SR *InfuGreen* 810 / SD 477X

Green Epoxy systems for Injection and Infusion

GreenPoxy®

TYPE APPROVED PRODUCT DNV DNV.COM/AF

***InfuGreen* 810** is a two-component biosourced epoxy system. It has been specially formulated for resin transfer processes, such as injection or infusion.

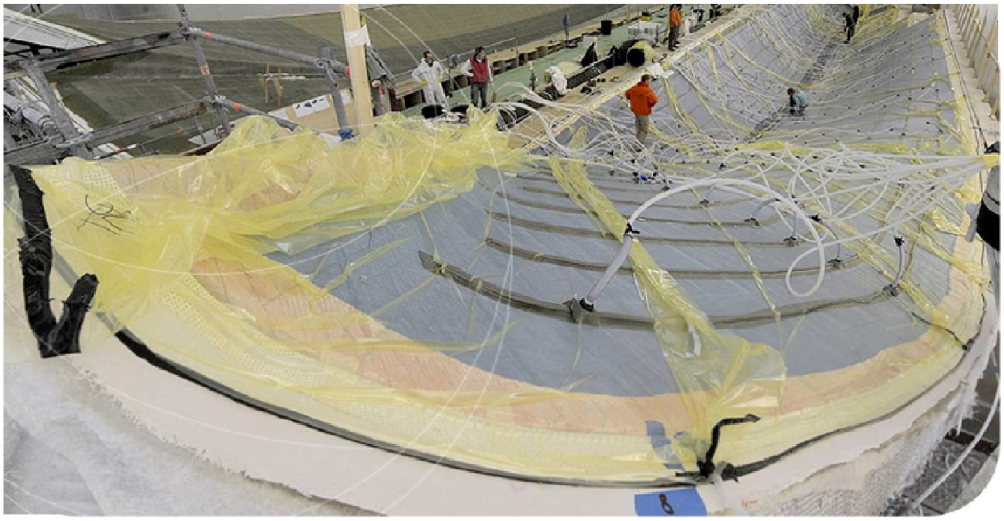
DNV certified

		SD 4775	SD 4773	SD 4771
Reactivity level		Fast	Medium	Slow
Initial viscosity (mPa.s)	20 °C	900	510	235
	30 °C	330	220	115
Pot Life (100 g)	20 °C	01 h 05	02 h 00	04 h 30
	30 °C	20 min	35 min	01 h 50
Mixing ratio				
	By weight	100 / 29	100 / 29	100 / 29
	By volume	100 / NR	100 / NR	100 / NR
Maximum strength	N/mm^2	68	71	72
% Elongation at max strength	%	5,1	4,5	4,8
Tg max onset	°C	94	92	92
Gel Time (1 mm)	20 °C	06 h 10	11 h 10	22 h 00
	30 °C	03 h 10	05 h 30	12 h 00
Optimal infusion time	20 °C	-	01 h 10	05 h 20
	30 °C	35 min	01 h 20	04 h 00
Latest flow under vacuum	20 °C	02 h 55	05 h 45	13 h 30
	30 °C	01 h 50	03 h 15	07 h 40
Earliest vacuum off time	20 °C	09 h 50	17 h 40	32 h 00
	30 °C	04 h 25	08 h 30	18 h 00
Demold time	20 °C	18 h 30	33 h 30	66 h 00
	30 °C	09 h 30	16 h 30	36 h 00

***InfuGreen* 810** is a two-component epoxy system Bio-sourced and shipbuilding.
It has been formulated for resin transfer processes, such as injection or infusion, specially for thick composite parts.

- This system has a very low viscosity at ambient temperature.
- Different hardeners allow the production of small to very large parts.
- Cured system gives a temperature resistance up to 90 °C (Tg onset)

***SR InfuGreen* 810** epoxy resin is produce with about 38 % of carbon from plant origin and has a lower environmental impact than standard Epoxy systems.
The bio-based Carbon content of our resin is certified by an independent laboratory using Carbon 14 measurements (ASTM D6866 or XP CEN/TS 16640).
This percentage is function of the carbon origin contained in the epoxy molecule.



