PRF
Composite Materials

Epoxy Resin Systems
Product Data

Room temperature cure laminating system

RS-L135

Hardeners RS-H135 to RS-H138

Applications

- Boats and shipbuilding
- Wind energy turbine blades
- Sports Equipment
- Models

Processing Methods

- Wet layup
- Filament winding
- Pressure moulding
- Pultrusion
- Vacuum bag moulding

TDS016

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RS-L135

Approvals

- Germanischer Lloyds approved

Processing

- Between 10°C and 50°C
- Pot life from ca. 25 minutes to ca. 12 hours

Processing methods

- Wet layup
- Filament winding
- Pressure moulding
- Pultrusion

Other features

- Very good physiological properties
- Very good mechanical properties

Introduction

This low viscosity laminating system has been designed for the manufacture of glass, carbon and aramid fibre composite components requiring high static and fatigue strength properties. The resins and hardeners contain neither solvent nor fillers, and are Germanischer Lloyds approved, making the RS-L135 epoxy laminating system particularly suitable for marine applications and the manufacture of wind energy turbine blades.

Careful selection of precursors has ensured this system is low in odour and has very good physiological properties, minimising skin irritation and allergy problems.

For optimum processing flexibility, there is a range of 4 hardeners varying in reactivity, with pot life from 25 minutes to 12 hours. 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-L135 epoxy resin system exhibits good mechanical properties after curing at room temperature. If high temperature strength is not required, finished products made with the selection of hardeners up to RS-H136 may be used without further heat treatment. Post curing (heat treatment) will further enhance the mechanical properties and will also increase the heat resistance.

The mixed viscosity of this resin system ensures 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.

Product Specification

Resin	RS-L135
Density at 25°C (g/cm^3)	1.14 - 1.18
Viscosity at 25°C (mPa s)	2400 - 2900
Epoxide equivalent	175 - 185
Colour / Gardner	max. 3

Hardeners	RS-H135	RS-H136	RS-H137	RS-H138
Density at 25°C (g/cm^3)	0.94 - 1.00	0.95 - 1.00	0.94 - 0.98	0.93 - 0.96
Viscosity at 25°c (mPa s)	50 - 150	20 - 100	10 - 50	10 - 50
Amine value (mgKOH/g)	450 - 500	450 - 500	450 - 500	450 - 500
Colour / Gardner	max. 4*	max. 4*	max. 4*	max. 4*

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

Storage

The resins and hardeners can 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 any 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;**
- **The use safety equipment (gloves, safety glasses, respirator) is mandatory;**
- **Work in a well ventilated area.**

RS-L135

Processing Data

	Resin	Hardeners
	RS-L135	RS-H135 → RS-H138
Average Epoxide Value	0.54 - 0.58	-
Amine Equivalent	-	60 - 65
Processing Temperature	10° - 50°C	
Mixed viscosity at 25°C	500 - 1000 mPa s	
Setting Temperature	initial cure at room temperature (20 - 25°C)	
Heat Treatment	15 h at 50°C - 10 min at 150°C	

The optimum processing temperature lies in the range between 20 - 25°C. Higher processing temperatures are possible but will shorten pot life. A 10°C temperature increase will halve the pot life. Water, contained in fillers for example, or very high relative humidity will accelerate the reaction 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.

Mixing Ratios

	RS-L135 : RS-H135 ~ RS-H138
Parts by Weight	100 : 35 (+/-2)
Parts by Volume	100: 40 (+/-2)

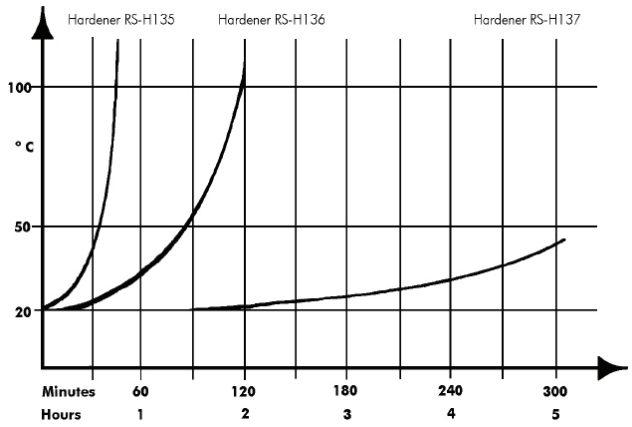
The specified mixing ratios must be observed; we therefore recommend weighing the resin and hardener precisely using accurate scales. Varying the quantity of hardener will adversely affect the properties of the matrix. The resin and hardener must be mixed thoroughly until they are homogeneously mixed, 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. Heat dissipation from mixing containers is poor, causing the resin-hardener mixture to warm up quicky as a result of the exothermic reaction of the two materials. Temperatures >200°C can be generated causing smoke-intensive burning of the resin-hardener mixture. To avoid this, mix small quantities in large, shallow containers.

