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. Temperature resistance: Tg1 max = 100°C

Approval n° : WP 0320005 HH
Germanischer Lloyd

Epoxy resin SR 1710 Injection

Aspect / colour		Yellow liquid
Viscosity (mPa.s) *Rheometer* *CP 50 mm* *Shear rate 10 s^{-1}*	@ 15 °C @ 20 °C @ 25 °C @ 30 °C @ 40 °C	3 250 ± 300 1700 ± 200 950 ± 100 580 ± 100 240 ± 50
Density (g/cm^3) *Picnometer* *According to ISO 2811-1*	@ 20 °C	1.15 ± 0.01
Storage	25°C < ambient Temp. < 30°C 10°C < ambient Temp. < 20°C	6 months 12 months

Hardeners

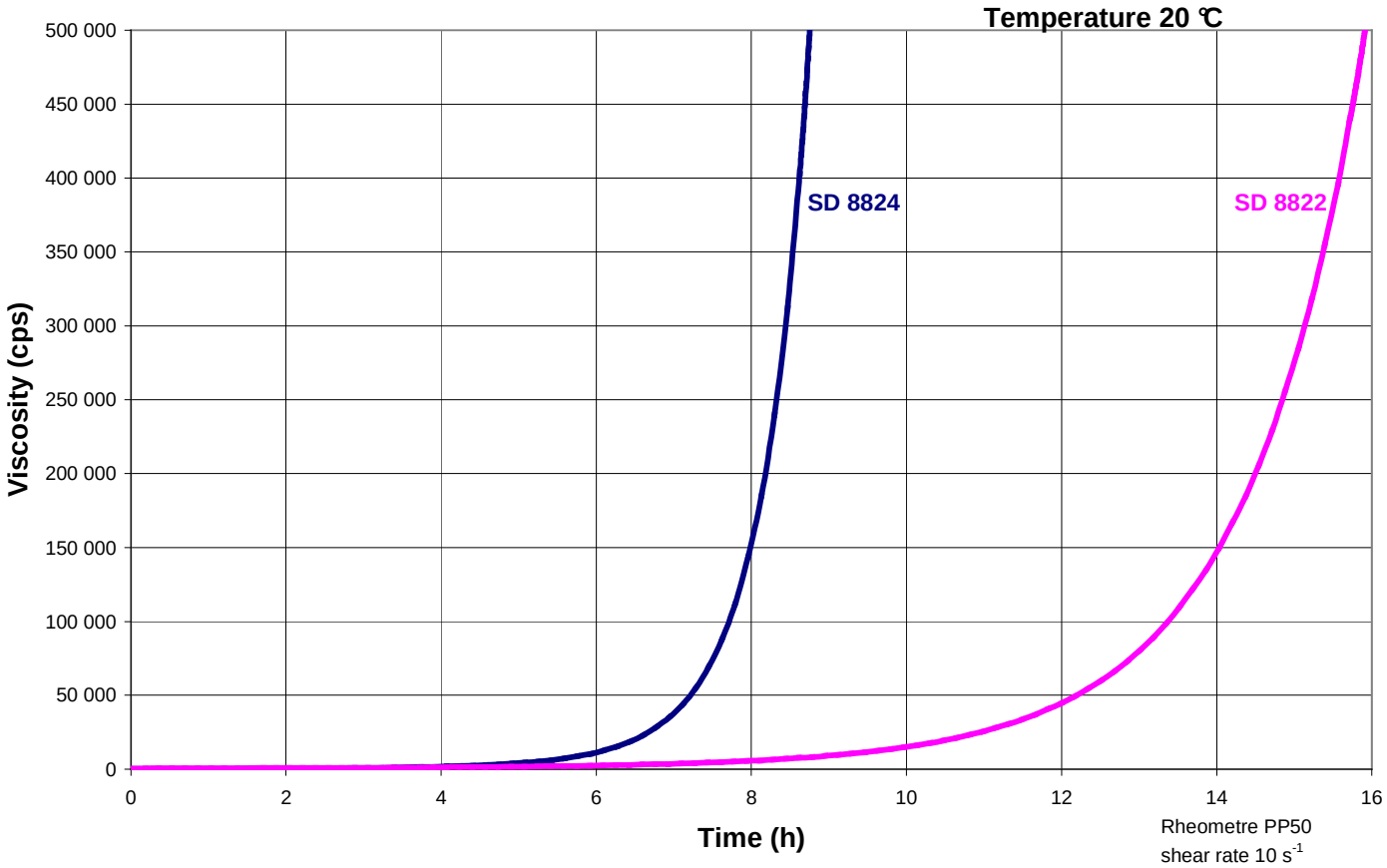
		SD 8822	***SD 8824***
Reactivity type		***« slow »***	***« standard »***
Aspect / colour		Light yellow liquid	Light yellow liquid
Viscosity (mPa.s) *Rheometer* *CP 50 mm* *Shear rate 10 s^{-1}*	@ 15 °C @ 20 °C @ 25 °C @ 30 °C @ 40 °C	27 ± 5 20 ± 5 16 ± 5 13 ± 5 9 ± 5	7 ± 2 6 ± 2 5 ± 2 4 ± 2 3 ± 1
Density (g/cm^3) *Picnometer* *According to ISO 2811-1*	@ 20 °C	0.937 ± 0.010	0.944 ± 0.010

