

## SR 1138

### Fire resistant epoxy systems

SR 1138 epoxy resin for hand lay-up process with specific hardeners :

- Is fire resistant, halogen free and flame retardant
- Meets the stringent fire protection standards specified in DIN EN 45545 HL3, DIN 5510 and FAR 25
- Requires hot post curing in the mould before release of part
- Is designed for civil engineering, automotive and transportation parts
- Available with 2 range of hardeners, SZ 851x & SD 477x

### Fire resistant Epoxy resin SR 1138

		<b>SR 1138</b>
Appearance		White viscous liquid
Shelf life		2 years @ 20°C Stir thoroughly before use
Viscosity (m.Pas)	@ 15 °C	28 000 ± 5 600
Rheometer	@ 20 °C	15 900 ± 3 200
CP 50 mm	@ 25 °C	9 600 ± 1 920
Shear rate 10 s <sup>-1</sup>	@ 30 °C	6 200 ± 1 240
	@ 40 °C	2 900 ± 580
Density		
Pycnometer	@ 20 °C	1.35 ± 0.01
ISO 2811-1		

#### **Hardeners SZ 851x**

- Catalytic chemistry, slow cure at room temperature
- Mild odor
- Hardeners SZ 851x provide excellent wet out, long pot life at room temperature and short curing time at 80°C and above.
- Glass transition T<sub>g</sub> (by DSC) up to 125 °C
- Visual color control of polymerisation
- Can be delivered clear or pigmented violet
- Mixing ratio: 100 / 8 by weight, SZ 8511 and SZ 8513 can be blended in all proportions for intermediate reactivities

#### **Hardeners SD 477x**

- Polyamine chemistry,
- SD 4775 (fast) and SD 4771 (ultra slow) provide good mechanical properties at room temperature and moderate post cure temperatures
- Low viscosity of resin & hardener mix
- Hardeners SD 477x provide excellent mechanical properties at room temperature
- White after cure
- Glass transition T<sub>g</sub> (by DSC) up to 95 °C
- Mixing ratio: 100 / 16 by weight, SD 4771 and SD 4775 can be blended in all proportions for intermediates reactivities
- Can be delivered clear or pigmented violet

## Hardeners SZ 8511

	<b>SZ 8513</b>	<b>SZ 8511</b>
Appearance / color	Liquid Light yellow or violet* *pigmented for secured process	Liquid Light yellow or violet* *pigmented for secured process
Reactivity	Slow	Ultra slow
Viscosity (mPa.s) @ 15 °C	56 ± 6	48 ± 10
Rheometer @ 20 °C	41 ± 8	35 ± 7
CP 50 mm @ 25 °C	31 ± 6	26 ± 5
Shear rate 10 s <sup>-1</sup> @ 30 °C	24 ± 5	21 ± 4
Density @ 20 °C	1.00 ± 0.01	1.00 ± 0.01
Pycnometer ISO 2811-1		
Refractive Index @ 25 °C	1.4906 ± 0.002* *without pigment	1.4653 ± 0.002* *without pigment

