

ST 94

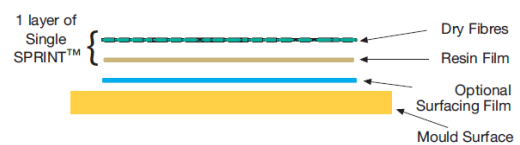
SINGLE SIDED SPRINT™

- ▮ Drape and thickness optimised for excellent handling
- ▮ Ideal for complex or vertical mouldings
- ▮ Excellent balance of mechanical performance and toughness
- ▮ DNV-GL Certified

INTRODUCTION

ST 94 single sided SPRINT™ is a moulding material that consists of a layer of dry reinforcement plied to a precast, pre-catalysed resin film.

ST 94 is a tough hot-melt, epoxy resin that offers an extremely good balance of mechanical properties. It has been formulated to give an ideal tack level at workshop temperature. It is ideal for structural components where improved impact performance and resistance to resin micro-cracking is desired. ST 94 has a flexible cure envelope from 10 hours at 85°C (185°F) to 60 minutes at 120°C (248°F). This makes it suitable for use in regular part production as well as for the development of trial components.



Cross-section of 1 ply of Structural SPRINT™

TYPICAL END USE APPLICATIONS

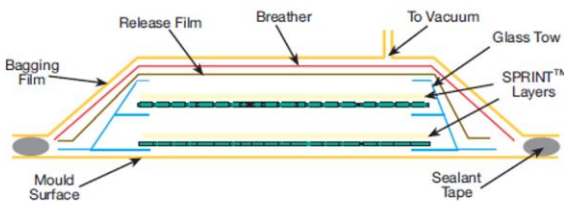
ST 94 SPRINT™ has been developed for use in large structures where heavyweight materials need to remain in the mould for long durations prior to curing.

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 lay-up of the SPRINT™. Please refer to Processing Notes for application details.

The required number of plies of SPRINT™ are then placed on to the tool face. A thermocouple may be inserted into the lay-up outside the net trim line. It is important to provide air paths to each ply. This can be achieved by staggering the edges of the plies such that each subsequent ply is smaller by 5-10mm. If space is not available dry glass tows can 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, can be applied over the top of the laminate stack. Note that for good secondary bonding of a peel-plyed 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 evaluate 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.

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

PLEASE NOTE:

If processing SPRINT™ with foam cores, additional resin will be required in order to provide good adhesion and fill any cuts or grooves present in the core.

The additional resin can be provided by using SA80 adhesive film between the laminate and core. Gurit can also provide SPRINT™ with a higher resin content which could be used as an alternative or in conjunction with SA80.

Core type, density, thickness, cut patterns and panel curvature will all have an effect on the additional resin requirement. Representative panels should be made to establish that sufficient additional resin has been used for the core type.

Further advice can be found in the SPRINT™ Processing Notes or by contacting Gurit Technical Support.

CURING SCHEDULE

CURE ENVELOPE AND CURED PROPERTIES

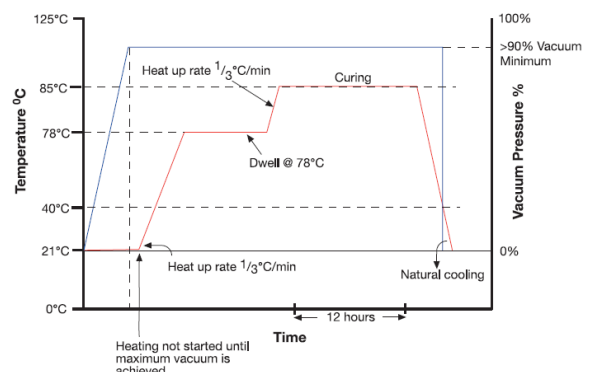
ST 94 SPRINT™ has a relatively flexible cure envelope. The minimum cure is 10 hours at 85°C (185°F) and rapid cure is 60 minutes at 120°C (248°F). Other cure temperatures and times are given in the Working Properties section.

ST 94 SPRINT™ works by first applying a vacuum to the laminate stack 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 until the part has been cooled to 40°C (104°F).

TYPICAL CURE PROFILES

The successful use of these cure schedules will depend on part size 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.

Ultra Slow Cure Cycle single sided SPRINT™



PRODUCT INFORMATION

ST 94 SPRINT™ is available in carbon, glass, aramid and hybrid formats, ranging in weight from 200g to 1600g. Please see price list for the latest product information. The product formats listed to the right also benefit from 3rd Party Certification

PRODUCT DESCRIPTION	STATUS	CERTIFICATION
± 45° Carbon Biax 410g/m ² 30-55% resin content	Renewal in progress	DNV-GL
E-Glass Quadraxial 1200g/m ² 30-55% resin content	Renewal in progress	DNV-GL

COMPATIBLE SURFACE FILMS

SPRINT™ can be used in combination with a variety of Gurit surfacing materials, suitable for many different applications. Please see price list for latest product information.

COMPATIBLE ADHESIVE FILMS

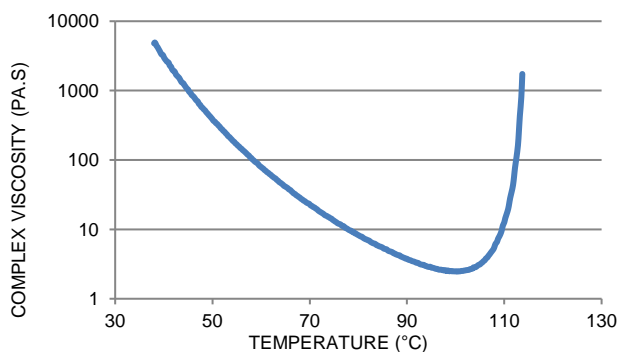
Gurit has a range of SA 80 adhesive films which can be used with all SPRINT™ materials. These are supplied with a supporting medium in 250g and 400g film weights.

