

## SR 1660

### Heat resistant epoxy systems

Systems developed for high service temperature tooling from 120 °C up to over 160 °C depending on the chosen hardener.

#### SD 7820 & SD 2630

Two component epoxy systems for parts or tooling with a service temperature up to 120 °C, 160 °C peak

Excellent chemical resistance, resistance to oxidization, low exothermic peak.

For laminating, press moulding, casting or injection.

Application type: Composite tooling for “120 °C” prepreg, thermoforming tooling, structural parts with a high service temperature.

#### SD 1305

Two component epoxy systems for parts or tooling with a service temperature up to 140 °C, 180°C peak

Excellent chemical resistance, resistance to oxidization, low exothermic peak.

For laminating, press moulding, casting or injection.

Application type: Composite tooling for “140°C” prepreg, thermoforming tooling, structural parts with a high service temperature.

### Epoxy resin SR 1660

		<b>SR 1660</b>
Aspect / colour		Yellow liquid
Viscosity (mPa.s) @ 15 °C		20 000 ± 4 000
Rheometer @ 20 °C		8 500 ± 1 500
CP 50 mm @ 25 °C		4 000 ± 1 000
Shear rate 10 s <sup>-1</sup>	@ 30 °C	2 100 ± 500
	@ 40 °C	700 ± 150
	@ 50 °C	330 ± 65
	@ 60 °C	155 ± 30
	@ 70 °C	85 ± 17
	@ 80 °C	50 ± 10
	@ 90 °C	32 ± 6
Density @ 20 °C		1.15 ± 0.01
Pycnometer ISO 2811-1		
Storage		Does not crystallize

## Hardeners SD xxxx

		<b>SD 1305</b>	<b>SD 2630</b>	<b>SD 7820</b>
Reactivity		<b>"Ultra slow"</b>	<b>"Very slow"</b>	<b>« Slow »</b>
Aspect / colour		Dark yellow liquid	Reddish yellow liquid	Clear to light yellow liquid
Viscosity (mPa.s)	@ 15 °C	426 ± 80	430 ± 80	120 ± 20
Rheometer	@ 20 °C	278 ± 50	250 ± 50	80 ± 15
CP 50 mm	@ 25 °C	173 ± 30	150 ± 30	60 ± 15
Shear rate 10 s <sup>-1</sup>	@ 30 °C	110 ± 20	100 ± 20	45 ± 10
	@ 40 °C	55 ± 10	50 ± 10	25 ± 5
	@ 50 °C	27 ± 5,5		
	@ 60 °C	17 ± 3,5		
	@ 70 °C	11 ± 2		
	Density	@ 20 °C	0.991 ± 0.01	1.00 ± 0.01
Pycnometer ISO 2811-1				

