

Product Description

LTM25 is a low to medium viscosity resin matrix formulated for low temperature initial cure using autoclave, vacuum bag or press moulding techniques.

LTM25 will, after suitable post cure, give in service performance equivalent to a standard 120° system.

Features

- Low initial cure temperature 50°C - 60°C (122°F - 140°F).
- High quality components can be made from low cost/low temperature mould.
- Excellent mechanical properties, equivalent to 120°C (248°F) curing prepreg systems.
- Service temperatures under load up to 100°C (212°F).
- Available in a wide range of woven and unidirectional reinforcements.
- Good adhesion to core materials.
- Adhesive film variants (LTM25A and LTM25NC) available if required.

Instructions For Use

Prepreg should be removed from the freezer and allowed to reach room temperature prior to opening the sealed bag. The presence of moisture within a curing laminate may degrade the quality of the structure produced.

Prepreg should be cut prior to removal of the release films. The balance of prepreg not required should be resealed and returned to the freezer although it is preferable to cut up complete rolls on first removal from the freezer and store required amounts in separate packs.

The release paper should be removed from the appropriate side of the first ply which should be positioned into the carefully released mould. Great care should be taken to ensure that the prepreg conforms exactly to the tool shape, especially around internal corners to ensure consolidation without bridging. Rollers and shaped PTFE spatulas may be used to assist this operation. The top release film should be removed once the prepreg has been rolled out. Subsequent layers may then be applied in the same manner until the desired thickness is achieved.

The lay up should be vacuum debulked at regular intervals with 850-950 mbars (26-28inHg) of vacuum for 15-30 minutes, covering the laid up material with perforated release film plus a suitable breather. A low cost membrane may then be sealed into position to complete the vacuum bag.

On large components, which may take several days to prepare, the worklife of the LTM25 prepreg may be exceeded prior to elevated temperature cure. In such cases the unfinished lay up must be held under full vacuum during any shift changeover or waiting period. The release film and other consumables should then be removed before resuming lay up with LTM25 prepreg which remains within its worklife. In this way large or thick components can be moulded without significantly affecting mechanical properties.

LTM25 prepreg can be used with a variety of core materials such as foams, balsa and honeycombs to produce lightweight, stiff sandwich structures. Many core materials readily absorb and retain moisture which may cause problems during component manufacture. The correct selection of cure process is required to avoid problems. Please consult Advanced Composites Group Technical Department for more details.

For applications requiring maximum bond strength between skin and honeycomb core, the use of LTM25A adhesive film is recommended. However, this may not be required in components which will be lightly stressed in service. In such cases LTM25 prepreg may be cured directly onto the selected core material.

Initial Cure

ACG LTM25 prepreg may be processed by vacuum, autoclave, or press moulding techniques. Initial cure can be carried out at any temperature from ambient to 150°C(302°F).

General recommendations for time/temperature conditions to be applied during cure of LTM25 are summarised in the following table:-

INITIAL CURE TEMPERATURE	OPTIMUM CURE TIME
50°C (122°F)	24 hours
55°C (131°F)	10 hours
60°C (140°F)	8 hours
65°C (149°F)	5 hours
70°C (158°F)	4 hours
80°C (176°F)	2 hours

Shorter time/higher temperature cures have been developed for specialist press moulding applications. Details available from ACG Technical Department.

Exotherm

NOTE: You are advised to read this section before proceeding with initial cure.

LTM prepregs contain highly reactive resins which can undergo severe exothermic heat build up during the initial curing process if incorrect curing procedures are followed.

Great care must be taken to ensure that safe heating rates, dwell temperatures and lay-up /bagging procedures are adhered to, especially when moulding solid laminates in excess of 3-4mm thickness. The risk of exotherm increases with lay up thickness and increasing cure temperature, and it is strongly recommended that trials representative of all the relevant circumstances are carried out by the user to allow a safe cure cycle to be specified. It is also important to recognise that the model or tool material and its thermal mass, combined with the insulating effect of breather/bagging materials can affect the risk of exotherm in particular cases. ACG Technical Department may be consulted for advice on exotherm behaviour.

Typical Cure Cycles

Vacuum/Oven cure:

Apply 860 mbar (26in Hg) vacuum at room temperature.

Heat to $60 \pm 5/-0^{\circ}\text{C}$ ($140 \pm 9/-0^{\circ}\text{F}$) @ 1°C (2°F) / minute maximum.

Maintain at $60 \pm 5/-0^{\circ}\text{C}$ ($140 \pm 9/-0^{\circ}\text{F}$) under the applied vacuum for a minimum of 8 hours.

Remove heating and cool to room temperature slowly under vacuum.

[Alternative time/temperature options are provided in the cure guidelines on page 2.]

Autoclave Cure:

Apply 860 mbar (26in Hg) vacuum at room temperature. Maintain for 15 minutes.

Heat to $60 \pm 2^{\circ}\text{C}$ ($140 \pm 4^{\circ}\text{F}$) @ 0.5°C (1°F)/minute, 1°C (2°F)/minute maximum and apply desired pressure.

