

SR 1710 Injection

Structural epoxy system for Resin Transfer Moulding

Description

Two component epoxy system, specially design for Resin Transfer Moulding processes (infusion, injection...)

This system has a very low viscosity and a low reactivity hardener for large parts manufacturing. SR 1710 Inj. has very high mechanical properties, especially interlaminar shear strength. Excellent retention of the mechanical characteristics in a wet environment.

Epoxy resin SR 1710 Inj.

Aspect		Liquid
Gardner color		3 maximum
Color:		Light yellow
Viscosity (mPa.s)	@ 15 °C	3 250 ± 650
	@ 20 °C	1700 ± 340
	@ 25 °C	950 ± 190
	@ 30 °C	580 ± 120
	@ 40 °C	240 ± 50
	@ 50 °C	125 ± 25
	@ 60 °C	70 ± 15
Density (g/cm ³)	@ 20 °C	1.15 ± 0.01
Storage	25°C < ambient Temp. < 30°C	12 months
	10°C < ambient Temp. < 20°C	24 months
		Cristalisation free

Approval n° :
 WP 0320005 HH 
Germanischer Lloyd

Hardeners SD 882x

		SD 8822	SD 8823	SD 8824
Reactivity type		« slow »	« intermediate »	« standard »
Aspect / colour		Light yellow liquid		
Viscosity (mPa.s)	@ 15 °C	27 ± 5	12 ± 3	7 ± 2
	@ 20 °C	20 ± 4	9 ± 2	6 ± 2
	@ 25 °C	16 ± 3	8 ± 2	5 ± 1
	@ 30 °C	13 ± 3	7 ± 2	4 ± 1
	@ 40 °C	9 ± 2	5 ± 1	3 ± 1
Density (g/cm ³)	@ 20 °C	0.937 ± 0.010	0.942 ± 0.010	0.944 ± 0.010

*: SD 8823 is a blend SD 8824 / SD 8822 50/50 by weight

SR 1710 inj / SD 882x mix

		SD 8822	SD 8823	SD 8824
Mix viscosity (mPa.s)	@ 20 °C	500 ± 100	370 ± 70	290 ± 60
	@ 25 °C	360 ± 70	220 ± 50	130 ± 30
	@ 30 °C	250 ± 50	200 ± 40	115 ± 13
Mixing ratio by weight		100 / 35	100 / 28	100 / 23
Mixing ratio by volume		100 / 43	100 / 34	100 / 28

Tests carried out in accordance with the following norms:

Gardner Color : NF EN ISO 4630 Visual method

Refractive Index : NF ISO 280

Determination of viscosities : NF EN ISO 3219 Rheometer 50 mm shear rate 10s⁻¹

Density : NF EN ISO 2811-1 Pyknometer method

Reactivity of the mix SR 1710 inj / SD 882x

		SD 8822	SD 8824
Exothermic temperature (°C) on 500 g mix	@ 20 °C	177	> 215
	@ 25 °C	> 215	> 215
Time to reach the exothermic peak on 500 g mix	@ 20 °C	6 hrs	2 hrs 40'
	@ 25 °C	2 hrs 35'	1 hrs 20'
Time to reach 50 °C on 500 g mix	@ 20 °C	5 hrs 25'	2 hrs 30'
	@ 25 °C	2 hrs 10'	1 hrs 10'

Polymerisation

	SD 8822	SD 8823	SD 8824	
Time to wait before post-curing*	@ 20 °C	20 hrs	12 hrs	9 hrs
	@ 30 °C	9 hrs	6 hrs	5 hrs
Minimum post-cure cycle	20 hrs @ 50°C	20 hrs 50 °C	24 hrs @ 40°C	
Advised post-cure cycle	16 hrs @ 60°C	12 hrs 60 °C	8 hrs @ 60°C	

*have to be respected in case of thick laminate (> 3 mm).

→ Limit the risk of exothermic reaction.

