

 English

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Technical data

Elastic properties

kuraray

Trosifol® SentryGlas®

Introduction

Interlayer strength, depth and capabilities

Delivering your window into the world of advanced interlayers for laminated safety glass, Kuraray's Advanced Interlayer Solutions Division (AIS) is underpinned by decades of innovation, application knowledge, domain experience and market success.

OUR ADVANCED INTERLAYER PORTFOLIO – comprising Trosifol® PVB and SentryGlas® ionoplast interlayers – has continually revolutionized aesthetic, structural and functional glass design, fabrication and installation in the architectural and automotive/transportation segments.

Designed to benefit consumers, society and industry, our products are advancing the functionality of glass, while our engineers and consultants are setting new application benchmarks by collaborating on solutions that both sustain and inspire.

We are committed to helping you transform your mindset and take your applications to the next level – aesthetically, functionally and structurally. Enjoy greater design freedom and give your glazing strength, clarity, character and purpose with solutions that cover safety, security, sound insulation, UV/solar/energy management, color and print.





Steve Jobs Theater Pavilion | Photo: © Eddersley O'Callaghan

OUR DIVERSE PRODUCT RANGE, the broadest on the global market and our domain expertise create strength; and we channel this strength into helping you succeed. We strive to be your strongest ally and supporter and will help you navigate and conquer the ever-changing demands of the global glass industry. Worldwide production, R&D and support, means we are always by your side... no matter where you are.



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Shear Relaxation Modulus G(t)/ MPa