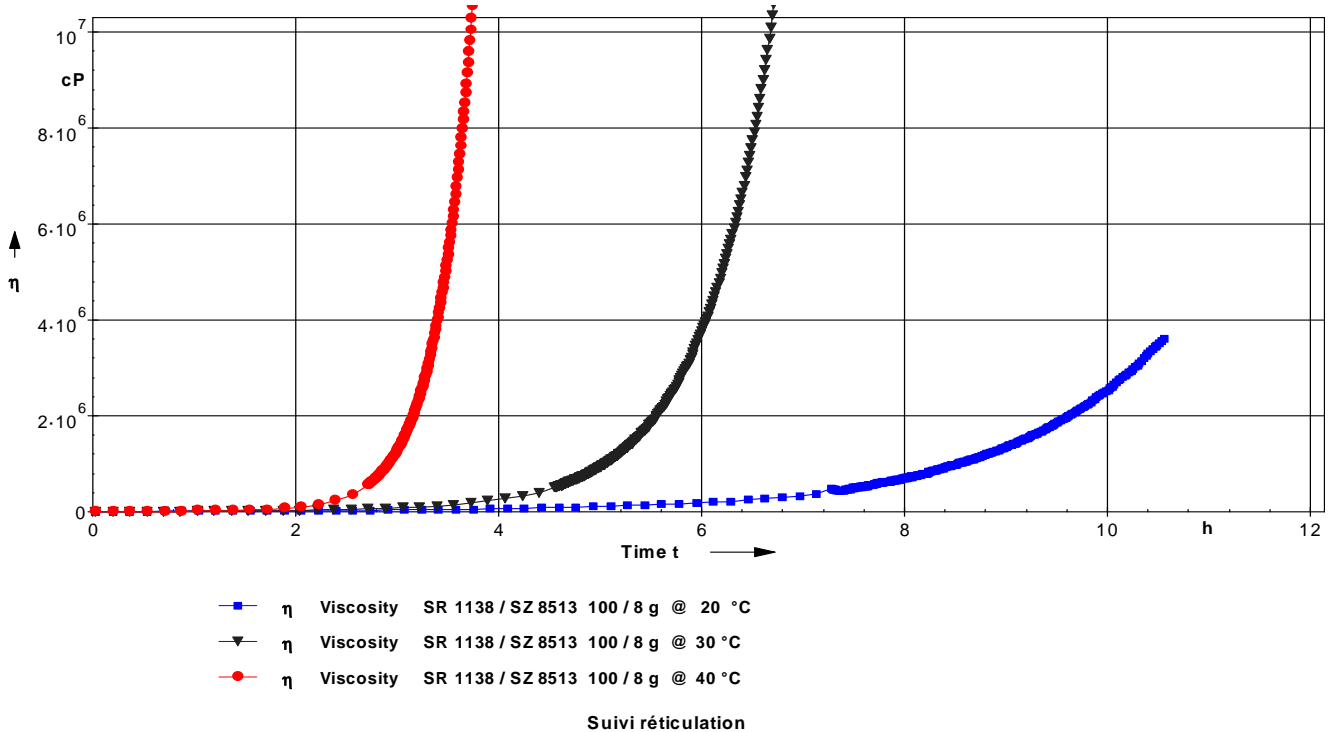
## Epoxy system SR 1138 / SZ 851x

	<b>SR 1138 SZ 8513</b>	<b>SR 1138 SZ 8511</b>
Appearance uncured	White liquid	White liquid
Appearance cured	Ivory to Chestnut	Ivory to Chestnut
Weight ratio	<b>100 g / 8 g</b>	<b>100 g / 8 g</b>
Volume ratio	<b>100 / 10 ml</b>	<b>100 / 10 ml</b>
Viscosity (m.Pas)		
Rheometer @ 20 °C	9 500 ± 1 900	6 900 ± 1 380
CP 50 mm @ 30 °C	4 800 ± 960	2 800 ± 550
Shear rate 10 s <sup>-1</sup> @ 40 °C	3 000 ± 600	1 500 ± 300
Density @ 20 °C	1.35 ± 0.01	1.35 ± 0.01

