Technical data

Epoxy Resin L

+ Hardener S, L, CL, W 300, GL 1, GL 2

Description

- **Low viscosity (700 ± 70 mPa·s, at 25 °C)**
- **Free of solvents and fillers**
- **Fast impregnation of glass, aramid, and carbon fibres**
- **High static and dynamic strength**

The R&G Epoxy Resin L is a bisphenol A/F resin. The bisphenol F component reduces the viscosity and prevents the resin from forming crystals at low storage temperatures (less than +5 °C).

The resin is diluted with a difunctional compound and is generally regarded as having a good physiological tolerance.
Owing to its low surface tension the system exhibits good filler absorption properties. And it has **excellent wetting properties with respect to reinforcing fibres** of glass, aramid, and carbon.

Application

Fibre composites (GFRP, SFRP, CFRP) in (**ultralight) aircraft construction, model construction, design of sports equipment, mould construction** and **motor sports.**

Processing

The resin is **suitable for all processing methods**, e.g. hand lay-up operations, winding, casting, and press moulding (also in vacuum). Metal, wood, plastics, ceramics, etc., can be joined with high-strength bonds without the application of contact pressure.
Curing takes place virtually free of shrinkage.

The **hardeners** S, L, CL, W 300, GL 1 and GL 2 are formulations of aliphatic and cycloaliphatic amines. They define the properties of the moulded materials.

Epoxy Resin L	Unit	Value
Delivered state	-	liquid
Colour	-	yellowish
Density	g/cm³/23 °C	1.14 ± 0.01
Viscosity	mPa*s/25 °C	700 ± 70
Epoxy value	100/equivalent	0.56
Epoxy equivalent	g/equivalent	179
Chlorine content total	%	< 1
Chlorine content hydrolysable	ppm	< 500
Vapour pressure	mbar/ 25 °C	< 1
Refractive index	n_D 25	1.547
Flash point (ISO 3679)	°C	>150
Storage (sealed, at 15 °C)	months	36

Ausgabe 07/2024, Änderungen vorbehalten

Hardeners for Epoxy Resin L

The hardeners exhibit different processing times so that you can select the one best suited to your needs:

Hardener S (15 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 15 minutes**
- **Free of nonylphenol, benzyl alcohol and DETA**
- **Low viscosity (210 ± 30 mPa·s, at 25 °C)**
- **Curing temperatures from 5 °C**

Application

Modified cycloaliphatic polyamine hardener for small laminates, glued joints, and repairs. Good static and dynamic strength. Fast curing in the thinnest layers as well.

Owing to the high reactivity and the resulting reaction heat, laminates may not be manufactured with a thickness exceeding 5 mm in one working cycle.

Material characteristics (pure resin cured) Epoxy Resin L with Hardener S:

Flexural strength DIN EN ISO 178 in MPa	110
Tensile strength DIN EN ISO 527 in MPa	68
Compressive strength DIN EN ISO 14126 in MPa	116
Initial viscosity ISO 3219 in mPas	880

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Hardener L (40 min)

Description

- **Hardener for Epoxy Resin L**
- **Low viscosity (95-135 mPa•s, at 25 °C)**
- **Processing time 40 minutes**
- **Free of nonylphenol and DETA**
- **Curing temperatures from 8 °C**

Application

Modified cycloaliphatic polyamine hardener for larger laminates, glued joints, and mould construction.
Good static and dynamic strength, fast curing in the thinnest layers as well.

Hardener L is the most frequently used hardener for Epoxy Resin L.
Owing to the high reactivity and the resulting reaction heat, laminates may not be manufactured with a thickness exceeding 8 mm in one working cycle.

Mechanical properties (pure resin cured*) of Epoxy Resin L + Hardener L:

Flexural strength DIN EN ISO 178 in MPa	111
Tensile modulus DIN EN ISO 178 in MPa	2950
Tensile strength DIN EN ISO 527 in MPa	69
Compressive strength DIN EN ISO 14126 in MPa	91
Hardness Shore D	90
Elongation at break DIN EN ISO 178 in %	5.9

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Hardener CL (60 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 60 minutes**
- **Free of nonylphenol and DETA**
- **Low viscosity (70-120 mPa•s, at 25 °C)**
- **Curing temperatures from 15 °C**
- **Tack-free curing even of thin layers**
- **Glass transition temperature (Tg) > 90 °C (post-curing at 70 °C / 15 h)**
- **High static and dynamic strength (equal to Epoxy Resin L 285 with Hardener 285)**

Application

This resin system yields superior impregnating and wetting properties towards carbon, glass, aramid and natural fibres. It is especially suitable for carbon coating of automotive parts.