## SR 1660 / SD xxxx Mixes

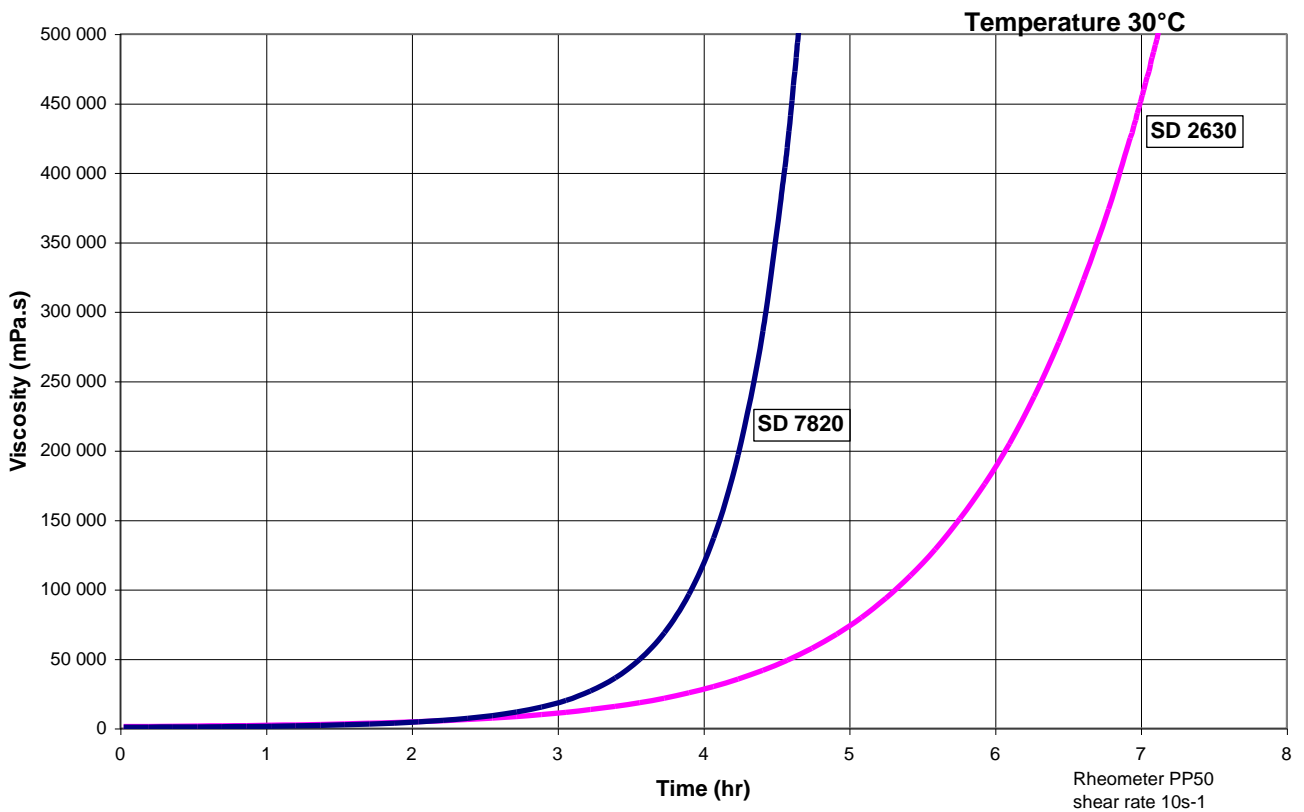
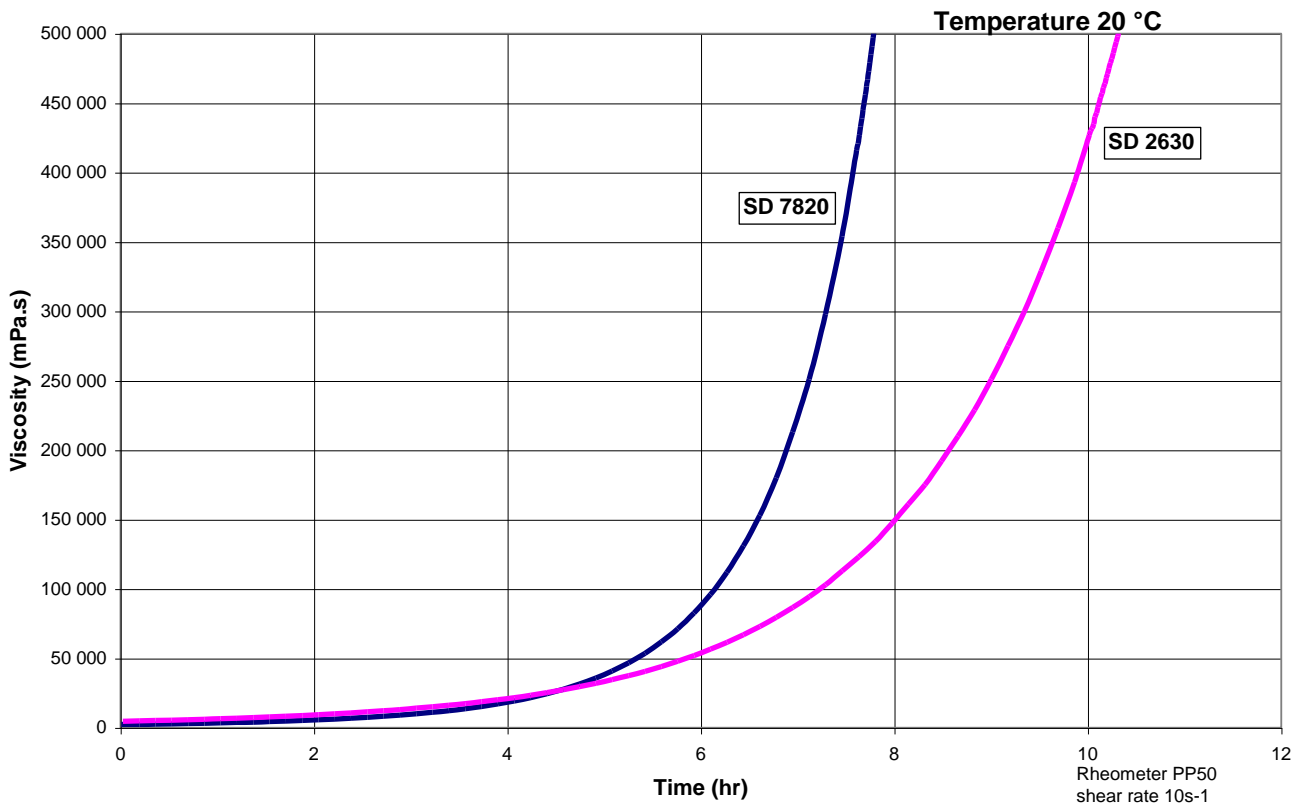
		<b>SR 1660 / SD 1305</b>	<b>SR 1660 / SD 2630</b>	<b>SR 1660 / SD 7820</b>
Viscosity (mPa.s)				
Rheometer	@ 20 °C	4 000 ± 800	4 650 ± 800	2 400 ± 500
CP 50 mm	@ 30 °C	1 000 ± 200	1 250 ± 250	750 ± 150
Shear rate 10 s <sup>-1</sup>	@ 40 °C	600 ± 100		240 ± 50
	@ 50 °C	300 ± 50		150 ± 30
	@ 60 °C	150 ± 30		80 ± 20
	@ 70 °C	60 ± 10		
	Weight ratio		100 / 32	100 / 31
Volume ratio		100 / 39	100 / 36	100 / 39
Glass Transition Tg1 max. (°C)		165	150	150

