

ST 95

Carbon Structural SPRINT®

- **Good balance of mechanical properties**
- **Excellent laminate quality**
- **Extremely low void content**
- **Drapeable and conformable**
- **Good tack**
- **Fast layup**
- **No debulk necessary between plies**
- **Variable cure temperature (85-125°C)**

Introduction

The patent-approved ST 95 Structural SPRINT® is a moulding material that consists of two layers of carbon reinforcement either side of a precast, precatalysed resin film. The material therefore has the appearance of dry reinforcement that has resin concealed at its centre. Carbon SPRINT® is available in woven or unidirectional fabric skewed to $\pm 45^\circ$ angles in a range of weights and fabric formats with a light tack film on one side to aid mould placement.

ST 95 is a toughened hot-melt, epoxy resin that offers an extremely good balance of mechanical properties. It has been specially formulated to maximise the outlife of SPRINT® products at room temperature. It is ideal for structural components where improved impact performance and resistance to resin microcracking is desired. ST 95 has a flexible cure envelope from 12 hours at 85°C to 1 hour at 120°C. This makes it suitable for use in regular part production as well as for the development of trial components. The material is highly drapeable and has been designed for simple vacuum bag processing.

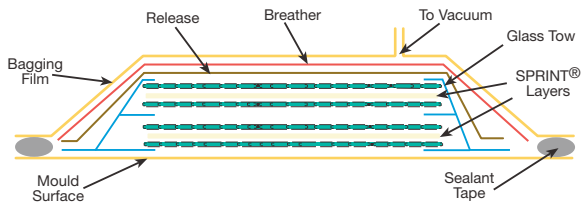
Structural SPRINT® ST 95 can be used in the making of chassis, bulkheads and general structural items for automotive, marine and industrial applications.

Instructions for Use

1. The moulding surface must first be treated with a release agent. If a Surface Film is required, this should be applied directly to the tool face prior to the layup of SPRINT®. Please refer to Processing Notes for application details.

The required number of plies of SPRINT® are then placed on to the tool and a thermocouple inserted into the lay-up outside the net trim line. Dry glass tows should be inserted between plies of SPRINT® to provide an air evacuation path out of the laminate. The second end of the tow should be made available for contact with the breather

2. If required, a peel ply, pre-impregnated or dry, can be applied over the top of the laminate stack. Note that for good secondary bonding of a peel-ply surface of a laminate, a nylon peel ply such as Tygavac Stitch Ply A is strongly recommended. The peel ply is covered entirely with a non-perforated release film such as Tygavac WL3600 or a low bleed release film, such as WL3600RP2. The release film is then covered with breather material, such as Tygavac Econoweave 44W, so that it extends over the release film in all directions and contacts the dry glass strands.



Typical processing diagram showing two SPRINT® layers

3. Once the lay up is complete, a vacuum bag is installed by standard techniques. At least two vacuum stems should be inserted through the bag, one connecting to the vacuum source and the other, at a point on the part furthest from the source, to a calibrated vacuum gauge. The major benefit of SPRINT® is that it enables all of the air to be removed from the laminate prior to fibre wet out and resin cure. It is recommended that a vacuum is applied at ambient temperature prior to cure, to fully evacuate the laminate stack. This should be held for between 5 minutes and 1 hour, depending upon the size and thickness of the component. Full vacuum is then maintained throughout the cure.

PLEASE NOTE: Further advice can be found in the SPRINT® Processing Notes or by contacting Technical Services.

4. Cure the laminate in accordance with the specification given later in this data sheet.

Curing Schedule

Cure Envelope and Cured Properties

Structural SPRINT® ST 95 has a relatively flexible cure envelope. The minimum cure is 12 hours 85°C and a rapid cure is 1 hour at 120°C. Other cure temperatures and times are given in the Working Properties section.

Structural SPRINT® ST 95 works by first applying a vacuum to the laminate to remove all air. It is recommended that an ambient vacuum is applied prior to cure, to fully evacuate the laminate stack. The temperature is then increased so that the matrix resin reduces in viscosity and wets the evacuated reinforcement within the laminate. A dwell can be used at the "infusion" temperature to ensure good laminate quality. The temperature is then further increased to cause the matrix resin to cross-link and is then held at the cure temperature until the cross linking process is complete. Once this is achieved heating is removed so that the temperature is reduced under natural cooling. The vacuum must be maintained throughout the cure and until the part has cooled to 40°C.

