

## SR 1138

### Fire resistant epoxy systems

SR 1138 epoxy resin 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<br>Stir thoroughly before use |
| Viscosity (m.Pas)             | @ 15 °C | 28 000 ± 5600                                |
| Rheometer                     | @ 20 °C | 15 900 ± 3200                                |
| CP 50 mm                      | @ 25 °C | 9 600 ± 1920                                 |
| Shear rate 10 s <sup>-1</sup> | @ 30 °C | 6 200 ± 1240                                 |
|                               | @ 40 °C | 2 900 ± 580                                  |
| Density                       |         |  |
| Picnometer                    | @ 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><br>Liquid<br>Light yellow or violet*<br>*pigmented for secured process | <b>SZ 8511</b><br>Liquid<br>Light yellow or violet*<br>*pigmented for secured process |
|-------------------------------|---------|---|---|
| Appearance / color            |         | slow  | Ultra slow  |
| Reactivity                    |         | 56 ± 6  | 48 ± 10   |
| Viscosity (mPa.s)             | @ 15 °C | 41 ± 8  | 35 ± 7  |
| Rheometer                     | @ 20 °C | 31 ± 6  | 26 ± 5  |
| CP 50 mm                      | @ 25 °C | 24 ± 5  | 21 ± 4  |
| Shear rate 10 s <sup>-1</sup> | @ 30 °C |   |   |
| Density                       | @ 20 °C | 1.00 ± 0.01   | 1.00 ± 0.01   |
| Picnometer ISO 2811-1         |         |   |   |
| Refractive Index              | @ 25 °C | 1.4906 ± 0.002*<br>*without pigment   | 1.4653 ± 0.002*<br>*without pigment   |

