

EPIKOTE™ Resin MGS® LR 285

EPIKURE™ Curing Agent MGS® LH 285, 286, 287

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Approval	German Federal Aviation Authority
Application	production of gliders, motor gliders and motor planes, boat and shipbuilding, sports equipment, model airplanes, moulds and tools
Operational temperature	-60 °C up to +50 °C (-76 °F up to 122 °F) without heat treatment -60 °C up to +80 °C (-76 °F up to 176 °F) after heat treatment
Processing	at temperatures between 10 °C and 50 °C (50-122 °F) all usual processing methods
Features	extremely good physiological compatibility, good mechanic and thermic properties, pot life of approx. 45 min. to approx. 4 hours
Special modifications	LR 285 T: thixotropic LR 285 W: white
Storage	shelf life of 24 month in originally sealed containers

Characteristics

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May, 2006

EPIKOTE™ Resin MGS® LR 285

Laminating resin system approved by the **GERMAN FEDERAL AVIATION AUTHORITY** with different pot lives for processing of glass, carbon and aramide fibres, featuring high static and dynamic loadability.

After heat treatment at 50 - 55 °C (122-131 °F), the system meets the standards for gliders and motor gliders (operational temperatures -60°C (-76°F) to +54°C (129 °F). In order to meet the standards for motor planes (operational temperatures -60°C (-76 °F) to +72 °C (161 °F), heat treatment at 80 °C (176 °F) is necessary.

The range of pot lives is between approx. 45 min and 4 h. The hardeners have the same mixing ratio and can be mixed among themselves in any ratio. This permits a selection of the optimum system for all processing methods. After initial curing at room temperature, the components manufactured are workable and demouldable. You will receive high-gloss and non-tacky surfaces, even with unfavourable precuring conditions, e. g. lower temperatures or high humidities.

The mixing viscosity guarantees fast and complete impregnation of the reinforcement fibres; however, the resin will not spill out of the fabrics on vertical surfaces. In order to obtain special properties, it is also possible to add fillers to the mixture of resin/hardener, such as Aerosil, microballoons, cotton flakes, metal powder, etc.

If high heat resistance or aircraft approval are not necessary, hardener LH 285 can also be used without heat treatment afterwards. However, the indicated properties will only be obtained after heat treatment at temperatures over 50 °C (122 °F).

As a matter of experience LR 285 can be combined with suitable gelcoats on UP, PU and EP basis.

Although our resin systems are very unlikely to crystallize at low temperatures, storage conditions of 15-30 °C (59-86 °F) and low humidity are recommended. After dispensing material, the containers must again be closed carefully, to avoid contamination or absorption of water. All amine hardeners show a chemical reaction when exposed to air, known as „blushing“. This reaction is visible as white carbamide crystals, which could make the materials unusable.

Crystallization is visible as a clouding or solidification of the contents of the container. If crystallisation of either component should be observed, it can be removed by warming up. Slow warming up to approx. 50-60 °C (122-140 °F) in a water bath or oven and stirring or shaking will clarify the contents of the container without any loss of quality. Use only completely transparent products. Before warming up, open containers slightly to permit equalization of pressure. Caution during warm-up! Do not warm up over an open flame! While stirring up use safety equipment (gloves, eyeglasses, gas mask).

Since the approval of laminating resin LR 285 in 1985, it has been used by nearly all manufacturers of planes and gliders and - especially because of the extremely good physiological compatibility - it is the most commonly used system in the aircraft industry today. It often happens that workers who have experienced problems with some epoxy resins concerning allergies or skin irritation are able to process laminating resin LR 285.

The relevant industrial safety regulations for the handling of epoxy resins and hardeners and our instructions for safe processing are to be observed.

Application

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EPIKOTE™ Resin MGS® LR 285

Specification

		Laminating resin LR 285
Density	[g/cm ³]	1,18 - 1,23
Viscosity	[mPas]	600 - 900
Epoxy equivalent	[g/ equivalent]	155 - 170
Epoxy value	[equivalent /100g]	0,59 - 0,65
Refractory index		1,525 - 1,5300

Measuring conditions:

measured at 25 °C / 77 °F

		Hardener LH 285	Hardener LH 286	Hardener LH 287
Density	[g/cm ³]	0,94 - 0,97	0,94 - 0,97	0,93 - 0,96
Viscosity	[mPas]	50 - 100	60 - 100	80 - 120
Amine value	[mg KOH/g]	480 - 550	450 - 500	450 - 500
Refractory index		1,5020 - 1,5500	1,4995 - 1,5100	1,4950 - 1,4990