Tempera- ture	Product type	Load duration											
		1 sec	3 sec	5 sec	10 sec	30 sec	1 min	5 min	10 min	30 min	1 hour	6 hours	12 hours
-20°C (-4°F)	Trosifol® Clear/UltraClear	250	230	220	210	180	170	140	120	99	85	53	42
	Trosifol® SC Monolayer	210	180	160	150	120	100	71	58	41	31	14	9.9
	Trosifol® SC Multilayer	65	40	31	21	11	7.4	3.4	2.7	2.1	1.8	1.5	1.4
	Trosifol® Extra Stiff	460	440	420	400	370	350	290	270	220	200	120	100
	SentryGlas®	291	290	290	289	289	288	285	284	283	281	280	279
	SentryGlas® Xtra™	245	243	243	242	240	238	236	233	227	226	221	213
0°C (32°F)	Trosifol® Clear/UltraClear	180	150	140	120	100	94	67	55	40	32	14	10
	Trosifol® SC Monolayer	48	32	26	19	12	7.8	3.5	2.6	1.7	1.2	0.7	0.6
	Trosifol® SC Multilayer	2.6	2.0	1.9	1.7	1.5	1.4	1.2	1.1	0.92	0.79	0.50	0.45
	Trosifol® Extra Stiff	420	390	370	350	310	290	230	200	150	130	70	51
	SentryGlas®	260	258	257	256	254	252	249	248	246	244	236	232
	SentryGlas® Xtra™	203	199	196	193	186	182	172	169	160	144	124	107
10°C (50°F)	Trosifol® Clear/UltraClear	86	66	57	46	31	23	10	6.9	3.5	2.4	1.0	0.81
	Trosifol® SC Monolayer	5.1	3.1	2.5	1.9	1.1	0.90	0.61	0.55	0.48	0.45	0.39	0.36
	Trosifol® SC Multilayer	1.5	1.3	1.3	1.2	1.1	0.94	0.65	0.54	0.45	0.41	0.35	0.32
	Trosifol® Extra Stiff	380	350	330	310	270	240	170	150	110	85	36	24
	SentryGlas®	240	236	235	230	228	225	220	214	217	206	199	194
	SentryGlas® Xtra™	181	179	178	176	172	170	161	143	126	120	91.6	85.1
20°C (68°F)	Trosifol® Clear/UltraClear	12	6.6	4.8	3.2	1.7	1.2	0.74	0.64	0.54	0.50	0.43	0.41
	Trosifol® SC Monolayer	0.86	0.66	0.60	0.54	0.47	0.45	0.39	0.37	0.33	0.30	0.23	0.20
	Trosifol® SC Multilayer	1.2	1.0	0.91	0.78	0.58	0.50	0.40	0.38	0.34	0.32	0.24	0.21
	Trosifol® Extra Stiff	280	240	210	190	140	120	67	49	26	17	4.2	2.6
	SentryGlas®	217	211	209	205	206	192	188	181	175	169	158	151
	SentryGlas® Xtra™	162	155	144	135	131	125	120	115	100	80.1	55.1	50.0
25°C (77°F)	Trosifol® Clear/UltraClear	2.7	1.5	1.2	0.92	0.69	0.61	0.50	0.47	0.43	0.41	0.34	0.31
	Trosifol® SC Monolayer	0.58	0.50	0.47	0.44	0.41	0.38	0.33	0.30	0.26	0.23	0.15	0.12
	Trosifol® SC Multilayer	1.0	0.75	0.66	0.55	0.45	0.42	0.36	0.33	0.29	0.27	0.18	0.15
	Trosifol® Extra Stiff	190	150	130	100	70	51	20	13	5.4	3.3	1.3	1.1
	SentryGlas®	176	167	163	157	149	142	117	115	106	101	90.6	86.2
	SentryGlas® Xtra™	141	136	126	117	115	97.9	80.4	63.3	45.8	37.2	27.0	21.0
30°C (86°F)	Trosifol® Clear/UltraClear	0.93	0.69	0.63	0.56	0.50	0.47	0.41	0.39	0.35	0.33	0.25	0.22
	Trosifol® SC Monolayer	0.47	0.43	0.41	0.39	0.35	0.33	0.26	0.23	0.19	0.16	0.091	0.070
	Trosifol® SC Multilayer	0.71	0.54	0.49	0.44	0.39	0.37	0.31	0.29	0.24	0.21	0.13	0.10
	Trosifol® Extra Stiff	73	44	33	21	10	5.8	2.0	1.4	1.0	0.92	0.75	0.71
	SentryGlas®	151	141	138	130	119	110	83	75.2	66	60	55.3	52.3
	SentryGlas® Xtra™	106	101	95.6	91.2	84.8	80.1	55.1	50.0	38.2	26.0	16.2	10.6
