



Technical data

Epoxy Resin L

+ Hardener S, L, CL, W 300, GL 1, GL 2 and EPH 161

Description

- Low viscosity, 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, GL 2 and EPH 161 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/cm ³ /23 °C | 1.14 ± 0.01 |
| Viscosity | mPa*s/25 °C | 710 ± 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 |

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Hardeners

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
- 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
- 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 |



Hardener CL (60 min)

Description

- Hardener for Epoxy Resin L
- Processing time 60 minutes
- Free of nonylphenol and DETA
- 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/cm ³ | 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 |
| Tensile modulus DIN EN ISO 178 in MPa | 3220 |

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 |

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

Shrinkage

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

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Hardener GL 1 (30 min)

Description

- Hardener for Epoxy Resin L
- Processing time 30 minutes
- Free of nonylphenol, benzyl alcohol and DETA
- Low viscosity (820 mPas at 25 °C)
- 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.

Hardener GL 2 (210 min)

Description

- Hardener for Epoxy Resin L
- Processing time 210 minutes
- Free of nonylphenol, benzyl alcohol and DETA
- Extremely low-viscous (Mixing viscosity 250 mPas at 25 °C)
- Highly transparent (Colour index < 1 Gardner)
- 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

| approx. pot life in minutes (100 g at 23 °C with epoxy L) | Quantity of GL 1 in % | Quantity of 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 EPH 161 (90 min)

Description

- Hardener for Epoxy Resin L and L 20
- Processing time 90 minutes
- Free of DETA
- Curing temperatures from 18 °C



Application

The well-proven R&G Epoxy Resin L in combination with Hardener EPH 161 **is approved for the construction of vehicle components.**

For heat-resisting laminates up to max. 120 °C in conjunction with Epoxy Resin L and L 20.

Components of this system are curing very good at room temperature and can be demoulded and processed without difficulty. The system yields a low-viscosity laminating resin that exhibits superior impregnating and wetting properties to glass, aramid, and carbon fibres. The static and dynamic stability is very good..

To increase the heat resistance and get ideal mechanical strength properties, the components must be post cured at elevated temperatures. As standard value a post-curing about 15 hours at approx. 60 °C is recommended. The Tg-forerun averages approx. 20 °C. That means:

| Curing temperature (15 h) | Glasstransition temperature (TG) (approx.) |
|---------------------------|--------------------------------------------|
| 60 °C | 80 °C |
| 70 °C | 90 °C |
| 80 °C | 100 °C |
| 90 °C | 110 °C |
| 100 °C | 120 °C |

From a curing temperature of 110 °C the maximum heat distortion temperature of approx. 130 °C is reached.

Mechanical properties (pure resin cured*) of Epoxy Resin L + Hardener EPH 161:

| | |
|------------------------------------------------------|------|
| Flexural strength DIN EN ISO 178 in MPa | 156 |
| Tensile modulus DIN EN ISO 178 in MPa | 4300 |
| Tensile strength DIN EN ISO 527 in MPa | 70 |
| Elongation at break DIN EN ISO 527 in % | 9,5 |
| Initial viscosity ISO 3219 in mPas | 500 |
| heat deflection temperature after tempering up to °C | 120 |

