SR CA 85 / SD 870X

DRAFT VERSION - Sealing & casting epoxy resin system

SR CA 85 is a system formulated for sealing, embedding and casting allowing all thicknesses up to 12 cm in one shot thanks to the wide range of hardeners.

Its hydrophobia and high density allow ***SR CA 85*** to harden very well under water.

CA 85 shows very good mechanical properties, especially in compression and has a very good behaviour towards fire.

Thanks to the mixability of the SD 870x hardeners, ***SR CA 85*** reactivity can be adjusted to every casting whatever the thickness and/or the temperature.

		SD 8705	SD 8703	SD 8702	SD 8701
Reactivity level		Very Fast	Standard	Slow	Ultra slow
Initial viscosity (mPa.s)	20 °C	14 100	6 220	4 550	2 580
	30 °C	5 320	2 050	1 600	1 480
Pot Life (150 g)	20 °C	55 min	02 h 00	03 h 00	05 h 00
	30 °C	15 min	40 min	01 h 05	02 h 00
Mixing ratio					
	By weight	100 / 17,5	100 / 17,5	100 / 17,5	100 / 17,5
	By volume	100 / 30	100 / 30	100 / 30	100 / 30
Density		1,51	1,51	1,51	1,51
Tg max onset	°C	91	94	84	82
Gel Time (1 mm)	20 °C	03 h 00	06 h 20	10 h 10	19 h 20
	30 °C	01 h 50	04 h 00	06 h 00	10 h 20
Demold time	20 °C	08 h 45	19 h 00	30 h 00	58 h 00
	30 °C	05 h 30	12 h 00	18 h 00	31 h 00

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Epoxy resin SR CA 85

Appearance		thick liquid
Color		white
Viscosity (mPa.s)	15 °C	130000 ± 26000
	20 °C	57000 ± 11400
	25 °C	31500 ± 6500
	30 °C	12000 ± 2400
	40 °C	4500 ± 900
Density	20 °C	1,65
Storage (months)	23 °C	24

Hardener(s)

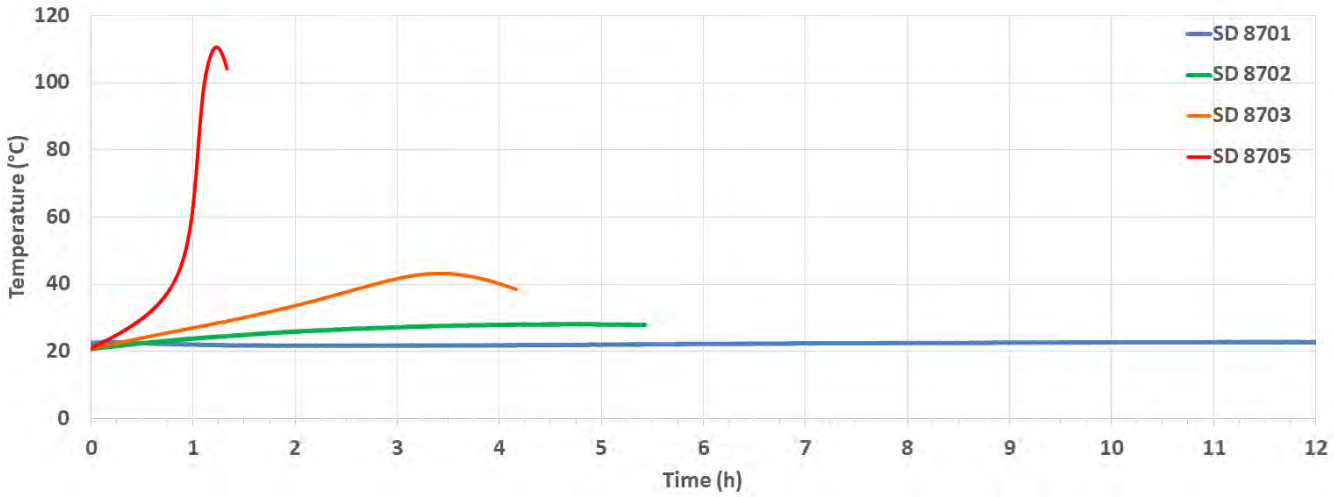
		SD 8705	SD 8703	SD 8702	SD 8701
Appearance		liquid	liquid	liquid	liquid
Color		yellow	light yellow	colourless	light yellow
Gardner color		≤ 6	≤ 5	≤ 4	≤ 2
Reactivity level		Very Fast	Standard	Slow	Ultra slow
Viscosity (mPa.s)	15 °C	475 ± 95	68 ± 14	38 ± 8	18 ± 4
	20 °C	300 ± 60	50 ± 10	28 ± 6	14 ± 3
	25 °C	200 ± 40	38 ± 7	23 ± 4	12 ± 2
	30 °C	140 ± 30	29 ± 6	18 ± 3	10 ± 2
Density	20 °C	1,02	0,98	0,97	0,95
Storage (months)	23 °C	24	24	24	24

