

### 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

TDS017





## Main Features

### Approvals

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

### Operational Temperature

- -60°C → +50°C without heat treatment
- -60°C → +80°C after heat treatment

### Processing

- Between 15°C and 50°C
- Pot life from ca. 30 minutes to ca. 3.5 hours at 25°C

### Processing methods

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

### Other features

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

### Special modifications

- RS-L285 T - Thixotropic
- RS-L285 K2 - Hot thixotropic adhesive



## Introduction

This low viscosity laminating system has been designed for the manufacture of aircraft components requiring high static and dynamic loadability. The resins and hardeners 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 30 minutes to 3.5 hours. The individual hardeners have the same mixing ratio and 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 mixed viscosity of the RS-L285 laminating system is very low, ensuring a fast and 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.

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  $100^{\circ}\text{C}$  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  $50^{\circ}\text{C}$ .

This system meets the requirements for gliders and motor-gliders after post curing at  $50 - 55^{\circ}\text{C}$  (operational temperatures  $-60 - +54^{\circ}\text{C}$ ) and for powered light aircraft when cured above  $80^{\circ}\text{C}$  (operational temperatures  $-60 - +72^{\circ}\text{C}$ ).

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 suitable gelcoats on UP, PU and EP basis. However, comprehensive tests are recommended.

Since the approval of laminating resin RS-L285 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 of skin irritation are able to process RS-L285.



## Product Specification

Resin	RS-L285
Density at 25°C (g/cm <sup>3</sup> )	1.18 - 1.23
Viscosity at 25°C (mPa s)	600 - 900
Refractory index at 25°C	1.525 - 1.530

Hardeners	RS-H285	RS-H286	RS-H287
Density at 25°C (g/cm <sup>3</sup> )	0.94 - 0.97	0.94 - 0.97	0.93 - 0.96
Viscosity at 25°C (mPa s)	50 - 100	60 - 100	80 - 120
Refractory index at 25°C	1.500 - 1.506	1.498 - 1.502	1.495 - 1.499
Potlife (mins) Measured in 30°C water bath, 100g sample	15 - 20	approx. 40	approx. 140
Tg <sub>pot</sub> unconditioned (°C)	80 - 85	85 - 90	90 - 95
Tg <sub>pot</sub> conditioned (°C) Conditioned at 40°C / 90% r.H.	65 - 70	78 - 82	83 - 88

## Storage

The resins and hardeners may be stored for a minimum of 12 months in the original sealed containers at 15 -30°C in low humidity.

Epoxy resins are super cooled liquids, therefore crystallisation may occur at temperatures below 15°C. In an early stage, crystallisation is visible as a clouding, and can progress to a stage where the resin becomes a wax-like solid. This physical phenomenon is reversible and is no restriction to quality after its reversion, in fact a high purity of material will increase a tendency for crystallisation. Crystallisation can be reversed by slow heating of the product to approx. 40 - 60°C in a water bath or oven, and stirring or mixing until the liquid becomes clear. Use only completely transparent products.