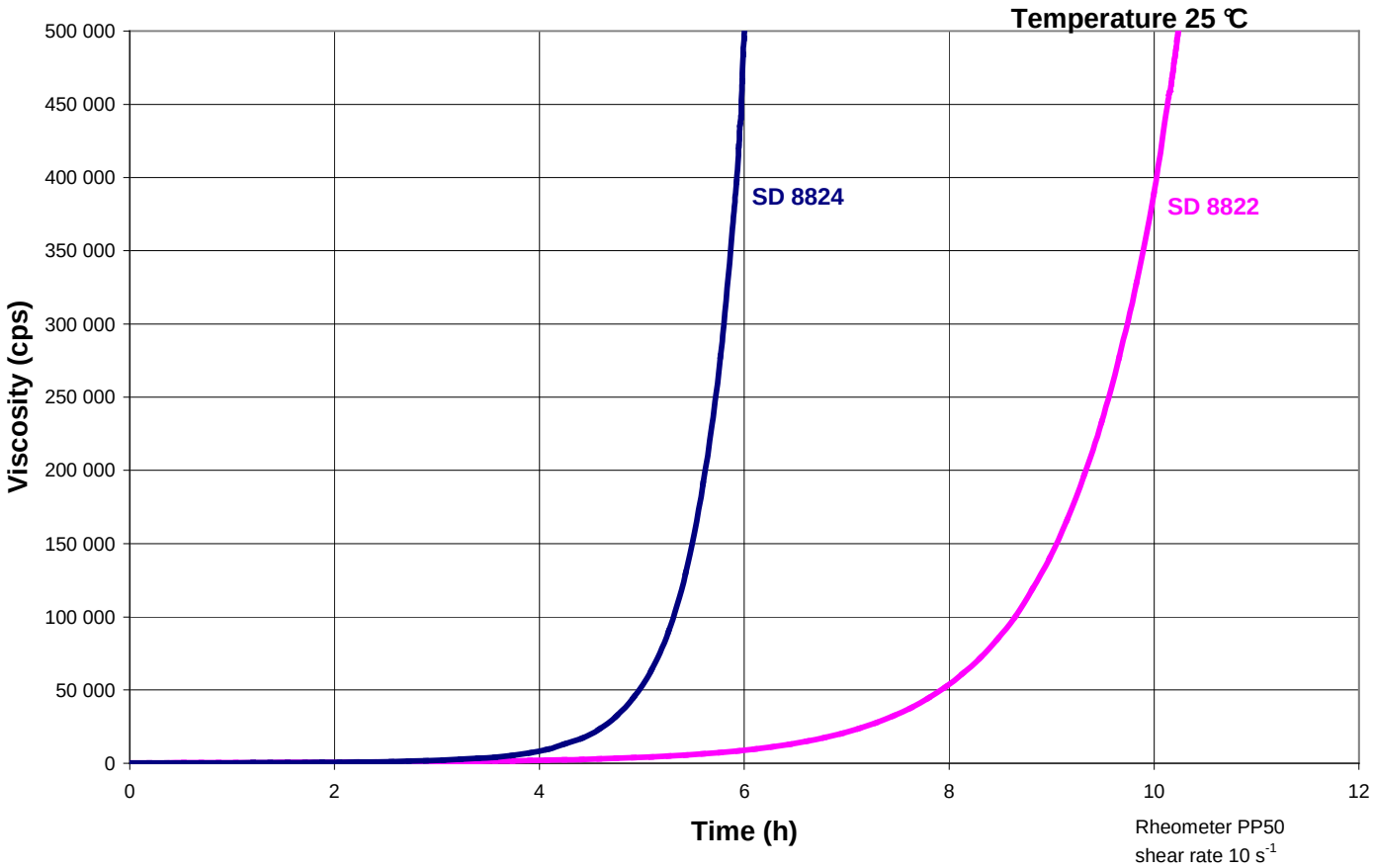
SR 1710 inj / SD 882x Mix

		SD 8822	**SD 8824**
Mix viscosity (mPa.s) *Rheometer* *PP 50 mm* *Shear rate 10 s^{-1}*	@ 20 °C @ 25 °C	500 ± 50 360 ± 30	290 ± 30 130 ± 20
Mixing ratio by weight		**100 g / 35 g**	**100 g / 23 g**
Mixing ratio by volume		**100 ml / 43 ml**	**100 ml / 28 ml**

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 h	2 h 40’
	@ 25 °C	2 h 35'	1 h 20’
Time to reach 50 °C on 500 g mix			
	@ 20 °C	5 h 25'	2 h 30’
	@ 25 °C	2 h 10'	1 h 10’





Packaging (in Kg)

Resin **SR 1710 Inj.**	Hardener **SD 8822**	Hardener **SD 8824**
224	8 x 9.8 or 3 x 26.2	8 x 6.44 or 2 x 25.8
28	9.8	6.44
12	4.2	2.76
5	1.75	1.15
2	0.7	0.46

Other possibility

SR 1710 inj / SD 7820 : For better thermal resistance and a longer pot life
100 g / 36g, $Tg1_{max}$ = 130 ℃

Polymerisation

	SD 8822	**SD 8824**
Time to wait @ 20℃ Before post-curing*	20 hours	6 h ours
Minimum post-cure cycle	20 hours @ 50℃	24 hours @ 40℃
Advised post-cure cycle	16 hours @ 60℃	8 hours @ 60℃

*have to be respected in case of thick laminate (> 3 mm).
Limit the risk of exothermic reaction.

Mechanical properties on cast resin

Curing cycles →		SR 1710 Inj. / SD 8822			SR 1710 Inj. / SD 8824			
		24 h @ amb.temp + 24 h @ 40 ℃	24 h @ amb.temp + 16 h @ 60 ℃	24 h @ amb.temp + 4 h @ 80 ℃	24 h @ amb.temp + 24 h @ 40 ℃	24 h @ amb.temp + 8 h 60 ℃	24 h @ amb.temp + 16 h @ 60 ℃	24 h @ amb.temp + 4 h @ 80 ℃
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	℃	67	87	80	67	81	84	88
Tg1 max.	℃			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℃ t o 180℃ under nitrogen gaz*
	Tg1 or Onset : 1st point at 20 ℃/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	
Curing cycles →		24h @ amb.temp + 16 h @ 60℃	24h @ amb.temp + 16 h @ 60℃	24h @ amb.temp + 24 h @ 40℃
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	℃	83	87	71
Tg1 max.	℃	96	95	

