L A M I N A T I N G R E S I N
LH 160
H A R D E N E R S 135 - 136, 285 –287, 500 – 502
H 147

Instruction for use, technical specifications

Characteristics	
Approval:	---
Application:	Boat and shipbuilding Sports equipment Model airplanes Moulds and tools Adhesives Casting
Operational temperature:	- 60 °C - > + 50-60 °C (s H 300 do 80°C)
Processing:	At temperatures between 10 °C a 50 °C All usual processing methods
Special properties:	Good mechanical properties Pot life from approx. 15 min. to approx. 5 hours

Laminating curing systems for curing at room temperatures

Special laminating resin combinations are available for curing at room temperatures from 10 - 30°C. These systems have been modified such that they will cure completely at room temperature and can be worked and used without additional heat treatment.
Hear resistance of 40 – 60°C can be obtained with curing at room temperature (rule of thumb: curing temperature +30°C = maximum heat resistance). The heat resistance of some systems (hardeners 135 – 136 and H 300) can be increased to approx. 80°C by subsequent heat treatment.
In addition to the systems described below, some other resin/hardener combinations can be also used after curing at room temperature unless they must fulfil special requirements (aircraft approval, etc.).
Examples of suitable combinations:

Laminating resin LH 160
Standard bisphenol A-based low viscosity resin.
Viscosity: 700– 900mPas/25°C. Does not crystallize at normal storage temperatures.

Hardeners 135 – 136
Hardener series with various processing times (from approx. 25 min. to approx. 5 hours) for processing at temperatures >18°C.

Laminating resin L 285 with hardener 285 or laminating resin L 335 with hardeners 335/340

Hardeners 285 – 287
Good curing is ensured from temperatures +10°C. Processing time is between 50 min. to cca 2 hours. When cured between 50 - 60°C 3 hours the system fulfil the requirements for engine aircrafts (i.e.. –60 - +80°C.)

Hardeners 500 – 502
Intended specifically for use at lower temperatures. Good curing with this system is obtained at temperatures starting at + 10 °C. Heat resistance is lower than for hardeners 135 - 136.

Application
Low-viscosity laminating resin systems not containing solvents or fillers intended for processing and curing at room temperature. Suitable for production of parts with glass, carbon and aramide fibre reinforcements featuring high static and dynamic loadability.
The range of pot life is between approx. 25 min. and 5 hours. Non-tacky, high gloss surfaces are obtained even with unfavourable curing conditions, such as lower temperatures or high relative humidity.
The mixing viscosities with laminating resin LH 160 are very low, which is advantageous for processing at low temperatures or special processing methods, e.g. injection etc.
Thanks to their excellent adhesive properties, these systems can be also used as adhesives for wood, metal, glass, concrete and numerous plastics. Fillers (e.g. metal powder, talcum, cotton flakes etc.) may be admixed to obtain special system properties.
Due to elongation 4 – 7 %, which is advantageous for use as a laminating resin, the shear strength and peel resistance are somewhat lower than those of our special adhesive resins.

Specification

		Laminating resin LH 160
Density	**g/cm^3 / 25 °C**	1,13 - 1,17
Viscosity	**mPas / 25 °C**	700 – 900
Epoxide equivalent	**-**	166 – 182
Epoxide value	**-**	0,55 - 0,60
Colour	**Gardner**	max 3

Hardener 135 – 136
Hardener 285 - 287
Hardener 500 - 502
Hardener H 147

Specification

		Hardener 135	Hardener 136	Hardener 500
Density	**g/cm^3 / 25 °C**	0,98 - 1,07	0,94 - 0,98	1,00-1,06
Viscosity	**mPas / 25 °C**	50 - 150	20 - 100	200-350
Amine value	**mg KOH / g**	450 - 500	450 - 500	350-400
Colour	**Gardner**	max 4 (*)	max 4 (*)	max 5 (*)

		Hardener 285	Hardener 286	Hardener 287
Density	**g/cm^3 / 25 °C**	0,94 - 0,97	0,94 - 0,97	0,93 - 0,96
Viscosity	**mPas / 25 °C**	50 - 100	60 - 100	80 - 100
Amine value	**mg KOH / g**	480 - 550	450 - 500	450 - 500
Colour	**Gardner**	max 3 (*)	max 3 (*)	max 3 (*)