Glass transition DSC : ISO 11357-2 : 1999 -5°C to 250°C under nitrogen gaz  
 Tg1 or Onset : 1st point at 20 °C/mn  
 Tg1 maximum or Onset : second passage

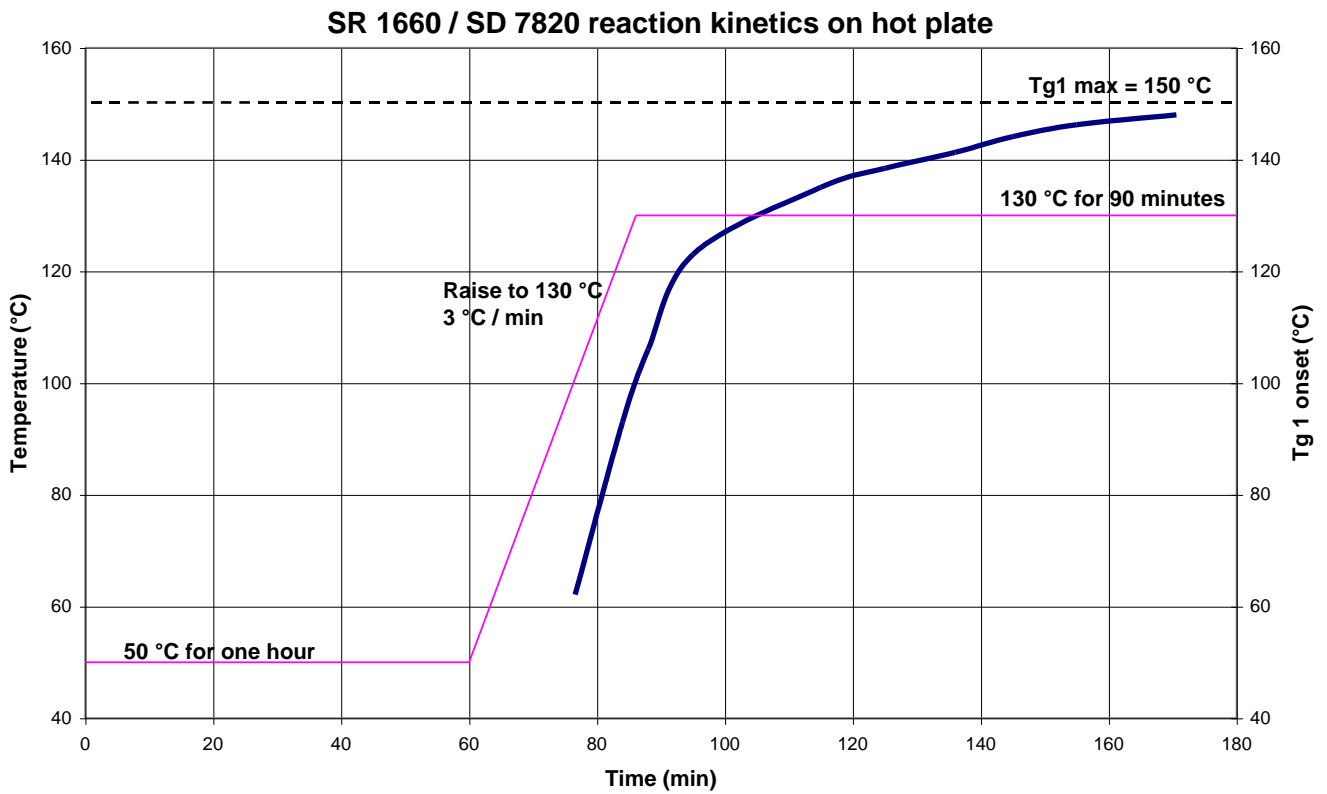
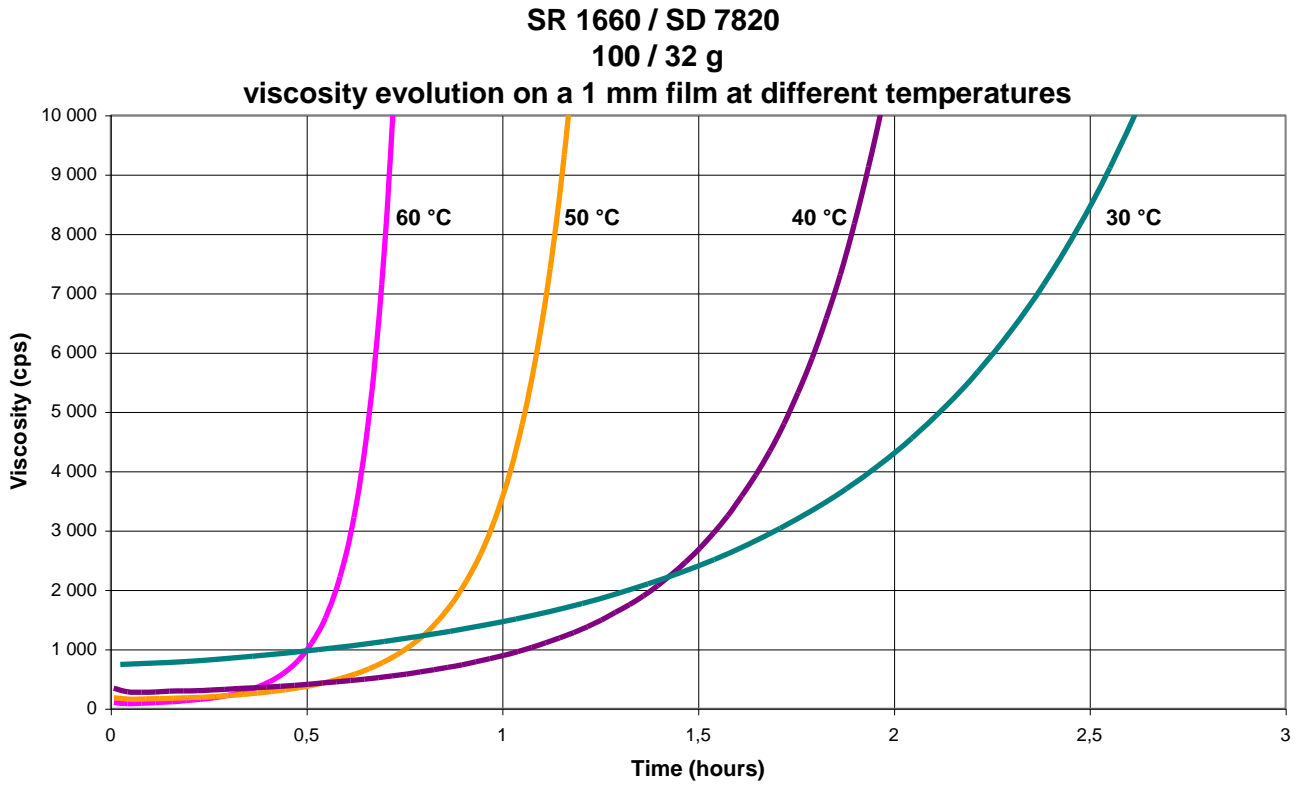
## Mix reactivity SR 1660 / SD xxxx