Tests carried out in accordance with the following norms:

Flexion : *NF T 57-105*

Shear: *NF T 57-104*

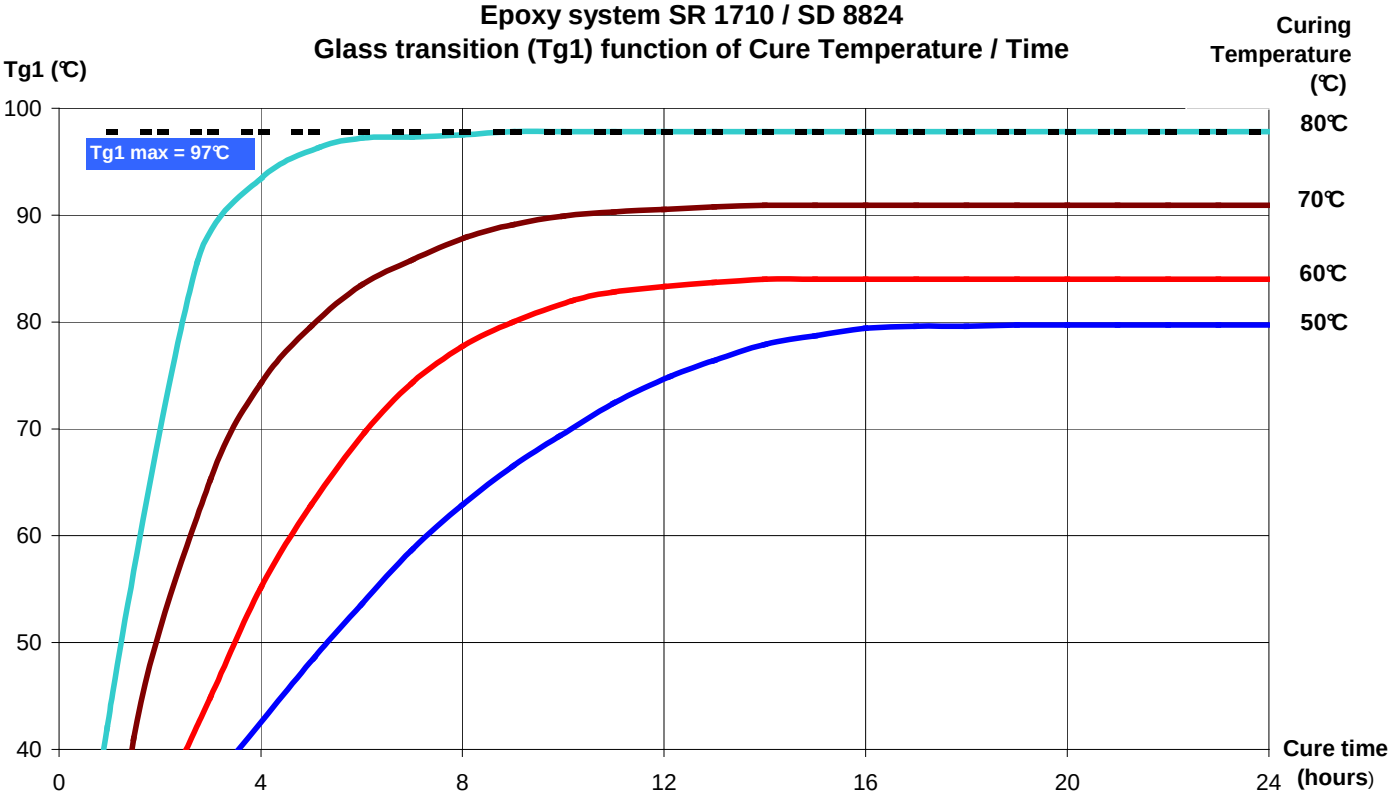
Charpy Impact Strength: *NF T 57-108*

Glass transition DSC : *ISO 11357-2 : 1999 -5℃ t o 180℃ under nitrogen gaz*
Tg1 or Onset : 1st point at 20 ℃/mn
Tg1 maximum or Onset : second passage

