

Warm curing epoxy system based on Epoxy Resin XB 3585 / Hardener XB 3486

Epoxy Resin XB 3585

Hardener XB 3486 is an aliphatic polyamine

Applications	Industrial composites, repair of composites (containers, pressure vessels etc.)		
Properties	Reactive diluent free laminating system. Exhibits very high ultimate elongation in combination with a long pot life and high temperature resistance.		
Processing	Filament Winding Resin Transfer Moulding (RTM) Pressure Moulding Wet lay-up		
Key data	Epoxy Resin XB 3585		
	Aspect (visual)	clear liquid	
	Colour (Gardner, ISO 4630)	≤ 3	
	Viscosity at 25 °C (ISO 12058-1)	6500 - 9000	[mPa s]
	Density at 25 °C (ISO 1675)	1.15 - 1.20	[g/cm ³]
	Flash point (ISO 2719)	> 200	[°C]
	Storage temperature (see expiry date on original container)	2 - 40	[°C]
	Hardener XB 3486		
	Aspect (visual)	clear, colourless to slightly yellow liquid	
	Viscosity at 25 °C (ISO 12058-1)	10 - 20	[mPa s]
	Density at 25 °C (ISO 1675)	0.94 - 0.95	[g/cm ³]
	Flash point (ISO 2719)	123	[°C]
	Storage temperature (see expiry date on original container)	2 - 40	[°C]
	Storage	<p>Provided that the products described above are stored in a dry place in their original, properly closed containers at the above mentioned storage temperatures they will have the shelf lives indicated on the labels.</p> <p>Partly emptied containers should be closed immediately after use.</p> <p>Epoxy Resin XB 3585 which has crystallized and looks cloudy can be restored to its original state by heating to 60 - 80 °C.</p>	

Processing data

Mix ratio	<i>Components</i>	<i>Parts by weight</i>	<i>Parts by volume</i>
	Epoxy Resin XB 3585	100	100
	Hardener XB 3486	32	40

We recommend that the components are weighed with an accurate balance to prevent mixing inaccuracies which can affect the properties of the matrix system. The components should be mixed thoroughly to ensure homogeneity. It is important that the side and the bottom of the vessel are incorporated into the mixing process.

When processing large quantities of mixture the pot life will decrease due to exothermic reaction. It is advisable to divide large mixes into several smaller containers.

Initial mix viscosity (Hoepler, ISO 9371B)	<i>[°C]</i>	<i>[mPa s]</i>
	at 25	500 - 650
	at 30	280 - 380

Viscosity build-up (Hoepler, ISO 9371B)	<i>[°C]</i>	<i>[mPa s]</i>	<i>[min]</i>
	at 25	to 1500	17 - 23
	at 25	to 3000	110 - 125

Pot life (Tecam, 100 ml, 65 % RH)	<i>[°C]</i>	<i>[min]</i>
	at 23	480 - 580
	at 30	370 - 430

Gel time (Hot plate)	<i>[°C]</i>	<i>[min]</i>
	at 80	32 - 40
	at 100	11 - 15
	at 120	5 - 8

The values shown are for small amounts of pure resin/hardener mix. In composite structures the gel time can differ significantly from the given values depending on the fibre content and the laminate thickness.

Gelation at 23 °C (in thin layers: 0.4 - 0.7 mm)		<i>[h]</i>
	Start	11 - 12.5
	End	15 - 17

Typical cure cycles	
	5 h 100 °C

Optimum properties cannot be reached with room temperature cure.

The optimum cure cycle has to be determined case by case depending on the processing and the economic requirements.

