

SE 84LV

LOW TEMPERATURE CURE EPOXY PREPREG

- ▣ Versatile, high-strength prepreg system
- ▣ Curable at temperatures as low as 80°C (176°F)
- ▣ Can be processed with vacuum-only processing
- ▣ Excellent tack
- ▣ Low Viscosity – Ideal for use with heavy fibre weights
- ▣ Germanischer Lloyd Certified
- ▣ Lloyd's Register Certified

INTRODUCTION

SE 84LV is an exceptionally versatile hot-melt, epoxy prepreg. It can be cured at temperature as low as 80°C (176°F), or can be used for faster moulding of components at 120°C (248°F). This is achieved with an extremely good outlife of up to 8 weeks at 18-22°C (64-72°F). It is a toughened system, and offers excellent mechanical properties on a wide variety of reinforcing fabrics and fibres.

SE 84LV is commonly used in vacuum bagging, press-moulding, autoclave and other pressure moulding processes.

SE 84LV is a very low viscosity system used with heavy fibre weights where low-flow processing conditions (vacuum bag pressure and minimum cure temperature), are likely to be used. With its high compressive strength it is widely used in large heavily loaded components, such as yacht hulls, and spars. It has been selected for use by various America's Cup syndicates and boats racing in the Volvo Ocean Race.

SE 84LV is widely used in sandwich structures with honeycomb, foam and balsa cores, primarily with the toughened SA 80 Adhesive Film.



PROCESSING NOTES - GENERAL

PREPARATION

When preparing the lay-up the prepreg should be removed from the freezer and allowed to thaw in a sealed bag. This may take 6 to 24 hours depending on roll size. This prevents atmospheric moisture from condensing on the prepreg which may cause voiding on cure. The mould surface should be release coated and must have been tested for vacuum integrity prior to lay-up.

LAYING-UP

The following procedure is recommended for preparing vacuum cured laminates.

1. Place the lay-up on a tool or caul sheet which has been treated with a release agent or film. Insert a thermocouple into the lay-up near the centre ply of the thickest edge section, outside the net trim line. A separate prepreg nylon peel ply is available for covering a mould tool prior to lay-up in order to leave a clean, textured surface for subsequent bonding.

2. Apply a peel ply to the surface of the lay-up. Note that for good secondary bonding of a peel-plyed surface of an SE 84LV prepreg laminate, a nylon peel ply, such as Gurit's Stitch Ply A, is strongly recommended. This is particularly important where the cure temperatures are in excess of 90°C (194°F). Cover the peel ply entirely with a perforated release film. Normally, no edge resin bleeder system is used. For thin sections, Gurit WL3600P90 grade release film are recommended, while for sections of 4mm and above, Gurit WL3600P release film is also suitable. With WL3600P the amount of resin bled away is controlled by the number of dry plies of resin bleeder cloth placed over the perforated release film.

3. Install a vacuum bag by standard techniques. Insert at least two vacuum stems through the bag connecting one to the vacuum source and the other, at a point on the part furthest from the source, to a calibrated vacuum gauge. Position part in the oven or autoclave and draw vacuum to check for bag or system leaks.

4. Commence the heat-up cycle, typically between 0.3°C(0.5°F)/min and 2°C(3.6°F)/min to the final cure temperature. At 85°C (185°F), the temperature should be held up for 10 hours. Faster cures may be obtained at elevated temperatures, e.g. 6 hours at 90°C (194°F), 3 hours at 100°C (212°F) or 1 hour at 120°C (248°F). All temperatures measured by the previously installed thermocouple. When curing at 80°C (176°F) a minimum of 12 hours is recommended. Vacuum should be maintained as high as possible, with a minimum of 85% throughout the cure cycle.

5. Upon completion of cure, turn off heat and cool until part temperature has fallen below 60°C (140°F). When fully cooled, the part may be debagged, trimmed and machined as necessary. A post-cure is not required.

CORE BONDING

This product can be used in conjunction with typical core materials. Representative test panels should be made to ensure that the laminate construction, curing method and other variables allow full filling of any cuts or slits in the foam. The cure cycles given in this datasheet are for typical monolithic flat panels and may not be appropriate for sandwich panels.

When using Nomex™ or aluminium honeycombs, the separate SA 80 adhesive film is recommended and full details of use are provided on the separate SA 80 data sheet. This adhesive film is supplied on a lightweight glass carrier, or in some cases it can be supplied directly coated onto one face of the SE 84LV prepreg.

