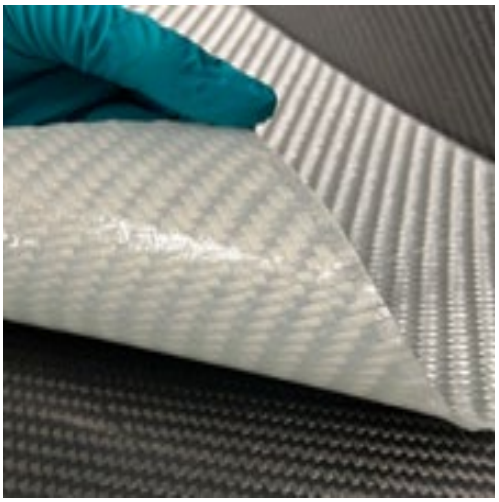
Gurit PREPREG

PRODUCT DATASHEET

Gurit



ST90

SINGLE SIDED SPRINT™

ST90 single sided SPRINT is a molding material that consists of a layer of dry reinforcement applied to a pre-catalysed resin film. Standard T1 variants suit use in temperatures below 25°C (77°F), the T0 variant available on request is more suitable in temperatures of 25°C (77°F) and above. Cured properties are the same for both tack variants.

T90 is a hot-melt epoxy resin designed for marine and industrial applications. It has been formulated to give an ideal tack level at workshop temperatures. It is a simple to use, multi-use system ideal for curing both large and small components in a short space of time. ST90 has a flexible cure envelope between 70ºC (158ºF) to 120°C (248ºF).

- Hot melt, industrial epoxy prepreg optimized for large open mold structures
- Drape and tack optimized for excellent handling, tack options
- Builds on the established heritage of Gurit's SPRINT ranges
- Flexible curing options as low at 70°C (77°F)
  12 hours at 70ºC (158ºF)
  6 hours at 80ºC (176ºF)
  35 minutes at 120ºC (248ºF)
- Low toxicity formulation
- Low void content, out of autoclave processing
- DNVGL and Lloyds Register certified formats available

DNV

Lloyd's Register

INSTRUCTIONS FOR USE

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 mold 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 out of autoclave vacuum cured laminates:

1. Place the lay-up on a tool which has been treated with a high temperature release agent or film.
2. 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.
3. A layer of dry peel ply can be added on top of the SPRINT followed by a low perforation release film and breather layer
4. Install a vacuum bag. Position part in the oven and draw vacuum to check for bag or system leaks.
5. It is not recommended to cure ST90 under vacuum pressures of less than 85%.
6. Cure under full vacuum as described in the following section.
7. 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.

CORE BONDING

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 SA75-90 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 adhesive film.

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.

PRODUCT INFORMATION

AVAILABILITY

ST90 SPRINT is available in either tack variant with glass and carbon reinforcement formats, typically ranging in weight from 300g/m^2 to 1230g/m^2 in glass and 200g/m^2 to 660g/m^2 in carbon.

The product formats listed below also benefit from 3rd Party Certification.

PRODUCT DESCRIPTION	FIBER WEIGHTS	STATUS	BODY	CERTIFICATE NUMBER
ST90 glass biaxial	300-905g/m²	Valid	DNV Lloyds Register	TA-DNVGL-CP-0431-07113-0 LR2297339ALP
ST90 glass quadraxial	600-1230g/m²	Valid	DNV Lloyds Register	TA-DNVGL-CP-0431-07112-0 LR2297340ALP
ST90 glass woven rovings	580-850g/m²	Valid	DNV Lloyds Register	TA-DNVGL-CP-0431-07502-1 LR2297346ALP
ST90 woven glass	300-400g/m²	Valid	DNV	TA-DNVGL-CP-0431-07501-1
ST90 biaxial carbon	150-611g/m²	Valid	DNV	TA-DNVGL-CP-0431-06904-1
ST90 woven carbon	200-660g/m²	Valid	DNV	TA-DNVGL-CP-0431-06905-1

COMPATIBLE ADHESIVE FILMS

SA75-90 adhesive film, developed for this system, is supplied with or without a supporting medium in 150g to 400g film weights.

COMPATIBLE SURFACING FILMS

SPRINT can be used in combination with a variety of Gurit surfacing materials, suitable for many different applications. SF75-90 and SFG75-90 have been developed specifically for this SPRINT system and the other 75 and 90 ranges.