Mixe(s) SR CA 85 / SD 870x

		SD 8705	SD 8703	SD 8702	SD 8701
Appearance		liquid	liquid	liquid	liquid
Color		off-white	off-white	off-white	off-white
Mixing ratio					
	By weight	100 / 17,5	100 / 17,5	100 / 17,5	100 / 17,5
	By volume	100 / 30	100 / 30	100 / 30	100 / 30
Density	20 °C	1,51	1,51	1,51	1,51
Initial viscosity (mPa.s)	20 °C	14 100	6 220	4 550	2 580
	30 °C	5 320	2 050	1 600	1 480

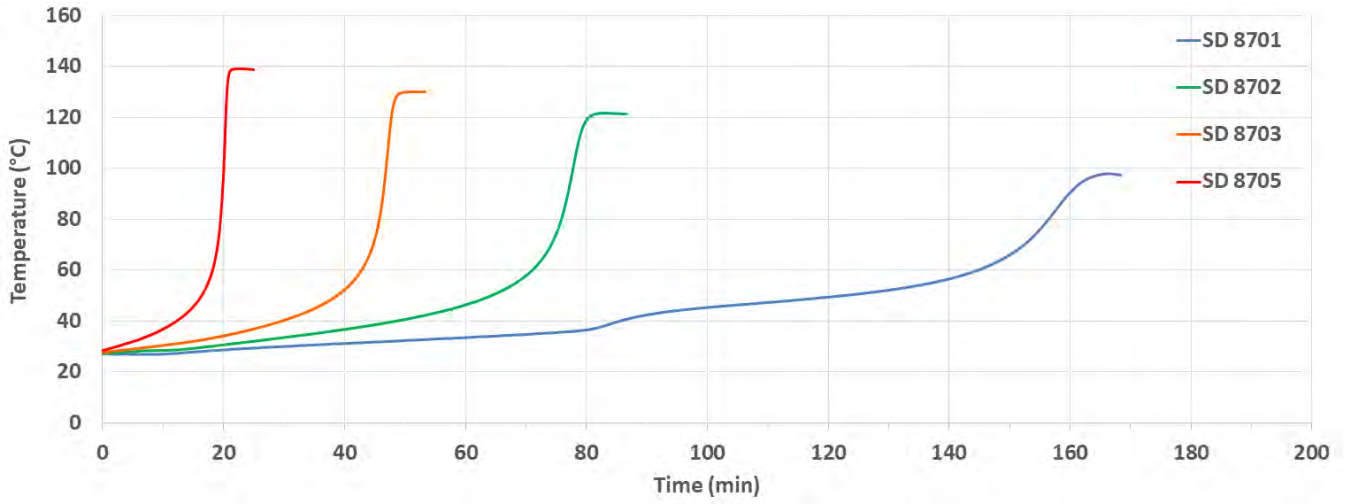
Reactivity 20 °C for 150 g SR CA 85 / SD 870x

