

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

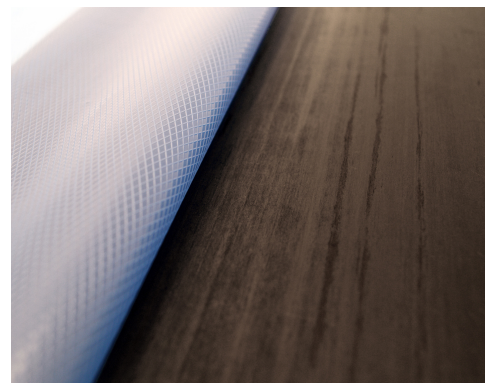
INTRODUCTION

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

Various core materials can be used with the prepreg system, including foams and honeycombs. However, due to the wide variety of PVC and other foams available, and the cure temperatures involved, special procedures have been developed which must be carefully followed. For details of these processes, please contact Technical Services.

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 20 and Ampreg 26 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.

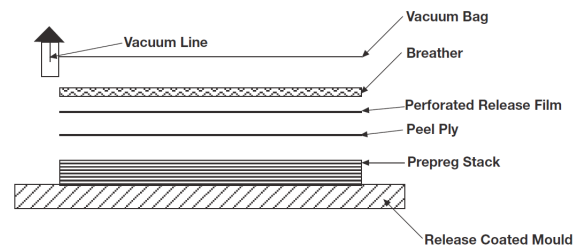
PROCESSING NOTES - CURING

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 300gm²), 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 preregs 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
Prepreg Resin Statement of Acceptance	Lloyd's Register
SE84LV/HEC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/HMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register

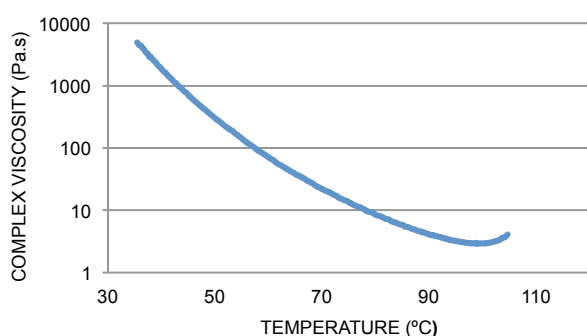
PRODUCT DESCRIPTION	CERTIFICATION
SE84LV/HSC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/IMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/RC200T (& 400g (XC416T))	Lloyd's Register
SE84LV/RC416T	Lloyd's Register
SE84LV/UMC/120/37/+/-3% & 200g, 300g, 450g, 600g	Lloyd's Register
SE84LV/XC305 & 400g, 600g (XC411 & XC611)	Lloyd's Register
SE84LV-RE100 H4	Lloyd's Register
SE84LV-RE200 P	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 T _g , (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.

LAMINATE PROPERTIES

CURED RESIN PROPERTIES

Oven cured using standard processing techniques and a minimum cure time of 12 hours at 80°C (176°F).

PROPERTY	SYMBOL	SE 84LV RESIN CAST		TEST STANDARD
Tensile Strength	σ_T	82 MPa	11.9 ksi	ISO 527-2
Tensile Modulus	E_T	3.9 GPa	0.57 Msi	ISO 527-2
Flexural Strength	σ_F	123 MPa	17.8 Ksi	ISO 178
Flexural Modulus	E_F	3.5 GPa	0.51 Msi	ISO 178
Compressive Strength	σ_C	163 MPa	23.6 Ksi	ISO 604

UNIDIRECTIONAL LAMINATE PROPERTIES

Cured using standard vacuum bag processing techniques and a minimum cure time of 12hrs at 80°C (176°F).

PROPERTY	SYMBOL	T700 HS CARBON FIBRE		TRH50 60K 300G		TEST STANDARD
Fibre Density	ρ_{fibre}	1.84 g/cm ³	0.066 lb/in ³	1.82 g/cm ³	0.066 lb/in ³	-
Fibre Modulus	E_{fibre}	240 GPa	35 Msi	250 GPa	36 Msi	-
Fibre Strength	X_{fibre}	4.9 GPa	0.71 Msi	4.9 GPa	0.71 Msi	-
Resin Content	%	37		34		ASTM D 3171 Method II
Cured Ply Density	ρ_{ply}	1.5 g/cm ³	0.054 lb/in ³	1.5 g/cm ³	0.054 lb/in ³	ASTM D792
Glass Transition Temperature	T_{g1}	115°C	239°F	115°C	239°F	ISO 6721
Cured Ply Thickness	t_{ply}	0.29 mm	0.011 in	0.30 mm	0.012 in	ASTM D 3171 Method II
0° Tensile Cured Fibre Volume*	V_f	59.1 %		56.2 %		ASTM D 3171 Method II
0° Tensile Strength (Normalised to 60%)	X_T	2887 MPa	419 ksi	2150 MPa	312 ksi	ISO 527-4
0° Tensile Modulus (Normalised to 60%)	E_t	131 GPa	19 Msi	144 GPa	21 Msi	ISO 527-4
0° Tensile Poisson's Ratio	ν_{11}	-		0.78		ISO 527-4
0° Compressive Str. Fibre Volume *	V_f	56.7 %		55.4 %		ASTM D 3171 Method II
0° Compressive Strength (Normalised to 60%)	X_C	1256 MPa	182 ksi	1304 MPa	189 ksi	SACMA SRM1-94
0° Compressive Mod. Fibre Volume *	V_f	56.3 %		55.9 %		ASTM D 3171 Method II
0° Compressive Modulus (Normalised to 60%)	E_{c11}	124 GPa	18 Msi	140 GPa	20 Msi	SACMA SRM1-94
90° Tensile Cured Fibre Volume*	V_f	-		56.6 %		ASTM D 3171 Method II
90° Tensile Strength	Y_T	-	-	53 MPa	7.7 ksi	ISO 527-4
90° Tensile Modulus	E_{T22}	-	-	8.2 GPa	1.2 Msi	ISO 527-4
90° Compressive Str. Fibre Volume *	V_f	-		57.8 %		ASTM D 3171 Method II
90° Compressive Strength	Y_C	-	-	202 MPa	29 ksi	SACMA SRM1-94
90° Compressive Mod. Fibre Volume *	V_f	-		56.0 %		ASTM D 3171 Method II
90° Compressive Modulus	E_{c22}	-	-	9.0 GPa	1.3 Msi	SACMA SRM1-94
0° Flexural Fibre Volume *	V_f	-		56.9%		ASTM D 3171 Method II
0° Flexural Strength	X_F	-	-	1617 MPa	235 ksi	ISO 14125
0° Flexural Modulus	E_{F11}	-	-	121 GPa	18 Msi	ISO 14125
±45° IPS Fibre Volume*	V_f	-		55.9 %		ASTM D 3171 Method II
±45° In-Plane Shear Strength	τ_{12}	-	-	77 MPa	11 ksi	ISO 14129
±45° In-Plane Shear Modulus	G_{12}	-	-	4.3 GPa	0.62 Msi	ISO 14129
±45° In-Plane Shear Poisson's Ratio	ν_{12}	-		0.82		ISO 14129
0° ILSS Fibre Volume*	V_f	55.0 %		58.0%		ASTM D 3171 Method II
0° ILSS	X_{ILSS}	76 MPa	11.0 ksi	91 MPa	13.2 ksi	ISO 14130