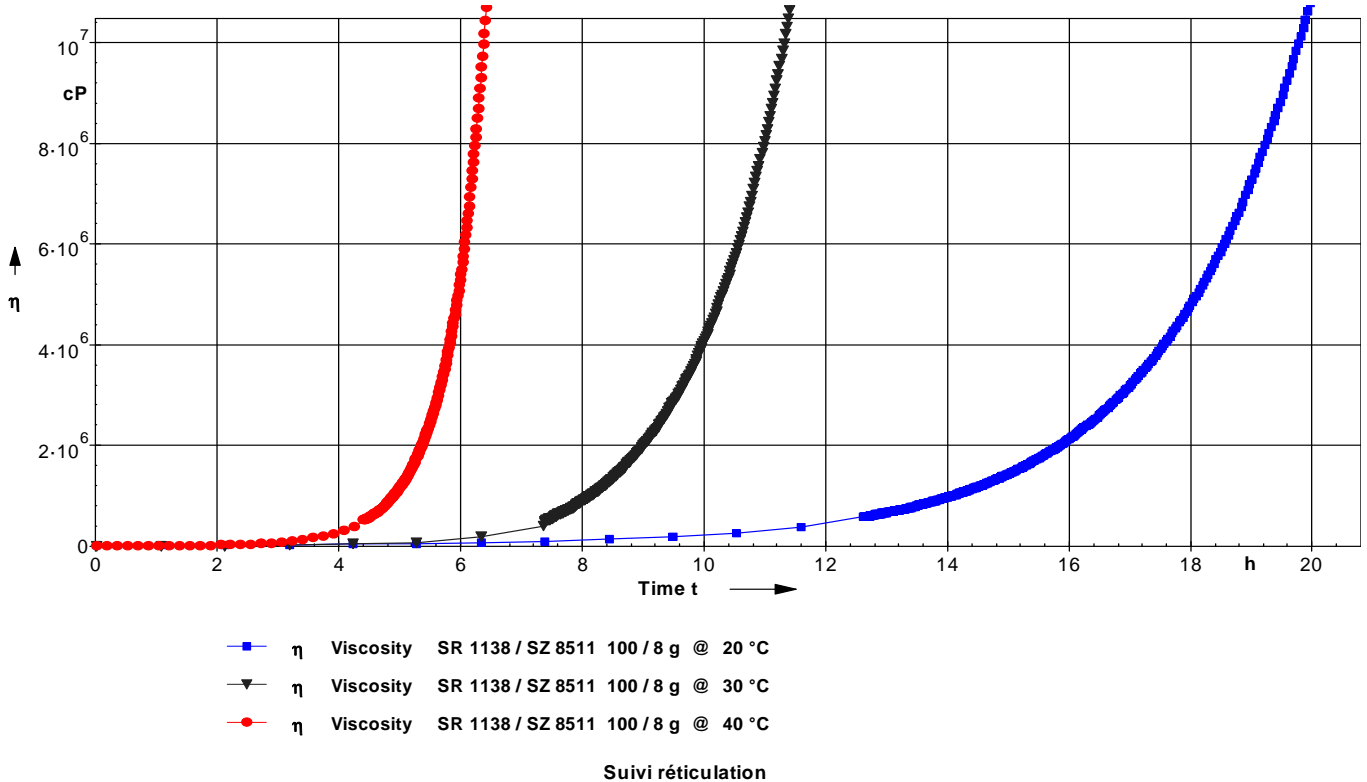
## Visual control of polymerisation:

"Ivory"	"Caramel"	"Chestnut"
Color of the blend @ room temperature	Color after cure @ 50 - 60 °C	Color after cure @ 110 °C

**Viscosity increase for a 1 mm film @ 20, 30 and 40 °C  
SR 1138 with SZ 8513**



**SR 1138 with SZ 8511**



### Hardeners SD 477x :

		<b>SD 4775</b>	<b>SD 4771</b>
Aspect / color		Clear Liquid	Clear to red Liquid
Gardner ASTM D 1544 Disc 4/30		5 maximum	12 maximum
Reactivity levels		Medium	Ultra slow
Viscosities	@ 15 °C	285 ± 60	13 ± 3
(m.Pas ± 20 %)	@ 20 °C	190 ± 40	11 ± 2.5
Rheometer CP 50 mm	@ 25 °C	130 ± 30	9 ± 2
Shear rate 10 s <sup>-1</sup>	@ 30 °C	95 ± 20	7 ± 1.5
	@ 40 °C	55 ± 10	5 ± 1
Density (g/cm <sup>3</sup> ± 0.005) Picnometer NF EN ISO 2811-1	@ 20 °C	1.01 ± 0.01	0.95 ± 0.01