Epoxy resin SR InfuGreen 810

Appearance		liquid
Color		colourless
Gardner color		≤ 1
Viscosity (mPa.s)	15 °C	2500 ± 500
	20 °C	1350 ± 250
	25 °C	830 ± 170
	30 °C	500 ± 100
Density	20 °C	1,16
Bio-based Carbon content (%)		37 ± 4
Storage (months)	23 °C	24

Hardener(s)

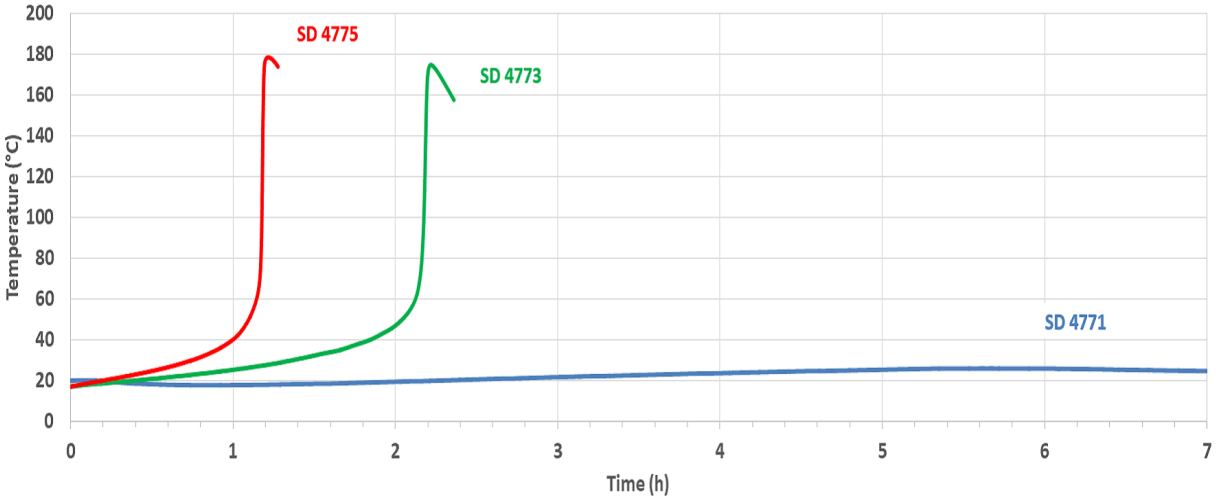
		SD 4775	SD 4773	SD 4771
Appearance		liquid	liquid	liquid
Color		light yellow	yellow	colourless
Gardner color		≤ 5	≤ 4	≤ 1
Reactivity level		Fast	Medium	Slow
Viscosity (mPa.s)	15 °C	200 ± 40	51 ± 10	13 ± 3
	20 °C	135 ± 30	41 ± 8	11 ± 2
	25 °C	95 ± 20	31 ± 6	9 ± 2
	30 °C	70 ± 15	24 ± 5	7 ± 1
Density	20 °C	1,00	0,98	0,94
Storage (months)	23 °C	24	24	24

Mixe(s) SR InfuGreen 810 / SD 477X - DNV

		SD 4775	SD 4773	SD 4771
Appearance		liquid	liquid	liquid
Color		light yellow	light yellow	colourless
Mixing ratio				
By weight		100 / 29	100 / 29	100 / 29
By volume		100 / NR	100 / NR	100 / NR
Initial viscosity (mPa.s)	20 °C	900	510	235
	30 °C	330	220	115
Density	20 °C	1,18	1,17	1,16