The system is fully compatible with Ampreg wet layup epoxy systems and therefore all types of cores may be bonded to a first skin by using a separate 'wet-bonding' operation. In this case, the addition of filler powders to the appropriate resin system is required to provide the correct paste-like consistency.

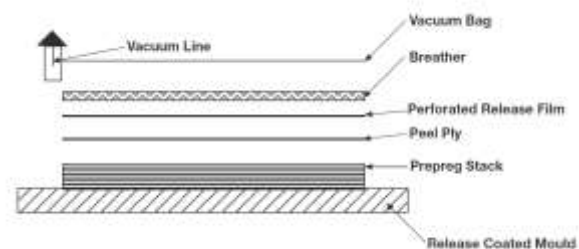
PROCESSING NOTES - CURING

CURE CYCLES

For a good balance of composite properties, it is recommended that the laminate is cured at 80°C (176°F) for a minimum of 12 hours. A laminate may be cured in two stages - if, for example, making a cored component. However in a two stage cure, a minimum of 4 hours at 85°C (185°F) or 5 hours at 80°C (176°F) is recommended before debagging a skin, and it must be ensured that this skin is cured for the equivalent of at least 10 hours at 85°C (185°F) or 12 hours at 80°C (176°F) before going into service.

SE 84LV may be cured at higher temperatures for a shorter time. At a cure temperature of 100°C (212°F) cure can be achieved in 3 hours or at 120°C (250°F) cure can be achieved in 1 hour.

It is not recommended to cure SE 84LV under vacuum pressures of less than 85%. If a ramp rate of less than 0.3°C/min (0.5°F/min) is used, users should satisfy themselves that this allows adequate flow.



CURING AT 80°C (176°F)

When curing at 80°C (176°F) it is important to ensure the temperature is monitored off the trailing thermocouple. 80°C (176°F) should be treated as the minimum cure temperature for SE 84LV; 70-75°C (158-167°F) will not generate adequate mechanical properties.

THIN LAMINATES

When using very thin laminates (e.g. with a total laminate fibre weight of less than 300g/m²), care needs to be taken to avoid extracting excessive amounts of resin during the cure process. To avoid this, a microporous release film can be used, and for particularly critical components, a prepreg peel ply should be used.

PRODUCT INFORMATION

AVAILABILITY

SE 84LV prepregs are available in a wide variety of fabric forms and collimated unidirectional tapes. Unidirectional materials are normally supplied on a single release paper and fabrics on a single polythene film. Please contact Customer Support to discuss specific requirements and availability. The product formats listed below also benefit from 3rd Party Certification.

PRODUCT DESCRIPTION	CERTIFICATION
Unidirectional Epoxy Prepreg 150g/m ² , 200g/m ² 300g/m ² , 450g/m ²	Germanischer Lloyd
SE84LV/HEC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/IMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register

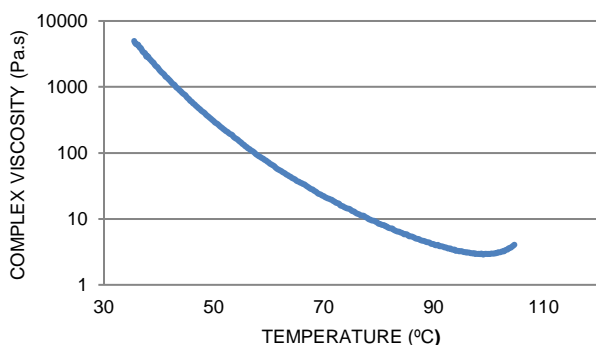
PRODUCT DESCRIPTION	CERTIFICATION
SE84LV/HMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/UHMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/RC200T (& 400g (XC416T))	Lloyd's Register
SE84LV/RC416T	Lloyd's Register
SE84LV/XC305 & 400g, 600g (XC411 & XC611)	Lloyd's Register
SE84LV/XE905	Lloyd's Register

PREPREG PROPERTIES

RHEOLOGY DATA

SE 84LV resin viscosity profile conducted at 1°C (1.8°F) per minute.

PROPERTY	VALUE	
Minimum Viscosity	2.9 Pa.s	28.8 P
Temperature at Minimum Viscosity	99°C	210°F



TRANSPORT & STORAGE

When stored sealed & out of direct sunlight.