		<b>SR 1660 / SD 1305</b>	<b>SR 1660 / SD 2630</b>	<b>SR 1660 / SD 7820</b>
Exothermic temperature on 500 g mix (°C):				
	@ 20 °C	-	35	180
	@ 30 °C	-	70	>210
	@ 40 °C	85	205	>210
Time to reach exothermic peak on 500 g mix:				
	@ 20 °C	-	7 h 45'	6 h
	@ 30 °C	-	4 h	1 h 50'
	@ 40 °C	2 h	1 h 20'	54'

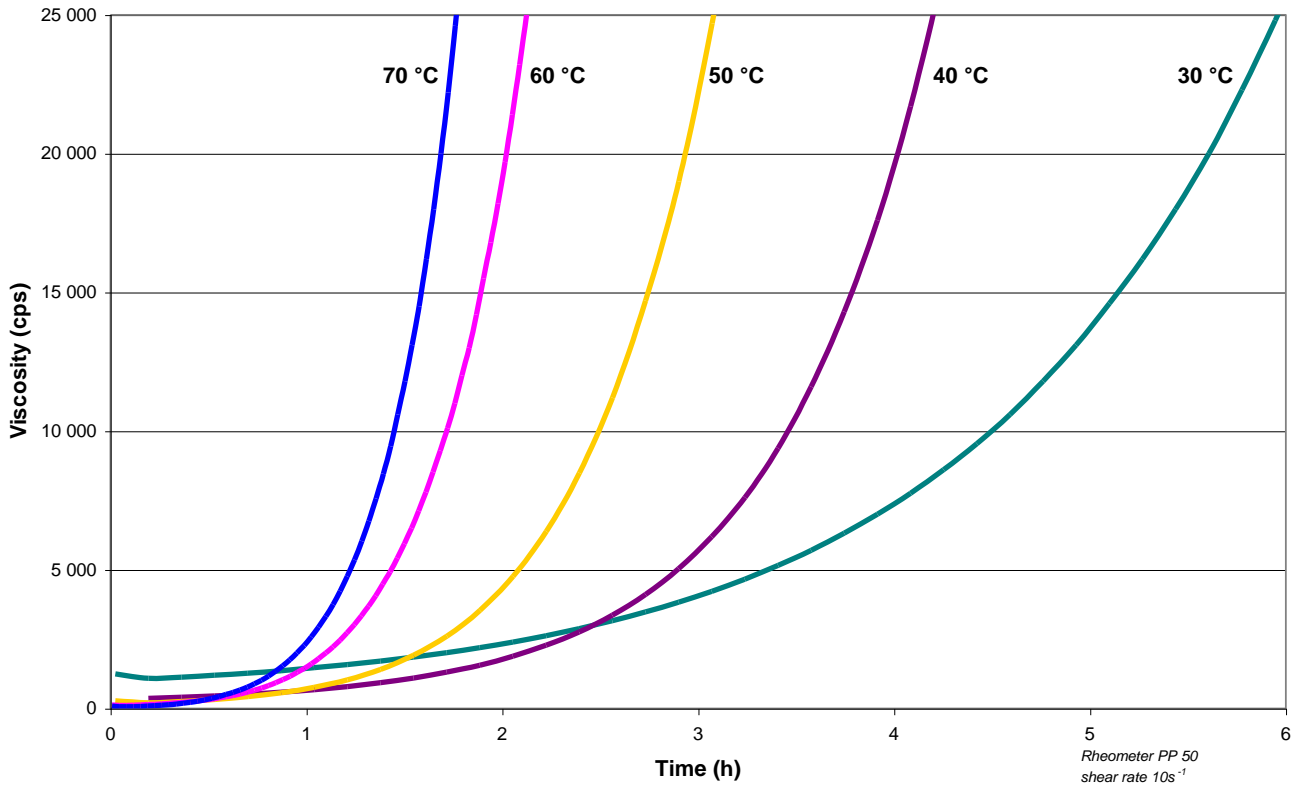
Reactivity – Viscosity evolution on a 1 mm film



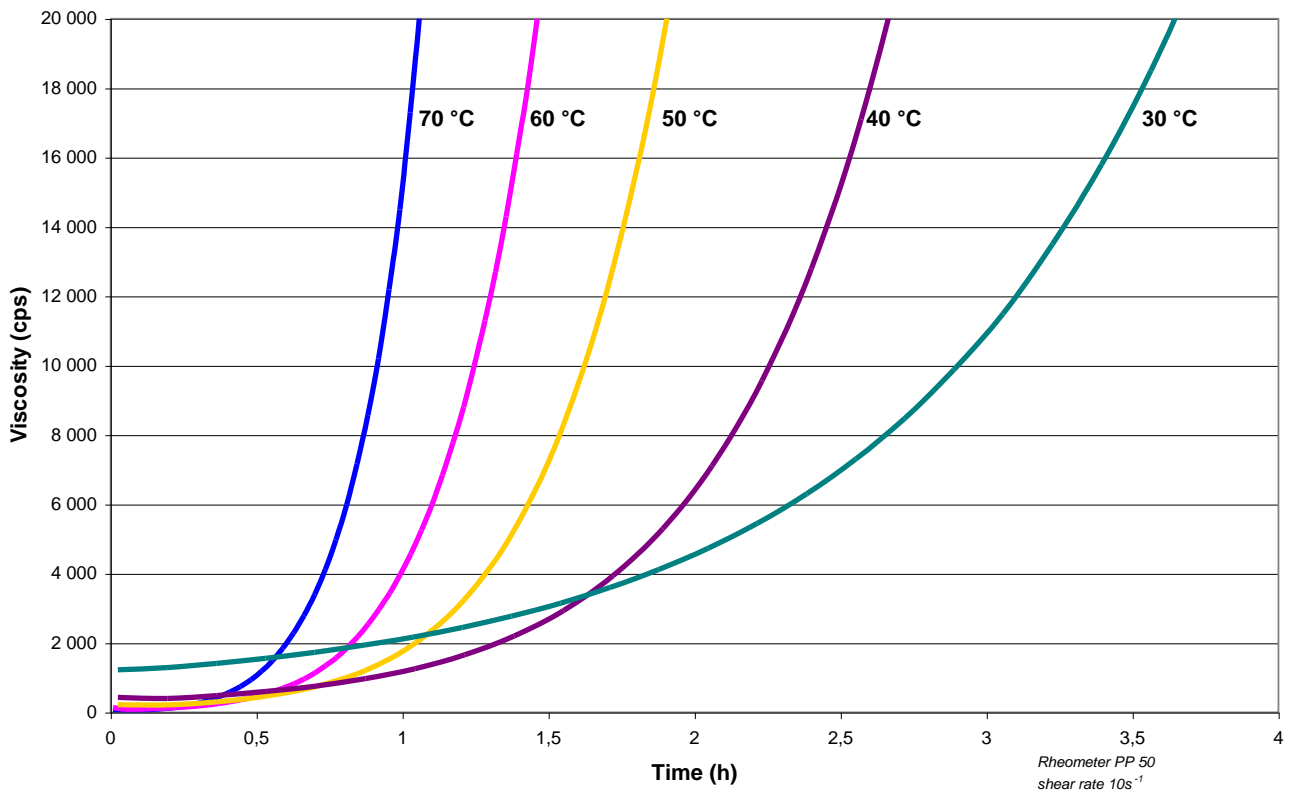
**Example of SR 1660 / SD 7820 for infusion**