TRANSPORT AND STORAGE

STORAGE TEMPERATURE	UNITS	VALUE
-18°C (0°F)	Months	24
+18-20°C (64-67°F)	Days	21

The ambient storage advice is based on the potential for self- impregnation which can impair air breathing. The rheological and reactivity time at +18-20°C (64-67°F) is 8 weeks. However, this is reduced at higher temperatures at 30°C(86°F) this will be 3 weeks.

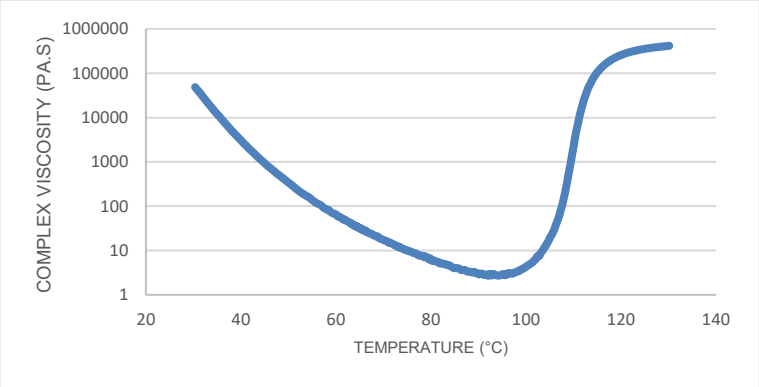
It is recommended that ambient temperature storage is below 20°C (71°F) as higher storage temperatures will induce premature self-impregnation or resin wet-out of the reinforcement. This may impair the air breathing properties of the material. While self-impregnation will vary from product to product, 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. 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.

PREPREG PROPERTIES

RHEOLOGY DATA

ST90 resin viscosity profile conducted at 1°C (1.8°F) /minute.



PROPERTY	UNITS	VALUE
Minimum viscosity	Pa.s (P)	2.7 (27)
Temperature at minimum viscosity	°C (°F)	92 (197)

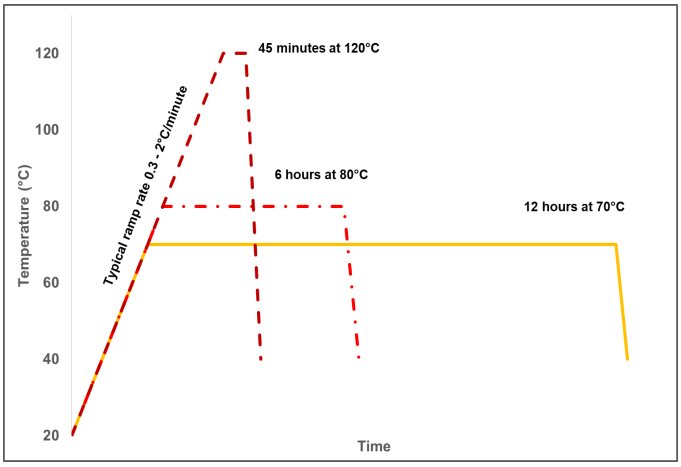
TYPICAL CURE TIME AND TEMPERATURES

Ramp between 0.3°C (0.5°F)/min and 2°C (3.6°F)/min to the final cure temperature. At 70°C (158°F), the temperature should be held for 12 hours. 70°C (158°F) should be treated as the minimum cure temperature for ST90; 65-70°C (149-158°F) will not generate adequate mechanical properties. Faster cures are obtained at elevated temperatures, e.g. 6 hours at 80°C (176°F), 45 minutes at 120°C (248°F). All temperatures measured on the laminate surface not oven air. Vacuum should be maintained as high as possible throughout the cure cycle.

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 resin flow.

PROPERTY	70°C CURE (158°C)	80°C CURE (176°C)	120°C CURE (248°C)	TEST METHOD
Processing method	Vacuum bag/autoclave	Vacuum bag/autoclave	Vacuum bag/autoclave	
Typical ramp rate	0.3 – 2°C/minute	0.3 – 2°C/minute	0.3 – 2°C/minute	
Cure time	12 hrs*	6hrs*	45 minutes*	
Cure pressure	-1 Bar / +6 Bar	-1 Bar / +6 Bar	-1 Bar / +6 Bar	
Dry Tg (DMA)	88°C (190°F)	98°C (208°F)	110°C (230°F)	ASTM D7028

*** Please refer to each product technical datasheet for minimum cure of ancillary products SA75-90, SFG75-90, SF75-90 and MP75-90**



MECHANICAL PROPERTIES

All values are representative of the typical properties to be expected but do not constitute a guaranteed specification.