Measuring conditions:

measured at 25 °C / 77 °F

	Resin LR 285	Hardener LH 285	Hardener LH 286	Hardener LH 287
Average EP - Value	0,62	-	-	-
Average amine equivalent		64	64	64

Processing details

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EPIKOTE™ Resin MGS® LR 285

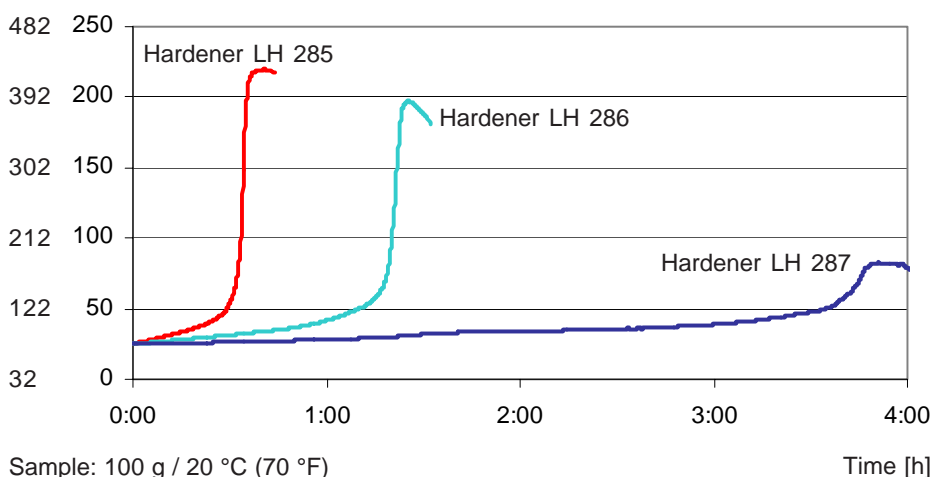
	Laminating resin LR 285: Hardeners LH 285, 286, 287
Parts by weight	100 : 40 ± 2
Parts by volume	100 : 50 ± 2

Mixing ratios

The mixing ratio stated must be observed carefully. Adding more or less hardener will not result in a faster or slower cure, but in incomplete curing with limited performance, that can not be corrected in any way.

Resin and hardener must be mixed carefully. Mix until no clouding is visible in the mixing container. Special attention must be paid to the walls and bottom of the mixing container.

[°F] [°C] Temperature



Temperature development

The optimum processing temperature is in the range between 20 and 40°C. Higher processing temperatures are possible, but will shorten pot life. An increase in temperature of 10°C will halve the pot life. Water (for example very high humidity or contained in fabrics or fillers) causes an acceleration of the resin / hardener reaction. Different temperatures and humidities during processing have no significant effect on the mechanical properties of the cured product.

	Resin LR 285 Hardener LH 285	Resin LR 285 Hardener LH 286	Resin LR 285 Hardener LH 287
68 - 77 °F 20 - 25 °C	app. 2-3 hours	app. 3-4 hours	app. 5-6 hours
104 - 113 °F 40 - 45 °C	app. 45-60 min	app. 60-90 min	app. 80-120 min

Gel time

Film thickness 1 mm at different temperatures

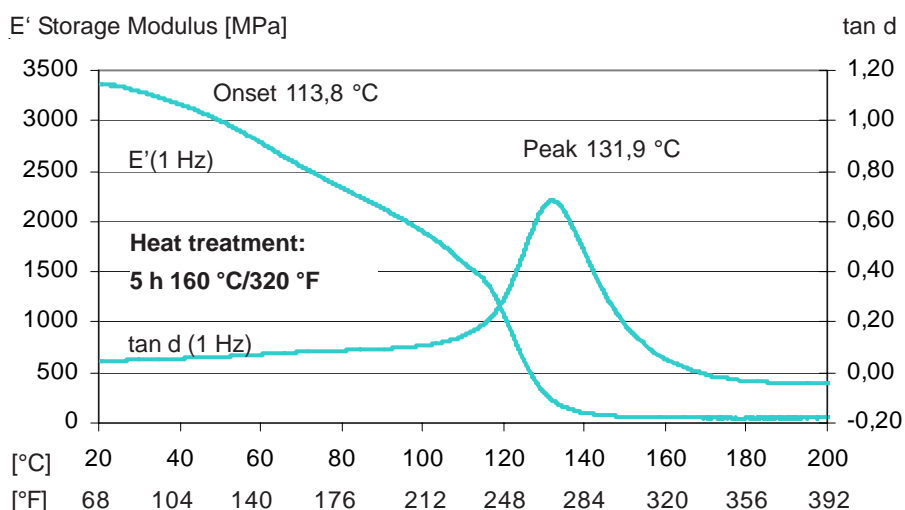
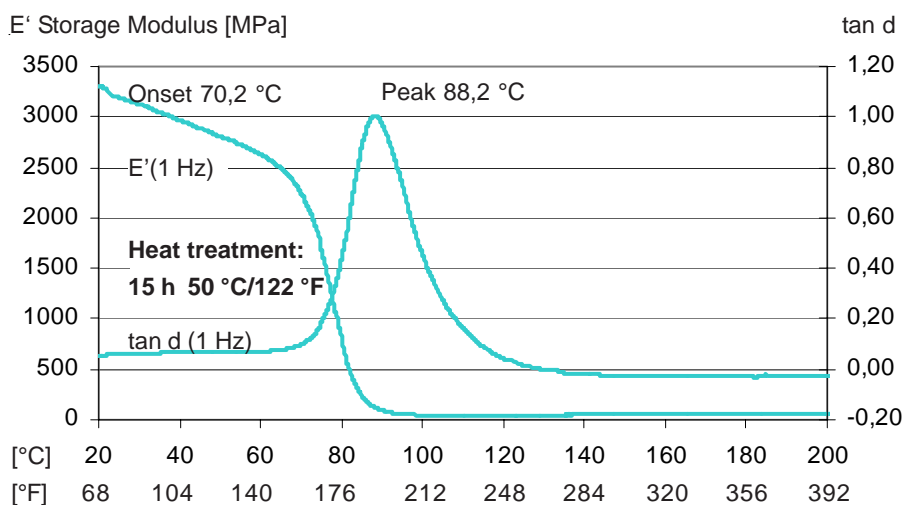
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EPIKOTE™ Resin MGS® LR 285