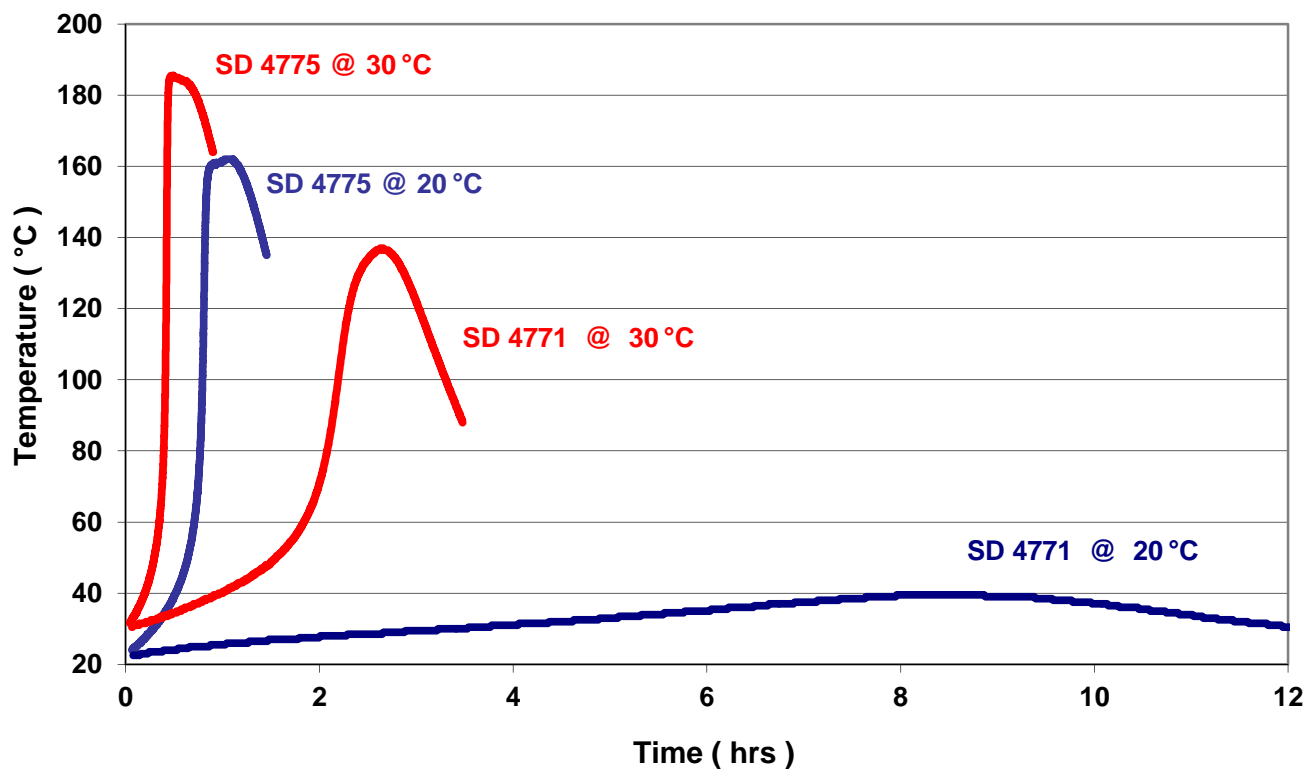
### Epoxy systems SR 1138 / SD 477x :

		<b>SR 1138 SD 4775</b>	<b>SR 1138 SD 4771</b>
Appearance cured		White solid	White solid
Weight ratio		100 g / 16 g	100 g / 16 g
Volume ratio		100 / 22 ml	100 / 23 ml
Viscosity (m.Pas)			
Rheometer	@ 20 °C	4 200 ± 840	1 600 ± 320
CP 50 mm	@ 30 °C	2 300 ± 460	1 000 ± 200
Shear rate 10 s <sup>-1</sup>	@ 40 °C	1 750 ± 350	370 ± 75
Density	@ 20 °C	1.33 ± 0.01	1.33 ± 0.01