Other possibility

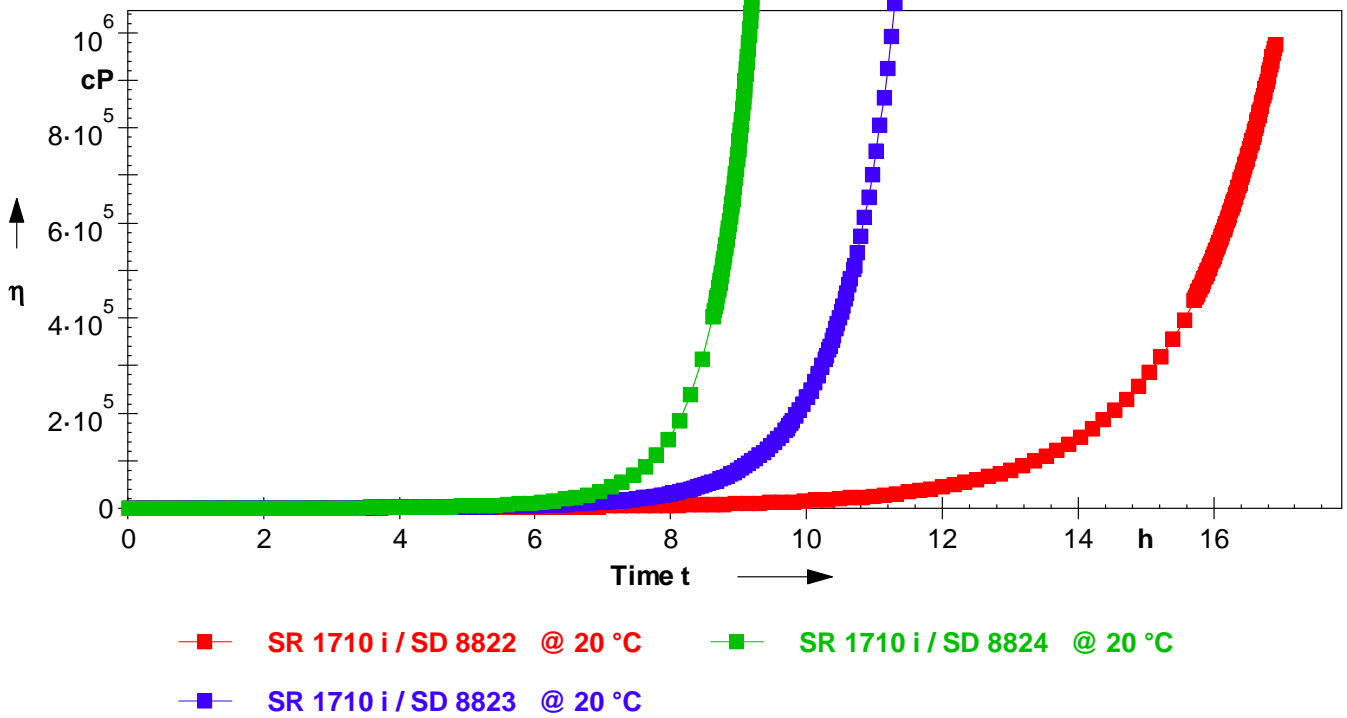
For better thermal resistance and a longer pot life:

SR 1710 inj / SD 7820

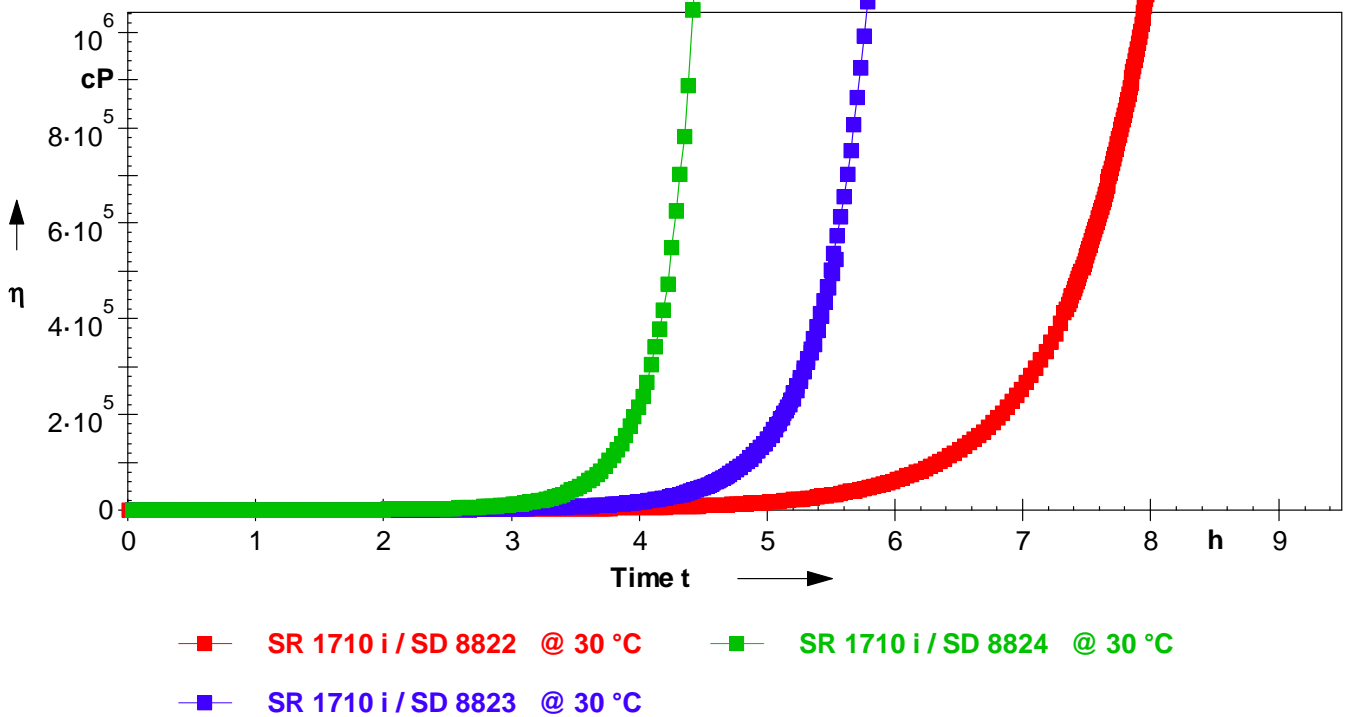
100 g / 36g, Tg_{1max} = 130 °C

Reactivity – 1 mm film viscosity evolution with the temperature


SR 1710 / SD 882x @ 20 °C



SR 1710 / SD 882x @ 30 °C



Mechanical properties on cast resin

Curing cycles 	SR 1710 Inj. / SD 8822			SR 1710 Inj. / SD 8824				
	24 h @ amb.temp + 24 h @ 40 °C	24 h @ amb.temp + 16 h @ 60 °C	24 h @ amb.temp + 4 h @ 80 °C	24 h @ amb.temp + 24 h @ 40 °C	24 h @ amb.temp + 8 h 60 °C	24 h @ amb.temp + 16 h @ 60 °C	24 h @ amb.temp + 4 h @ 80 °C	
Tensile								
Modulus of elasticity	N/mm ²	3650	3680	3070	3430	3460	3050	2890
Maximum resistance	N/mm ²	70	85	76	78	88	85	79
Resistance at break	N/mm ²	70	85	68	77	86	84	78
Elongation at max.load	%	2.2	3.1	5.1	2.8	4.6	4.8	5
Elongation at break	%	2.2	3.1	7	3	4.6	5.3	5.7
Flexion								
Modulus of elasticity	N/mm ²	3740	3720	3420	3390	3390	3350	3140
Maximum resistance	N/mm ²	115	136	125	127	135	129	126
Elongation at max.load	%	3.5	5.2	5.4	5	5.8	5.7	6.5
Elongation at break	%	3.5	7.3	10.3	6.8	7.6	8.3	8.9
Charpy impact strength	KJ/m ²	17	25	16	13	17	22	20
Glass Transition / DSC								
Tg1	°C	67	87	80	67	81	84	88
Tg1 max.	°C			101				96