	SD 8705	SD 8703	SD 8702	SD 8701
Exothermic temperature (°C)	111	43	28	23
Exothermic peak time	01 h 15	03 h 20	04 h 30	11 h 30
Time to reach 50 °C	55 min	-	-	-



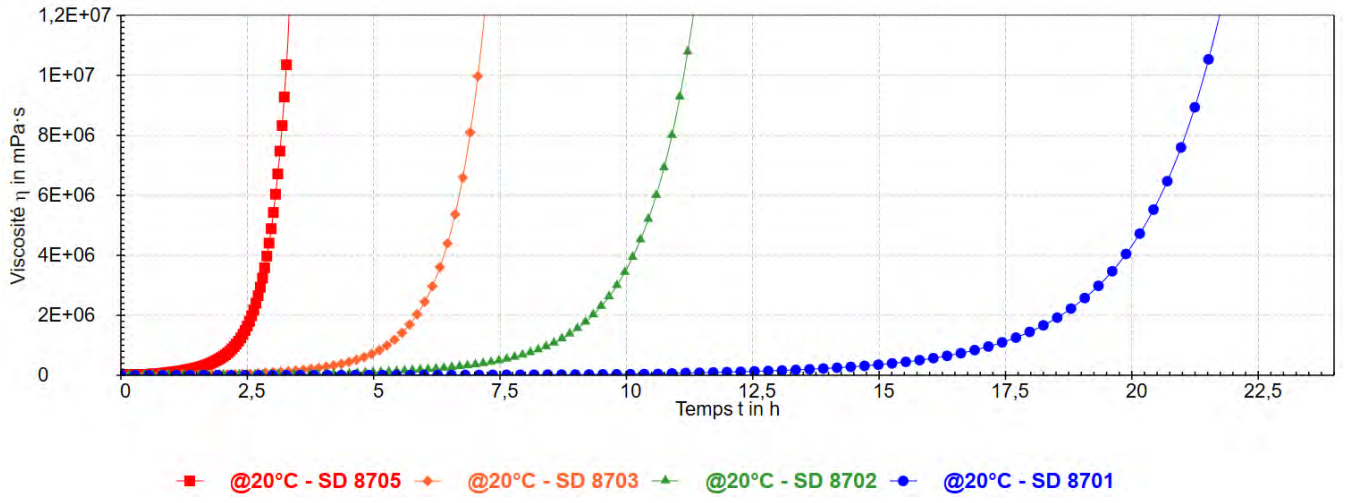
Reactivity 30 °C for 150 g SR CA 85 / SD 870x

	SD 8705	SD 8703	SD 8702	SD 8701
Exothermic temperature (°C)	139	130	122	98
Exothermic peak time	20 min	50 min	01 h 20	02 h 45
Time to reach 50 °C	15 min	40 min	01 h 05	02 h 00