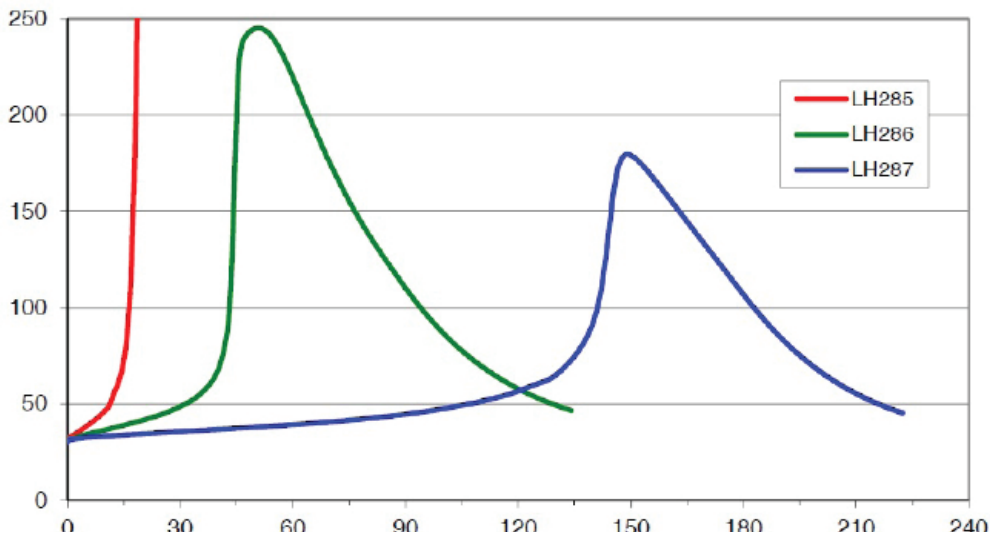
### CAUTION

- **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 ventilated area.**



## Temperature development

Temperature (°C)



Measuring conditions: 100g mixture at 30°C in a water basin

Optimum processing temperature is in the range of 20 to 35°C. Higher temperatures are possible, but will shorten pot life. A temperature increase of 10°C will halve the pot life. Water (e.g. high humidity or contained in additional fillers) causes an acceleration of the resin/hardener reaction. Different temperatures during processing are not known to have significant impact on the mechanical properties of the cured product.

Do not mix large quantities - particularly of high reactive systems - at elevated processing temperatures. As the heat dissipation in the mixing container is very slow, the contents will be heated up by the reaction heat (exothermic resin-hardener reaction) rapidly. This can result in temperatures of more than 200°C in the mixing container, which may cause smoke-intensive burning of the resin mass.



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## Mixing Ratios

### RS-L285 : RS-H285 ~ RS-H287

Parts by Weight 100 : 40 (+/-2)

Parts by Volume 100: 51 (+/-2)

The specified mixing ratios must be observed carefully; we therefore recommend weighing the resin and hardener precisely using accurate scales. Adding more or less hardener will not result in a faster or slower reaction - but in an incomplete curing which cannot be corrected in any way. 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. All hardeners have blue colour to distinguish between resin and hardeners, and for easier identification of a correct mixing process. Although unlikely, deviations in colour are possible (e.g. due to UV radiation after longer exposure to sunlight), but however have no effect on the processing and final properties of the material.