CURED RESIN PROPERTIES

Resin cast oven cured, mean values.

PROPERTY	SYMBOL	UNITS		12 HOURS 70°C (158°F)		6 HOURS 80°C (176°F)		45 MINUTES 120°C (248°F)		TEST METHOD
Cured resin density	ρ_{cured}	g/cm²		1.19		1.19		1.19		Archimedean principle
Tensile strength	σ_T	MPa	(ksi)	81	(11.7)	82	(11.9)	76	(11.0)	ISO 527-2
Tensile modulus	E_T	GPa	(Msi)	3.6	(0.52)	3.6	(0.52)	2.8	(0.41)	ISO 527-2
Flexural strength	σ_F	MPa	(ksi)	133	(19.3)	139	(20.1)	113	(16.4)	ISO 178
Flexural modulus	E_F	GPa	(Msi)	3.4	(0.50)	3.1	(0.45)	2.7	(0.39)	ISO 178
Compressive strength	σ_C	MPa	(ksi)	134	(19.4)	154	(22.3)	117	(17.0)	ISO 604

WOVEN CARBON LAMINATE PROPERTIES

Where test directions are provided, they are with respect to the warp direction of the roll. Cured 12 hrs at 70°C (158°F). Fabrics contained in these products are 2X2 twill woven with High Elongation Carbon (HEC). HEC fibers are characterised by having a tensile modulus between 227-257GPa. (32.9 -37.3 msi). Mean values from a single batch.

PROPERTY	SYMBOL	UNITS		ST90 RC200T		ST90/RC416T		ST90/RC660T		TEST METHOD
Resin content		%		42		42		42		ASTM D3171 method II
Fiber volume fraction	V_f	%		50		52		51		ASTM D3171 method II
Cured ply thickness		mm	(in)	0.22	(0.009)	0.44	(0.017)	0.70	(0.027)	
0° tensile strength*	X_T	MPa	(ksi)	911	(132)	934	(135)	961	(139)	ISO527-5
0° tensile modulus*	E_T	GPa	(Msi)	69	(10)	64	(9.28)	59	(8.56)	ISO527-5
0° compressive strength*	X_C	MPa	(ksi)	741	(107)	662	(96.0)	576	(83.5)	SACMA SRM1-94
0° compressive modulus*	E_{C11}	GPa	(Msi)	64	(9.28)	58	(8.41)	56	(8.12)	SACMA SRM1-94
90° tensile strength	Y_T	MPa	(ksi)	911	(132)	934	(135)	961	(139)	ISO527-5
90° tensile modulus	E_{T22}	GPa	(Msi)	68	(9.86)	56	(8.12)	59	(8.56)	ISO527-5
0° flexural strength	X_F	MPa	(ksi)	995	(144)	804	(117)	565	(81.9)	ISO14125
0° flexural modulus	E_{F11}	GPa	(Msi)	55	(7.97)	52	(7.54)	47	(6.82)	ISO14125
0° ILSS	X_{ILSS}	MPa	(ksi)	76	(11.0)	53	(7.69)	59	(8.56)	ISO14130

* Normalized to 55% V_f

BIAXIAL CARBON LAMINATE PROPERTIES

Where test directions are provided, they are with respect to the direction of the roll. Cured 12 hrs at 70°C. Fabrics contained in these products are 2 layers of unidirectional High Elongation Carbon (HEC) fibres stitched together at +/-45° to each other. HEC fibres are characterised by having a tensile modulus between 227-257GPa (32.9-37.3 msi). Mean values from a single batch.