Vent vacuum to atmosphere when pressure reaches 0.14 Mpa (20psi).

Dwell at $60 \pm 2^{\circ}\text{C}$ ($140 \pm 4^{\circ}\text{F}$) and desired pressure for a minimum of 8 hours.

Cool to room temperature at 1°C (2°F)/minute maximum under pressure

[Alternative time/temperature options are provided in the cure guidelines on page 2.]

NOTE

For single skin laminates normal pressure range advised is 50 psi - 100 psi, however the core crush strength must be considered when selecting the cure pressure for sandwich structures.

Cure temperature should be monitored by thermocouples attached to the component, and should be controlled as closely as possible, in accordance with the tolerances stated above.

Postcure

Laminates cured for the recommended period at 60°C (140°F) or higher temperatures may be used up to 60°C (140°F) (max.) in service without additional postcure.

In applications demanding maximum temperature resistance (eg. 100°C (212°F)) it is essential to develop the glass transition temperature of the resin to the maximum level. This may be achieved by using a postcure as follows:-

- Heat from room temperature to 60 ± 5°C (140 ± 9°F) at 1°C (2°F)/minute.
- Heat from 60± 5°C (212 ± 9°F) to 120 ± 5°C (248 ± 9°F) at 0.3°C (0.54°F)/minute.
- Dwell for 1 hour at 120 ± 5°C (248 ± 9°F).
- Cool to room temperature at 3°C (5°F)/minute.

Other postcure cycles can be used to achieve intermediate levels of cure for lower service temperatures.

Technical Data

Matrix Resin Properties

CURED RESIN PROPERTIES	UNITS	LTM25
Cured Resin Density	g/cm3	1.23
Tg after 8 hours @ 60°C (140°F)	°C (°F)	75 (167°F)
Tg after postcure to 120°C (248°F)	°C (°F)	125 (257°F)

Typical Laminate Properties

The tables which follow contain typical mechanical properties of Carbon and Glass woven/unidirectional reinforced laminates with the LTM25 resin matrix.

Laminates were moulded using a variety of cure cycles to a nominal moulded thickness of 2mm.

CRAG test methods were used throughout, and all flexural and tensile data has been normalised as stated at the foot of each table.

Key to symbols used in tables:-

Wet	=	2 hour boil in deionised water
ILSS	=	Interlaminar shear strength
RT	=	Room temperature
N/A	=	Currently not available



Typical Mechanical Properties

Carbon UD Laminates - T300 - Laid and tested in the 0° direction.

TYPE OF CURE PROCESS			AUTOCLAVE	AUTOCLAVE POSTCURED	VAC BAG	VAC BAG POSTCURED	PRESS	PRESS POSTCURED
CURE CONDITION	TEMP °C (°F)		60 (140)	60 (140)	60 (140)	60 (140)	110 (230)	110 (230)
	TIME	HOURS	24	24	24	24	0.50	0.50
	PRESSURE MPa (psi)		0.62 (90)	0.62 (90)	27in Hg	27in Hg	0.62 (90)	0.62 (90)
I L S S MPa	RT	DRY	89	83	80	78	83	82
	RT	WET	84	81	70	73	81	81
	50°C (122°F)	DRY	67	77	64	65	74	72
	50°C (122°F)	WET	69	69	61	57	68	68
	100°C (212°F)	DRY	N/A	53	N/A	49	N/A	58
	100°C (212°F)	WET	N/A	46	N/A	42	N/A	48
ULTIMATE FLEXURAL STRENGTH MPa	RT	DRY	1,800	1,790	1,780	1,580	1,710	1,480
	RT	WET	1,540	1,650	1,470	1,410	1,560	1,520
	50°C (122°F)	DRY	1,600	1,520	1,610	1,360	1,760	1,700
	50°C (122°F)	WET	1,590	1,240	1,400	1,210	1,760	1,580
	100°C (212°F)	DRY	N/A	1,190	N/A	970	N/A	1,280
	100°C (212°F)	WET	N/A	900	N/A	970	N/A	1,010
ULTIMATE FLEXURAL MODULUS GPa	RT	DRY	119	123	121	105	133	118
	RT	WET	118	118	116	101	131	125
	50°C (122°F)	DRY	133	113	119	104	137	121
	50°C (122°F)	WET	128	113	126	105	147	125
	100°C (212°F)	DRY	N/A	109	N/A	104	N/A	133
	100°C (212°F)	WET	N/A	110	N/A	100	N/A	124
Tg (TMA)	°C (°F)		85 (185)	117 (242)	83 (181)	121 (249)	120 (248)	130 (266)
MEAN WATER ABSORPTION % AFTER WET CONDITIONING (SEE NOTE 2)			0.61	0.35	0.71	0.46	0.39	0.54

- 1 Flexural results are normalised to 60 % Vf.
- 2 Wet Test condition = 2 hr boil in deionised water.

Typical Mechanical Properties

Woven carbon laminates - 285 gsm 4x4 Twill T300 - Fibres @ 0/90 (warp 0°) tested in the warp direction.