STORAGE TEMP		UNIT	VALUE
-18°C	0°F	months	24
+18-22°C	+64-72°F	weeks	8

All prepreg materials should be stored in a freezer when not in use to maximise their useable life, since the low temperature reduces the reaction of resin and catalyst to virtually zero. However, even at -18°C (0°F), the temperature of most freezers, some reaction will still occur. In most cases after some years, the material will become unworkable.

When not in use SE 84LV products should be maintained at -18°C (0°F). To avoid contamination on their surfaces, allow rolls to reach room temperature before unwrapping.

HEALTH AND SAFETY

Please refer to product SDS for up to date information specific to this product.

MINIMUM CURE TIME & TEMPERATURE

Recommended minimum cure is 12 hours at 80°C (176°F) using vacuum bag processing.

PROPERTY	OVEN / VAC BAG		TEST STANDARD
Typical Laminate	8 plies of SE 84 LV 300g/m ² unidirectional prepreg with 35% resin content		-
Typical Ramp Rate	1 – 2°C (2 – 4°F) per minute		-
Cure Temperature	80°C (176°F)	120°C (248°F)	-
Cure Dwell Time	12 (hours)	1 (hour)	-
Cure Pressure	-1bar (14.5Psi)		-
De-mould Temperature	< 60°C (140°F)		-
Dry Tg _i (DMA)	98°C / 208°F	115°C / 239°F	ISO 6721 (DMA)

*suitable for use in conjunction with hot-in / hot-out rapid component manufacture is possible using appropriate press tooling

CURING LARGE STRUCTURES

Gurit provides detailed processing notes for large structures to be built using SE84LV / SA 80; these notes are available from the Technical Department on request.

MECHANICAL PROPERTIES

Cured using standard vacuum bag processing techniques and a minimum cure time of 12hrs at 80°C (176°F). Values are representative of the typical properties to be expected but do not constitute a guaranteed specification.

CURED RESIN PROPERTIES

PROPERTY	SYMBOL	SE 84LV RESIN CAST	TEST STANDARD
Tensile Strength	σ_T	82 MPa	ISO 527-2
Tensile Modulus	E_T	3.9 GPa	ISO 527-2
Flexural Strength	σ_F	123 MPa	ISO 178
Flexural Modulus	E_F	3.5 GPa	ISO 178
Compressive Strength	σ_C	163 MPa	ISO 604
Glass Transition Temperature	T_{g1}	115°C	ISO 6721

UNIDIRECTIONAL LAMINATE PROPERTIES

Properties presented are averages of multiple batch data from a variety of fibre suppliers. Customers with specific requirements should contact Gurit technical support who can recommend appropriate fibres and formats.

PROPERTY	SYMBOL	UNIT	HEC FIBRE*	IMC FIBRE*	HMC FIBRE*	UHMC FIBRE*	TEST STANDARD
Typical Fibre Density	ρ_{fibre}	g/cm ³	1.8	1.79	1.82	1.84	-
Fibre Modulus	E_{fibre}	GPa	227 - 257	275 - 310	365 - 405	420 - 455	-
Resin Content	%	%	32 - 37	32 - 37	33 - 37	35	ASTM D 3171 Method II
Fibre Volume Fraction	v_f	%	55.0	55.5	54.4	54.3	ASTM D 3171 Method II
0° Tensile Strength**	X_T	MPa	2458	2894	2658	1980	ISO 527-5
0° Tensile Modulus**	E_t	GPa	134	170	222	250	ISO 527-5
0° Compressive Strength**	X_c	MPa	1354	1417	1166	1070	SACMA SRM1-94
0° Compressive Modulus**	E_{c11}	GPa	121	153	192	227	SACMA SRM1-94
90° Tensile Strength	Y_T	MPa	39.2	33.2	30.1	26.0	ISO 527-5
90° Tensile Modulus	E_{t22}	GPa	8.3	8.4	7.1	6.6	ISO 527-5
0° Flexural Strength	X_F	MPa	1448	1406	-	-	ISO 14125
0° Flexural Modulus	E_{F11}	GPa	106	129	-	-	ISO 14125
0° ILSS	X_{ILSS}	MPa	86.6	88.6	82.3	77.8	ISO 14130

*HEC = High Elongation Carbon, IMC = Intermediate Modulus Carbon, HMC = High Modulus Carbon, UHMC = Ultra-High Modulus Carbon

**Normalised to 60% fibre volume fraction

WOVEN LAMINATE PROPERTIES

Properties presented are averages of multiple batch data, where possible witnessed by a third party surveyor on a standard fibre type. Customers with specific requirements should contact Gurit technical support who can recommend suitable fibres and formats.