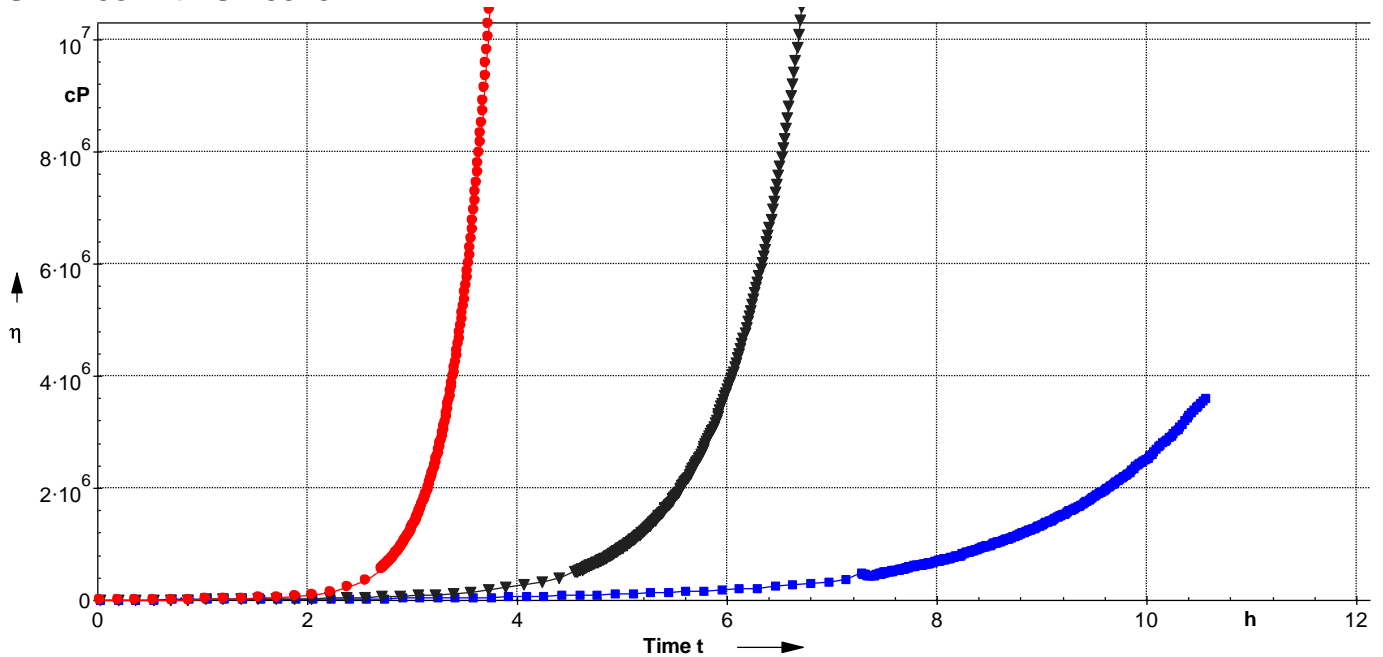
## Epoxy system SR 1138 / SZ 851x

|                               |         | <b>SR 1138</b><br><b>SZ 8513</b><br>White liquid<br>Ivory to Chestnut | <b>SR 1138</b><br><b>SZ 8511</b><br>White liquid<br>Ivory to Chestnut |
|-------------------------------|---------|---|---|
| Appearance uncured            |         |   |   |
| Appearance cured              |         |   |   |
| 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 | 9500 ± 1900   | 6 900 ± 1380  |
| 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<br>@ room temperature | Color after cure<br>@ 50 - 60 °C | Color after cure<br>@ 110 °C |