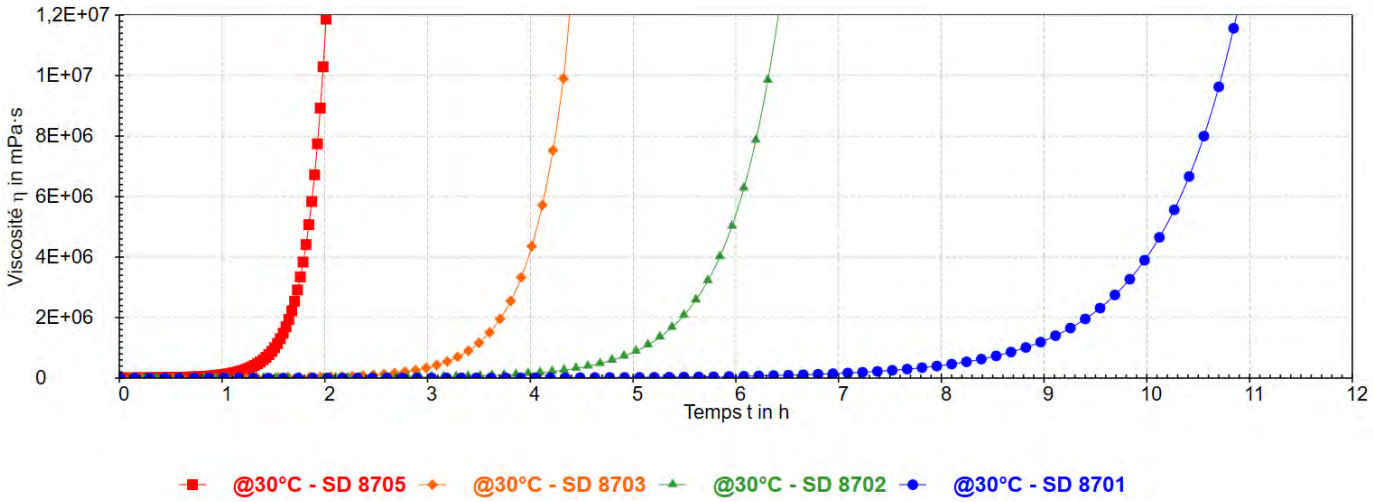


Reactivity on 1 mm thick layer

20 °C



30 °C


1,2E+07
1E+07
8E+06
6E+06
4E+06
2E+06
0
Viscosité η in mPa·s
0
1
2
3
4
5
6
7
8
9
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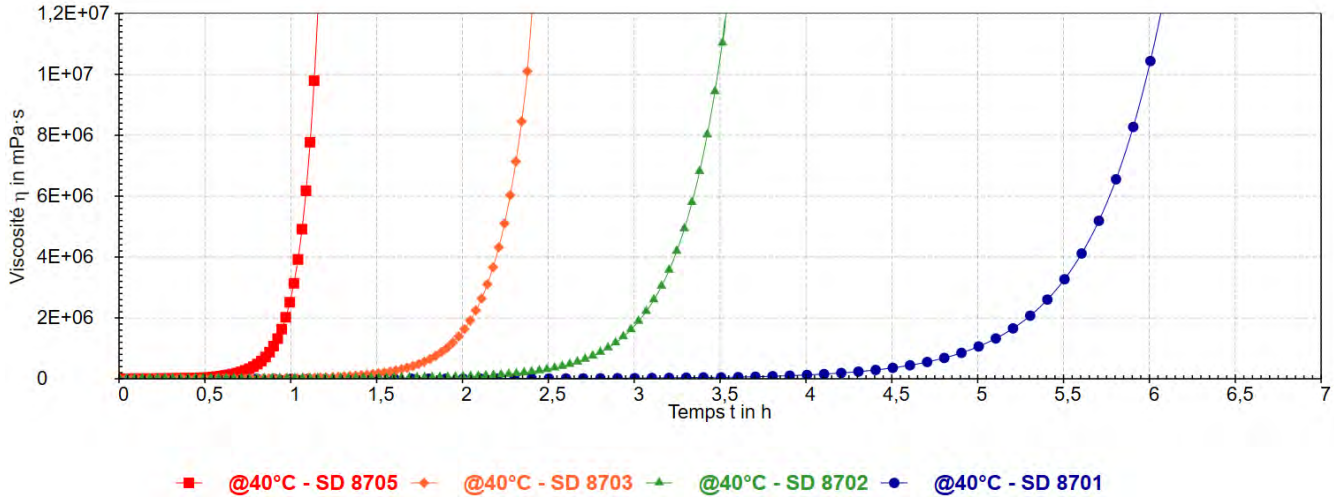
11
12
Temps t in h
@30°C - SD 8705
@30°C - SD 8703
@30°C - SD 8702
@30°C - SD 8701