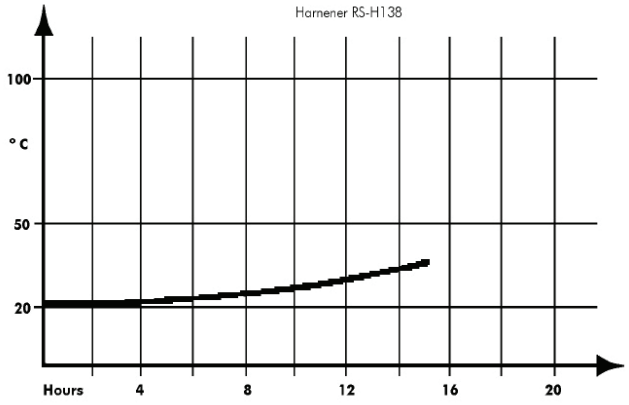
RS-L135

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

	Resin RS-L135			
Hardener	RS-H135	RS-H136	RS-H137	RS-H138
	ca. 25 - 35 min	ca. 90 - 120 mins	ca. 5 - 6 hours	ca. 10 - 12 hours

Temperature Rise





Gel Time - Film Thickness 1mm

	Resin RS-L135			
Temperature	RS-H135	RS-H136	RS-H137	RS-H138
20 - 25°C	ca. 4 - 5 hours	ca. 6 - 8 hours	ca. 10 - 12 hours	ca. 15 - 20 hours
45 - 50°C	ca. 40 - 50 min.	ca. 1 - 2 hours	ca. 3 - 4 hours	ca. 6 - 7 hours

RS-L135

Resin Matrix Properties
Glass Transition Temperature (Tg)

		RS-L135			
		RS-H135	RS-H136	RS-H137	RS-H137
7 days at 20 - 25°C	°C	45 - 50	45 - 50	-	-
24 h. RT + 15 h. 40 - 45°C	°C	55 - 60	50 - 55	50 - 55	50 - 55
24 h. RT + 15 h. 50 - 55°C	°C	60 - 65	60 - 65	60 - 65	60 - 65
24 h. RT + 15 h. 60 - 65°C	°C	70 - 75	70 - 75	70 - 75	70 - 75
24 h. RT + 10 h. 80 - 85°C	°C	85 - 90	85 - 90	85 - 90	85 - 90

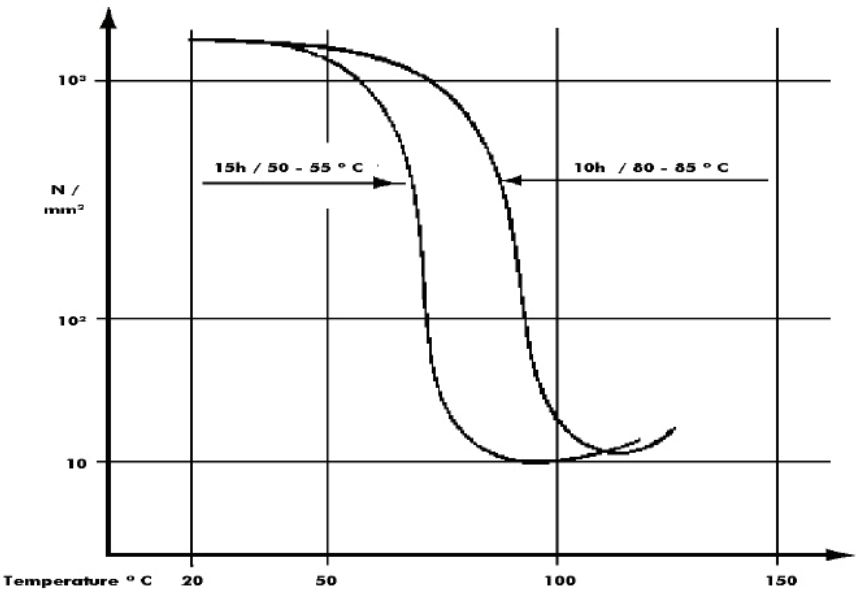
DSC - Data according to DIN 51002; System: Mettler TA 4000

Shear Modulus

Resin: RS-L135
Hardener: RS-H137

Initial cure
24hr @ 20 - 25°C

Post cure →



Cured - Un-reinforced Matrix Properties

CURING : 24h @ 25° + 15h @ 60 - 65°C		RS - L135 & RS-H135 - RS-H138
Density	g/cm^3	1.16 - 1.18
Flexural strength	N/mm^2	115 - 120
Tensile strength	N/mm^2	75 - 85
Impact Strength	Nmm/mm^2	35 - 40
Elongation	%	6.5 - 7.5
Compression strength	N/mm^2	110 - 120
Modulus of elasticity	kN/mm^2	3.0 - 3.2
Water absorption 24 hours / 23°C	%	0.10 - 0.15
Water absorption 7 days / 23°C	%	0.35 - 0.40
Fatigue under reverse bending stresses acc. DLR Brunswick	10%	$> 2 \times 10^6$
	90%	$> 2 \times 10^6$

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

RS-L135

Composite Properties
Cured - Fibre Reinforced Properties

CURING: 24h @ 25°C + 15h @ 60 - 65°C		V_f	RS-L135 & RS-H135 / RS-H138
Flexural strength	N/mm^2	GFC	470 - 500
		CFC	760 - 800
Tensile strength	N/mm^2	GFC	370 - 390
		CFC	520 - 550
Compressive strength	N/mm^2	GFC	310 - 350
		CFC	320 - 350
Interlaminar shear strength	N/mm^2	GFC	39 - 45
		CFC	49 - 53
Flexural modulus	kN/mm^2	GFC	20 - 23
		CFC	43 - 45

GFC - samples: 16 layers, glass fabric, 296g/m^2 8H Satin, 4mm thick.

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

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

Find out what PRF can do for your business

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RS-L135 ed. 3.3 Jul 2019 TDS016

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CERTIFICATE NO. RS 12803