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

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 @ 20 °C/mn

Tg1 maximum or Onset : second passage

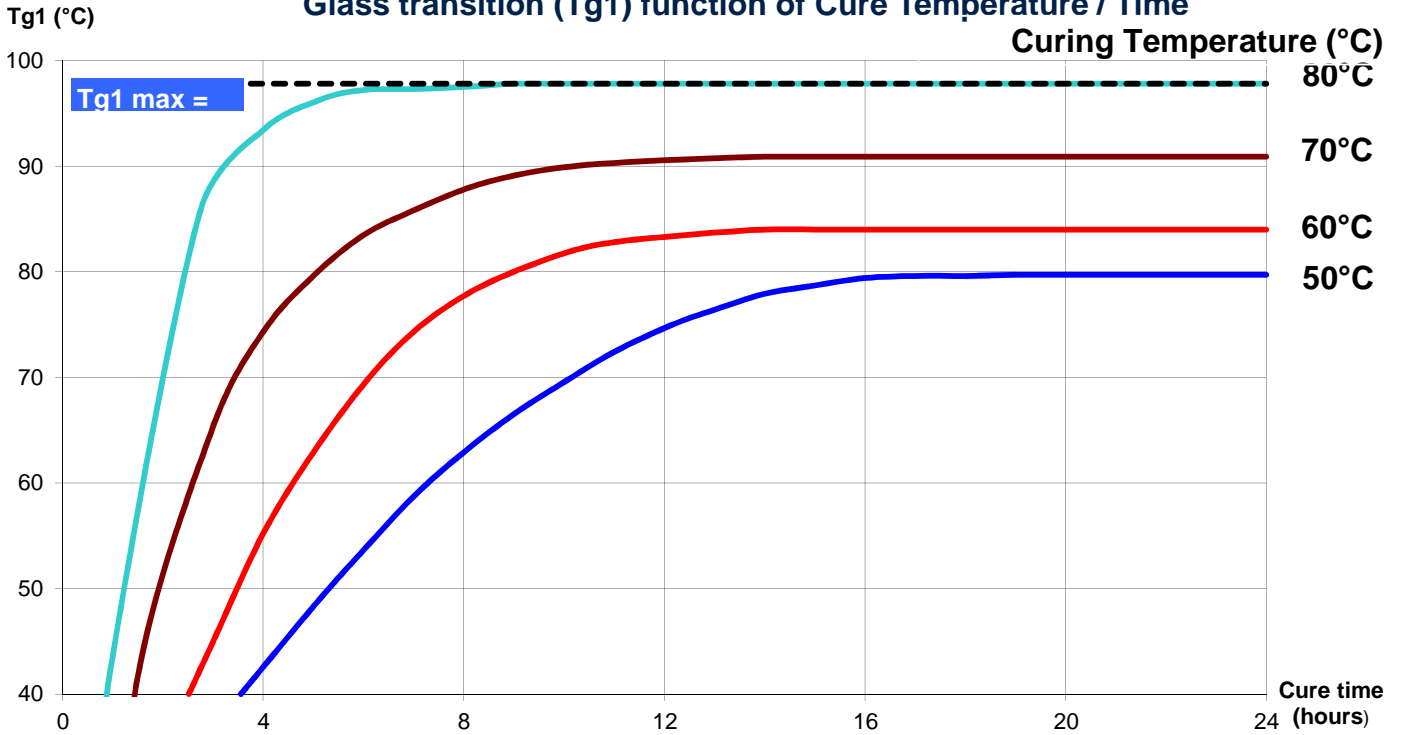
Mechanical properties of laminates based on SR 1710 resin