35°C (95°F)	Trosifol® Clear/UltraClear	0.59	0.51	0.49	0.46	0.42	0.40	0.35	0.32	0.27	0.24	0.16	0.13
	Trosifol® SC Monolayer	0.42	0.38	0.36	0.34	0.30	0.27	0.20	0.17	0.13	0.11	0.052	0.037
	Trosifol® SC Multilayer	0.51	0.43	0.41	0.38	0.34	0.32	0.26	0.23	0.18	0.15	0.076	0.056
	Trosifol® Extra Stiff	13	5.7	3.9	2.4	1.4	1.1	0.85	0.79	0.72	0.69	0.60	0.57
	SentryGlas®	114	102	96.9	89.9	77.7	70.5	53.4	47.7	37.9	34.7	26.4	23.1
	SentryGlas® Xtra™	78.7	70.3	65.5	61.5	55.1	44.9	29.0	22.0	13.5	10.0	4.60	3.99
40°C (104°F)	Trosifol® Clear/UltraClear	0.48	0.44	0.43	0.40	0.37	0.34	0.28	0.25	0.20	0.16	0.091	0.070
	Trosifol® SC Monolayer	0.38	0.34	0.32	0.30	0.25	0.22	0.15	0.13	0.089	0.068	0.029	
	Trosifol® SC Multilayer	0.40	0.36	0.35	0.32	0.28	0.25	0.18	0.15	0.10	0.079	0.033	0.023
	Trosifol® Extra Stiff	2.1	1.3	1.1	1.0	0.83	0.77	0.68	0.65	0.60	0.57	0.47	0.43
	SentryGlas®	77	63	56.4	48.1	37	31	19	15.8	11.4	9.3	5.76	5.06
	SentryGlas® Xtra™	50.3	46.3	40.5	35.5	33.1	27.0	15.0	12.0	6.99	5.20	2.64	1.99
50°C (122°F)	Trosifol® Clear/UltraClear	0.39	0.36	0.34	0.31	0.26	0.23	0.16	0.13	0.089	0.068		
	Trosifol® SC Monolayer	0.31	0.27	0.25	0.22	0.17	0.14	0.087	0.067	0.041	0.029		
	Trosifol® SC Multilayer	0.32	0.28	0.26	0.23	0.18	0.15	0.084	0.062	0.036	0.025		
	Trosifol® Extra Stiff	0.79	0.72	0.69	0.66	0.61	0.58	0.50	0.45	0.38	0.34	0.21	0.17
	SentryGlas®	36.2	26.4	22.1	18.5	13.5	11.3	7.31	6.19	4.9	4.2	3.24	2.98
	SentryGlas® Xtra™	22.1	12.7	8.45	5.98	4.90	3.89	2.71	2.45	2.00	1.70	1.20	1.10
60°C (140°F)	Trosifol® Clear/UltraClear	0.32	0.27	0.25	0.22	0.17	0.14	0.081	0.062				
	Trosifol® SC Monolayer	0.26	0.22	0.19	0.16	0.12	0.10	0.052	0.037				
	Trosifol® SC Multilayer	0.25	0.20	0.18	0.15	0.10	0.07	0.036	0.025				
	Trosifol® Extra Stiff	0.64	0.60	0.57	0.54	0.47	0.43	0.33	0.28	0.21	0.16		
	SentryGlas®	11.8	8.2	6.89	5.76	4.3	3.6	2.6	2.25	1.9	1.7	1.42	1.35
	SentryGlas® Xtra™	4.90	3.78	3.33	2.54	2.15	1.88	1.40	1.25	1.00	0.90	0.68	0.61
70°C (158°F)	Trosifol® Clear/UltraClear	0.26	0.21	0.19	0.16	0.11	0.088	0.047					
	Trosifol® SC Monolayer	0.20	0.16	0.14	0.11	0.076	0.058	0.027					
	Trosifol® SC Multilayer	0.18	0.13	0.11	0.088	0.054	0.039						
	Trosifol® Extra Stiff	0.54	0.48	0.45	0.40	0.33	0.28	0.18	0.14				
	SentryGlas®	3.77	2.9	2.71	2.45	2	1.9	1.4	1.15	1.0	0.8	0.65	0.63
	SentryGlas® Xtra™	2.20	1.73	1.43	1.30	1.05	0.90	0.68	0.65	0.45	0.40	0.28	0.26
80°C (176°F)	Trosifol® Clear/UltraClear	0.21	0.16	0.14	0.11	0.074	0.056						
	Trosifol® SC Monolayer	0.16	0.11	0.10	0.075	0.047	0.033						
	Trosifol® SC Multilayer	0.14	0.10	0.079	0.058	0.034	0.023						
	Trosifol® Extra Stiff	0.43	0.36	0.32	0.28	0.20	0.16						
	SentryGlas®	1.55	1.3	1.22	1.11	1.0	0.8	0.6	0.45	0.4	0.3	0.3	0.3
	SentryGlas® Xtra™	0.31	0.27	0.23	0.18	0.10	0.09	0.06	0.05	0.04	0.04	0.03	0.03

