained in additional fillers) causes an acceleration of the resin/ curing agent reaction. Different temperatures and humidity during processing are not known to have significant impact on the mechanical properties of the cured product.

Do not mix large quantities – particularly of highly reactive systems – at elevated processing temperatures. As the heat dissipation in the mixing container is very slow, the contents will be heated up by the reaction heat (exothermic resin-curing agent reaction) rapidly. This can result in temperatures of more than 200°C in the mixing container, which may cause smoke-intensive burning of the resin mass.

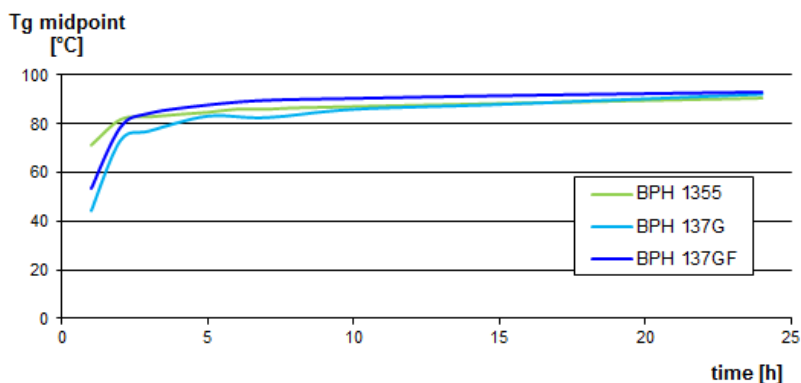
## TG DEVELOPMENT

Development of the glass transition temperature



Measuring conditions:

Curing: in oven at 70°C  
DSC-measuring heat rate: 10 K/min



Measuring conditions:

Curing: in oven at 80°C  
DSC-measuring heat rate: 10 K/min

## Applying & Curing

The recommended temperature for mixing and application is around 20 - 30°C. In general the part surface temperature should be <35°C when bonding paste is applied, depending on gap thickness and resin type, however higher surface temperatures can be possible. In any case, detailed processing tests are recommended. All excess bonding paste should be removed from the bond lines before cure. Parts should be heated at a slow rate (e.g. < 1°C/ minute) to minimize internal stresses during the curing process, see the table below. For thick bond lines (typically > 10 mm) a stepped cure may be necessary to avoid temperature excursions due to exothermic reaction of the bonding paste.

In parts with thick bond lines, temperatures at the centre of the bonding paste can be measured to help design/ define the cure profile to optimize manufacturing efficiency and adhesive performance.

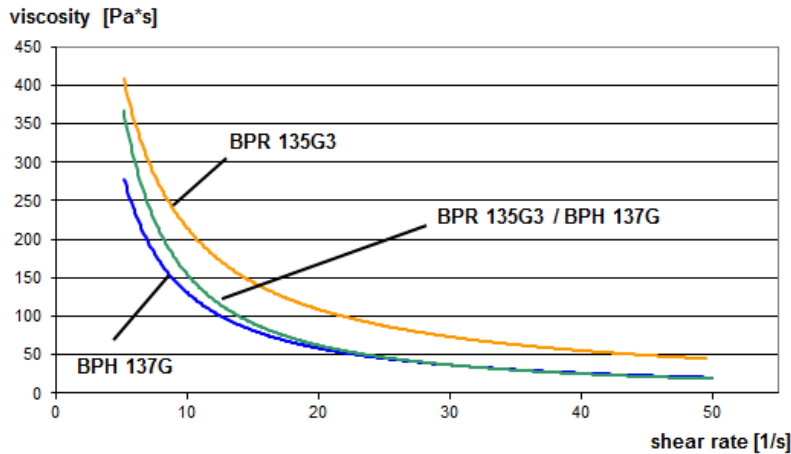
Gap thickness	Part surface temperature when applying bonding paste	Suggested cure schedule
< 10 mm	up to cure temperature	1. ramp at < 1°C/minute 2. hold at ~ 75°C for 4 hrs 3. cool to ambient at < 1°C/minute
10 – 20 mm	< 40°C	1. ramp at < 1°C/minute 2. hold at ~ 50°C at 1 hr 3. ramp at < 1°C/minute 4. hold at ~ 75°C for 4 hrs 5. cool to ambient at < 1°C/minute
20 – 30 mm	< 35°C	1. ramp at < 0.5°C/minute 2. hold at ~ 50°C at 1 hr 3. ramp at < 1°C/minute 4. hold at ~ 75°C for 4 hrs 5. cool to ambient at < 1°C/minute.

The information in the table is just a basic recommendation and can't replace processing tests based on the specific conditions at usage.