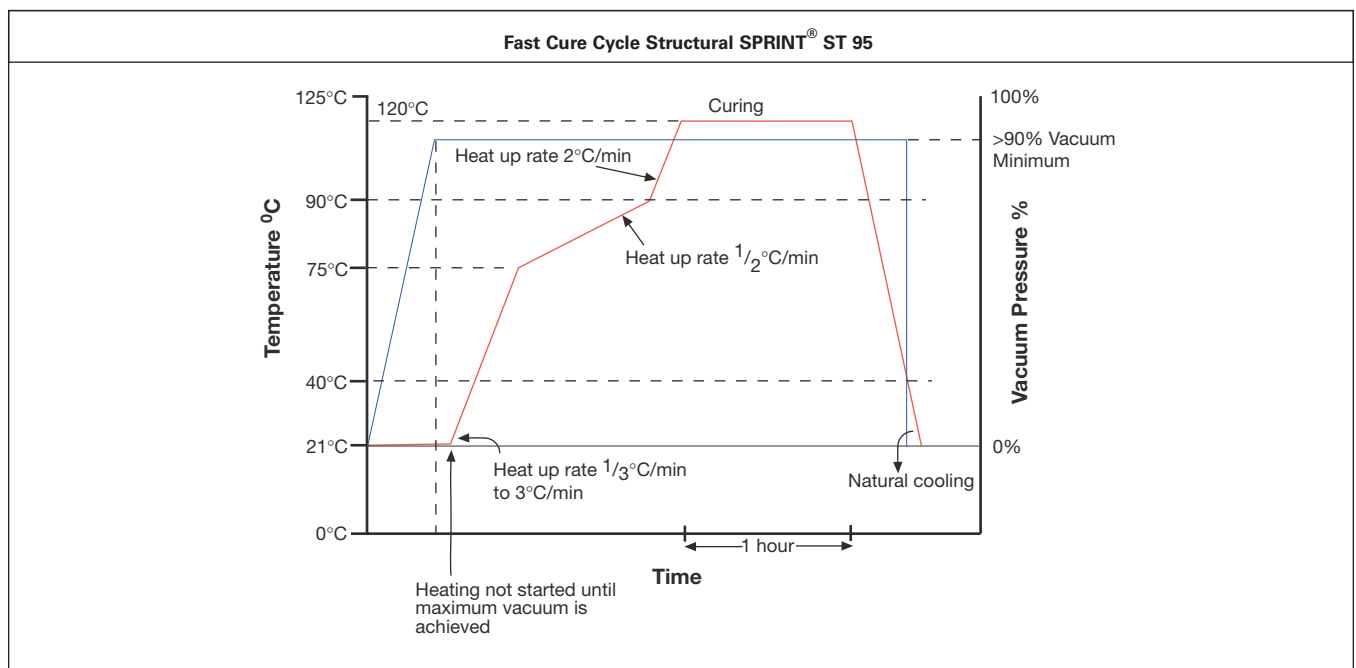
Note: The successful use of this cure schedule will depend on part size and laminate construction. Heat up rate and dwell periods need to be tailored to take consideration of oven capacity, thermal mass of tool, laminate construction etc. It is recommended that Gurit is contacted for further advice before utilising any of the suggested cure cycles. (See table on Cure Cycles).