1 day	2 days	5 days	1 week	3 weeks	1 month	1 year	10 years	50 years
33	25	16	14	7	6	1.5	0.7	0.5
6.8	4.9	3.2	2.7	1.7	1.5	0.66	0.47	0.41
1.3	1.2	1.1	1.0	0.84	0.79	0.45	0.35	0.30
81	61	38	32	16	13	2.1	1.0	0.78
278	277	276	276	275	273	268	260	250
209	192	187	186	184	176	159	139	131
7.0	4.7	2.7	2.3	1.3	1.2	0.62	0.48	0.42
0.5	0.5	0.4	0.4	0.4	0.4	0.30	0.21	0.14
0.42	0.39	0.36	0.35	0.31	0.30	0.19	0.090	0.044
36	24	13	10	4.4	3.5	1.1	0.78	0.69
231	227	225	224	222	221	210	201	194
101	95.3	85.1	83.8	75.0	70.6	54.7	42.9	38.9
0.69	0.61	0.53	0.52	0.47	0.46	0.37	0.28	0.21
0.34	0.32	0.28	0.27	0.22	0.21	0.11	0.042	
0.30	0.27	0.23	0.22	0.17	0.16	0.060		
16	9.5	4.7	3.6	1.9	1.6	0.86	0.70	0.62
190	188	178	180	172	171	161	153	146
67.2	57.4	46.6	42.6	36.8	34.1	22.6	16.5	13.2
0.39	0.36	0.33	0.32	0.27	0.26	0.14	0.063	
0.17	0.14	0.11	0.10	0.063	0.056			
0.18	0.15	0.11	0.10	0.065	0.057			
1.8	1.3	1.0	1.0	0.84	0.81	0.66	0.56	0.47
146	140	130	127	115	112	96.5	86.6	77.1
39.9	36.8	29.5	26.9	21.2	18.4	11.1	6.69	5.03
0.29	0.26	0.22	0.20	0.15	0.14	0.056		
0.10	0.078	0.054	0.046	0.027	0.024			
0.13	0.10	0.068	0.058	0.034	0.029			
0.94	0.85	0.78	0.75	0.69	0.68	0.56	0.43	0.33
80.5	70.8	60.8	55.1	45.1	42.4	32.1	24.3	18.1
18.6	17.9	15.4	14.2	11.1	10.5	5.61	3.31	2.44
0.19	0.16	0.12	0.11	0.070	0.062			
0.054	0.038	0.025						
0.078	0.057	0.036	0.031					
0.68	0.65	0.61	0.59	0.54	0.53	0.37	0.21	0.12
50	35.9	24.7	22.5	12.9	11.6	6.8	5.31	4.05
8.97	8.35	7.13	6.18	5.54	5.17	3.07	1.98	1.51
0.10	0.081	0.057	0.049					
0.027								
0.041	0.029							
0.54	0.50	0.45	0.43	0.36	0.34	0.17		
20.3	16.5	12.4	11.4	8.31	7.45	4.95	4.11	3.05
3.31	3.23	2.76	2.63	2.32	2.15	1.51	1.05	0.87
0.054								
0.39	0.34	0.28	0.25	0.18	0.17			
4.5	4.16	3.6	3.66	3.4	3.3	3.1	2.9	2.31
1.86	1.84	1.57	1.39	1.19	1.11	0.70	0.47	0.37
0.13	0.10							
2.8	2.67	2.4	2.42	2.2	2.2	2	2	1.82
1.05	1.00	0.92	0.74	0.61	0.54	0.43	0.23	0.17
1.3	1.26	1.2	1.18	1.1	1.1	1.0	0.97	0.74
0.58	0.43	0.40	0.38	0.31	0.28	0.18	0.12	0.09
0.6	0.58	0.5	0.54	0.5	0.5	0.5	0.45	0.35
0.24	0.20	0.17	0.14	0.12	0.11	0.07	0.05	0.04
0.3	0.29	0.2	0.25	0.2	0.2	0.2	0.2	0.16
0.02	0.01	0.01	0.01					