Systems	SR 1710 Inj. / SD 8822		SR 1710 Inj. / SD 8824	
	24 hrs @ amb.temp + 16 hrs @ 60°C		24 hrs @ amb.temp + 16 hrs @ 60°C	24 hrs @ amb.temp + 24 hrs @ 40°C
Curing cycles				
Laminate				
Reinforcement	3300		3300	3300
Number of layers	15		15	15
Glass content ratio by weight (Wf)	73		75	75
Flexion				
Modulus of elasticity	N/mm ²	25 700	30000	28500
Maximum resistance	N/mm ²	690	778	745
Elongation at maximum load	%	3.2	3.2	3.3
Shear strength				
Shear stress	N/mm ²	63	61	61
Charpy impact strength	KJ/m ²	210	222	223
Water absorption	%Weight	+ 0.17	+ 0.15	+ 0.13
Glass transition				
Tg 1	°C	83	87	71
Tg1 max.	°C	96	95	

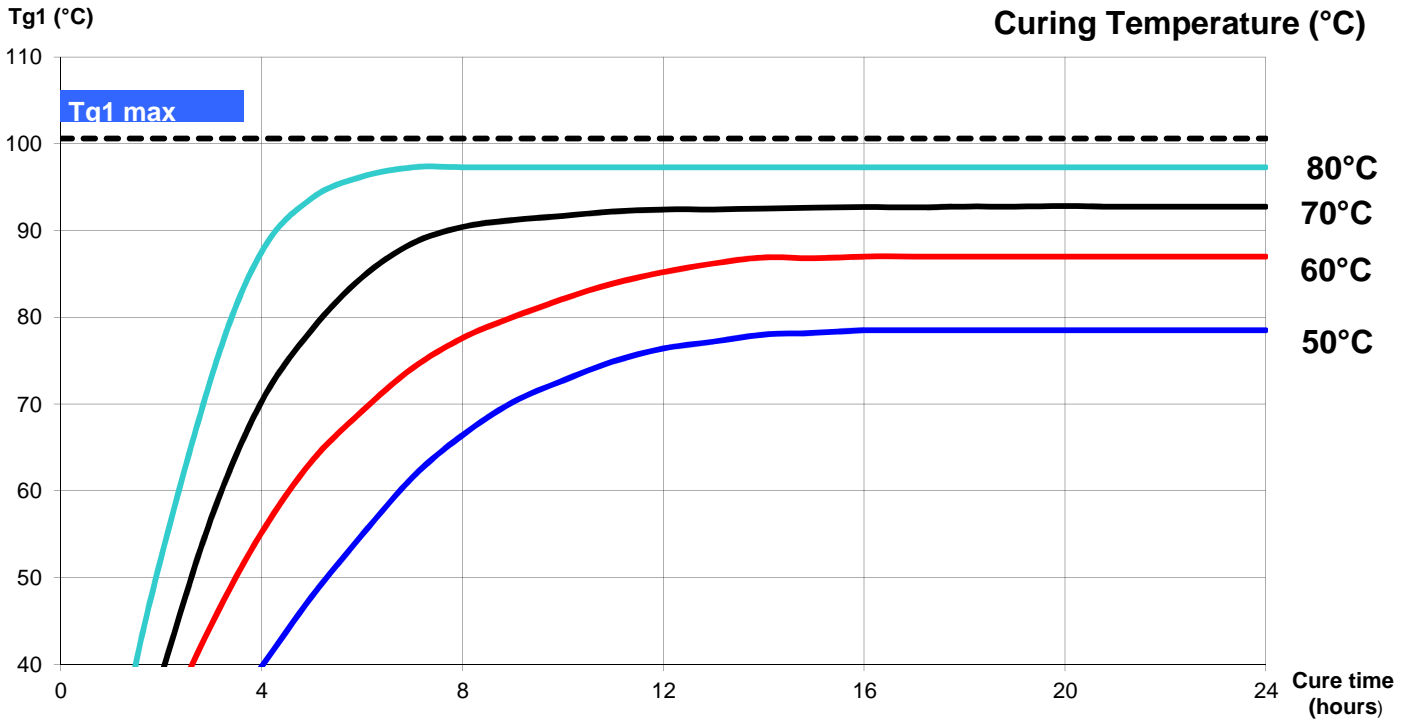
Tests carried out in accordance with the following norms:

Flexion :	NF T 57-105
Shear:	NF T 57-104
Charpy Impact Strength:	NF T 57-108
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
Water absorption:	Internal. Polymerisation according to cycle, machining, weighting, time spent in distilled water at 70 °C / 48 hours, weighting 1 hour after emerging, drying 24 h at 40°C, weighting, mechanical tests on 10 samples
Reinforcement 3300:	Twill 2/2 E Glass, weight 300 g/m2

Epoxy system SR 1710 / SD 8824
Glass transition (Tg1) function of Cure Temperature / Time

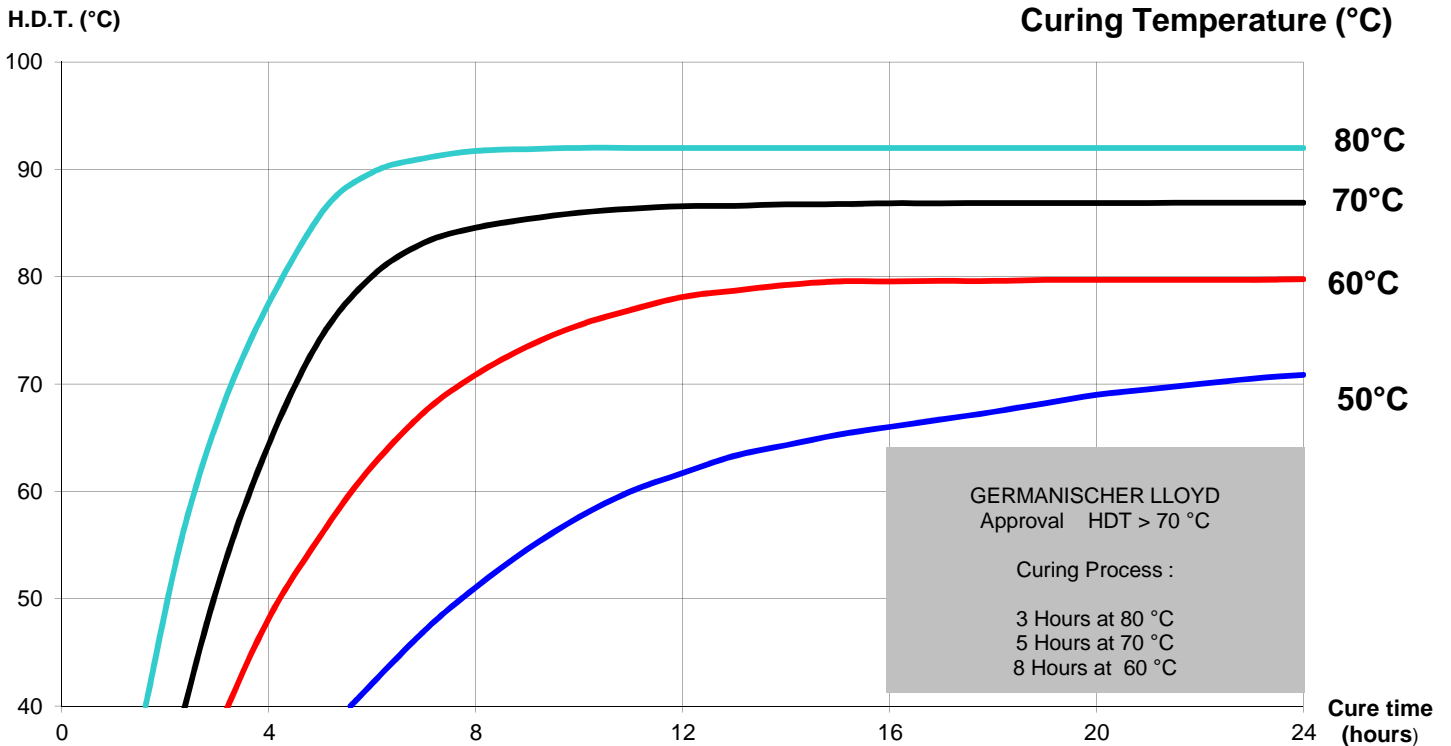


Epoxy system SR 1710 / SD 8822
Glass transition (Tg1) function of Cure Temperature / Time