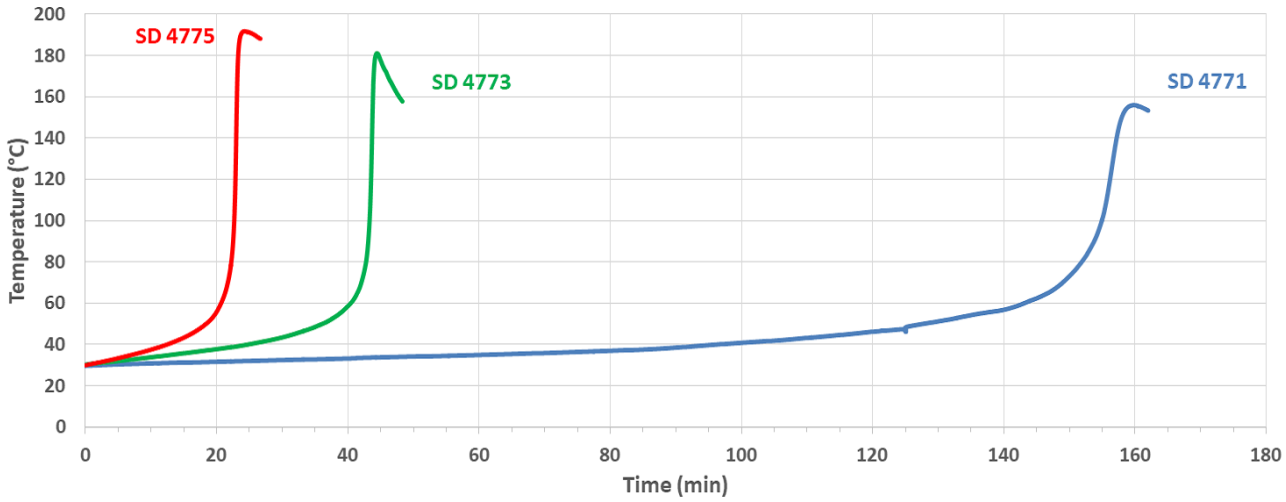
Reactivity 20 °C for 100 g SR InfuGreen 810 / SD 477X - DNV

	SD 4775	SD 4773	SD 4771
Exothermic temperature (°C)	179	175	204
Exothermic peak time	01 h 10	02 h 10	04 h 30
Time to reach 50 °C	01 h 05	02 h 00	04 h 00



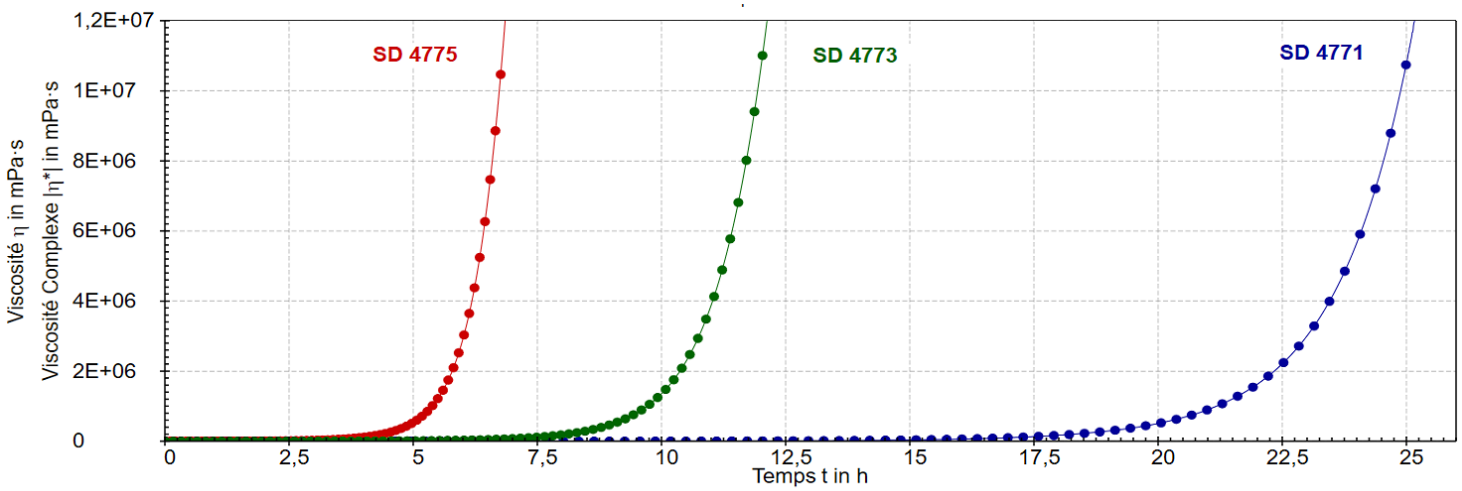
Reactivity 30 °C for 100 g SR InfuGreen 810 / SD 477X - DNV