PROPERTY	SYMBOL	UNITS		ST90 / XC150		ST90 / XC411		ST90/XC611		TEST METHOD
Resin content		%		42		42		42		ASTM D3171 method II
Fiber volume fraction	V_f	%		47		55		50		ASTM D3171 method II
Cured ply thickness		mm	(in)	0.21	(0.0083)	0.41	(0.016)	0.70	(0.027)	ASTM D792
+45° tensile strength*	X_T	MPa	(ksi)	1300	(188)	874	(126)	675	(97.9)	ISO527-5
+45° tensile modulus*	E_T	GPa	(Msi)	65	(9.43)	63	(9.14)	62	(8.99)	ISO527-5
+45° compressive strength*	X_C	MPa	(ksi)	703	(102)	644	(93.4)	606	(87.9)	SACMA SRM1-94
+45° compressive modulus*	E_{C11}	GPa	(Msi)	60	(8.70)	59	(8.56)	61	(8.85)	SACMA SRM1-94
-45° tensile strength*	Y_T	MPa	(ksi)	1187	(172)	832	(121)	616	(98.3)	ISO527-5
-45° tensile modulus*	E_{T22}	GPa	(Msi)	64	(9.28)	67	(9.72)	63	(9.14)	ISO527-5
-45° compressive strength*	X_C	MPa	(ksi)	673	(97.6)	679	(98.5)	554	(80.4)	SACMA SRM1-94
-45° compressive modulus*	E_{C22}	GPa	(Msi)	61	(8.85)	58	(8.41)	62	(8.99)	SACMA SRM1-94
+45° flexural strength	X_F	MPa	(ksi)	782	(113)	845	(123)	650	(94.3)	ISO14125
+45° flexural modulus	E_{F11}	GPa	(Msi)	45	(6.53)	51	(7.40)	45	(6.53)	ISO14125
-45° flexural strength	X_F	MPa	(ksi)	934	(135)	1056	(153)	815	(118)	ISO14125
-45° flexural modulus	E_{F22}	GPa	(Msi)	52	(7.54)	59	(8.56)	45	(6.53)	ISO14125
0° ILSS	X_{ILSS}	MPa	(ksi)	73	(10.6)	55	(7.98)	42	(6.09)	ISO14130

*Normalized to 55% fiber volume fraction

BIAXIAL GLASS LAMINATE PROPERTIES

PROPERTY	SYMBOL	UNITS		ST90 / XE300		ST90/XE603		ST90 / XE905		TEST METHOD
Resin content		%		35		35		35		ASTM D3171 method II
Fiber volume fraction	V_f	%		46		48		48		ASTM D3171 method II
Cured ply thickness		mm	in	0.25	(0.009)	0.48	(0.019)	0.72	(0.028)	ASTM D792
+45° tensile strength*	X_T	MPa	(ksi)	497	(72.1)	546	(79.2)	589	(86.7)	ISO527-5
+45° tensile modulus*	E_T	GPa	(Msi)	30	(4.35)	30	(4.35)	30	(4.35)	ISO527-5
+45° compressive strength*	X_C	MPa	(ksi)	675	(97.9)	742	(108)	683	(92.5)	SACMA SRM1-94
+45° compressive modulus*	E_{C11}	GPa	(Msi)	30	(4.35)	31	(4.49)	30	(4.30)	SACMA SRM1-94
-45° tensile strength*	Y_T	MPa	(ksi)	517	(75.0)	501	(72.7)	569	(82.5)	ISO527-5
-45° tensile modulus*	E_{T22}	GPa	(Msi)	30	(4.35)	29	(4.21)	30	(4.35)	ISO527-5
-45° compressive strength*	X_C	MPa	(ksi)	608	(88.2)	741	(107)	615	(89.2)	SACMA SRM1-94
-45° compressive modulus*	E_{C11}	GPa	(Msi)	30	(4.35)	30	(4.35)	30	(4.35)	SACMA SRM1-94
+45° flexural strength	X_F	MPa	(ksi)	688	(99.8)	788	(114)	726	(105)	ISO14125
+45° flexural modulus	E_{F11}	GPa	(Msi)	18	(2.61)	22	(3.19)	19	(2.75)	ISO14125
-45° flexural strength	X_F	MPa	(ksi)	743	(108)	742	(107)	696	(101)	ISO14125
-45° flexural modulus	E_{F11}	GPa	(Msi)	20	(2.90)	22	(3.19)	18	(2.61)	ISO14125
0° ILSS	X_{ILSS}	MPa	(ksi)	62	(8.99)	61	(8.85)	52	(7.54)	ISO14130