The resin system is ambient curing and develops no distinctive brittleness even at curing temperatures below 20 °C. We however recommend, to improve the mechanical and physical properties, to perform a post-curing at least at 40 °C over 15 h.

Technical data:

Viscosity at 23°C in mPa*s	70 - 120
Density at 23 °C in g/cm³	0.95 - 0.97
Colour (Gardner)	< 2
H*-equivalent weight in g/Eq	54
Solid content in %	100

Mechanical properties (pure resin cured*) of Epoxy Resin L + Hardener CL :

Flexural test

Flexural strength DIN EN ISO 178 in MPa	137
Surface strain at maximum stress	6.8
Surface strain at maximum stress	7

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Tensile test

Tensile strength (DIN EN ISO 527) in MPa	82.8
Elongation at maximum strain in %	4.9
Elongation at break in %	5.5
Tensile modulus in MPa	3190

Pressure test

Compressive strength (DIN EN ISO 604) in MPa at 6 % compression	111

Shrinkage

Linear shrinkage (DIN EN 12617-1) in %	0.3

Hardener GL 1 (30 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 30 minutes**
- **Free of nonylphenol, benzyl alcohol and DETA**
- **Low viscosity (100 ± 50 mPas, at 25 °C)**
- **Light yellow (Colour index < 5 Gardner)**
- **Fully cures at 10 °C**
- **Glass transition temperature (Tg) > 80 °C (post-curing at 70 °C / 15 h)**
- **Ambient curing does not result in brittleness (at 20 °C)**
- **High static and dynamic strength**

Application

The well-proven R&G Epoxy Resin L in combination with Hardener GL 1 offers an **approval by the Germanische Lloyd** for the construction of boats and rotor blades for wind turbines.

Fast hardener for small components and repairs. Also for accelerating hardener GL. 2

The resin component itself is absolutely free of crystallization due to its Bisphenol A/F base! The resin system is ambient curing and develops no distinctive brittleness even at curing temperatures below 20 °C. We however recommend, to improve the mechanical and physical properties, to perform a post-curing at least at 40 °C over 15 h.

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Hardener GL 2 (210 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 210 minutes**
- **Free of nonylphenol, benzyl alcohol and DETA**
- **Very low viscosity (14 ± 2 mPa·s, at 25 °C)**
- **Extremely low-viscous (Mixing viscosity 250 mPas at 25 °C)**
- **Highly transparent (Colour index (Gardner) < 1)**
- **Fully cures at 15 °C**
- **Glass transition temperature (Tg) > 85 °C (post-curing at 70 °C / 15 h)**
- **Ambient curing does not result in brittleness (at 20 °C)**
- **High static and dynamic strength**

Application

The well-proven R&G Epoxy Resin L in combination with Hardener GL 2 offers an **approval by the Germanische Lloyd** for the construction of boats and rotor blades for wind turbines.

Slow hardener for large components, especially in the vacuum infusion process.

The resin component itself is absolutely free of crystallization due to its Bisphenol A/F base! The resin system is ambient curing and develops no distinctive brittleness even at curing temperatures below 20 °C. We however recommend, to improve the mechanical and physical properties, to perform a post-curing at least at 40 °C over 15 h.

Mixing table with processing times of Epoxy Resin L + mixed Hardeners GL 1/2:

The mixing ratio of 100 : 30 resin to hardener remains unchanged.

Ungefähre Topfzeit in Minuten (100 g Ansatz bei 23 °C mit Epoxidharz L)	**Anteil GL 1 in %**	**Anteil GL 2 in %**
210	0	100
150	10	90
125	20	80
100	30	70
85	40	60
60	50	50
50	60	40
43	70	30
38	80	20
34	90	10
30	100	0

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Hardener W 300 (300 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 300 minutes**
- **Free of nonylphenol, benzyl alcohol and DETA**
- **Niedrige Viskosität (± 300 mPa•s, at 25 °C)**
- **Curing temperatures from 15 °C**
- **Tack-free curing even of thin layers**

Application

Highly transparent hardener with extended pot life. For coatings and thick laminates. Also for casting.