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

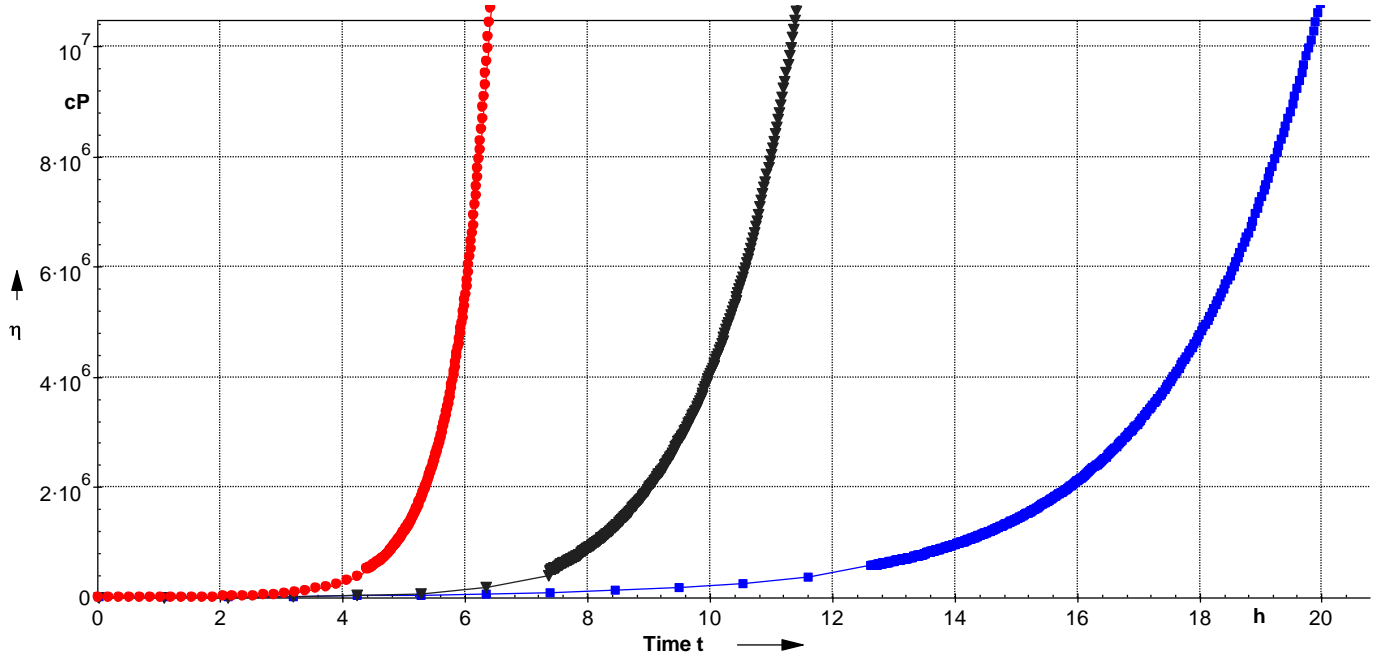


- $\eta$  Viscosity SR 1138 / SZ 8513 100 / 8 g @ 20 °C
- ▼  $\eta$  Viscosity SR 1138 / SZ 8513 100 / 8 g @ 30 °C
- $\eta$  Viscosity SR 1138 / SZ 8513 100 / 8 g @ 40 °C



Suivi réticulation

**SR 1138 with SZ 8511**



- $\eta$  Viscosity SR 1138 / SZ 8511 100 / 8 g @ 20 °C
- ▼  $\eta$  Viscosity SR 1138 / SZ 8511 100 / 8 g @ 30 °C
- $\eta$  Viscosity SR 1138 / SZ 8511 100 / 8 g @ 40 °C



Suivi réticulation

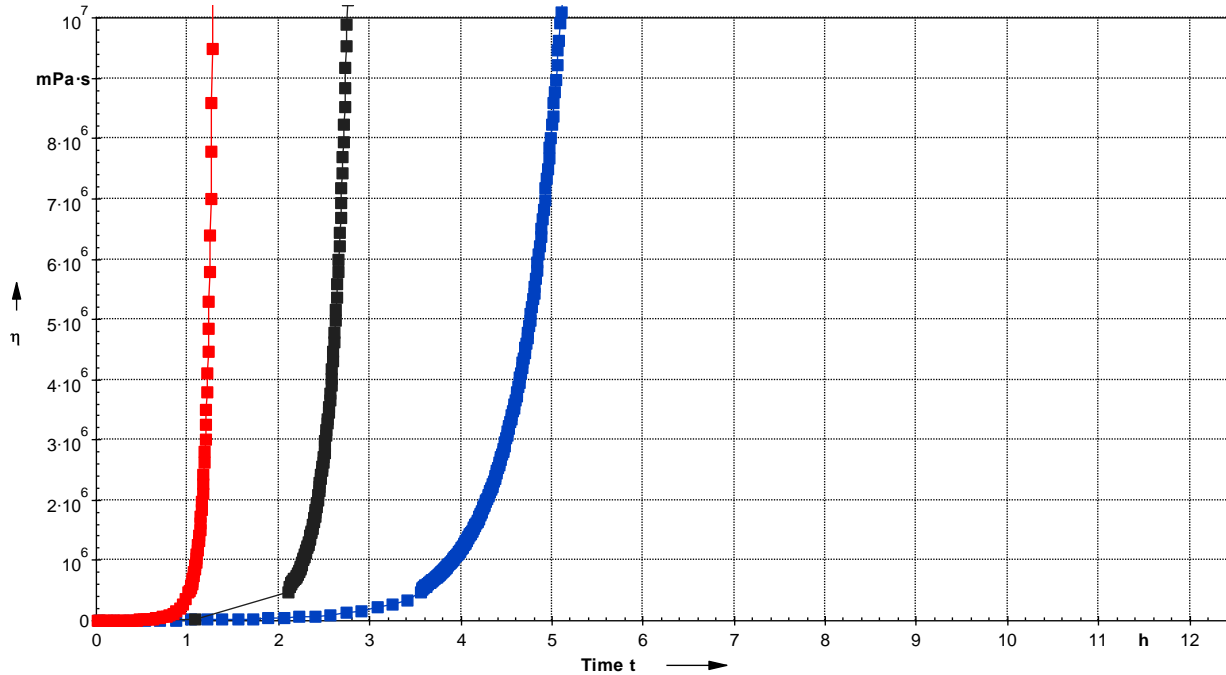
## Hardeners SD 477x :