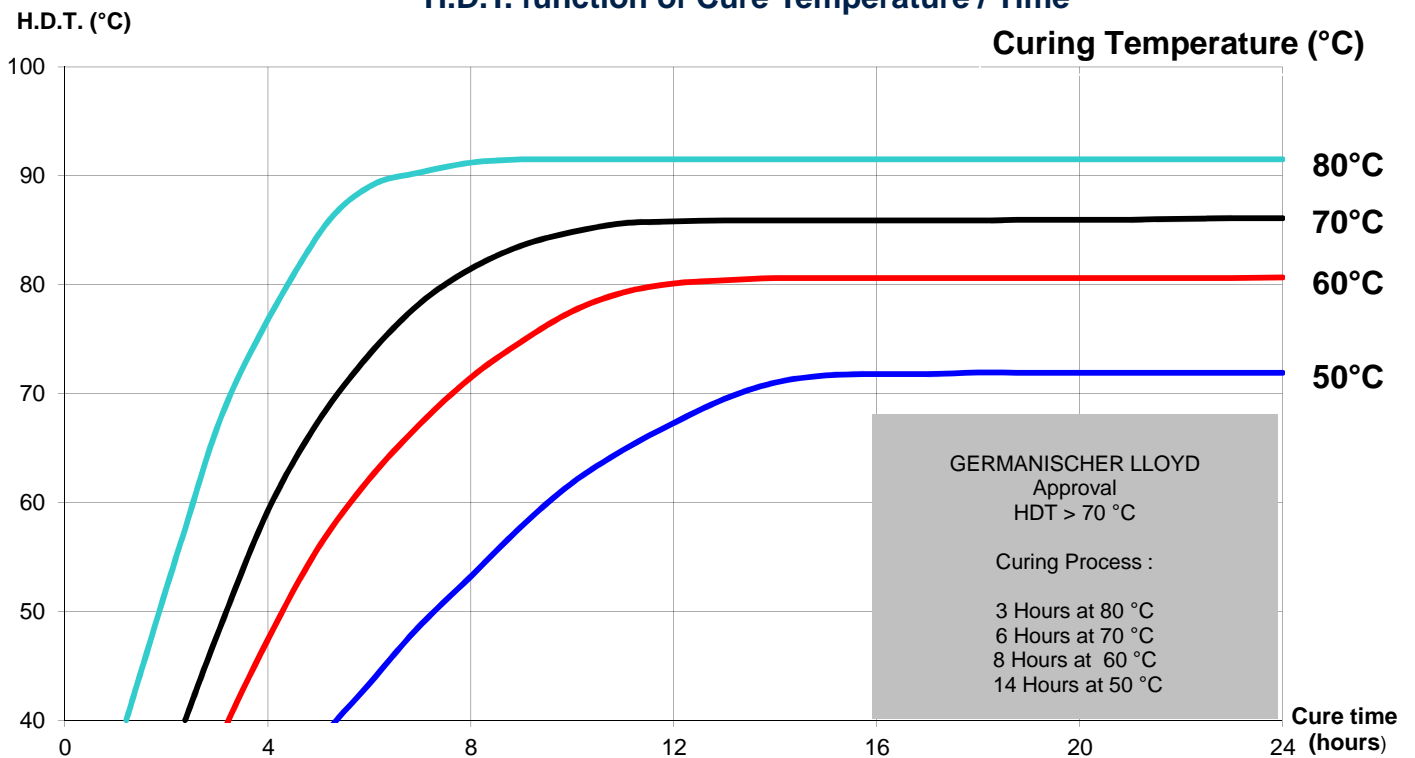
Glass transition measured by DSC according to standard ISO 11357-2 : 1999.

Epoxy system SR 1710 / SD 8822
H.D.T. function of Cure Temperature / Time



HDT : (Heat Deflection Temperature) according ISO 75-2 : 1993 (F)

Epoxy system SR 1710 / SD SD 8824
H.D.T. function of Cure Temperature / Time



HDT : (Heat Deflection Temperature) according ISO 75-2 : 1993 (F)