	SD 4775	SD 4773	SD 4771
Exothermic temperature (°C)	192	181	245
Exothermic peak time	25 min	45 min	02 h 15
Time to reach 50 °C	20 min	35 min	01 h 50

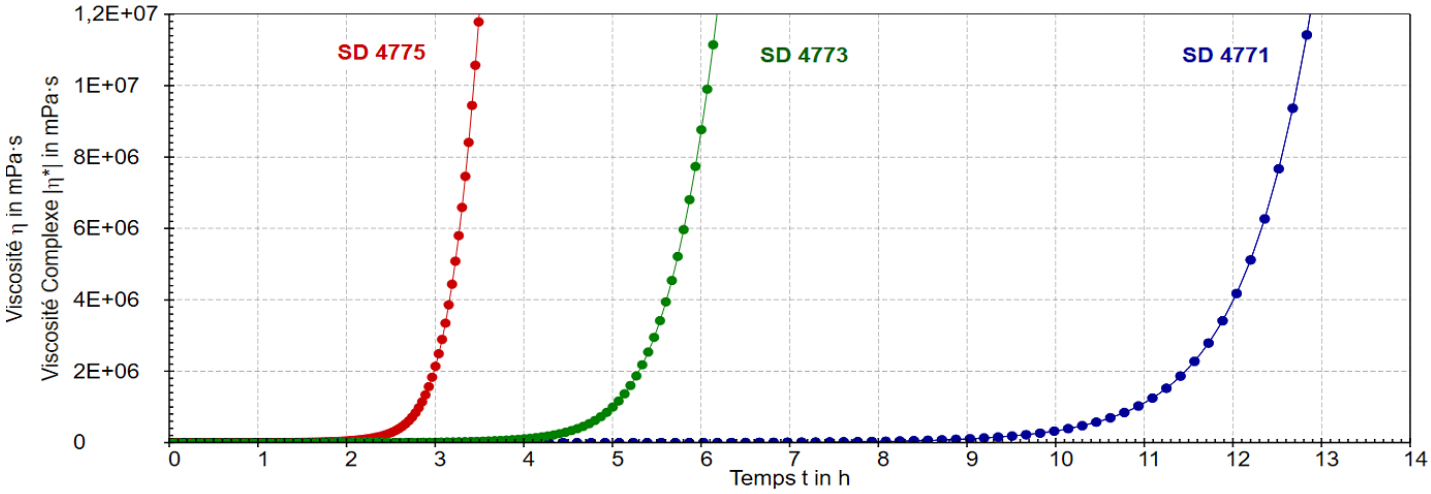


Reactivity on 1 mm thick layer

20 °C



30 °C



Post-curing

The thermomechanical values of an epoxy system can be optimized by implementing a post-curing cycle. The Sicomin laboratory provides several predefined post cure cycles on its data sheets allowing users to compare systems. These experimental cycles are adaptable to your specific applications, taking the following parameters into account:

- Selected epoxy system (Tg max)
- Available heat source
- Room Dimension and Sampling
- Nature of the tooling (thermal conductivity of material)

Many systems can provide good mechanical properties after curing at room temperature and from 18°C for 24 to 48 hours before demolding.
The mechanical properties progress very quickly with a slightly higher temperature of around 40°C for several hours.
Epoxy systems with high Tg and slow and extra-slow hardeners imperatively require post-curing at a higher temperature. It is possible to start the cycle as soon as the exothermic peak passes, but also to start post-curing later after assembly of the various components and before the finishing operations. If the nature of the models and tools is not suitable for high temperatures, we recommend carrying out the first stages up to the maximum admissible temperature then, after cooling and demoulding, continuing the cycle on a suitable former.
For a conventional epoxy system, we recommend carrying out a cycle in steps of 20°C for 4 hours.

