

Introduction

The LTM[®]318/LTS317 syntactic tooling system is a combination of LTF318B epoxy surfacing film based on ACG's ZPREG[®] partial impregnation technology and LTS317 syntactic bulking ply. These semi impregnated dry fabric type materials are significantly quicker to laminate than conventional fully impregnated tooling prepreg and, while shrinkage due to the high resin content of the syntactic plies may lead to minor inaccuracies, this system is particularly suited to the rapid production of short run or prototype tooling. This is particularly so where a high quality pit free finish is required from vacuum-only cure.

Initial cure is carried out between 65°C (149°F) and 120°C (248°F). Suitable post-curing offers thermal resistance to cycling up to 140°C (356°F).

Features

- Available in glass and carbon variants.
- Semi impregnated materials for ease of laminating and air removal giving a high quality pit free surface finish under vacuum-only cure.
- Syntactic bulk ply allowing rapid lamination and thickness build up.
- 65°C (149°F) vacuum-only initial cure.
- Ideal for the manufacture of prototype tooling, jigs, fixtures and components for use up to 140°C (356°F) after suitable post-cure.

Material Formats

System	Surface ply	Syntactic ply
Carbon	LTF318B/GF1200/CF0300	LTS317B/CF3500 0.75mm
Glass	LTF318B/GF1200/GF1100	LTS317B/GF1100 1.0mm

Pattern Requirements

The pattern can be manufactured from epoxy tooling block, epoxy tooling paste, wood, GRP, foam, aluminium, etc. The pattern must be vacuum integral, have a suitable surface finish and a minimum temperature stability of 70°C (158°F). Polyurethane based materials should not be used as these can inhibit the cure of the prepreg resin. Some pattern coating materials, such as Furane, may also inhibit the cure unless processed correctly. A 400-grit finish is adequate for parts that will

be painted or are non-cosmetic. For further information please contact Advanced Composites Group technical staff.

Release Agents

The recommended release agents are ACG's RA815 wax-based release agent or Freekote 700NC silicone based release agent. Small scale trials should be undertaken if other systems are to be used. In order to ensure that all remaining solvents are driven off the pattern should be baked for 30 minutes at 70°C (158°F) before it is used.

Laminate Schedule

For small to medium size tooling one surface ply and five syntactic plies has been found to give adequate wall thickness of around 6.5mm for the carbon variant and 7.0 mm for the glass variant. The following lay-up is recommended:

Surface ply	0/90
Syntactic ply	+/-45
Syntactic ply	0/90
Syntactic ply	0/90
Syntactic ply	+/-45
Syntactic ply	0/90

To eliminate bridging in sharp corner details and complex geometries, it is recommended that the entire tool is laminated using 50mm wide +/-45° strips in sharp corner details and 300mm wide squares in all other areas. The use of strips and squares is standard practise for manufacturing prepreg tools eliminating the need for cutting complex templates and making the laminating process significantly easier.

Using the Surface Ply

1. Allow the roll to reach room temperature before opening the protective bag.
2. Always support the roll on a roll stand or vertically on one end when it is not in use.
3. Cut +/-45° strips for use in all the corners to eliminate bridging.
4. Fill in the areas between the +/-45° strips with 300mm squares using approximately 5mm overlaps.
5. Use a 5 minute vacuum debulk with a perforated P3 release film and lightweight breather once the surface ply has been laminated.

Using the Syntactic Ply

1. Allow the roll to reach room temperature before opening the protective bag.
2. Always support the roll on a roll stand or vertically on one end when it is not in use.
3. Cut +/-45° strips for use in all the corners and details to eliminate bridging. Stagger the joints in successive corner strips by 10mm.

4. Fill in the areas between the +/-45° strips with 300mm squares using approximately 5mm overlaps.
5. Vacuum debulk after the second syntactic ply with a perforated P3 release film and a lightweight breather.
6. It is essential that air paths are maintained from the surface ply into the breather pack during the curing process. This is achieved by extending the surface ply 20mm beyond the syntactic plies around the laminate perimeter.

Bagging the job

1. Use P3 Halar release film.
2. Use a light weight breather material.
3. Apply vacuum membrane and apply vacuum. Ensure that there is no bridging of the breather or vacuum membrane and that the all the sharp corners and details are well consolidated.
4. Perform a vacuum leak test to ensure that there are no leaks.

Curing the job

Cure ramp rate should be 2°C (3.6°F)/minute	Temperature Cycle
Minimum initial cure	16 hours at 65°C (149°F)
Alternative initial cures	5 hours at 80°C (176°F)
	2 hours at 100°C (212°F)
	1 hour at 120°C (248°F)

Post-Cure

A post-cure is necessary to fully crosslink the polymer and prevent any dimensional shrinkage of the tool during use. A suitable post-cure for tools that will be used up to 140°C (284°F) is a 20°C (36°F)/hour ramp rate and a two hour dwell at 150°C (302°F).

Caution:

High tack vacuum bag sealant tape has the potential to cause damage to mould tool flange areas during its removal. Therefore, customers are advised to check the adhesion characteristics of their sealant tape prior to use and determine if removal of the tape is likely to lead to delamination. Where the potential for damage exists, a less aggressive, lower tack sealant tape should be sourced or steps taken, such as using a mould sealer or applying a flash breaker tape, to minimise the risk of damage.

Technical Data

	LTF318 LTS317 Carbon 1-4-1 Quasi-isotropic Tooling Laminate	LTF318 LTS317 Glass 1-4-1 Quasi-isotropic Tooling Laminate
CTE, 20 to 140°C	$6.5 \times 10^{-06} \text{ m/m/}^\circ\text{C}$	$18.0 \times 10^{-06} \text{ m/m/}^\circ\text{C}$

LTF318 LTS317 Carbon 1-4-1 Quasi-isotropic Tooling Laminate : 16 Hours @ 65°C (149°F)	
	Mean Linear Shrinkage (%)
As-Cured	0.019
120°C Post-cured	0.059
180°C Post-cured	0.070

LTF318 LTS317 Glass 1-4-1 Quasi-isotropic Tooling Laminate : 16 Hours @ 65°C (149°F)	
	Mean Linear Shrinkage (%)
As-Cured	0.085
120°C (248°F) Post-cured	0.135
180°C (356°F) Post-cured	0.172

Note: Shrinkage is quoted as a %. Therefore, 0.1% shrinkage equates to 1 mm in 1000 mm.