PROPERTY	SYMBOL	UNIT	RC200T	RC416T	TEST STANDARD
Resin Content	-	%	42	40	ASTM D 3171 Method II
Cured Ply Thickness	-	mm	0.23	0.43	ASTM D792
Fibre Volume Fraction	-	%	47 - 53	50 - 59	ASTM D 3171 Method II
0° Tensile Strength*	X _T	MPa	719	1006	ISO 527-4
0° Tensile Modulus*	E _t	GPa	60.6	59.1	ISO 527-4
90° Tensile Strength*	Y _T	MPa	662	858	ISO 527-4
90° Tensile Modulus*	E _{T22}	GPa	61.6	58.9	ISO 527-4
0° Compressive Strength*	X _c	MPa	759	649	SACMA SRM1-94
0° Compressive Modulus*	E _c	GPa	58.3	55.6	SACMA SRM1-94
90° Compressive Strength*	Y _c	MPa	731	659	SACMA SRM1-94
90° Compressive Modulus*	E _{C22}	GPa	59.0	55.2	SACMA SRM1-94
0° Flexural Strength	X _F	MPa	847	895	ISO 14125
0° Flexural Modulus	E _{F11}	GPa	51.2	49.4	ISO 14125
90° Flexural Strength	Y _F	MPa	857	892	ISO 14125
90° Flexural Modulus	E _{F22}	GPa	51.5	50.6	ISO 14125
ILSS	τ _M	MPa	74.8	55.8	ISO 14130

*Normalised to 55% fibre volume fraction

MULTIAXIAL LAMINATE PROPERTIES

Properties presented are multiple batch data, where possible witnessed by a third party surveyor on a standard fibre type. Customers with specific requirements should contact Gurit technical support who can recommend suitable fibres and formats.

PROPERTY	SYMBOL	UNIT	XC411	TEST STANDARD
Resin Content	-	%	40	ASTM D 3171 Method II
Cured Ply Thickness	-	mm	0.43	ASTM D792
Fibre Volume Fraction	-	%	47 - 59	ASTM D 3171 Method II
+45° Tensile Strength*	X _T	MPa	1124	ISO 527-4
+45° Tensile Modulus*	E _t	GPa	63.8	ISO 527-4
-45° Tensile Strength*	Y _T	MPa	1237	ISO 527-4
-45° Tensile Modulus*	E _{T22}	GPa	64.5	ISO 527-4
+45° Compressive Strength*	X _c	MPa	595	SACMA SRM1-94
+45° Compressive Modulus*	E _c	GPa	62.0	SACMA SRM1-94
-45° Compressive Strength*	Y _c	MPa	645	SACMA SRM1-94
-45° Compressive Modulus*	E _{C22}	GPa	60.2	SACMA SRM1-94
+45° Flexural Strength	X _F	MPa	815	ISO 14125
+45° Flexural Modulus	E _{F11}	GPa	41.5	ISO 14125
-45° Flexural Strength	Y _F	MPa	1004	ISO 14125
-45° Flexural Modulus	E _{F22}	GPa	57.0	ISO 14125
ILSS	τ _M	MPa	49.7	ISO 14130

*Normalised to 55% fibre volume fraction

NOTICE

All advice, instruction or recommendation is given in good faith but the Company only warrants that advice in writing is given with reasonable skill and care. No further duty or responsibility is accepted by the Company. All advice is given subject to the terms and conditions of sale (the Conditions) which are available on request from the Company or may be viewed at the Company's Website: www.gurit.com/terms-and-conditions.aspx.

The Company strongly recommends that Customers make test panels and conduct appropriate testing of any goods or materials supplied by the Company to ensure that they are suitable for the Customer's planned application. Such testing should include testing under conditions as close as possible to those to which the final component may be subjected. The Company specifically excludes any warranty of fitness for purpose of the goods other than as set out in writing by the Company. The Company reserves the right to change specifications and prices without notice and Customers should satisfy themselves that information relied on by the Customer is that which is currently published by the Company on its website. Any queries may be addressed to the Technical Services Department.

Gurit are continuously reviewing and updating literature. Please ensure that you have the current version, by contacting Gurit Marketing Communications or your sales contact and quoting the revision number in the bottom left-hand corner of this page.

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