DMA - T_g (peak) tan delta laminating resin LR 285 with hardener LH 286 measuring after heat treatment

DMA



Measurement conditions

Coupon thickness: 2 mm
 Heating rate: 2 K/min
 Frequency: 1 Hz

	Hardener LH 285	Hardener LH 286	Hardener LH 287
unconditioned	176-185 °F 80-85 °C	185-194 °F 85-90 °C	194-203 °F 90-95 °C
conditioned	149-158 °F 65-70 °C	172-179 °F 78-82 °C	181-190 °C 83-88 °C

T_g conditioned

Sample preparation:

Conditioned at 40 °C (104°F) 90 % rel. humidity

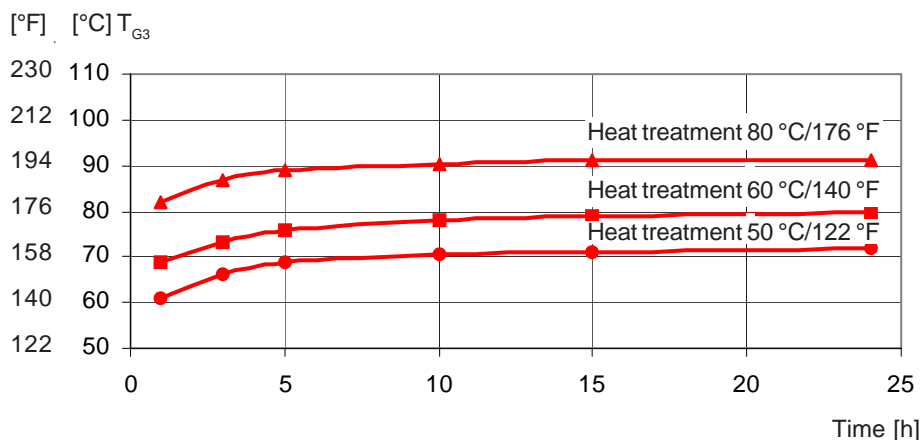
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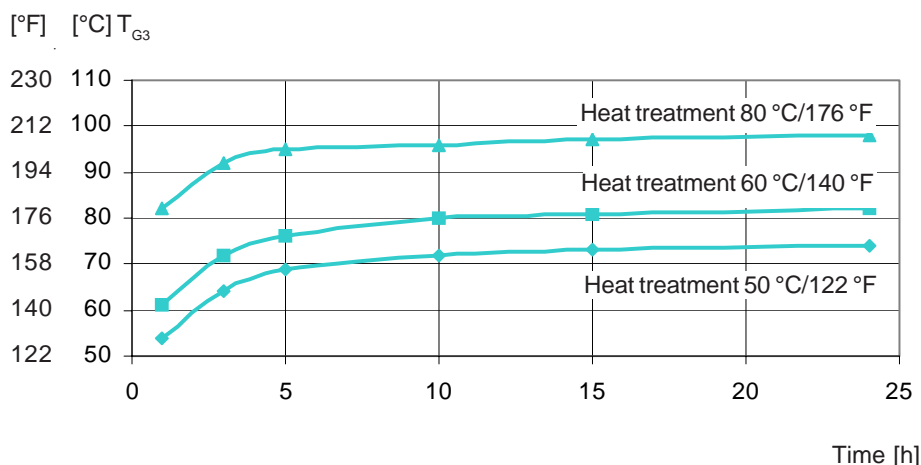
EPIKOTE™ Resin MGS® LR 285