*Normalized to 55% fiber volume fraction

QUADAXIAL GLASS LAMINATE PROPERTIES

PROPERTY	SYMBOL	UNITS		ST90 / QE600		ST90 / QE1230		TEST METHOD
Resin content		%		33		41		ASTM D3171 method II
Fiber volume fraction	V_f	%		46		46		ASTM D3171 method II
Cured ply thickness		mm	(in)	0.5	(0.019)	1	(0.039)	ASTM D792
0° tensile strength*	X_T	MPa	(ksi)	487	(70.6)	407	(59.03)	ISO527-5
0° tensile modulus*	E_T	GPa	(Msi)	24	(3.48)	24	(3.48)	ISO527-5
90° tensile strength*	X_T	MPa	(ksi)	410	(59.5)	381	(55.3)	ISO527-5
90° tensile modulus*	E_T	GPa	(Msi)	24	(3.48)	23	(3.34)	ISO527-5
+45° tensile strength*	Y_T	MPa	(ksi)	462	(67.0)	360	(52.2)	ISO527-5
+45° tensile modulus*	E_{T22}	Gpa	(Msi)	25	(3.63)	23	(3.34)	ISO527-5
-45° tensile strength*	Y_T	MPa	(ksi)	447	(64.8)	358	(51.9)	ISO527-5
-45° tensile modulus*	E_{T22}	Gpa	(Msi)	25	(3.63)	23	(3.34)	ISO527-5
0° compressive strength*	X_C	MPa	(ksi)	498	(72.2)	490	(71.1)	SACMA SRM1-94
0° compressive modulus*	E_{C11}	GPa	(Msi)	27	(3.92)	25	(3.63)	SACMA SRM1-94
90° compressive strength*	X_C	MPa	(ksi)	474	(68.8)	427	(61.9)	SACMA SRM1-94
90° compressive modulus*	E_{C11}	GPa	(Msi)	25	(3.63)	24	(3.48)	SACMA SRM1-94
+45° compressive strength*	X_C	MPa	(ksi)	504	(73.1)	362	(52.5)	SACMA SRM1-94
+45° compressive modulus*	E_{C11}	GPa	(Msi)	26	(3.77)	25	(3.63)	SACMA SRM1-94
-45° compressive strength*	X_C	MPa	(ksi)	544	(78.9)	377	(54.7)	SACMA SRM1-94
-45° compressive modulus*	E_{C11}	GPa	(Msi)	26	(3.77)	24	(3.48)	SACMA SRM1-94
0° ILSS	X_{ILSS}	MPa	(ksi)	58	(8.41)	48	(6.96)	ISO14130

*Normalized to 55% fiber volume fraction

WOVEN ROVINGS GLASS LAMINATE PROPERTIES

PROPERTY	SYMBOL	UNITS		ST90 / WRE581T		ST90 / WRE850T		TEST METHOD
Resin content		%		35		35		ASTM D3171 method II
Fiber volume fraction	V_f	%		50		49		ASTM D3171 method II
Cured ply thickness		mm	(in)	0.45	(0.018)	0.67	(0.026)	ASTM D792
0° tensile strength*	X_T	MPa	(ksi)	538	(78.0)	585	(84.8)	ISO527-5
0° tensile modulus*	E_T	GPa	(Msi)	30.6	(4.44)	30	(4.35)	ISO527-5
0° compressive strength*	X_C	MPa)	(ksi	546	(79.2)	561	(81.4)	SACMA SRM1-94
0° compressive modulus*	E_{C11}	GPa	(Msi)	31	(4.50)	30	(4.35)	SACMA SRM1-94
90° tensile strength*	Y_T	MPa	(ksi)	579	(84.0)	565	(81.9)	ISO527-5
90° tensile modulus*	E_{T22}	GPa	(Msi)	29	(4.21)	31	(4.50)	ISO527-5
90° compressive strength*	X_C	MPa	(ksi)	532	(77.2)	512	(74.3)	SACMA SRM1-94
90° compressive modulus*	E_{C11}	GPa	(Msi)	29	(4.21)	30	(4.35)	SACMA SRM1-94
0° flexural strength	X_F	MPa	(ksi)	740	(107)	739	(107)	ISO14125
0° flexural modulus	E_{F11}	GPa	(Msi)	22	(3.19)	23	(3.34)	ISO14125
0° ILSS	X_{ILSS}	MPa	(ksi)	61	(8.85)	56	(8.12)	ISO14130