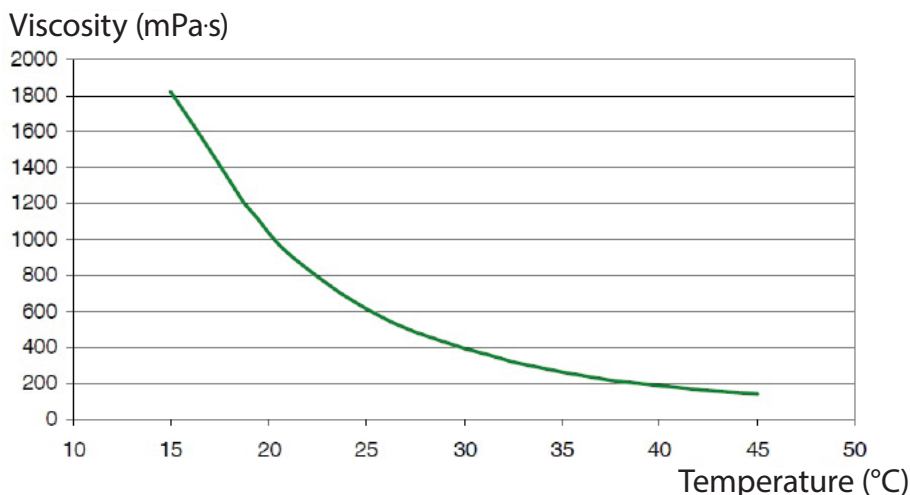
## Gel time

### 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

Measuring conditions: Film thickness 1mm at different temperatures

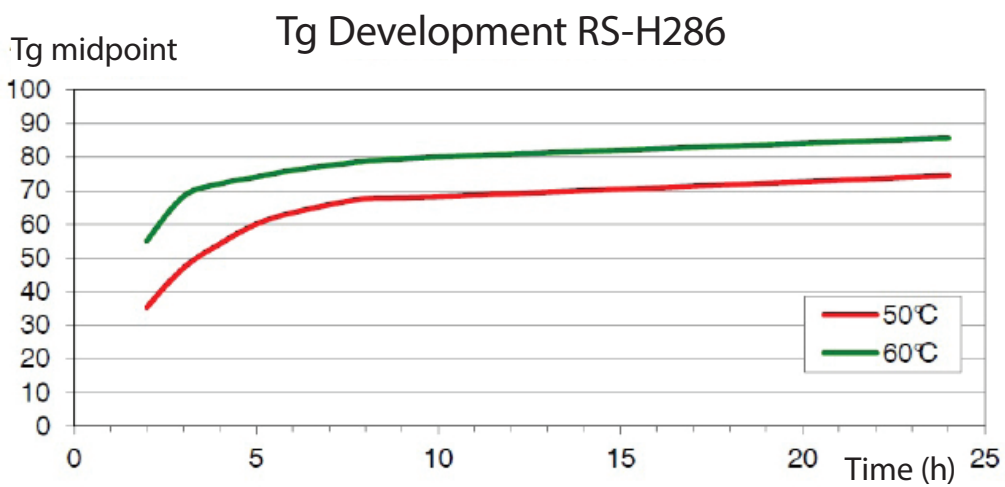
## Viscosity of Mixture



Measuring conditions:  
rotation viscosimeter, plate-plate configuration, measuring gap 0.2 mm

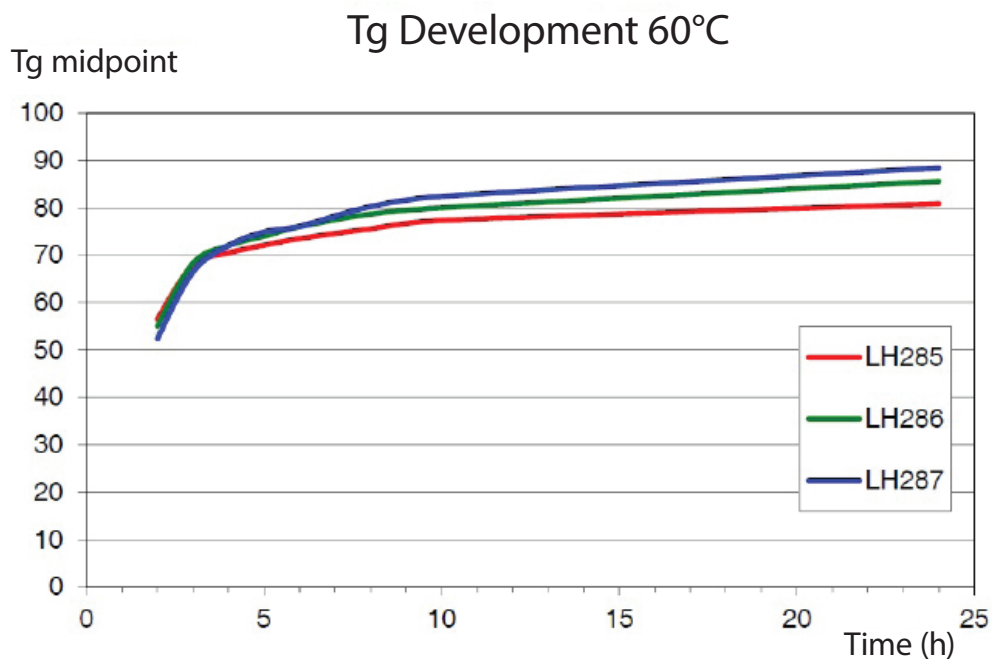
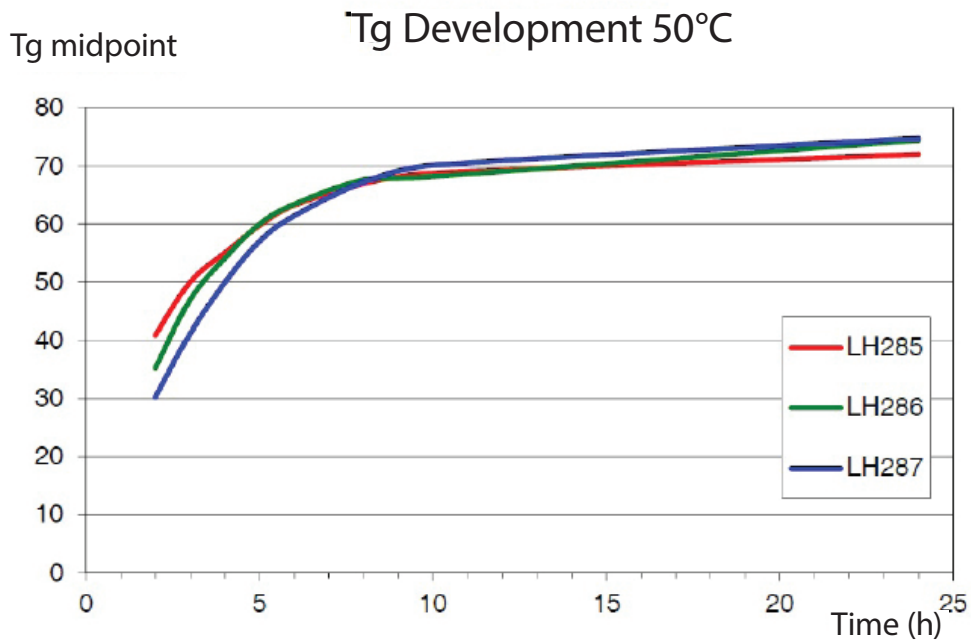