40 °C


1,2E+07
1E+07
8E+06
6E+06
4E+06
2E+06
0
Viscosité η in mPa·s
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5
5
5,5
6
6,5
7
Temps t in h
@40°C - SD 8705
@40°C - SD 8703
@40°C - SD 8702
@40°C - SD 8701

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 CA 85 / SD 8705			SR CA 85 / SD 8703		
		24 h 40 ° C	16 h 60 ° C	8 h 80 ° C	24 h 40 ° C	16 h 60 ° C	8 h 80 ° C
Tensile							
Modulus	N/mm^2	7 060	6 930	6 310	6 340	6 095	5 805
Maximum strength	N/mm^2	43	41	49	39	46	44
Breaking Strength	N/mm^2	43	41	49	39	46	44
Elongation at max strength	%	0,7	0,7	0,9	0,7	0,9	0,9
Elongation at break	%	0,7	0,7	0,9	0,7	0,9	0,9
Flexion							
Modulus	N/mm^2	9 960	6 170	5 460	6 160	5 995	5 796
Maximum strength	N/mm^2	69	70	86	69	75	76
Breaking Strength	N/mm^2	69	70	86	69	75	76
Elongation at max strength	%	1,2	1,2	1,7	1,2	1,4	1,5
Elongation at break	%	1,2	1,2	1,6	1,2	1,4	1,5
Shear							
Breaking Strength	N/mm^2	35	42	48	38	44	45
Compression							
Modulus	N/mm^2						
Yield strength	N/mm^2	101	106	112	92	99	100
Offset compression yield	%	10,6	11,8	13,4	27,2	33,6	17,7
Charpy impact strength							
Resilience	kJ/m^2	7,7	7,4	9	15	18	17
DSC glass transition							
Tg onset	°C	69	79	96	68	82	93
Tg max onset	°C			91			94

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 CA 85 / SD 8702			SR CA 85 / SD 8701		
		24 h 40 ° C	16 h 60 ° C	8 h 80 ° C	24 h 40 ° C	16 h 60 ° C	8 h 80 ° C
Tensile							
Modulus	N/mm^2	6 330	6 540	6 020	5 800	5 785	5 335
Maximum strength	N/mm^2	44	51	47	39	43	43
Breaking Strength	N/mm^2	44	51	47	39	43	43
Elongation at max strength	%	0,9	1,1	1	0,8	0,9	1
Elongation at break	%	0,9	1,1	1	0,8	0,9	1
Flexion							
Modulus	N/mm^2	6 290	6 250	5 710	6 160	5 970	4 845
Maximum strength	N/mm^2	71	80	78	69	72	62
Breaking Strength	N/mm^2	71	80	78	69	72	62
Elongation at max strength	%	1,2	1,5	1,6	1,3	1,4	1,4
Elongation at break	%	1,2	1,5	1,6	1,3	1,4	1,4
Shear							
Breaking Strength	N/mm^2	41	44	44	37	39	34
Compression							
Modulus	N/mm^2						
Yield strength	N/mm^2	94	97	95	86	87	91
Offset compression yield	%	12,7	17,1	16,7	11,3	11,7	12,2
Charpy impact strength							
Resilience	kJ/m^2	16	22	24	7,7	9,4	6,4
DSC glass transition							
Tg onset	°C	68	75	84	62	70	78
Tg max onset	°C			84			82

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%*

Mix

SR CA 85	Resin part + Hardener part (kg)	Resin part (kg)	Hardener part (kg)
SD 8705	1,18 5,88 29,38	1 5 25	0,18 0,88 4,38
SD 8703	1,18 5,88 29,38	1 5 25	0,18 0,88 4,38
SD 8702	1,18 5,88 29,38	1 5 25	0,18 0,88 4,38
SD 8701	1,18 5,88 29,38	1 5 25	0,18 0,88 4,38