*Normalized to 55% fiber volume fraction

WOVEN GLASS FABRIC LAMINATE PROPERTIES

PROPERTY	SYMBOL	UNITS		ST90/RE295H4		ST90 /RE301		ST90 / RE400		TEST METHOD
Resin content		%		40		35		35		ASTM D3171 method II
Fiber volume fraction	V_f	%				49		49		ASTM D3171 method II
Cured ply thickness		mm	(in)			0.24	(0.009)	0.31	(0.012)	ASTM D792
0° tensile strength*	X_T	MPa	(ksi)			532	(77.2)	585	(84.8)	ISO527-5
0° tensile modulus*	E_T	GPa	(Msi)			32	(4.64)	31	(4.50)	ISO527-5
0° compressive strength*	X_C	MPa	(ksi)	714	(103)	555	(80.5)	593	(86.0)	SACMA SRM1-94
0° compressive modulus*	E_{C11}	GPa	(Msi)	30	(4.35)	32	(4.64)	31	(4.50)	SACMA SRM1-94
90° tensile strength*	Y_T	MPa	(ksi)			490	(71.1)	496	(71.9)	ISO527-5
90° tensile modulus*	E_{T22}	GPa	(Msi)			31	(4.50)	26	(3.77)	ISO527-5
90° compressive strength*	X_C	MPa	(ksi)	644	(93.4)	500	(72.5)	466	(67.6)	SACMA SRM1-94
90° compressive modulus*	E_{C11}	GPa	(Msi)	30	(4.35)	30	(4.35)	29	(4.21)	SACMA SRM1-94
0° flexural strength	X_F	MPa	(ksi)	744	(108)	679	(98.5)	809	(117)	ISO14125
0° flexural modulus	E_{F11}	GPa	(Msi)	22	(3.2)	25	(3.63)	23	(3.34)	ISO14125
0° ILSS	X_{ILSS}	MPa	(ksi)	69	(10)	55	(7.98)	55	(7.98)	ISO14130

*Normalized to 55% fiber volume fraction

HEALTH AND SAFETY

The following points must be considered:

1. Skin contact must be avoided by wearing protective gloves. Gurit recommends the use of disposable nitrile gloves for most applications. The use of barrier creams is not recommended, but to preserve skin condition a moisturizing cream should be used after washing.
2. Protective clothing should be worn when mixing, laminating or sanding. Contaminated work clothes should be thoroughly cleaned before re-use.
3. Eye protection should be worn if there is a risk of resin, hardener, solvent or dust entering the eyes. If this occurs flush the eye with water for 15 minutes, holding the eyelid open, and seek medical attention.
4. Ensure adequate ventilation in work areas. Respiratory protection should be worn if there is insufficient ventilation. Solvent vapors should not be inhaled as they can cause dizziness, headaches, loss of consciousness and can have long term health effects.
5. If the skin becomes contaminated, then the area must be immediately cleansed. The use of resin-removing cleansers is recommended. To finish, wash with soap and warm water. The use of solvents on the skin to remove resins etc must be avoided.

   Washing should be part of routine practice:
   - before eating or drinking
   - before smoking & vaping
   - before using the lavatory
   - after finishing work

6. The inhalation of sanding dust should be avoided and if it settles on the skin then it should be washed off. After more extensive sanding operations a shower/bath and hair wash is advised.

Gurit produces a separate full Safety Data Sheet for all hazardous products. Please ensure that you have the correct SDS to hand for the materials you are using before commencing work.

NOTICE

All advice, instruction or recommendation is given in good faith but the selling Gurit entity (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 Gurit's Website: www.gurit.com/terms-and-conditions.aspx

The Company strongly recommends that Customers make test panels in the final process conditions and conduct appropriate testing of any goods or materials supplied by the Company prior to final use 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. Due to the varied nature of end-use applications, the Company does, in particular, not warrant that the test panels in the final process conditions and/or the final component pass any fire standards.

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 is continuously reviewing and updating literature. Please ensure that you have the current version by contacting your sales contact and quoting the revision number in the bottom left-hand corner of this page.

CONTACT INFORMATION

Please see local contact information at www.gurit.com

24-HOUR CHEMICAL EMERGENCY NUMBER

For advice on chemical emergencies, spillages, fires or exposures:

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Americas	+1 646 844 7309
APAC	+65 3158 1412