Water absorption: *Internal. Polymerisation according to cycle, machining, weighting, time spent in distilled water at 70 ℃ / 48 hours, weighting 1 hour after emerging, drying 24 h at 40℃, weighting, mechanical tests o n 10 samples*

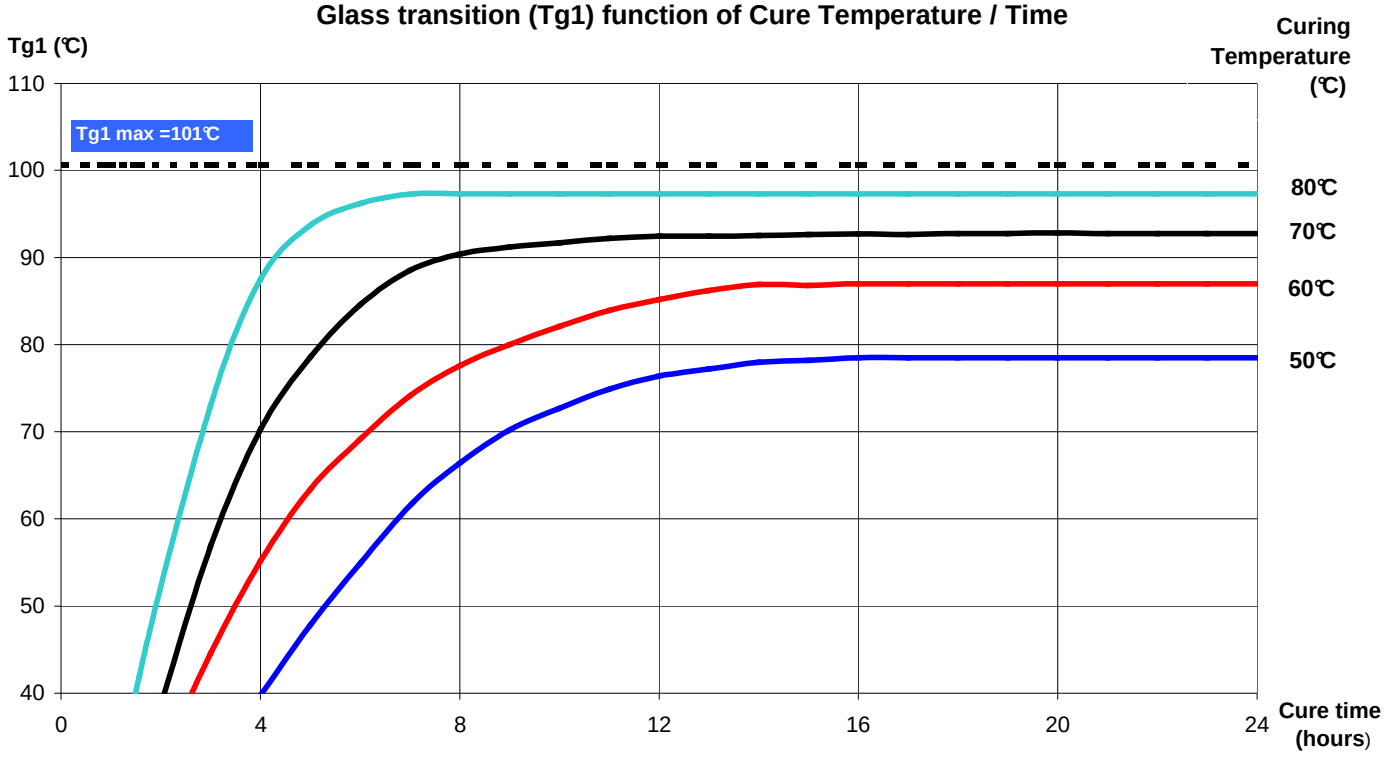
Reinforcement 3300: *Twill 2/2 E Glass, weight 300 g/m2*