### Reactivities on 500 g Mix SR 1138 / SD 477x :

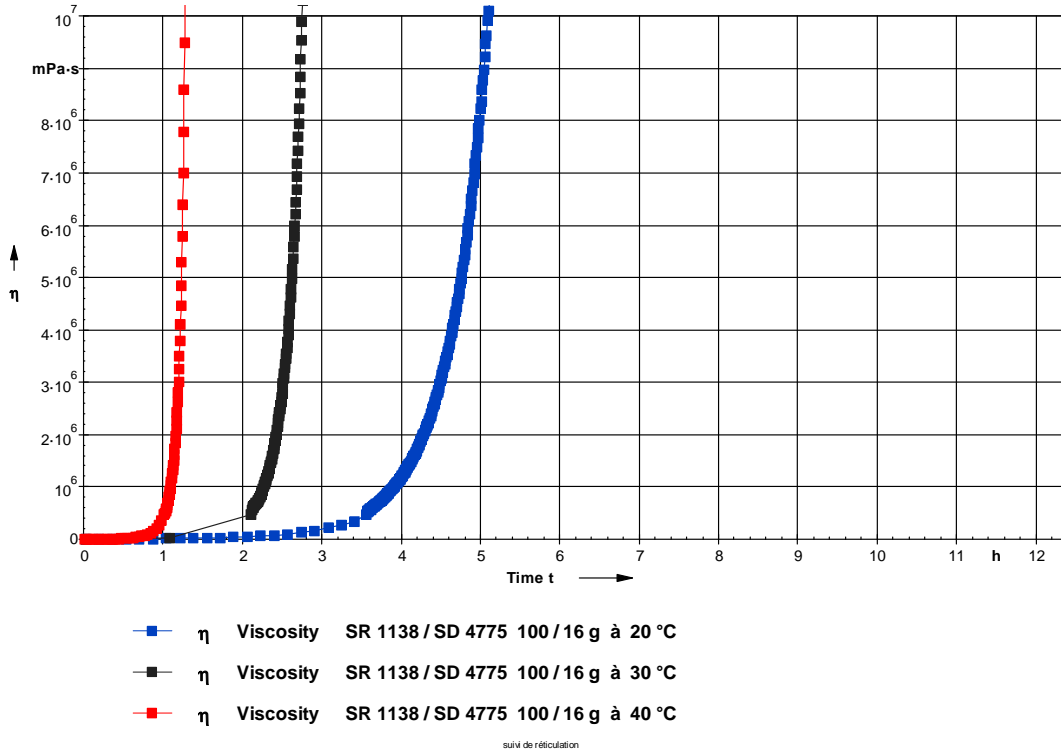
	SD 4775	SD 4771
Exothermic temperature ( °C ) :		
@ 20 °C	165	40
@ 30 °C	190	137
Time taken to achieve exotherm :		
@ 20 °C	1 hrs	8 hrs
@ 30 °C	28 '	2 hrs 40
Time taken to reach 50 °C :		
@ 20 °C	38'	-
@ 30 °C	17'	1 hrs 30