Typical Cure Profiles

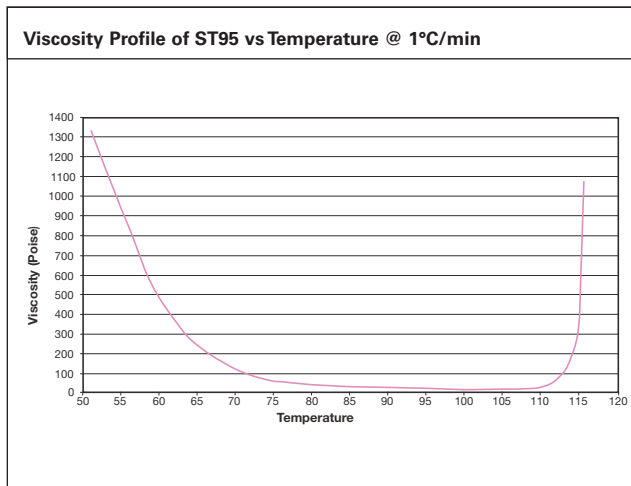
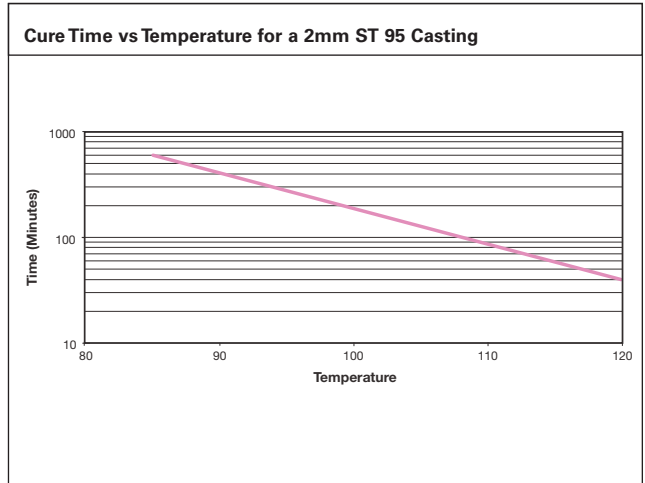
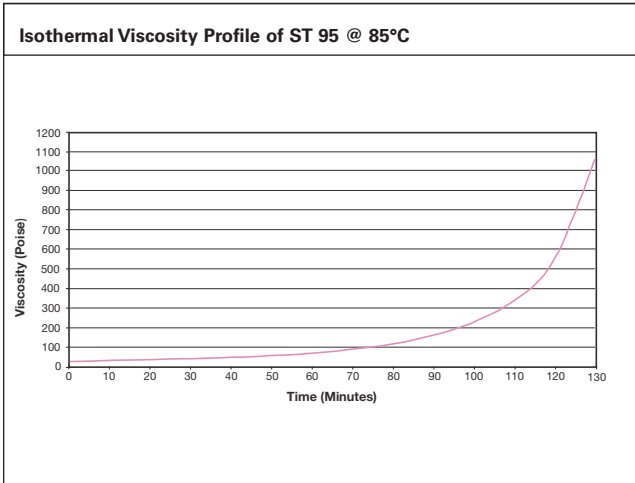
The successful use of these cure schedules will depend on part size and laminate construction. Heat up rate and dwell periods need to be tailored to take consideration of oven capacity, thermal mass of tool, laminate construction etc. Data in the table below is based on laminate temperatures, air temperatures may need to be higher. It is recommended that Gurit is contacted for further advice before utilising any of the suggested cure cycles (see table on cure cycles).

	Ultra Slow Cure Schedule	Standard Cure Schedule	Fast Cure Schedule
	0.3°C/minute ramp to 78°C	1°C/minute ramp to 85°C	2°C/minute ramp to 75°C
	2 hour dwell @ 78°C	10 hour dwell @ 85°C	1/2°C/minute Ramp to 90°C
	0.3°C/minute ramp to 85°C		2°C/minute ramp to 120°C
	10 hour dwell @ 85°C		45 minutes @ 120°C
Total Time	15 hours	11 hours	1 hour 55 minutes

NB. It is strongly recommended that laminate temperatures are monitored throughout the cure. 0.3°C/minute should be considered the minimum acceptable laminate ramp rate.



Properties



Product Range Parameters

Carbon SPRINT® is available from weights of 400g/sqm to 1320g/sqm on a range of fabric and fibre combinations. Products are available with a standard resin content (40-42% by wt) and extra resin for core-bonding (ranging from 47-50% by wt). See Price List for latest information.

Compatible Surface Films

SPRINT® can be used in combination with a variety of SP surfacing materials, suitable for many different applications. These are available in film weights ranging from 150g/sm to 700g/sqm, and provide a range of surface quality and performance options. See Product Catalogue for latest information.

Compatible Adhesive Films

SP-High Modulus have a range of SA 80 adhesive films that can be used with all SPRINT® materials. These are supplied with a supporting medium in 250g and 400g film weights. See Product Catalogue for latest information.

Properties (cont'd)

Mechanical Properties - SPRINT® Matrix			
	Material		
	Skewed Carbon ST 95 / +45C200 / 42% / -45C200	Skewed Carbon ST 95 / +45C200 / 42% / -45C200	Woven Carbon 2x2 twill 200g / RC200T / RC200T
Cure (time / temperature / pressure)	1 hour / 120°C / 1 Bar	10 hours / 85°C / 1 Bar	10 hours / 85°C / 1 Bar
Process	vacuum bag	vacuum bag	vacuum bag
Fibre Weight (g/sqm)	400	400	400
SPRINT® Areal Weight (g/sqm)	690	690	690
SPRINT® Resin Content (%bw)	42	42	41
Tensile Strength (MPa)	852.6	845.6	644.8
Tensile Modulus (GPa)	55.65	56.29	60.99
Tensile Laminate Fibre Volume (%)	45.52	45.6	49.1
Av. Cured Ply Thickness (mm)	0.49	0.49	0.457
Normalised Tensile Strength @ 60% FVF (MPa)	1123.8	1112.6	788
Normalised Tensile Modulus @ 60% FVF (GPa)	73.35	74.1	74.5
Compressive Strength (MPa)	505.4	497.6	537.2
Compressive Modulus (GPa)	50.9	51.5	54.0
Compressive Laminate Fibre Volume (%)	44.8	45.9	48.4
Normalised Compressive Strength @ 60% FVF (MPa)	676.9	650.3	679.9
Normalised Compressive Modulus @ 60% FVF (GPa)	66.6	67.2	66.9
ILSS (MPa)	57.5	50.5	62.3