|   |         | <b>SD 4775</b>  | <b>SD 4771</b>         |
|---|---------|-----------------|------------------------|
| Aspect / color  |         | Clear<br>Liquid | Clear to red<br>Liquid |
| Gardner<br>ASTM D 1544 Disc<br>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> ±<br>0.005) Pycnometer<br>NF EN ISO 2811-1 | @ 20 °C | 1.01 ± 0.01     | 0.95 ± 0.01            |

## Epoxy systems SR 1138 / SD 477x

|                               |         | <b>SR 1138<br/>SD 4775</b> | <b>SR 1138<br/>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                | 1600 ± 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                |

**Viscosity increase for a 1 mm film @ 20, 30 and 40 °C  
SR 1138 with SD 4775**

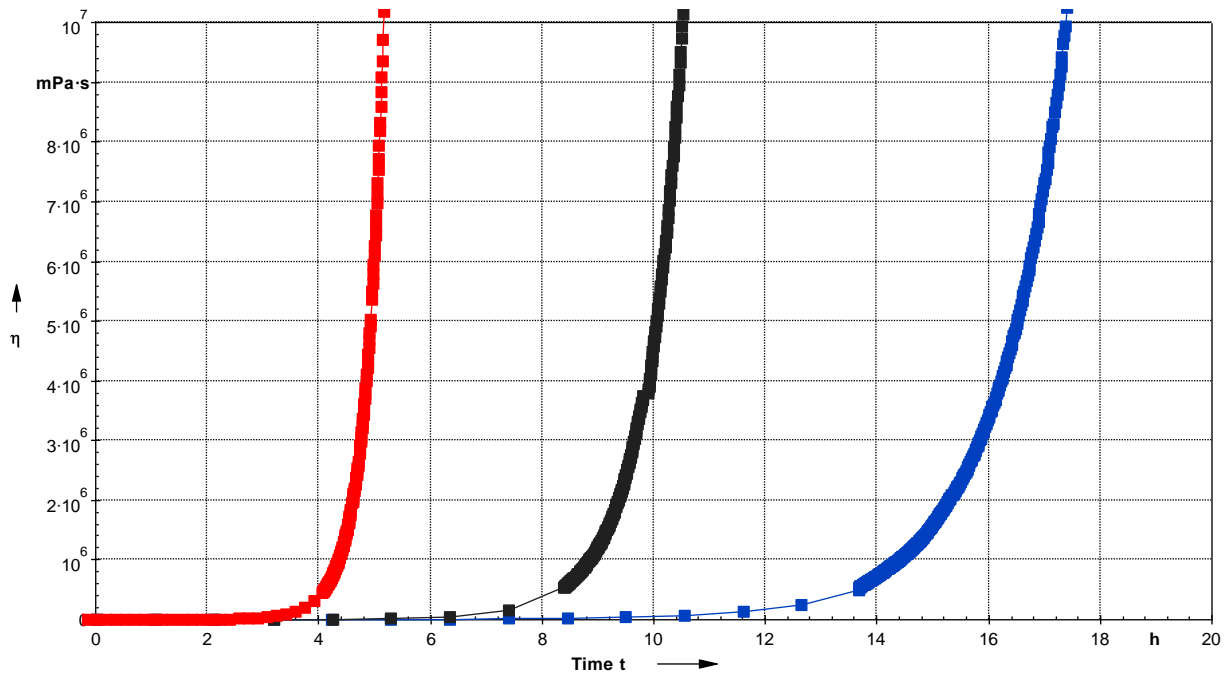


- η Viscosity SR 1138 / SD 4775 100 / 16 g à 20 °C
- η Viscosity SR 1138 / SD 4775 100 / 16 g à 30 °C
- η Viscosity SR 1138 / SD 4775 100 / 16 g à 40 °C