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



Glass transition measured by DSC according to standard ISO 11357-2 : 1999.
Tg1 : 1st point at 20℃/mn (Onset method) - Tg1 max : second run -5℃/180℃ under N_2

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



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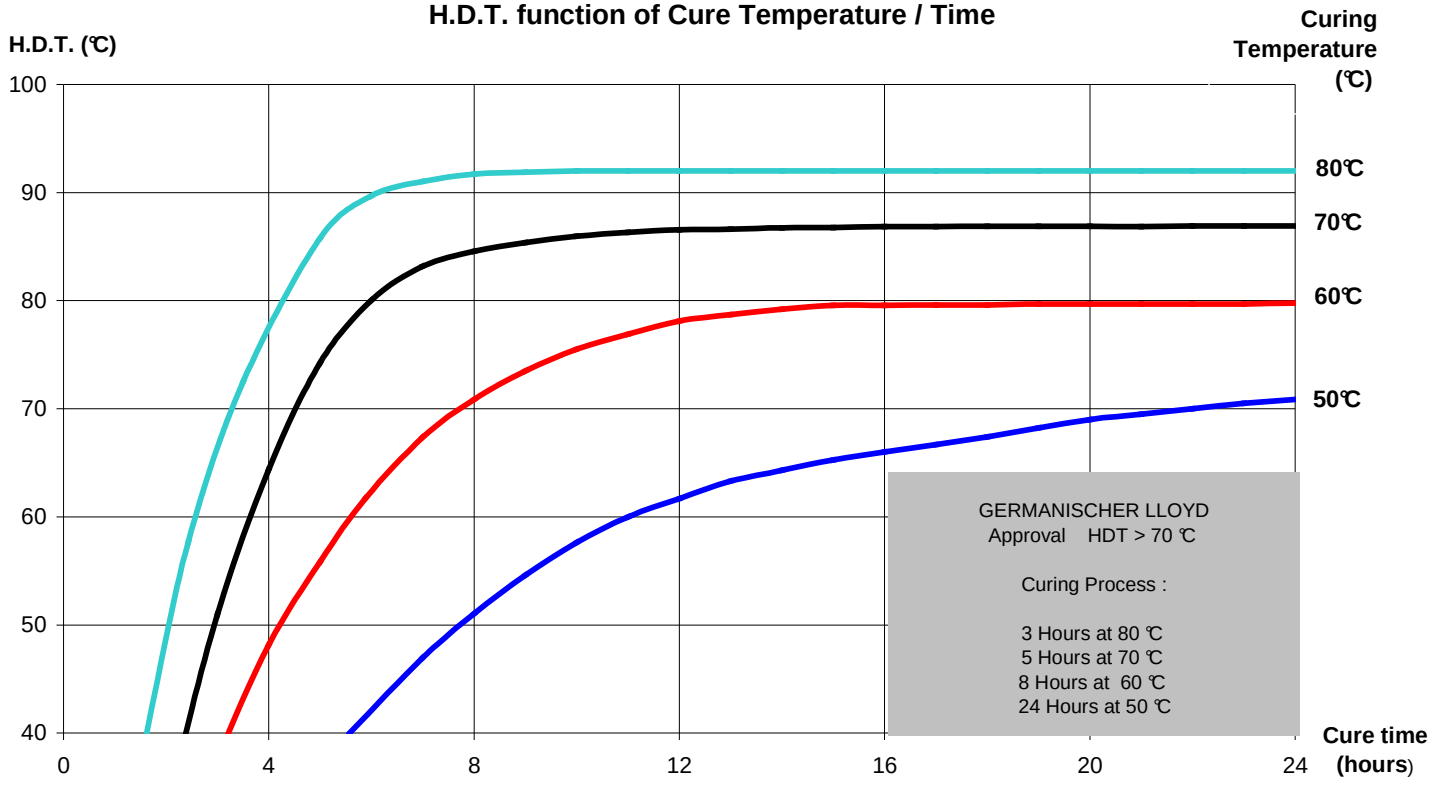
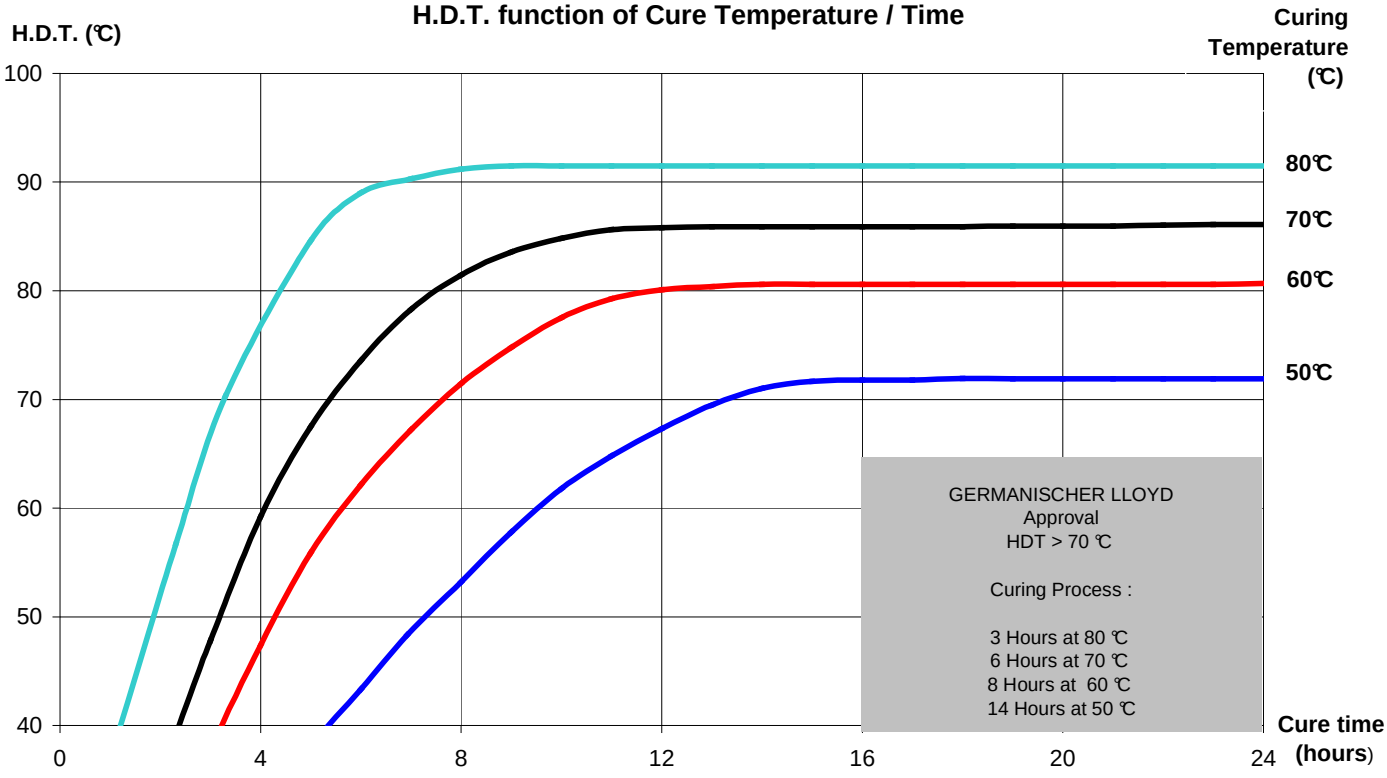
Epoxy system SR 1710 / SD 8822
H.D.T. function of Cure Temperature / Time



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)