Epoxy resin L with hardener W 300 is a frequently used laminating, coating and casting resin system from the R&G product range. Due to its low surface tension, good adhesion and low curing shrinkage, it is also very suitable for bonding wood, metal and PS rigid foams such as Styropor®. It can be processed in all common processes such as hand lamination, pressure and vacuum impregnation as well as pressing and winding.

Processing:

For optimum results, resin and hardener should be dosed by weight.
(Mixing ratio by weight is not equal to mixing ratio by volume due to different specific weights of resin and hardener.)

After mixing the resin and hardener, the casting resin **must be poured into the mould as quickly as possible to avoid an exothermic reaction in the mixing vessel.** This is especially true when larger quantities are processed.

The reaction heat (exothermic) generated during hardening limits the maximum quantity to be poured in one operation and the layer thickness.
The higher the temperature and/or layer thickness and/or volume, the shorter the processing/gelling time.
If a certain limit is exceeded, the resin system heats up exponentially until undesired reactions finally occur: The casting discolours completely or in places, from light yellow to dark brown, cracks appear and increased shrinkage occurs. Furthermore, a restless, wavy surface is formed. In extreme cases, the casting can "boil" completely or partially. Temperatures above 100 °C then occur.

Layer thicknesses up to 5 cm for small volumes up to approx. 500 ml and **layers from 1-2 cm for large volumes up to approx. 30 liters** can be cast.

Large moulded parts ("rivertables" etc.) with **layer thicknesses of more than 20 mm** should be cast in **two or more work steps/ layers** one after the other at intervals of about 12 hours.

At temperatures above 25 °C (77 °F), we strongly advise against casting larger layer thicknesses and/or larger volumes in one operation.

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Hardener LT (90 min)

Description

- **Hardener for Epoxy Resin L**
- **Processing time 90 minutes**
- **Very low viscosity (< 40 mPa·s, at 25 °C)**
- **Colour index (Gardner) < 2**

Aplication

The Epoxy Resin L + Hardener LT system is ideal for bonding wood, metal and wood-based materials due to its low surface tension adhesion and low curing shrinkage, the system is very suitable for bonding wood, metal and rigid PS rigid foams such as Styropor®. It can be used in all common processes such as hand laminating, pressure and vacuum impregnation as well as pressing and winding.

Curing time:
24 hours at room temperature, followed by approx. 12 hours of hot curing at at least 60 °C.

Heat deflection temperature:
max. 70 °C at 24 hours/23 °C curing
max. 120 °C with additional 15 h heat curing at 100 °C
(Values may vary depending on laminate thickness and fiber content).

Viscosity in mPa·s (25 °C)	< 40
Density in g/cm³	ca. 0,93
Colour index (Gardner)	< 2
H*-equivalent weight in g/Eq	43
Solid content in %	100

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Overwiev about the technical data of all epoxy resin systems with Epoxy Resin L

	Resin L + Hardener S	Resin L + Hardener L	Resin L + Hardener CL	Resin L + Hardener W 300	Resin L + Hardener GL 1	Resin L + Hardener GL 2
Processing time 100 g-Ansatz at 20 °C	15 Min	40 min	60 min	300 min	30 min	210 min
Mixing ratio in parts by weight	**100 : 40**	**100 : 40**	**100 : 30**	**100 : 35**	**100 : 30**	**100 : 30**
Mixing ratio in parts by volume	100 : 45	100 : 45	100 : 36	100 : 42	100 : 35	100 : 35
Mixed viscosity in mPa.s	887 ± 100	580 ± 100	500 ± 100	300 ± 100	820	248
Colour	light yellow	light yellow	highly transparent	highly transparent	light yellow	transparent
Areas of application	Fast hardener for small components and repairs. Also suitable for bonding.	Hardener with medium pot life for many applications in model and sports equipment. Also suitable for bonding.	Highly transparent hardener with medium pot life for many applications in model and sports equipment. Excellent mechanical properties. Specially developed for CFRP coatings.	Highly transparent hardener with extended pot life. For coatings and thick laminates. Also suitable for potting.	Fast hardener for small components and repairs. Also for accelerating hardener GL. 2	Slow hardener for large components, especially in the vacuum infusion process
Characteristics	Medium viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) Curing temperatures from 5 °C	Low viscosity Solvent-free and filler-free Free of nonylphenol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) Tack free curing even in very thin layers Curing temperatures from 8 °C	Low viscosity Solvent-free and filler-free Free of nonylphenol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) Largely UV stable Tack free curing even in very thin layers Excellent fibre wetting Increased heat resistance after heat curing Curing temperatures from 15 °C	Very low viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA Very good impact strenght Very good UV resistance Tack free curing even in very thin layers Curing temperatures from 15 °C	Medium viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength Curing temperatures from 10 °C	Very low viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength Curing temperatures from 15 °C
Admission	CYTOX	CYTOX			DNV	DNV
Curing	Curing at RT (23° C) for 16-24 h	Curing at RT (23 °C) above 24 h	24 h at RT (23 °C) above 24 h annealing optional	Curing at RT (23 °C) 48 -72 h	24 h at RT(23 °C) + Annealing 15h at min. 40 °C	24 h at RT (23 °C) + Annealing 15h at min. 40 °C
Heat resistance	≈ 60 °C	≈ 60 °C	Max. 85 °C at add. annealing 15 h / 70 °C	≈ 60 °C	Max. 80 °C at add. annealing 15 h / 70 °C	Max. 85 °C at add. annealing 15 h / 70 °C

