

Product Data

Epoxy Resin Systems



Room temperature cure laminating system

RS-L285

Hardeners RS-H285, RS-H286,
RS-H287

Applications

- Gliders and Light Aircraft
- Boats & Automotive
- Sports Equipment
- Other high performance products

Processing Methods

- Wet layup
- Filament winding
- Pressure Moulding
- Injection moulding (RTM)
- Pultrusion
- Vacuum bag moulding





Main Features

Approvals

- German Federal Aviation Authority approved for the manufacture of Gliders, motor gliders and light aircraft.

Operational Temperature

- -60°C → +60°C without post cure
- -60°C → +100°C with post cure

Processing

- Between 10°C and 40°C
- Pot life from ca. 40 minutes to ca. 5 hours

Processing methods

- Wet layup
- Filament winding
- Pressure moulding
- Injection moulding
- Pultrusion

Other features

- Extremely good physiological properties
- Excellent mechanical properties
- Hardeners may be inter-mixed to achieve various gel times

Special modifications

- RS-L285 T - Thixotropic
- RS-L285 K2 - Hot thixotropic adhesive
- RS- L285 W - Pigmented white



Introduction

This low viscosity laminating system has been designed for the manufacture of aircraft components requiring high static and fatigue strength properties. The resins and hardeners contain neither solvent nor fillers and are approved by the German Federal Aviation Authority for the processing of glass, carbon and aramid fibre composites.

For optimum processing flexibility, there is a range of 3 hardeners varying in reactivity, with pot life from approximately 40 minutes to 5 hours. The individual hardeners can be inter-mixed in any ratio, enabling users to optimise the pot life of the system to meet their individual requirements. All of the resin/hardener combinations will cure, and are de-mouldable, at room temperature (20-25°C). The cured laminate surface will have a high gloss and will be tack-free even in an unfavourable working environment, for instance, high humidity and low temperatures.

The RS-L285 epoxy resin system exhibits good mechanical properties after curing at room temperature. If high temperature strength ($\geq +60^{\circ}\text{C}$), or aircraft approval is not required, finished products made with the selection of hardener RS-H285 may be used without further heat treatment. Post curing (heat treatment) will further enhance the mechanical properties and will also increase the high temperature strength, up to 100°C being achievable depending on the selected hardener and post cure cycle used. The properties indicated in this document may only be achieved by curing/post-curing above 50°C .

This system meets the requirements for gliders and motor-gliders after post curing at $50 - 55^{\circ}\text{C}$ and for powered light aircraft when cured above 80°C . See page 5 for details.

The mixed viscosity of the RS-L285 laminating system is very low ensuring a fast, complete, impregnation of reinforcement fibres without drainage on vertical surfaces. The addition of fillers such as colloidal silica, microballoons, metal powder etc., is also acceptable to obtain special properties.

Due to the hydrophilic nature of this resin system (high moisture absorption, low resistance to water vapour diffusion), compatibility problems are not expected when combined with polyester gelcoats or the various polyurathane based paints. However, comprehensive tests are recommended.



Product Specification

RESIN	RS-L285
Density at 25°C (g/cm ³)	1.18 - 1.23
Viscosity at 25°C (mPa s)	600 - 900
Epoxide equivalent	150 - 165
Colour / Gardner	max. 3

HARDENERS	RS-H285	RS-H286	RS-H287
Density at 25°C (g/cm ³)	0.94 - 0.97	0.95 - 0.98	0.93 - 0.96
Viscosity at 25°C (mPa s)	60 - 100	60 - 100	60 - 100
Amine value (mgKOH/g)	480 - 550	450 - 500	450 - 500
Colour / Gardner	max. 4*	max. 4*	max. 4*

*for colourless hardeners only - standard hardeners are coloured translucent blue

Storage

The resins and hardeners may be stored for a minimum of 12 months in the original sealed containers at 15 - 25°C. Crystallisation of these materials may occur at temperatures below 15°C and is visible as a clouding or solidification of the liquid within the container. Before processing the crystallisation must be removed. This can be done, without degrading the product, by slowly warming the material to approximately 50 - 60°C in a water bath, or oven, and stirring or mixing until the liquid becomes clear.

CAUTION

- Do not heat over a naked flame;
- Before warming, open containers to equalise pressure;
- Use safety equipment (gloves, safety glasses, respirator);
- Work in a well ventiated area.