### Pot life 500 g mix @ 20 and 30 °C

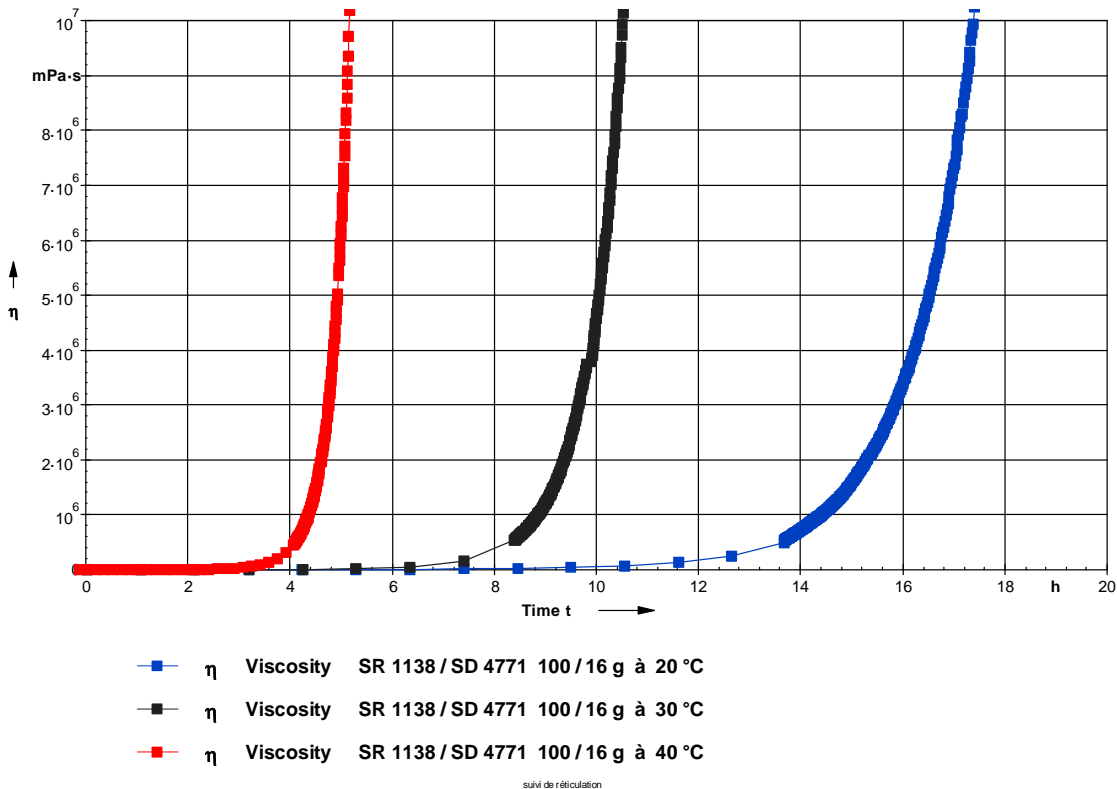


## Viscosity increase for a 1 mm film @ 20, 30 and 40 °C

### SR 1138 with SD 4775



### SR 1138 with SD 4771



## Mecanical properties on cast resin

		SR 1138 / SZ 8513		
Curing schedule		AT 16 hrs 23 °C + 4 hrs 60 °C + 4 hrs 80 °C	AT 16 hrs 23 °C + 4 hrs 60 °C + 4 rsh 80 °C + 2 hrs 100 °C	AT 16 hrs 23 °C + 4 hrs 60 °C + 4 hrs 80 °C + 2 hrs 100 °C + 2 hrs 120 °C
<b>Tensile</b>				
Modulus of elasticity	N/mm <sup>2</sup>	6 000	5 300	4 900
Maximum resistance	N/mm <sup>2</sup>	30	36	37
Resistance at break	%	0.5	0.8	0.9
Elongation at max.load	%	0.5	0.8	0.9
Elongation at break				
<b>Flexion</b>		5 000	4 700	4 600
Modulus of elasticity	N/mm <sup>2</sup>	61	63	65
Maximum resistance	N/mm <sup>2</sup>	1.2	1.3	1.4
Elongation at max. load	%	1.2	1.3	1.4
Elongation at break	%			
<b>Charpy impact strength</b>		4	5	5
Resilience	kJ/m <sup>2</sup>			
<b>Glass transition</b>				
Tg1 / Tg1 maximum	°C	109	122	126 / 128