TYPE OF CURE PROCESS			AUTOCLAVE	AUTOCLAVE POSTCURED	VAC BAG	VAC BAG POSTCURED	PRESS	PRESS POSTCURED
CURE CONDITION	TEMP °C (°F)		60 (140)	60 (140)	60 (140)	60 (140)	110 (230)	110 (230)
	TIME HOURS		24	24	24	24	0.50	0.50
	PRESSURE MPa (psi)		0.62 (90)	0.62 (90)	27" Hg	27" Hg	0.62 (90)	0.62 (90)
I L S S MPa	RT	DRY	66	64	60	58	58	62
	RT	WET	52	58	48	57	52	57
	50°C (122°F)	DRY	51	51	51	52	56	53
	50°C (122°F)	WET	49	55	48	49	52	50
	100°C (212°F)	DRY	N/A	38	N/A	37	N/A	44
	100°C (212°F)	WET	N/A	30	N/A	33	N/A	39
ULTIMATE FLEXURAL STRENGTH MPa	RT	DRY	1,000	830	960	860	920	920
	RT	WET	940	830	880	840	870	910
	50°C (122°F)	DRY	830	840	790	790	970	880
	50°C (122°F)	WET	930	790	760	790	850	800
	100°C (212°F)	DRY	N/A	680	N/A	550	N/A	820
	100°C (212°F)	WET	N/A	470	N/A	450	N/A	690
ULTIMATE FLEXURAL MODULUS GPa	RT	DRY	58	54	58	55	55	58
	RT	WET	59	54	56	55	55	58
	50°C (122°F)	DRY	48	54	51	53	58	55
	50°C (122°F)	WET	57	52	49	53	60	53
	100°C (212°F)	DRY	N/A	52	N/A	50	N/A	59
	100°C (212°F)	WET	N/A	42	N/A	51	N/A	55
Tg (TMA)	°C (°F)		83 (181)	122 (251)	95 (203)	123 (253)	124 (255.)	125 (257)
MEAN WATER ABSORPTION % AFTER WET CONDITIONING (SEE NOTE 2)			0.61	0.40	0.79	0.38	0.45	0.36

- 1 Flexural results are all normalised to 55 % Vf.
- 2 Wet Test condition = 2 hr boil in deionised water.

Typical Mechanical Properties

Woven Glass Laminates - 300 gsm 8 Harness Satin (Epoxy Silane) - Fibres 0/90°
(Warp 0°) tested in the warp direction.

TYPE OF CURE PROCESS		AUTOCLAVE	AUTOCLAVE POSTCURED	PRESS	PRESS POSTCURED	
CURE CONDITION	TEMP °C (°F)	60 (140)	60 (140)	110 (230)	110 (230)	
	TIME HOURS	24	24	0.50	0.50	
	PRESSURE MPa (psi)	0.62 (90)	0.62 (90)	0.62 (90)	0.62 (90)	
I L S S MPa	RT	DRY	53	50	51	51
	RT	WET	36	44	41	N/A
	50°C (122°F)	DRY	47	44	47	47
	50°C (122°F)	WET	35	38	40	N/A
	100°C (212°F)	DRY	N/A	33	N/A	38
	100°C (212°F)	WET	N/A	26	N/A	N/A
ULTIMATE FLEXURAL STRENGTH MPa	RT	DRY	780	650	540	680
	RT	WET	430	490	410	N/A
	50°C (122°F)	DRY	630	570	520	630
	50°C (122°F)	WET	380	470	370	N/A
	100°C (212°F)	DRY	N/A	460	N/A	520
	100°C (212°F)	WET	N/A	320	N/A	N/A
ULTIMATE FLEXURAL MODULUS GPa	RT	DRY	26	22	16	22
	RT	WET	27	23	22	N/A
	50°C (122°F)	DRY	23	20	15	21
	50°C (122°F)	WET	22	23	16	N/A
	100°C (212°F)	DRY	N/A	19	N/A	24
	100°C (212°F)	WET	N/A	19	N/A	N/A
Tg (TMA)	°C (°F)	89 (192)	113 (233)	116 (240)	134 (273)	
MEAN WATER ABSORPTION % AFTER WET CONDITIONING (SEE NOTE 2)		0.69	0.45	0.55	N//A	

- 1 Flexural results are all normalised to 55 % Vf.
- 2 Wet Test condition = 2 hr boil in deionised.

Availability

All LTM25 prepregs are available in a wide range of reinforcing fabrics and unidirectional tapes including glass, carbon, aramid and hybrids.

Outlife and Storage

Out Life: 5-6 days at 21°C (70°F)

Storage life: Minimum 6 months from date of manufacture at -18°C (0°F)

Health and Safety

LTM25 prepregs contain epoxy resin which can cause allergic reactions by skin contact. Avoid prolonged or repeated contact with skin. Gloves and protective clothing must be worn.

Wash the skin thoroughly with soap and water or resin removing cream after handling. Do not use solvents for cleaning the skin

Use mechanical exhaust ventilation when heat curing the resin system.

For further information consult ACG Material Safety Data Sheet no 078.