Processing Data

	RESIN	HARDENERS		
	RS-L285	RS-H285	RS-H286	RS-H287
Epoxide Value	0.61 - 0.66	-	-	-
Amine Equivalent	-	62 - 67	62 - 67	62 - 67
Processing Temperature	10 - 40°C			
Storage	> 12 months in original sealed containers			
Mixed viscosity at 25°C	300 - 500 mPa s			
Temperature rise	see diagram			
Initial curing temperature	20 - 25°C at room temperature			
Heat Treatment	see charts on page 8			

The optimum processing temperature lies in the range between 20 - 25°C. Higher processing temperatures are possible, but will shorten pot life, an increase of 10°C halving it. Exposure to moisture, for example in fillers, or very high relative humidity will accelerate the reaction rate of the resin/hardener mixture. However, there is no significant effect to the strength of the cured product as a result of different temperatures and relative humidity levels during processing.

Laminates produced with the selection of hardener RS-H285 or RS-H286 will be sufficiently cured for demoulding after a period of 24h at room temperature (20 - 25°C).

If hardener RS-H287 is selected, demoulding is required after a period of 48h curing at room temperature (20 - 25°C), or 2-3 hrs at 40-50°C after initial gelation.

Curing Instructions for Gliders and Light Aircraft

To conform to their respective airworthiness requirement, gliders and motor gliders should be post cured for a minimum of 10 hours at 50-55°C, and powered light aircraft for a minimum of 10 hours at 80-85°C.



Mixing Ratios

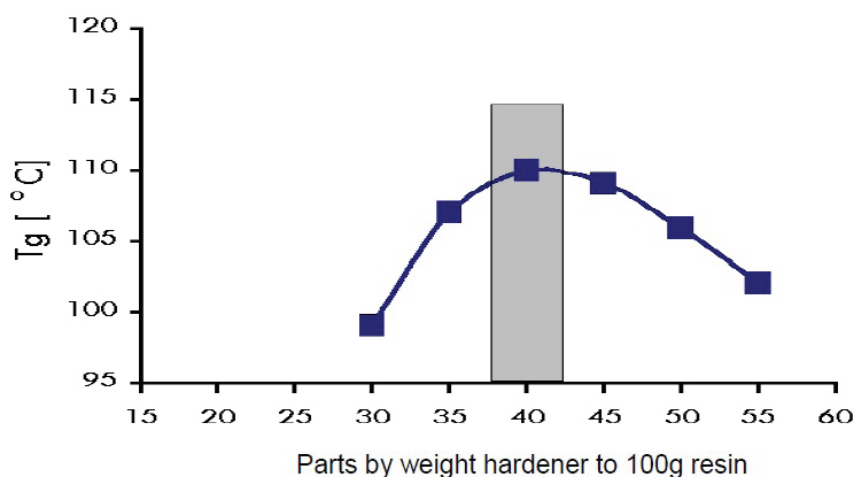
RESIN RS-L285 : HARDENERS RS-H285 - RS-H287	
Parts by Weight	100 : 40 (+/-2)
Parts by Volume	100: 50 (+/-2)

The specified mixing ratios must be observed carefully; we therefore recommend weighing the resin and hardener precisely using accurate scales. Varying the quantity of hardener adversely affects the matrix properties (see below). Mix the resin and hardener thoroughly until they are homogeneously mixed, paying special attention to the walls and the bottom of the mixing container. Do not mix large quantities, especially if highly reactive systems are being used.