TAB 1 G(t) data were determined by Dynamic Mechanical Analysis in accordance to EN ISO 6721 within the linear range of deformation. All samples were stored at 23°C for 4 weeks before measurement. G(t) data were experimentally verified by 4-Point-Bend-Tests on laminated glass following prEN 16613 at third party labs for selected time-load combinations.

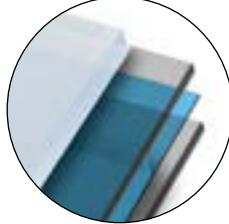
Young Relaxation Modulus E(t)/MPa

Tempera- ture	Product type	Load duration											
		1 sec	3 sec	5 sec	10 sec	30 sec	1 min	5 min	10 min	30 min	1 hour	6 hours	12 hours
-20°C (-4°F)	Trosifol® Clear/UltraClear	750	680	650	610	550	500	400	360	290	250	160	130
	Trosifol® SC Monolayer	610	520	490	430	350	310	210	170	120	93	43	29
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	1400	1300	1200	1200	1100	1000	860	790	660	570	360	300
	SentryGlas®	838	835	835	832	832	829	821	818	815	809	806	804
0°C (32°F)	SentryGlas® Xtra™	725	719	719	716	710	705	699	670	672	669	654	631
	Trosifol® Clear/UltraClear	530	450	410	370	310	280	200	160	120	95	42	30
	Trosifol® SC Monolayer	140	95	77	58	35	23	11	7.7	4.9	3.6	2.1	1.8
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	1200	1100	1100	1000	930	850	670	580	450	380	210	150
10°C (50°F)	SentryGlas®	749	743	740	737	732	726	717	714	708	703	680	668
	SentryGlas® Xtra™	601	589	580	571	551	539	512	500	474	426	367	317
	Trosifol® Clear/UltraClear	260	200	170	140	92	69	31	21	11	7.0	3.0	2.4
	Trosifol® SC Monolayer	15	9.1	7.4	5.6	3.4	2.7	1.8	1.6	1.4	1.3	1.2	1.1
	Trosifol® SC Multilayer												
20°C (68°F)	Trosifol® Extra Stiff	1100	1000	970	900	780	700	510	430	310	250	110	70
	SentryGlas®	693	681	678	664	661	651	638	618	629	597	574	560
	SentryGlas® Xtra™	536	530	527	521	509	503	477	423	373	355	271	252
	Trosifol® Clear/UltraClear	37	20	14	9.4	5.1	3.7	2.2	1.9	1.6	1.5	1.3	1.2
	Trosifol® SC Monolayer	2.6	2.0	1.8	1.6	1.4	1.3	1.2	1.1	0.98	0.90	0.67	0.59
25°C (77°F)	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	820	690	630	540	420	350	200	140	77	50	12	7.7
	SentryGlas®	629	612	606	594	602	567	549	525	511	493	458	438
	SentryGlas® Xtra™	480	459	426	400	389	370	355	340	296	237	163	148
	Trosifol® Clear/UltraClear	7.9	4.4	3.5	2.7	2.1	1.8	1.5	1.4	1.3	1.2	1.0	0.94
30°C (86°F)	Trosifol® SC Monolayer	1.7	1.5	1.4	1.3	1.2	1.1	0.97	0.90	0.76	0.68	0.44	0.37
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	560	430	370	310	210	150	59	37	16	9.6	3.7	3.1
	SentryGlas®	511	485	474	456	433	413	340	334	308	294	263	250
	SentryGlas® Xtra™	417	403	373	346	340	289	238	187	136	110	79.9	62.2