PREPREG PROPERTIES

RHEOLOGY DATA

ST 94 resin viscosity profile conducted at 1°C (1.8°F)/minute.

PROPERTY	VALUE	
Minimum Viscosity	2.46 Pa.s	24.6 P
Temperature at Minimum Viscosity	100 °C	212°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	days	21

It is recommended that ambient temperature storage is below 22°C (71°F) as higher storage temperatures will induce premature self-impregnation or resin wet-out of the reinforcement. This may impair the air breathing properties of the material. While self-impregnation will vary from product to product, most SPRINT™ materials stored at ambient temperatures will only start to self-impregnate after approximately three weeks. All SPRINT™ 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. To avoid condensation on the rolls allow 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

ST 94 SPRINT™ using vacuum bag processing with recommended minimum cure of 10 hours at 85°C (185°F)

PROPERTY	ULTRA SLOW CURE CYCLE	STANDARD CURE CYCLE	FAST CURE CYCLE	TEST STANDARD
Processing Method	Vacuum Bag			
Typical Ramp Rate	0.3°C (0.5°F) per minute	1°C (1.8°F) per minute	2°C (3.6°F) per minute	-
Dwell Temperature	78°C (172°F)	78 °C (172°F)	75°C (167°F)	-
Dwell Time	120 (min)	60 (min)	0.5°C (0.9°F) per minute to 90°C (194°F)	-
Cure Temperature	85°C (185°F)	85°C (185°F)	2°C per minute to 120°C (248°F)	-
Cure Time	600 (min)	600 (min)	45 (min)	-
Cure Pressure	-1 (bar)			-
Dry Tg ₁ (DMA)	100 to 105°C (212 to 221°F)		117°C (243°F)	ASTM D7028

* It is recommended that laminate temperatures are monitored throughout the cure. 0.3°C (0.5°F)/min should be considered the minimum ramp rate.

LAMINATE PROPERTIES

Where possible properties presented are multiple batch data and 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.

CURED RESIN PROPERTIES

Resin cast oven cured using standard processing techniques and standard cure of 10 hours at 85°C (185°F)

PROPERTY	SYMBOL	UNIT	10 HOURS @ 85 °C (185°F)	TEST STANDARD
Tensile Strength	σ_T	MPa	69	ISO 527-2
Tensile Modulus	E_T	GPa	3.4	ISO 527-2
Flexural Strength	σ_F	MPa	102	ISO 178
Flexural Modulus	E_F	GPa	2.6	ISO 178
Compressive Strength	σ_C	MPa	137	ISO 604
Compressive Modulus	E_C	GPa	3.4	ISO 604

WOVEN LAMINATE PROPERTIES

Cured using standard processing techniques and standard cure of 10 hours at 85°C (185°F). Where test directions are provided they are with respect to the warp direction of the roll.

PROPERTY	SYMBOL	UNIT	ST94 / RC200T	ST94 / WRE581T	TEST STANDARD
Resin Content	-	%	42	33	ASTM D 3171 Method II
Cured Ply Thickness	-	mm	0.20	0.44	ASTM D792
Fibre Volume Fraction	-	%	55.7	51.0	ASTM D 3171 Method II
0° Tensile Strength*	X_T	MPa	1090	682	ISO 527-4
0° Tensile Modulus*	E_t	GPa	68	31	ISO 527-4
90° Tensile Strength*	Y_T	MPa	899	-	ISO 527-4
90° Tensile Modulus*	E_{T22}	GPa	64	-	ISO 527-4
0° Compressive Strength*	X_C	MPa	714	527	SACMA SRM1-94
0° Compressive Modulus*	E_c	GPa	62	32	SACMA SRM1-94
90° Compressive Strength*	Y_C	MPa	702	-	SACMA SRM1-94
90° Compressive Modulus*	E_{C22}	GPa	58	-	SACMA SRM1-94
0° Flexural Strength	X_F	MPa	1010	785	ISO 14125
0° Flexural Modulus	E_{F11}	GPa	59	23	ISO 14125
ILSS	τ_M	MPa	69	54	ISO 14130

*Normalised to 55% fibre volume fraction

MULTIAXIAL LAMINATE PROPERTIES

Cured using standard processing techniques and standard cure of 10 hours at 85°C (185°F). Where test directions are provided they are with respect to the warp direction of the roll.

PROPERTY	SYMBOL	UNIT	ST94 / XC411	TEST STANDARD
Resin Content	-	%	42	ASTM D 3171 Method II
Cured Ply Thickness	-	mm	0.46	ASTM D792
Fibre Volume Fraction	-	%	49.1	ASTM D 3171 Method II
+45° Tensile Strength*	X_T	MPa	1052	ISO 527-4
+45° Tensile Modulus*	E_t	GPa	61	ISO 527-4
-45° Tensile Strength*	Y_T	MPa	932	ISO 527-4
-45° Tensile Modulus*	E_{T22}	GPa	59	ISO 527-4
+45° Compressive Strength*	X_C	MPa	654	SACMA SRM1-94
+45° Compressive Modulus*	E_c	GPa	-	SACMA SRM1-94
-45° Compressive Strength*	Y_C	MPa	637	SACMA SRM1-94
-45° Compressive Modulus*	E_{C22}	GPa	-	SACMA SRM1-94
ILSS	τ_M	MPa	61	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.

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