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Overwiev about the technical data of all epoxy resin systems with Epoxy Resin L

Mechanical characteristics pure resin samples	Resin L + Hardener S	Resin L + Hardener L	Resin L + Hardener CL	Resin L + Hardener W 300	Resin L + Hardener GL 1	Resin L + Hardener GL 2
Tensile strength in MPa max. to	68	69	83	-	74	74.8
Compressive strength in MPa max.to	116	91	111	-	-	-
Flexural strength in MPa max.to	110	111	137	-	165	119
Elongation at break in % max. to	-	5.9	5.5	-	-	-
Impact strength in kJ/m² max.to	-	-	-	-	-	-
Modulus of elasticity in bending test in Mpa max. to	-	2950	3220	-	-	-

Mechanical characteristics of GRP	Resin L + Hardener S	Resin L + Hardener L	Resin L + Hardener CL	Resin L + Hardener W 300	Resin L + Hardener GL 1	Resin L + Hardener GL 2
Tensile strength in MPa max. to	238	302				316
Compressive strength in MPa max. to	390	253				282
Flexural strength in MPa max. to	310	431				431
Elongation at break in % max. to	376	91				97
Impact strength in kJ/m² max. to	14725	15900				15500
MPa max. to						

Mechanical characteristics of CFRP	Resin L + Hardener S	Resin L + Hardener L	Resin L + Hardener CL	Resin L + Hardener W 300	Resin L + Hardener GL 1	Resin L + Hardener GL 2
Tensile strength in MPa max. to	384	698				752
Compressive strength in MPa max. to		384				421
Flexural strength in MPa max. to	607	720				723
Elongation at break in % max. to		49				87
Impact strength in kJ/m² max. to	35413	50400				51200
Modulus of elasticity in bending test in Mpa max. to						

Tensile strength according to DIN EN ISO 527-4
Compressive strength according to DIN EN ISO 1426
Flexural strength according to DIN EN ISO 14125/ Verfahren A
Impact strength according to DIN EN ISO 179-1
Modulus of elasticity in bending test according to DIN EN ISO 14125 / Verfahren A

Structure sample twill GRP (3 mm thickness): 12 layers of glass fabric 296 g / m² Atlas, ITG92626 Quasi-isotropic laminate structure / Laminated by hand Cured at room temperature + 15 hours at 60 ° C for 24 h

Structure sample twill carbon fiber (3.5 mm thickness): 12 layers carbon fabric 200 g / m² canvas Style 450
Quasi-isotropic laminate structure / Laminated by hand
Cured at room temperature + 15 hours at 60 ° C for 24 h

Tensile strength according to DIN EN ISO 527-4 compressive strength according to DIN EN ISO 1426 flexural strength according to DIN EN ISO 14125 / Method A impact strength according to DIN EN ISO 179-1 modulus bending test according to DIN EN ISO 14125 / Method A Interlaminar shear strength according to DIN EN ISO 2563

Structure sample twill GRP (4 mm thickness): 16 layers of glass fabric 296g / m2 Atlas, ITG91745
Laminate construction 0 ° / 90 ° / manufactured in RTM
Curing for 24 h at RT + 15h at 60 ° C

Structure sample twill carbon fiber (2 mm thickness): 8 layers of 200 g / m2 Canvas, Style 450
Laminate construction 0 ° / 90 ° / manufactured in RTM
Curing for 24 h at RT + 15h at 60 ° C

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