Example for an epoxy system Tg max 100°C:
4 hrs at 40°C + 4 hrs at 60°C + 4 hrs at 80°C + cooling to room temperature before unmoulding.

There are many short cycle, high temperature epoxy systems that do not fit into this post-cure scheme (pultrusion, hot press, pre-preg). For these systems, initial curing provides maximum thermomechanical performance without post-curing.

We invite you to contact our technical department for your questions on this subject.

Mechanical properties on cast resin :

		SR InfuGreen 810 / SD 4775			SR InfuGreen 810 / SD 4773		
		24 h TA 24 h 40 °C	24 h TA 16 h 60 °C	24 h TA 8 h 80 °C	24 h TA 24 h 40 °C	24 h TA 16 h 60 °C	24 h TA 8 h 80 °C
Tensile							
Modulus	N/mm^2	3 440	3 230	2 980	3 430	3 270	3 040
Maximum strength	N/mm^2	80	73	68	72	73,5	71
Breaking Strength	N/mm^2	70	72	68	70	73,4	70
Elongation at max strength	%	3,3	4,6	5,1	3,3	4	4,5
Elongation at break	%	5,5	5,4	5,1	3,9	4,1	5,9
Flexion							
Modulus	N/mm^2	3 300	3 180	3 110	3 230	3 240	3 055
Maximum strength	N/mm^2	119	119	121	114	123	121
Breaking Strength	N/mm^2	99	115	118	95	114	113
Elongation at max strength	%	5	6	6,6	4,6	5,7	6,6
Elongation at break	%	7,7	7,1	7,7	6,7	7,4	8,82
Shear							
Breaking Strength	N/mm^2	48	48	50	48	47	49
Compression							
Modulus	N/mm^2						
Yield strength	N/mm^2	108	104	102	108	104	103
Offset compression yield	%	12,8	15,3	20,3	12,4	15,1	17,3
Charpy impact strength							
Resilience	kJ/m^2	37	35	31	49	31	32
DSC glass transition							
Tg onset	°C	67	85	94	65	85	92
Tg max onset	°C			94			92

These curing cycles are applied after a 24-hour hardening period at room temperature, allowing the reaction to freeze and exotherm bevond.

Mechanical properties on cast resin :

		SR InfuGreen 810 / SD 4771		
		24 h Ta 24 h 40 °C	24 h Ta 16 h 60 °C	24 h Ta 8 h 80 °C
Tensile				
Modulus	N/mm^2	3 380	3 080	3 000
Maximum strength	N/mm^2	69	70	72
Breaking Strength	N/mm^2	53	66	66
Elongation at max strength	%	3,6	4,3	4,8
Elongation at break	%	6,8	6	6,3
Flexion				
Modulus	N/mm^2	3 120	2 950	2 915
Maximum strength	N/mm^2	113	110	116
Breaking Strength	N/mm^2	63	74	89
Elongation at max strength	%	5	6,2	6,2
Elongation at break	%	11,8	11.2	11
Shear				
Breaking Strength	N/mm^2	45	47	47
Compression				
Modulus	N/mm^2			
Yield strength	N/mm^2	104	93	96
Offset compression yield	%	11,7	11,3	15,6
Charpy impact strength				
Resilience	kJ/m^2	29	64	57
DSC glass transition				
Tg onset	°C	65	79	92
Tg max onset	°C			92

These curing cycles are applied after a 24-hour hardening period at room temperature, allowing the reaction to freeze and exotherm bevond.