**SR 1660 / SD 1305 film reactivity in warm conditions**



**SR 1660 / SD 2630 film reactivity in warm conditions**



**Casting: epoxy system/ Aluminium granules 200 / 1000 microns :**

Resin / hardener Mix: 1 kg  
Aluminium granules: 1.3 to 2 kg

Maximum thickness of casting @ 20 °C

With **SR 1660** / **SD 7820** : 15 cm maximum

With **SR 1660** / **SD 2630** : 30 cm maximum


**Post cure cycle for tooling with high dimensional stability required:**

48 h @ 25°C + 24 h @ 30°C + 12 h @ 50°C ( release possible at this stage, better if post cured at 60°C before release) + 3 h @ 70°C + 3 h 90°C + 3 h 110°C + 3 h @ 130°C + 3 h @ 150°C.

With **SD 1305**, an additional 4 hours of post-curing at 160 °C is recommended

About casting for tooling, see also the Fill Cast 21

## Mechanical properties on cast resin:


		SR 1660 / SD 2630			SR 1660 / SD 7820			
		48 h TA + 16 h 60 °C + 6 h 100 °C	48 h TA + 16 h 60 °C + 4 h 120 °C	48 h TA + 16 h 60 °C + 3 h 150 °C	48 h TA + 16 h 60 °C	48 h TA + 8 h 60 °C + 4 h 90 °C	48 h TA + 8 h 60 °C + 4 h 90 °C + 4 h 120 °C	48 h TA + 8 h 60 °C + 4 h 90 °C + 4 h 120 °C + 4 h 150 °C
Cure cycles								
<b>Tension</b>								
Modulus of elasticity	N/mm <sup>2</sup>	3100	2760	2500	2850	2550	2200	2100
Maximum resistance	N/mm <sup>2</sup>	85	83	65	81	68	63	65
Resistance at break	N/mm <sup>2</sup>	85	83	65	81	68	63	65
Elongation at max. resistance	%	4.7	4.6	3.3	3.8	3.6	4.1	4.5
Elongation at break	%	4.7	4.6	3.3	3.8	3.6	4.1	4.5
<b>Flexion</b>								
Modulus of elasticity	N/mm <sup>2</sup>	3100	2950	3000	3400	2950	2700	2450
Maximum resistance	N/mm <sup>2</sup>	130	127	121	130	121	107	102
Elongation at max. resistance	%	6.5	6.8	4.9	5.3	6.5	7.1	6.3
Elongation at break	%	7.7	7.8	4.9	6.4	7.6	7.6	6.4
<b>Compression</b>								
Compressive yield strength	N/mm <sup>2</sup>	119	120		110	117	116	122
Offset compressive yield	%	16	12		11.6	13.6	12.4	14.1
<b>Charpy impact strength</b>	KJ/m <sup>2</sup>	22	18	19	24	20	14	15
<b>Glass Transition / DSC</b>								
Tg1	°C	118	128	147	90	114	141	150
Tg1 max.	°C			149				150

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

Measures undertaken according to the following norms :