*original laminate fibre volume fraction

WOVEN LAMINATE PROPERTIES

Cured using recommended processing and curing techniques.

PROPERTY	SYMBOL	RC200T		RC200T		WRE293		TEST STANDARD
Resin Content	-	42 %		42 %		42 %		ASTM D 3171 Method II
Cure Method	-	Vacuum Bag		Press		Press		-
Cure Schedule	-	10hrs / 85°C (185°F) / 1Bar		1hrs / 120°C (248°F) / 6Bar		1hrs / 120°C (248°F) / 6Bar		-
Cured Ply Density	ρ_{ply}	1.5 g/cm ³	0.054 lb/in ³	1.5 g/cm ³	0.054 lb/in ³	1.8g/cm ³	0.065 lb/in ³	ASTM D792
Glass Transition Temperature	T _{g1}	115°C	239°F	115°C	239°F	115°C	239°F	ASTM D7028
Cured Ply Thickness	t _{ply}	0.23 mm	0.009 in	0.20 mm	0.008 in	0.23 mm	0.009 in	ASTM D 3171 Method II
0° Tensile Cured Fibre Volume*	V _f	53.0 %		55.4 %		51.8 %		ASTM D 3171 Method II
0° Tensile Strength (Normalised to 60%)	X _T	730 MPa	106 ksi	1163 MPa	169 ksi	633 MPa	92 ksi	ISO 527-4
0° Tensile Modulus (Normalised to 60%)	E _t	72 GPa	10.4 Msi	65 GPa	9.4 Msi	37 GPa	5.4 Msi	ISO 527-4
90° Tensile Cured Fibre Volume*	V _f	46.2 %		-		-		ASTM D 3171 Method II
90° Tensile Strength (Normalised to 60%)	Y _T	878 MPa	127 ksi	-	-	-	-	ISO 527-4
90° Tensile Modulus (Normalised to 60%)	E _{T22}	66 GPa	9.6 Msi	-	-	-	-	ISO 527-4
0° Comp. Str. Fibre Volume *	V _f	51.0 %		50.4 %		64.0%		ASTM D 3171 Method II
0° Compressive Strength (Normalised to 60%)	X _C	846 MPa	123 ksi	914 MPa	133 ksi	644 MPa	93 ksi	SACMA SRM1-94
0° Comp. Mod. Fibre Volume *	V _f	46.9 %		56.2 %				ASTM D 3171 Method II
0° Compressive Modulus (Normalised to 60%)	E _c	69 GPa	10.0 Msi	65 GPa	9.4 Msi	-	-	SACMA SRM1-94
90° Comp Str. Fibre Volume	V _f	50.6 %		-		-		ASTM D 3171 Method II
90° Compressive Strength	Y _C	775 MPa	112 ksi	-	-	-	-	SACMA SRM1-94
90° Comp. Mod. Fibre Volume*	V _f	46.9 %		-		-		ASTM D 3171 Method II
90° Compressive Modulus	E _{C22}	67 GPa	9.7 Msi	-	-	-	-	SACMA SRM1-94
0° Flexural Cured Fibre Volume*	V _f	48.4 %		-		-		ASTM D 3171 Method II
0° Flexural Strength	X _F	917 MPa	133 ksi	-	-	-	-	ISO 14125
0° Flexural Modulus	E _{F11}	42 GPa	6.1 Msi	-	-	-	-	ISO 14125
0° ILSS Fibre Volume*	V _f	48%		56.5 %		41.0%		ASTM D 3171 Method II
ILSS	τ_M	75 MPa	10.9 ksi	67 MPa	9.7 ksi	58 MPa	8.4 ksi	ISO 14130

*original laminate 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.

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