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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
- 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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Overview 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 | Resin L + Hardener EPH 161 |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Processing time 100 g-Ansatz at 20 °C | 15 Min | 40 min | 60 min | 300 min | 30 min | 210 min | 90 min |
| Mixing ratio in parts by weight | 100 : 40 | 100 : 40 | 100 : 30 | 100 : 35 | 100 : 30 | 100 : 30 | 100 : 25 |
| Mixing ratio in parts by volume | 100 : 45 | 100 : 45 | 100 : 36 | 100 : 42 | 100 : 35 | 100 : 35 | 100 : 29 |
| Mixed viscosity in mPa.s | 887 ± 100 | 580 ± 100 | 500 ± 100 | 300 ± 100 | 820 | 248 | 560 ± 100 |
| Colour | | | | | | | |
| 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 | Slow hardener for large components and thick laminates. With resin L approved for the construction of vehicle components. |
| Characteristics | Medium viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) | Low viscosity Solvent-free and filler-free Free of nonylphenol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) | Low viscosity Solvent-free and filler-free Free of nonylphenol and DETA High static and dynamic strength Non-cytotoxic (cell damaging) Largely UV stable | Very low viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA Very good impact strength Very good UV resistance Tack free curing even in very thin layers | Medium viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength | Very low viscosity Solvent-free and filler-free Free of nonylphenol, benzyl alcohol and DETA High static and dynamic strength | Low viscosity Solvent-free and filler-free Free of DETA High static and dynamic strength Excellent fibre wetting Increased heat resistance after heat curing |
| Admission | | | | | | | |
| 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 | 24 h at RT (23 °C) + Tempering 15 h at min. 60 °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 | Max. 120 °C (at add. annealing 15 h/100 °C) |

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Overview 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 CO | Resin L + Hardener W 300 | Resin L + Hardener GL 1 | Resin L + Hardener GL 2 | Harz L + Härter EPH 161 |
|------------------------------------------------------|----------------------|----------------------|-----------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| Tensile strength in MPa max. to | 68 | 69 | 83 | - | 74 | 74.8 | 70 |
| Compressive strength in MPa max. to | 116 | 91 | 111 | - | - | - | 125 |
| Flexural strength in MPa max. to | 110 | 111 | 137 | - | 165 | 119 | 130 |
| Elongation at break in % max. to | - | 5.9 | 5.5 | - | - | - | 9.5 |
| Impact strength in kJ/m² max. to | - | - | - | - | - | - | 40 |
| Modulus of elasticity in bending test in Mpa max. to | - | 2950 | 3220 | - | - | - | 4300 |

| Mechanical characteristics of GRP | Resin L + Hardener S | Resin L + Hardener L | Resin L + Hardener CO | Resin L + Hardener W 300 | Resin L + Hardener GL 1 | Resin L + Hardener GL 2 | Harz L + Härter EPH 161 |
|------------------------------------------------------|----------------------|----------------------|-----------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| Tensile strength in MPa max. to | 238 | 302 | | | | 316 | - |
| Compressive strength in MPa max. to | 390 | 253 | | | | 282 | 360 |
| Flexural strength in MPa max. to | 310 | 431 | | | | 431 | 488 |
| Elongation at break in % max. to | 376 | 91 | | | | 97 | 205 |
| Impact strength in kJ/m² max. to | 14725 | 15900 | | | | 15500 | 23500 |
| Modulus of elasticity in bending test in Mpa max. to | | | | | | | 36 |

| Mechanical characteristics of CFRP | Resin L + Hardener S | Resin L + Hardener L | Resin L + Hardener CO | Resin L + Hardener W 300 | Resin L + Hardener GL 1 | Resin L + Hardener GL 2 | Harz L + Härter EPH 161 |
|------------------------------------------------------|----------------------|----------------------|-----------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| Tensile strength in MPa max. to | 384 | 698 | | | | 752 | |
| Compressive strength in MPa max. to | | 384 | | | | 421 | 444 |
| Flexural strength in MPa max. to | 607 | 720 | | | | 723 | 730 |
| Elongation at break in % max. to | | 49 | | | | 87 | |
| Impact strength in kJ/m² max. to | 35413 | 50400 | | | | 51200 | 46000 |
| Modulus of elasticity in bending test in Mpa max. to | | | | | | | 54 |

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>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</p> <p>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</p> <p>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</p> | <p>Tensile strength and compressive strength according to DIN EN ISO 1426 flexural strength a5 / Method A impact strength according to DIN EN ISO 179-1 modulus N EN ISO 14125 / Method A Interlaminar shear strength according</p> <p>Structure sample t5 layers of glass fabric 296g / m2 Atlas, ITG91745 Laminate construct in RTM Curing for 24 h at t</p> <p>Structure sample tness): 8 layers of 200 g / m2 Canvas, Style 450 Laminate construct in RTM Curing for 24 h at t</p> |
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