Laminating resin LR 285 Hardener LH 285

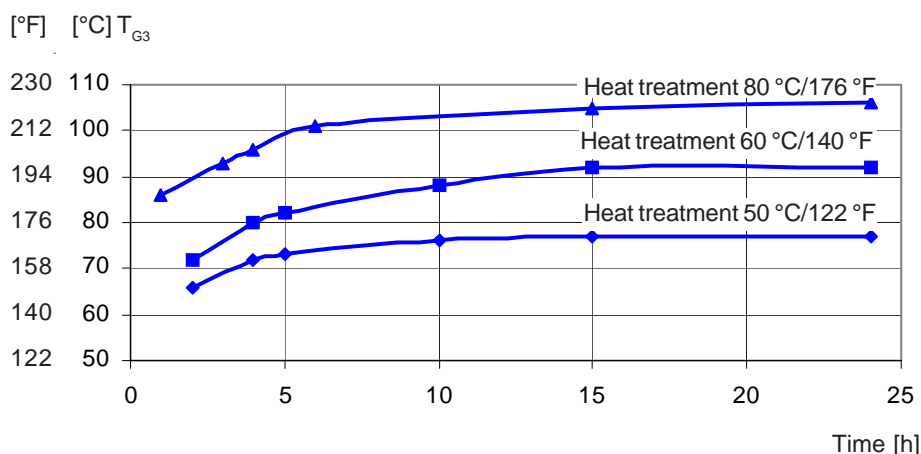
Development of T_g



Laminating resin LR 285 Hardener LH 286



Laminating resin LR 285 Hardener LH 287



Sample preparation:

Initial curing before heat treatment 24 h at room temperature

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EPIKOTE™ Resin MGS® LR 285
Mechanical data

Mechanical data of neat resin		
Density	[g/cm ³]	1,18 - 1,20
Flexural strength	[N/mm ²]	110 - 120
Modulus of elasticity	[kN/mm ²]	3,0 - 3,3
Tensile strength	[N/mm ²]	70 - 80
Compressive strength	[N/mm ²]	120 - 140
Elongation of break	[%]	5,0 - 6,5
Impact strength	[KJ/m ²]	45 - 55
Water absorption at 23°C	24 h [%] 7 d [%]	0,20 - 0,30 0,60 - 0,80
Fatigue strength under reversed bending stresses acc. to DLR Brunsw.	10 % 90 %	> 2 x 10 ⁴ > 2 x 10 ⁶
Curing: 24 h at 23 °C (74 °F) + 15 h at 60 °C (140 °F)		
Typical data according to WL 5.3203 Parts 1 and 2 of the German Aviation Materials Manual.		

Advice:

Mechanical data are typical for the combination of laminating resin LR 285 with hardener LH 287. Data can differ in other applications.

EPIKOTE™ Resin MGS® LR 285**Data of reinforced resin
Static tests in standard climate****Mechanical data**

Reinforced with		GRC Glass fibre	CRC Carbon fibre	SRC Aramide fibre
Flexural strength	[N/mm ²]	510 - 560	720 - 770	350 - 380
Tensile strength	[N/mm ²]	460 - 500	510 - 550	400 - 480
Compressive strength	[N/mm ²]	410 - 440	460 - 510	140 - 160
Interlaminar shear strength	[N/mm ²]	42 - 46	47 - 55	29 - 34
Modulus of elasticity	[kN/mm ²]	20 - 24	40 - 45	16 - 19
<p>GRC samples: 16 layers of glass fabric, 8H satin, 296 g/m² (8.5 oz/sq.yd.), 4 mm (0.16 in) thick</p> <p>CRC samples: 8 layers of carbon fabric, plain, 200 g/m² (5.9 oz/sq.yd.) 2 mm (0.08 in) thick</p> <p>SRC samples: 15 layers of aramide fabric, 4H satin, 170 g/m² (5.0 oz/sq.yd.), 4 mm (0.16 in) thick</p> <p>Fibre content of samples during processing/testing: 40 - 45 vol% Data calculated for fibre content of 43 vol%</p> <p>Typical data according to WL 5.3203 Parts 1 and 2 of the GERMAN AVIATION MATERIALS MANUAL</p>				

Measuring conditions:

Curing: 24 h at 23 °C (74 °F)
+ 15 h at 80 °C (176 °F)