suivi de réticulation

**SR 1138 with SD 4771**



- η Viscosity SR 1138 / SD 4771 100 / 16 g à 20 °C
- η Viscosity SR 1138 / SD 4771 100 / 16 g à 30 °C
- η Viscosity SR 1138 / SD 4771 100 / 16 g à 40 °C



suivi de réticulation

## Mecanical properties on cast resin

|                               |                   | <b>SR 1138 / SZ 8513</b>                          |   |   |
|-------------------------------|-------------------|---|---|---|
| <b>Curing schedule</b>        |                   | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 hrs 80 °C | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 rsh 80 °C<br>+ 2 hrs 100 °C | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 hrs 80 °C<br>+ 2 hrs 100 °C<br>+ 2 hrs 120 °C |
| <b>Tensile</b>                |                   |   |   |   |
| Modulus of elasticity         | N/mm <sup>2</sup> | 6000  | 5300  | 4900  |
| 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>                |                   |   |   |   |
| Modulus of elasticity         | N/mm <sup>2</sup> | 5000  | 4700  | 4600  |
| Maximum resistance            | N/mm <sup>2</sup> | 61  | 63  | 65  |
| Elongation at max. load       | %                 | 1.2   | 1.3   | 1.4   |
| Elongation at break           | %                 | 1.2   | 1.3   | 1.4   |
| <b>Charpy impact strength</b> |                   |   |   |   |
| Resilience                    | kJ/m <sup>2</sup> | 4   | 5   | 5   |
| <b>Glass transition</b>       |                   |   |   |   |
| Tg1 / Tg1 maximum             | °C                | 109   | 122   | 126 / 128   |

|                               |                   | <b>SR 1138 / SZ 8511</b>                          |   |   |
|-------------------------------|-------------------|---|---|---|
| <b>Curing schedule</b>        |                   | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 hrs 80 °C | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 rsh 80 °C<br>+ 2 hrs 100 °C | AT 16 hrs 23 °C<br>+ 4 hrs 60 °C<br>+ 4 hrs 80 °C<br>+ 2 hrs 100 °C<br>+ 2 hrs 120 °C |
| <b>Tensile</b>                |                   |   |   |   |
| Modulus of elasticity         | N/mm <sup>2</sup> | 6000  | 5200  | 4900  |
| 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>                |                   |   |   |   |
| Modulus of elasticity         | N/mm <sup>2</sup> | 5000  | 4600  | 4600  |
| Maximum resistance            | N/mm <sup>2</sup> | 61  | 65  | 68  |
| Elongation at max. load       | %                 | 1.2   | 1.3   | 1.5   |
| Elongation at break           | %                 | 1.2   | 1.3   | 1.5   |
| <b>Charpy impact strength</b> |                   |   |   |   |
| Resilience                    | kJ/m <sup>2</sup> | 4   | 5   | 6   |
| <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<br>+ 24 hrs 40 °C | AT 16h 23 °C<br>+ 8 hrs 60 °C |
| <b>Tensile</b>                |                   |                                |                               |
| Modulus of elasticity         | N/mm <sup>2</sup> | 5500                           | 5000                          |
| 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> | 4900                           | 4900                          |
| 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<br>+ 24 hrs 40 °C | AT 16h 23 °C<br>+ 16 hrs 60 °C |
| <b>Tensile</b>                |                   |                                |                                |
| Modulus of elasticity         | N/mm <sup>2</sup> | 5300                           | 4700                           |
| 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> | 5000                           | 4500                           |
| 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                        |

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 11377-2 : 1999 -5°C to 180°C under nitrogen gaz  
 Tg1 or Onset : 1st point at 20 °C/mn  
 Tg1 maximum or Onset : second passage