Tests carried out on samples of pure cast resin, without prior degassing, between steel plates.

Measures undertaken according to the following norms:

Mechanical tests:	
Tension:	*NF EN ISO 527-2:2012*
Flexion:	*NF EN ISO 178:2011*
Compression:	*NF EN ISO 604:2004 or NF EN ISO 844:2014 (foam product)*
Charpy impact strength:	*NF EN ISO 179-1:2010*
Shear Strength:	*ASTM D732–17 (Punch Tool)*
Interlaminar shrinkage strength:	*ASTM D5528-13*
Toughness (GIC et KIC) :	*ISO 13586:2000*
Water absorption:	*Internal. Polymerization according to cycle, machining, weighing, time spent in distilled water at 70 °C / 48 hours, weighing 1 hour after emerging,*
Bonding Strength Double lap shear:	*ASTM D3528-96* *ADH = adhesive failure* *COH = cohesive failure* *TLC = thin-layer cohesive failure* *FT = fiber-tear failure.* *LFT = light-fiber-tear failure*
Thermal tests:	
Glass transition DSC:	*NF EN ISO 11357-2:2014 -5°C to 180 °C under nitrogen gas* *T_{G1} or Onset: 1st scan at 20 °C/min* *T_{G1} maximum or Onset: 2nd scan at 20 °C/min*
Glass transition DTMA:	*Temperature ramp 0 °C to 180 °C @ 2°C/min under normal atmosphere* *NF EN ISO 11357-1:2016 T_G onset G'* *ASTM D4065-12 T_G peak G''*
Physical tests:	
Gardner color:	*NF EN ISO 4630:2016 Visual method*
Refractive index:	*NF ISO 280:1999*
Viscosity:	*NF EN ISO 3219:1994 Rheometer 50 mm, shear 10 s^{-1}*
Density on liquids:	*ISO 2811-1:2016 Pycnometer*
Density on solid:	*NF EN ISO 1183-3:1999 Helium Pycnometer*
Density on foam:	*NF EN ISO 845:2009*
Gel time:	*Cross G' G'' Rheometer CP50 - Shear rate 10 s^{-1}*
Green Carbone content:	*ASTM D6866-16 or XP CEN/TS 16640 Avril 2014*
TA:	*Ambient temperature (20 to 25 °C)*
NC:	*No information Communicated*
NB:	*No Breaking (maximum flexion deformation : 15 %)*

Table 1st page:

Pot Life:	*Time to reach 50 °C or time limit for use*
Gel time:	*Intersection of tangents on the viscosity curve of 1 mm thick layer*
Release time:	*Time required to obtain sufficient mechanical strength to release*
Minimum Vacuum Time:	*Time in which vacuum can be applied (25000 mPa.s)*
Maximum Vacuum time:	*Limit time below which a vacuum can be applied (G'G " crossing)*
Optimum Infusion time:	*Time to reach 400 mPa.s*
Max Infusion Time:	*Time to reach 25000 mPa.s*
Vacuum cut-off time:	*Time to reach G'G " crossover + 20%*

LEGAL NOTES:
Information given in writing or verbally, in the context of our technical assistance and our trials, does not engage our responsibility. Information is given in good faith based on SICOMIN's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with SICOMIN's recommendations. We advise users of SICOMIN products to check by some practical trials that they are suitable for the intended processes and applications. The customer's storage, the use, the implementation and the transformation of the supplied products are not under SICOMIN's control and entirely under the sole responsibility of the user.
SICOMIN reserves the right to change the properties of its products. All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data and tolerance may vary due to circumstances beyond our control.
If our responsibility should nevertheless be involved, it would be, for all the damages, limited to the value of the goods supplied by us and processed by the customer. We guaranty the non-reproachable quality of our products, in the general context of sales and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

Mix

SR InfuGreen 810	Resin part + Hardener part (kg)	Resin part (kg)	Hardener part (kg)
SD 4775			
SD 4773			
SD 4771			