## Tg development





## Tg development (Cont...)



Measuring conditions for all Tg measurements: DSC, ISO 11357





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## Mechanical data of neat resin

### RS-L285 & RS-H287

Density DIN EN ISO 1183-1	g/cm <sup>3</sup>	1.18 - 1.20
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Flexural strength DIN EN ISO 178	MPa	110 - 120
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Tensile strength DIN EN ISO 527-2	MPa	70 - 80
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Impact Strength ISO 179-1	kJ/m <sup>2</sup>	45 - 55
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Elongation at break DIN EN ISO 527-2	%	5.0 - 6.5
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Compressive strength DIN EN ISO 604	MPa	120 - 140
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Modulus of elasticity DIN EN ISO 178	GPa	3.0 - 3.3
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Water absorption at 23°C DIN EN ISO 175	24 h (%)	0.20 - 0.30
	7 d (%)	0.60 - 0.80

Curing: 24h at 23°C + 15h at 60°C

Advice: Mechanical data are typical for the combination of laminating resin RS-L285 with hardener RS-L287. Data can differ in other applications



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## Mechanical data of reinforced resin

MECHANICAL DATA			RS-L285 & RS-H285 - RS-H287
Flexural strength	MPa	GFC	510 - 560
		CFC	720 - 770
		AFC	350 - 380
Tensile strength	GPa	GFC	460 - 500
		CFC	510 - 550
		AFC	400 - 480
Compressive strength	MPa	GFC	410 - 440
		CFC	460 - 510
		AFC	140 - 160
Interlaminar shear strength	MPa	GFC	42 - 46
		CFC	47 - 55
		AFC	29 - 34
Modulus of Elasticity	MPa	GFC	20 - 24
		CFC	40 - 45
		AFC	16 - 19

Curing: 24h at 23°C + 15h at 80°C

GF (Glass fibre laminate) - samples: 16 layers of glass fabric, 296g/m<sup>2</sup> 8H Satin, 4mm thick.

CF (Carbon fibre laminate) - samples: 8 layers of carbon fabric, 200g/m<sup>2</sup> plain weave, 2mm thick.

AF (Aramid fibre laminate) - samples: 15 layers of aramid fabric, 170g/m<sup>2</sup> 4H Satin, 4mm thick.

Fibre content of samples during processing/testing: 40 - 45 vol%. Data calculated to fibre volume 43 vol%.

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 RS-L285 with hardener RS-H287. Data can differ in other applications.



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

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