Properties of the cured, neat formulation

Glass transition temperature (T_g) (IEC 1006, DSC, 10 K/min)	<i>Cure:</i>		T_g [°C]	
	7 days at 23 °C		38 - 43	
	20 h 40 °C		48 - 53	
	16 h 50 °C		61 - 67	
	16 h 60 °C		78 - 84	
	8 h 80 °C		88 - 94	
	1 h 100 °C		93 - 98	
	2 h 100 °C		99 - 104	
	3 h 100 °C		100 - 105	
	4 h 100 °C		100 - 105	
	5 h 100 °C		100 - 110	
5 h 120 °C		103 - 112		
Torsional test (ISO 6721, DMA, 2 K/min)	<i>Cure:</i>		T_g [°C]	
	15 h 50 °C		77 - 83	
Tensile test (ISO 527)	<i>Cure:</i>		5 h 100 °C	
	Tensile strength	[MPa]	70 - 74	
	Elongation at tensile strength	[%]	5.5 - 6.5	
	Ultimate strength	[MPa]	66 - 70	
	Ultimate elongation	[%]	8 - 10	
	Tensile modulus	[MPa]	2700 - 2900	
Flexural test (ISO 178)	<i>Cure:</i>		15 h 50 °C	5 h 100 °C
	Flexural strength	[MPa]	128 - 138	120 - 130
	Elongation at flexural strength	[%]	4.5 - 5.5	6.5 - 7.5
	Ultimate strength	[MPa]	75 - 87	105 - 125
	Ultimate elongation	[%]	7 - 11	9 - 12
	Flexural modulus	[MPa]	3200 - 3500	2750 - 2950
	Fracture properties	<i>Cure:</i>		5 h 100 °C
Bend notch test (PM 258-0/90)	Fracture toughness K_{1C}	[MPa \sqrt{m}]	0.9 - 1.02	
	Fracture energy G_{1C}	[J/m ²]	250 - 300	
Water absorption (ISO 62)	<i>Immersion:</i>	<i>Cure:</i>	5 h 100 °C	
	10 days H ₂ O 23 °C	[%]	0.45 - 0.55	

Properties of the cured, reinforced formulation

Flexural test (ISO 178)	Samples: 12 layers of E-glass fabric UD, 425 g/m ²		
	Laminate thickness t = 2.8 - 3.0 mm		
	Fibre volume content: 59 - 62 %		
	<i>Cure:</i>		1.5 h 90 °C + 5 h 100 °C
	Flexural strength	[MPa]	1000 - 1200
	Elongation at flexural strength	[%]	2.4 - 2.6
	Ultimate strength	[MPa]	980 - 1180
Ultimate elongation	[%]	2.45 - 2.65	
Flexural modulus	[MPa]	37000 - 42000	
Interlaminar shear strength (ASTM D 2344)	Short beam: 12 layers of E-glass fabric UD, 425 g/m ²		
	Laminate thickness t = 2.8 - 3.2 mm		
	Fibre volume content: 59 - 62 %		
	<i>Cure:</i>		1.5 h 90 °C + 5 h 100 °C
Shear strength	[MPa]	59 - 63	

Handling precautions

Mandatory and recommended industrial hygiene procedures should be followed whenever our products are being handled and processed. For additional information please consult the corresponding product safety data sheets and the brochure "Hygienic precautions for handling plastics products" (Publ. No. 24264/e).

Personal hygiene

Safety precautions at workplace

protective clothing	yes
gloves	essential
arm protectors	recommended when skin contact likely
goggles/safety glasses	yes

Skin protection

before starting work	Apply barrier cream to exposed skin
after washing	Apply barrier or nourishing cream

Cleansing of contaminated skin

Dab off with absorbent paper, wash with warm water and alkali-free soap, then dry with disposable towels. Do not use solvents

Disposal of spillage

Soak up with sawdust or cotton waste and deposit in plastic-lined bin

Ventilation

of workshop	Renew air 3 to 5 times an hour
of workplaces	Exhaust fans. Operatives should avoid inhaling vapours

First aid

Contamination of the eyes by resin, hardener or mix should be treated immediately by flushing with clean, running water for 10 to 15 minutes. A doctor should then be consulted.

Material smeared or splashed on the skin should be dabbed off, and the contaminated area then washed and treated with a cleansing cream (see above). A doctor should be consulted in the event of severe irritation or burns. Contaminated clothing should be changed immediately.

Anyone taken ill after *inhaling* vapours should be moved out of doors immediately. In all cases of doubt call for medical assistance.

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