## FLOW CURVE

Flow curve (Viscosity as a function of shear rate)

BPR 135G3 with curing agent BPH 137G



Measuring conditions:

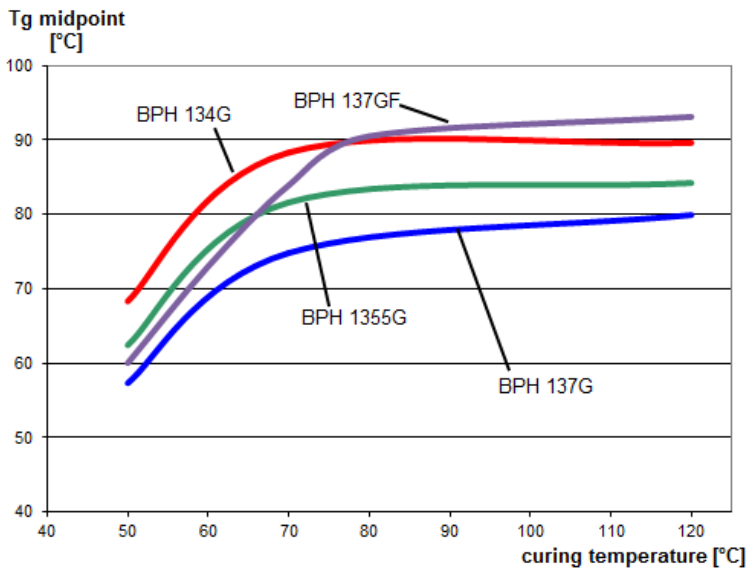
Shear rate: variable

Temperature: 25°C

Physica MC1, plate-plate configuration

## GLASS TRANSITION TEMPERATURE

Development of the glass transition temperature



Measuring conditions:

Curing: in oven for 10 hours at different temperatures  
 DSC-measuring heat rate: 10 K/min  
 Diagram states Tg midpoint

## Mechanical Data

Mechanical data				
lap shear strength [N/mm <sup>2</sup> ] DIN EN ISO 1465	bonding gap			
Curing: 7h/70°C at standard climate	0,5 mm approx 24,0	3 mm approx 15,0		
Peel strength [N/mm] DIN EN ISO 11339	2,8			
Curing: 7h/70°C				
tensile test DIN EN ISO 527	Tg midpoint [°C]	tensile strength [MPa]	tensile modulus [MPa]	ultimate strain [%]
Curing: 10h/70°C	81	75	5500	2,9
bending test DIN EN ISO 178	Tg midpoint [°C]	bending strength [MPa]	bending modulus [MPa]	ultimate strain [%]
Curing: 10h/70°C	81	110	5300	2,7

Advice:

Mechanical data is typical for the combination of EPIKOTE™ Resin MGS™ BPR 135G3 with EPIKURE™ Curing Agent MGS™ BPH 137G/137GF. Data can differ in other applications.

## Paste Application – Sagging / Vertical Gaps

The system is particularly suitable for vertical surfaces and wide gaps and is designed not to sag at typical cure temperatures. The bonding paste does not bleed out of vertical gaps even if the parts are immediately cured.

Bonding Paste Resins

EPIKOTE™ Resin MGS™ BPR 135G2 paste thickness up to app. 5 mm

EPIKOTE Resin MGS BPR 135G-Series and EPIKURE Curing Agent MGS BPH 134G-137GF

<https://www.hexion.com/en-US/product/~archive-epikote-resin-mgs-bpr-135g-series-and-epikure-curing-agent-mgsbph-134g-137gf>

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EPIKOTE™ Resin MGS™ BPR 135G25 paste thickness up to app. 15 mm

EPIKOTE™ Resin MGS™ BPR 135G3 paste thickness up to app. 30 mm

## MIXING

Adding more or less curing agent outside the permissible tolerance range will not speed up or slow down the reaction rate (gel time) – it will cause incomplete curing of the bonding paste which cannot be corrected in any way by reworking. The resin and curing agent components are thick and must be mixed very thoroughly. Mix until no clouding is visible in the mixing container. The different colours of the resin and curing agent components facilitate visual verification. Pay special attention to the walls and the bottom of the mixing container. Manual mixing of larger quantities of resin and curing agent is very difficult due to the high viscosity of the components. In order to guarantee good mixing of large volumes in production, the use of suitable mixing machines is essential.

## Mixing Ratio

	BPR 135G with all curing agents
Parts by weight	100 : 45 ± 2
Parts by volume	100 : 50 ± 2

The mixing ratio stated must be observed very carefully. Adding more or less curing agent will not result in a faster or slower reaction, but in incomplete curing which cannot be corrected in any way.

Resin and curing agent must be mixed very thoroughly. Mix until no clouding is visible in the mixing container. Pay special attention to the walls and bottom of the mixing container.

## Surface Preparation

Direct application to non-porous material surfaces is possible. Porous, absorbent surfaces should be primed with a liquid resin mix (e.g. laminating resin MGS™ LR135 with curing agents MGS™ LH133-138). The bonding paste can then be applied either immediately or following slight gelling. Priming with bonding paste is not recommended.

## Storage

The resins and curing agents can be stored for at least 24 months in the carefully sealed original containers. The products do not crystallize at storage temperatures between 10°C and 30°. At storage temperatures above 30°C, some liquid formation may be observed for the curing agents, which is a natural phenomenon for pastes. Liquid formation will increase with storage time and storage temperature.