Effect of Mixing Ratio on Glass Transition Temperature

Resin : RS-L285

Hardener : RS-H287

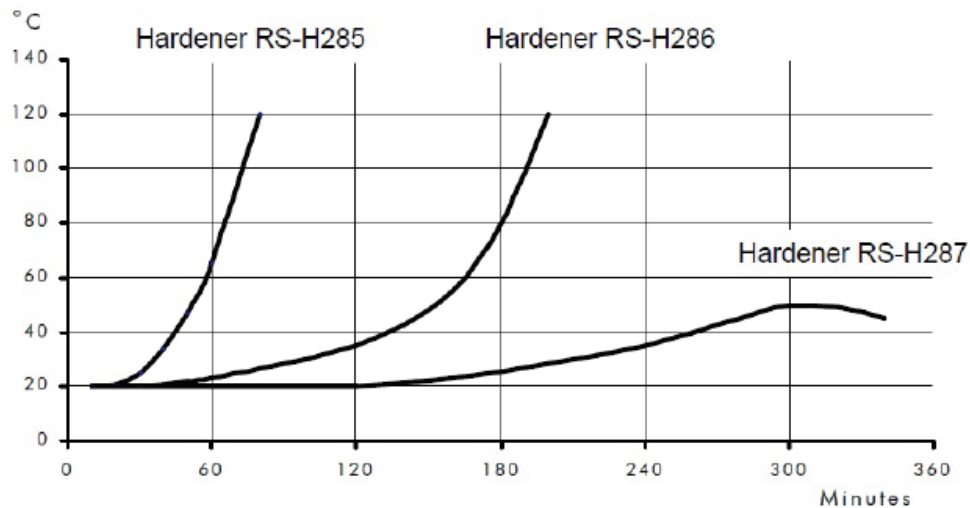




Processing Time (Pot Life) 100g / 23°C

RESIN RS-L285			
Hardener	RS-H285	RS-H286	RS-H287
minutes	40 - 45	100 - 120	ca. 260

Temperature Rise



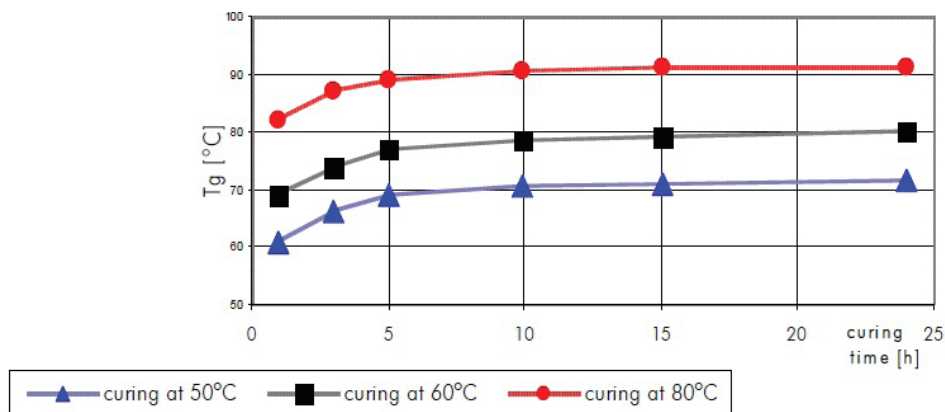
Gel Time - Film Thickness 1mm

RESIN RS-L285				
Temperature	Time	RS-H285	RS-H286	RS-H287
20 - 25°C	Hours	ca. 2 - 3	ca. 3 - 4	ca. 5 - 6
40 - 45°C	Minutes	ca. 45 - 60	ca. 60 - 90	ca. 80 - 120

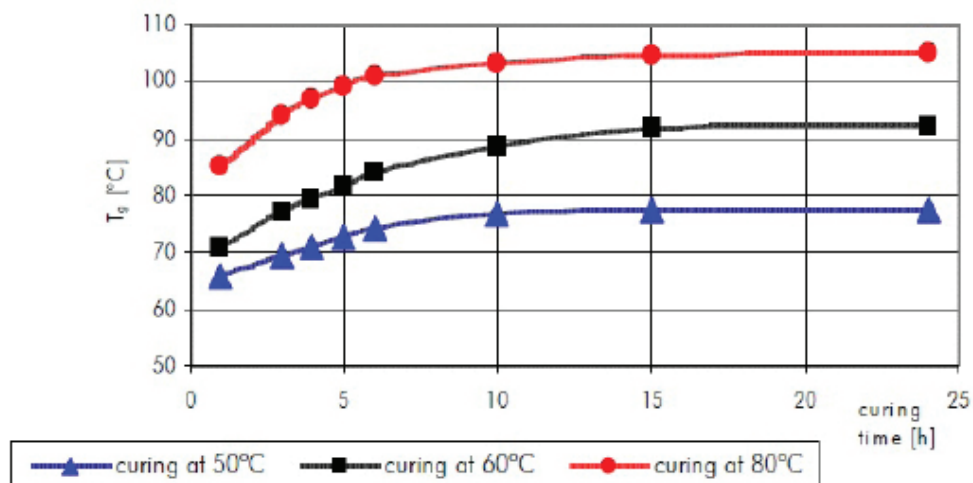


Glass Transition Temperature (T_g)