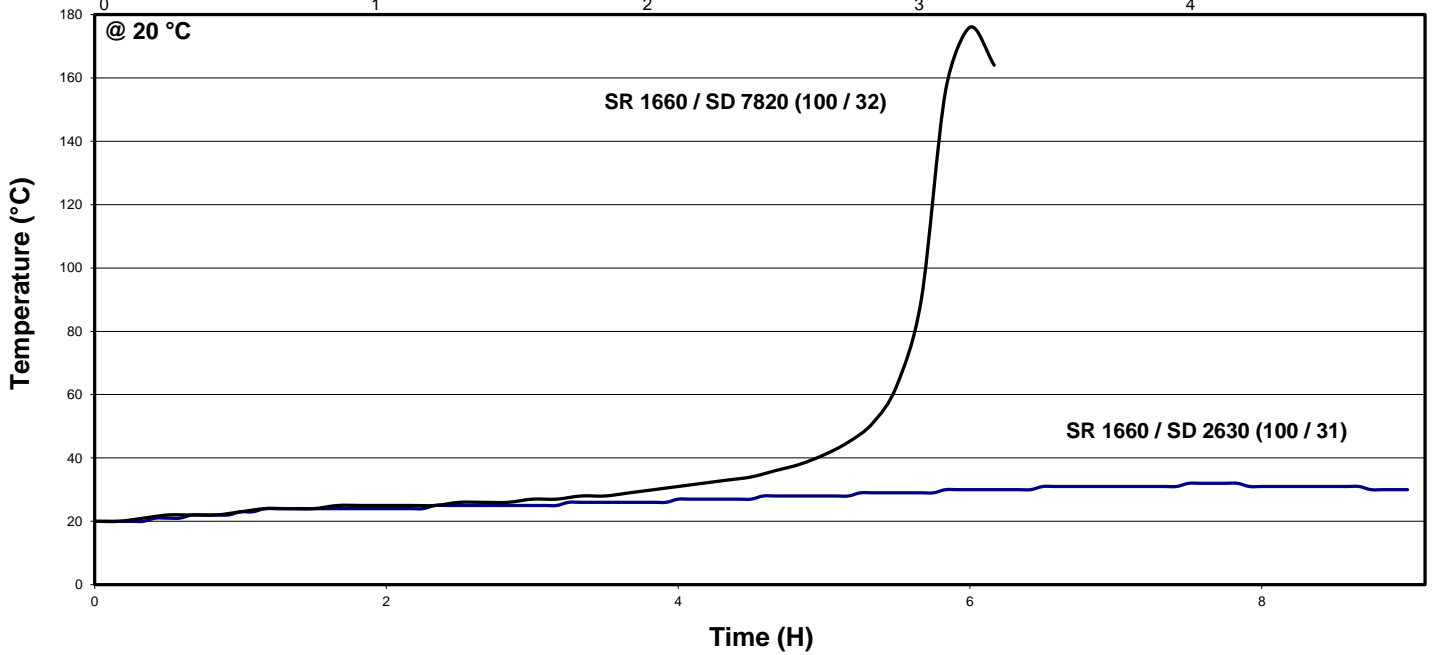
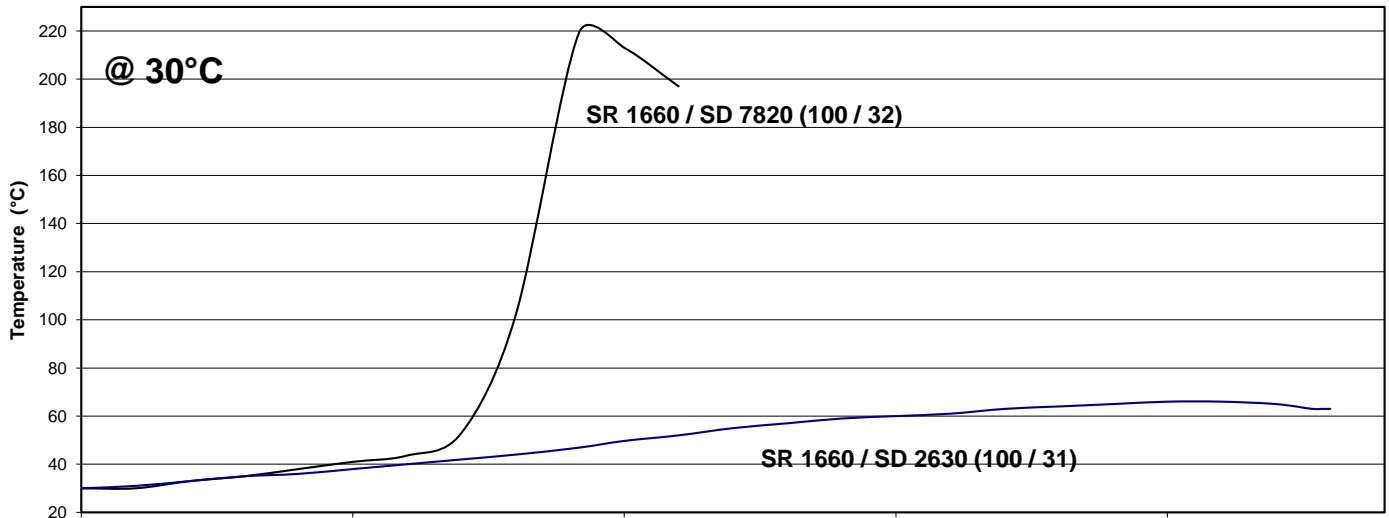
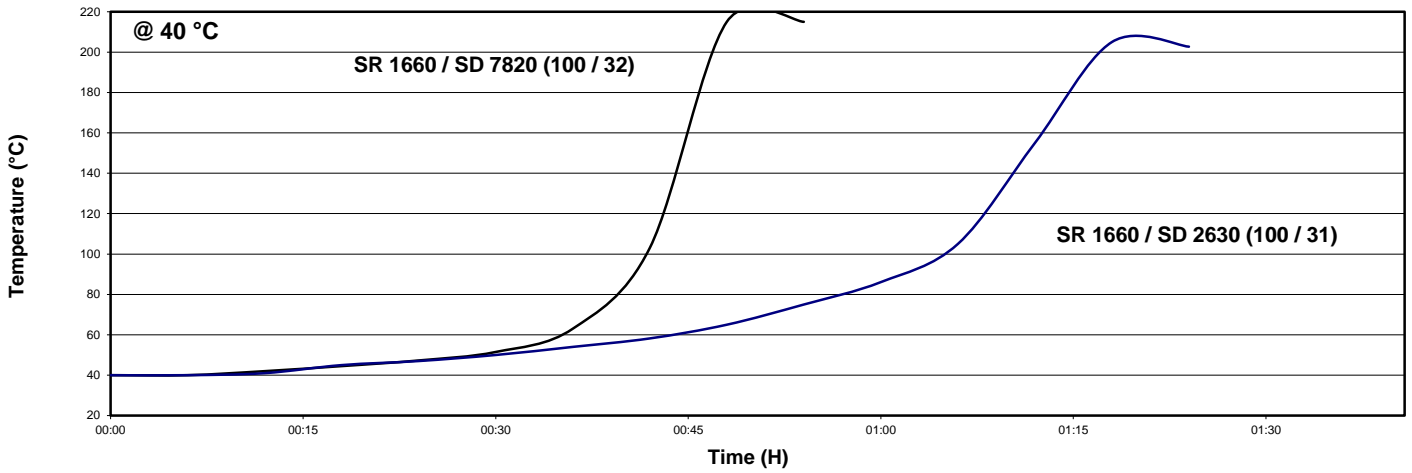
Tension: NF T 51-034  
 Flexion : NF T 51-001  
 Compression: NF T 51-101  
 Charpy impact strength: NF T 51-035  
 Glass transition DSC : ISO 11357-2 : 1999 -5°C to 180°C under nitrogen gaz  
 Tg1 or Onset : 1st point at 20 °C/mn  
 Tg1 maximum or Onset : second passage