(*) For colourless hardener only – hardeners are coloured transparent blue

		Hardener 501	Hardener 502
Density	**g/cm^3 / 25 °C**	0,98 - 1,05	0,98 - 1,05
Viscosity	**mPas / 25 °C**	100 - 250	30 – 100
Amine value	**mg KOH / g**	470 - 550	400 – 500
Colour	**Gardner**	max 4	max 4

		Hardener H 147
Density	**g/cm^3 / 25 °C**	
Viscosity	**mPas / 25 °C**	600
Amine value	**mg KOH / g**	
Colour	**Gardner**	

Processing details

	Resin LH 160	Hardener 135 – 136, 500	Hardener 501 – 502
Average EP value	0,56	-	**-**
Average amine equivalent	-	62	72
Storage	> 12 months in original containers		
Processing temperature	10 - 50 °C		
Curing	Curing at room temperature or curing in the mould at high temperatures.		
Heat treatment	Not necessary – possible at 50 °C > 150 °C		

	Hardener 285 - 287	Hardener H 147	
Average amine equivalent	64	-	
Storage	> 12 month in original containers		
Processing temperature	10 - 50 °C		
Curing	Curing at room temperature or curing in the mould at high temperatures.		
Heat treatment	Not necessary – possible at 50 °C > 150 °C		

Storage
The resin and hardeners can be stored for at least 12 month in the carefully sealed containers. The resin and hardeners may crystallize at temperatures below +15°C. The crystallization is visible as clouding or solidification of the contents of the container. Before processing, the crystallization must be removed by warming up. Slow warming up to approx. 50 – 60°C in a water bath or oven and stirring or shaking will clarify the contents of the container without any loss of quality. Use only completely transparent products. Before warming up, open containers slightly to permit equalization of pressure. Caution during warm-up! Do not warm up over an open flame! While stirring up use safety equipment (gloves, eyeglasses, respirator).

Mixture ratios

	Resin LH 160 : Hardeners 135 – 136
Parts by weight	**100 : 35 (+/-2)**
Parts by volume	**100 : 40 (+/-2)**

	Resin LH 160 : Hardeners 285 – 287
Parts by weight	**100 : 40 (+/-2)**
Parts by volume	**100 : 50 (+/-2)**

	Resin LH 160 : Hardeners 500 – 502
Parts by weight	**100 : 40 (+/-2)**
Parts by volume	**100 : 50 (+/-2)**

	Resin LH 160 : Hardeners H 147
Parts by weight	**100 : 25 (+/-2)**
Parts by volume	**---**

The specified mixture ratios must be observed as exactly as possible. Adding more or less hardener will not effect a faster or slower reaction – only incomplete curing which cannot be corrected in any way.
The mixture of resin and hardener must be mixed very thoroughly. Mix until no clouding is visible in the mixing container. Pay special attention to the walls and the bottom of the mixing container.

The optimal processing temperature is in the range between 20 and 25°C. Higher processing temperatures are possible, but will shorten pot life. A rise in temperature of 10°C will halve the pot life. Water (for example very high humidity or contained in fillers) causes an acceleration of the resin/hardener reaction. Different temperatures and humidities during processing have no significant effect on the strength of the hardened product.

Do not mix large quantities, especially if highly reactive systems are used. The heat flow from the mixing container is very low, so the contents will be warmed up very fast because of the reaction heat (exothermic resin – hardener reaction). This can cause temperatures > 200°C which causes smoke intensive burning of the resin-hardener mixture.

Gel time – film thickness 1 mm at various temperatures

	Hardener 135	**Hardener 136**	**Hardener 500**
20 - 25 °C	app. 4 - 5 hours	app. 6 - 7 hours.	app. 45-60 min
40 - 45 °C	app. 50 min.	app. 1 - 2 hours	app. 20-30 min

	Hardener 501	**Hardener 502**
20 - 25 °C	app. 2 - 3 hours	app. 4 - 5 hours
40 - 45 °C	app. 40 - 50 min.	app. 60 - 80 min.

	Hardener 285	**Hardener 286**	**Hardener 287**	**Hardener 147**
20 - 25 °C	app. 2 - 3 hours	app. 3 - 4 hours	app. 5 - 6 hours	app. 70min
40 - 45 °C	app. 45 – 60 min.	app. 60 - 90 min.	app. 80 – 120 min.	