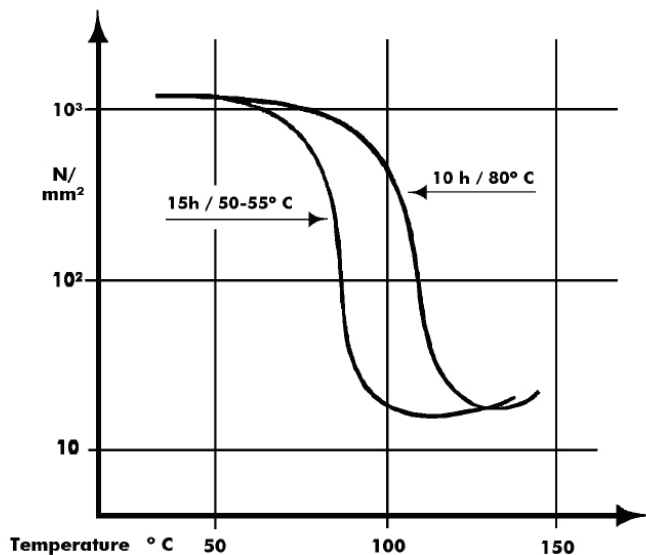
Resin: RS-L285
 Hardener: RS-H285
 Initial cure
 24 hr @ 20 -25°C
DSC



Resin: RS-L285
 Hardener: RS-H287
 Initial cure
 24 hr @ 20 -25°C
DSC



Shear Modulus



Resin: RS-L285
 Hardener: RS-H287
 Initial cure
 24 hr @ 20 -25°C
 ← **Post cure**



Resin Matrix Properties

Cured - Un-Reinforced Matrix Properties

CURING : 24h @ 20 - 25°C + 15h @ 55 - 60°C		RS-L285 & RS-H285 - RS-H287
Density	g/cm ³	1.18 - 1.20
Flexural strength	N/mm ²	110 - 120
Tensile strength	N/mm ²	70 - 80
Impact Strength	Nmm/mm ²	45 - 55
Elongation	%	5.0 - 5.5
Compression strength	N/mm ²	125 - 135
Modulus of elasticity	kN/mm ²	3.3 - 3.4
Water absorption	24 hours / 23°C	0.15 - 0.30
	7 days / 23°C	0.60 - 0.80
Shore Hardness	D	80 - 85
Fatigue under reverse bending stresses acc. DLR Brunswick	10%	> 2 x 10 ⁴
	90%	> 2 x 10 ⁶

Representative data in accordance with WL 5.3203 parts 1 & 2 of the German Aviation Materials Manual.



Composite Properties

Cured - Fibre Reinforced Properties

CURING: 24h @ 20 - 25°C + 15h @ 55 - 60°C V _f 43%		RS-L285 & RS-H285 - RS-H287	
Flexural strength	N/mm ²	GFC	480 - 500
		CFC	690 - 720
		AFC	340 - 360
Tensile strength	N/mm ²	GFC	370 - 400
		CFC	530 - 550
		AFC	480 - 520
Compressive strength	N/mm ²	GFC	320 - 350
		CFC	360 - 390
		AFC	140 - 160
Interlaminar shear strength	N/mm ²	GFC	40 - 45
		CFC	50 - 55
		AFC	28 - 32
Flexural modulus	kN/mm ²	GFC	21 - 23
		CFC	43 - 45
		AFC	26 - 27

GFC - samples: 16 layers of glass fabric, 296g/m² 8H Satin, 4mm thick.

CFC - samples: 8 layers of SM 3K carbon fabric, 200g/m² plain weave, 2mm thick.

AFC - samples: 15 layers of Kevlar[®] fabric style 285, 170g/m² 4H Satin, 4mm thick.

Fibre volume fraction of samples 40% - 45%. Data calculated to fibre volume 43%.

Representative data in accordance with WL 5.3203 parts 1 & 2 of the German Aviation Materials Manual, part II.

Kevlar[®] is a DuPont registered trademark.



Health and Safety - Refer to the full Material Safety Datasheet before use.

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Important Notice

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Prepreg



Reinforcements



Resin



Aerospace
Adhesives



Shears



Tooling Block



Mould Release



Consumables