AT : Ambient Temperature

		<b>SR 1660 / SD 1305</b>		
		48 h TA + 16 h 60 °C + 6 h 100 °C	48 h TA + 16 h 60 °C + 4 h 120 °C	48 h TA + 16 h 60 °C + 3 h 150 °C
Cure cycles				
<b>Tension</b>				
Modulus of elasticity	N/mm <sup>2</sup>	3300	3000	3000
Maximum resistance	N/mm <sup>2</sup>	90	80	83
Resistance at break	N/mm <sup>2</sup>	89	78	81
Elongation at max. resistance	%	5.1	4.0	5.0
Elongation at break	%	5.1	4.0	5.0
<b>Flexion</b>				
Modulus of elasticity	N/mm <sup>2</sup>	3100	2900	2700
Maximum resistance	N/mm <sup>2</sup>	133	126	126
Elongation at max. resistance	%	5.2	5.3	6.5
Elongation at break	%	5.4	5.3	6.7
<b>Compression</b>				
Compressive yield strength	N/mm <sup>2</sup>	127	127	120
Offset compressive yield	%	8.6	9.8	10.8
<b>Charpy impact strength</b>	KJ/m <sup>2</sup>	23	17	19
<b>Glass Transition / DSC</b>				
Tg1	°C	121	147	159
Tg1 max.	°C			157



Exothermic temperature on 500 g Mix



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

Measures undertaken according to the following norms:

Tension : Iso 527 - 2  
Flexion : Iso 178  
Charpy impact strength: NF T 51-035  
Shear Strength ASTM D 732 - 93  
Compressive ISO 604  
Water absorption: Internal. Polymerisation according to cycle, machining, weighing, time spent in distilled water at 70 °C / 48 hours, weighing 1 hour after emerging,  
Glass transition DSC : ISO 11357-2 : 1999 -5°C to 180°C under nitrogen gaz  
Tg1 or Onset : 1st point at 20 °C/mn Tg1 maximum or Onset : second passage  
Glass transition DTMA: ISO 11357-1 - TG onset G' Temperature ramp 0°C to 180 °C @ 2°C/min  
ASTM D4065 - TG peak G''

Physical tests according standard ::

Gardner color: NF EN ISO 4630 Visual method  
Refractive index : NF ISO 280  
Viscosity: NF EN ISO 3219 Rheometer 50 mm, shear 10s<sup>-1</sup>  
Density: NF EN ISO 2811-1 Pyknometer  
Gel time : Cross G' G'' / rheometer CP50 - Shear rate 10 s<sup>-1</sup>  
GreenCarbon content: ASTM D6866 or XP CEN/TS 16640 Avril 2014

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