Working Properties - SPRINT® Matrix		
	Test Method	
Minimum Cure Temperature (°C)	85	DSC
Minimum Cure Time (@ minimum cure temperature) (hours)	10	DSC
Minimum Viscosity (isothermal @ minimum cure temperature) (P)	38-54p	Rheometer
Minimum Viscosity (1°C/minute ramp) (P)	24-28p	Rheometer
Temperature @ minimum viscosity (1°C/minute ramp) (°C)	100-102°C	Rheometer
Minimum Cure Time @ 90°C (hours:minutes)	6:00	DSC
Minimum Cure Time @ 100°C (hours:minutes)	3:00	DSC
Minimum Cure Time @ 110°C (hours:minutes)	1:30	DSC
Minimum Cure Time @ 120°C (hours:minutes)	0:45	DSC

Thermal Properties	10 hours @ 83°C	1 hour @ 120°C	10 hours @ 85°C + 1 hour @ 120°C
Tg1 (DMTA)	104	123	123

Health and Safety

Although SPRINT® materials have improved health and safety characteristics when compared to wet lay-up epoxy systems and conventional preregs, the following points must still be considered:-

1. Avoid skin contact - wear disposable nitrile gloves.
2. Avoid eye contact. If this occurs, flush with water for 15 minutes and seek medical advice.
3. Ensure good ventilation of vacuum pump exhaust during laminate cure.
4. Avoid inhalation and eye contact with sanding dust. After any sanding operation of reasonable size a shower or bath should be taken and should include hair washing.
5. Wear overalls or other protective clothing. Thoroughly clean or discard soiled garments.
6. Use only resin removing creams/soap and water on exposed skin. Do not use solvents.

Washing should be part of routine practice:

- **before eating or drinking**
- **before smoking**
- **before using the lavatory**
- **after finishing work**

In the pre-cured state SPRINT® materials contain 'dry' fibres which can be released when the material is being cut or processed. Care should be taken while handling the material to prevent contact with the skin and to control the egress of fibres into the workplace. Products that contain carbon fibres should be treated with particular care as carbon fibre is electrically conductive. Electrical equipment should be protected from carbon dust and fibres.

Gurit produces a separate full Material Safety Data Sheet for all hazardous products. Please ensure that you have the correct MSDS to hand for the materials you are using before commencing work. A more detailed guide for the safe use of Gurit resin systems is also available from Gurit, and can be found on our website at www.gurit.com

Applicable Risk & Safety Phrases

R 36/38, 43, 51/53
S 24, 26, 28, 37/39, 57, 60

Storage Conditions & Outlife

Storage time and temperature will have an effect on resin reactivity and fibre impregnation. The product can be stored for two years at -18°C or for 2 weeks at ambient temperature (18-22°C) without affecting resin reactivity. However, at ambient temperature the material will begin to self-impregnate much sooner than this, depending on size and tension of the roll, resin content and fabric style. We recommend therefore, that rolls of SPRINT® are stored frozen at -18°C and only brought to room temperature when pieces of material are required for use. Having cut the necessary pieces, we recommend that they are stored flat until use. Minimising the out time of the SPRINT® at room temperature will reduce the resin migration and preserve the handling properties. When not being used SPRINT® should be stored in the freezer at all times.

The self-impregnation of the SPRINT® can compromise its ability to generate high quality laminates as the air breathing properties decrease after a certain length of time at ambient temperature. Self-impregnation will increase the tack and reduce the drape of the material. While self-impregnation will vary from product to product, most SPRINT® materials stored at ambient temperatures will self-impregnate within approximately two weeks. It is recommended that ambient temperature storage is below 22°C as higher storage temperatures will induce premature self impregnation. Contact Technical Services for further advice.

Rolls of SPRINT® should be removed from freezer storage in sufficient time to allow them to warm up to ambient temperature before they are used. For most rolls an overnight defrost will suffice, however large rolls may take longer. Rolls of SPRINT® should always be supported horizontally by their cardboard tube, as laying the rolls on the floor or bench may result in lines of partially wet-out material at the areas of high pressure under the roll. Material should not be allowed to remain for long periods at ambient temperature before application, as this will compromise the handling properties.



Transport & Storage

When not in use SPRINT® products should be maintained at -18°C. Shelf life for SPRINT® ST 95 is two years at -18°C and two weeks at 18-22°C. To avoid condensation on the rolls allow to reach room temperature before unwrapping.

Notice

SP-High Modulus is the marine business of Gurit (the company). 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/termsandconditions_en.html.

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 right-hand corner of this page.

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