		SR 1138 / SZ 8511		
Curing schedule		AT 16 hrs 23 °C + 4 hrs 60 °C + 4 hrs 80 °C	AT 16 hrs 23 °C + 4 hrs 60 °C + 4 rsh 80 °C + 2 hrs 100 °C	AT 16 hrs 23 °C + 4 hrs 60 °C + 4 hrs 80 °C + 2 hrs 100 °C + 2 hrs 120 °C
<b>Tensile</b>				
Modulus of elasticity	N/mm <sup>2</sup>	6 000	5 200	4 900
Maximum resistance	N/mm <sup>2</sup>	30	42	43
Resistance at break	%	0.5	0.8	1.0
Elongation at max.load	%	0.5	0.8	1.0
<b>Flexion</b>		5 000	4 600	4 600
Modulus of elasticity	N/mm <sup>2</sup>	61	65	68
Maximum resistance	N/mm <sup>2</sup>	1.2	1.3	1.5
Elongation at max. load	%	1.2	1.3	1.5
Elongation at break	%			
<b>Charpy impact strength</b>		4	5	6
Resilience	kJ/m <sup>2</sup>			
<b>Glass transition</b>				
Tg1 / Tg1 maximum	°C	109	121	126 / 125

		<b>SR 1138 / SD 4775</b>	
<b>Curing schedule</b>			
		AT 16h 23 °C + 24 hrs 40 °C	AT 16h 23 °C + 8 hrs 60 °C
<b>Tensile</b>			
Modulus of elasticity	N/mm <sup>2</sup>	5 500	5 000
Maximum resistance	N/mm <sup>2</sup>	33	30
Resistance at break	%	33	30
Elongation at max.load	%	0.6	1.1
Elongation at break		0.6	1.1
<b>Flexion</b>			
Modulus of elasticity	N/mm <sup>2</sup>	4 900	4 900
Maximum resistance	N/mm <sup>2</sup>	57	63
Elongation at max. load	%	1.1	1.2
Elongation at break	%	1.1	1.2
<b>Charpy impact strength</b>			
Resilience	kJ/m <sup>2</sup>	6	7
<b>Glass transition</b>			
Tg1 / Tg1 maximum	°C	70	91 / 95

		<b>SR 1138 / SD 4771</b>	
<b>Curing schedule</b>			
		AT 16h 23 °C + 24 hrs 40 °C	AT 16h 23 °C + 16 hrs 60 °C
<b>Tensile</b>			
Modulus of elasticity	N/mm <sup>2</sup>	5 300	4 700
Maximum resistance	N/mm <sup>2</sup>	38	42
Resistance at break	%	32	42
Elongation at max.load	%	0.6	1.1
Elongation at break		0.6	1.1
<b>Flexion</b>			
Modulus of elasticity	N/mm <sup>2</sup>	5 000	4 500
Maximum resistance	N/mm <sup>2</sup>	57	64
Elongation at max. load	%	1.1	1.4
Elongation at break	%	1.1	1.5
<b>Charpy impact strength</b>			
Resilience	kJ/m <sup>2</sup>	4	5
<b>Glass transition</b>			
Tg1 / Tg1 maximum	°C	70	90 / 92



**Measures undertaken according to the following norms:**

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

Tension: ISO 527 - 2  
Flexion: ISO 178  
Charpy impact strength: NF T 51-035  
Shear Strength: ASTM D 732 - 93  
Compression: ISO 604  
Water absorption: Internal. Polymerization 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 gas  
T<sub>G1</sub> or Onset: 1<sup>st</sup> point at 20 °C/min T<sub>G1</sub> maximum or Onset: second passage

Glass transition DTMA: ISO 11357-1 - T<sub>G</sub> onset G' Temperature ramp 0 °C to 180 °C @ 2°C/min  
ASTM D4065 - T<sub>G</sub> 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 10 s<sup>-1</sup>  
Density: NF EN ISO 2811-1 Pycnometer  
Density solid NF EN ISO 845  
Gel time: Cross G' G'' Rheometer CP50 - Shear rate 10 s<sup>-1</sup>  
Green Carbone content: ASTM D6866 or XP CEN/TS 16640 Avril 2014

AT: Ambient temperature

**LEGAL NOTES:**

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