35°C (95°F)	Trosifol® Extra Stiff	210	130	96	63	29	17	5.8	4.2	3.0	2.7	2.2	2.1
	SentryGlas®	443	413	405	381	349	324	243	220	194	178	162	153
	SentryGlas® Xtra™	314	299	283	270	250	237	163	148	113	77.0	48.0	31.4
	Trosifol® Clear/UltraClear	2.8	2.1	1.9	1.7	1.5	1.4	1.2	1.2	1.0	0.97	0.74	0.64
	Trosifol® SC Monolayer	1.4	1.3	1.2	1.2	1.0	0.97	0.78	0.70	0.56	0.47	0.27	0.21
40°C (104°F)	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	39	17	11	7.2	4.1	3.3	2.5	2.3	2.1	2.0	1.8	1.7
	SentryGlas®	338	302	287	266	230	209	158	141	122	103	78.2	68.4
	SentryGlas® Xtra™	233	208	194	182	163	133	85.8	65.1	40.0	29.6	13.6	11.8
	Trosifol® Clear/UltraClear	1.4	1.3	1.3	1.2	1.1	1.0	0.82	0.73	0.58	0.49	0.27	0.21
50°C (122°F)	Trosifol® SC Monolayer	1.1	1.0	0.96	0.88	0.75	0.66	0.46	0.38	0.26	0.20	0.086	
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	6.1	3.7	3.2	2.8	2.4	2.3	2.0	1.9	1.8	1.7	1.4	1.3
	SentryGlas®	229	187	167	143	109	91.6	57	46.9	34	27.8	17.1	15.0
	SentryGlas® Xtra™	149	137	120	105	98.0	79.9	44.4	35.5	20.7	15.4	7.81	5.89
60°C (140°F)	Trosifol® Clear/UltraClear	1.2	1.1	1.0	0.92	0.78	0.69	0.48	0.39	0.27	0.20		
	Trosifol® SC Monolayer	0.94	0.80	0.74	0.66	0.52	0.43	0.26	0.20	0.12	0.086		
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	2.3	2.1	2.0	1.9	1.8	1.7	1.5	1.3	1.1	1.0	0.63	0.50
	SentryGlas®	108.6	78	66.3	55.1	40	33.8	21.7	18.57	14.6	12.6	9.72	8.94
70°C (158°F)	SentryGlas® Xtra™	65.4	37.6	25.0	17.7	14.5	11.5	8.02	7.25	5.92	5.03	3.55	3.26
	Trosifol® Clear/UltraClear	0.95	0.82	0.75	0.66	0.51	0.42	0.24	0.18				
	Trosifol® SC Monolayer	0.78	0.64	0.58	0.49	0.36	0.29	0.15	0.11				
	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	1.9	1.8	1.7	1.6	1.4	1.3	0.96	0.82	0.60	0.48		
80°C (176°F)	SentryGlas®	35.4	24.5	20.67	17.2	12.8	10.9	7.6	6.75	5.5	5.1	4.26	4.05
	SentryGlas® Xtra™	14.5	11.2	9.86	7.51	6.36	5.57	4.14	3.70	2.96	2.66	2.01	1.81
	Trosifol® Clear/UltraClear	0.78	0.63	0.56	0.47	0.34	0.26	0.14					
	Trosifol® SC Monolayer	0.61	0.47	0.41	0.33	0.23	0.17	0.080					
	Trosifol® SC Multilayer												
90°C (194°F)	Trosifol® Extra Stiff	1.6	1.4	1.3	1.2	0.97	0.83	0.52	0.40				
	SentryGlas®	11.31	8.8	8.13	7.3	6.3	5.64	4.2	3.45				
	SentryGlas® Xtra™	6.51	5.12	4.23	3.85	3.11	2.66	2.01	1.92	1.33			
	Trosifol® Clear/UltraClear	0.62	0.48	0.41	0.33	0.22	0.17	0.099					
	Trosifol® SC Monolayer	0.46	0.34	0.29		0.14							
100°C (212°F)	Trosifol® SC Multilayer												
	Trosifol® Extra Stiff	1.3	1.1	1.0	0.8	0.6	0.48						
	SentryGlas®	4.65	4.0	3.66	3.31	2.9	2.5	1.7	1.35	1.1	1.0	0.9	0.9
	SentryGlas® Xtra™	0.92	0.80	0.68	0.53	0.30	0.27	0.18	0.15	0.12	0.12	0.09	0.09
	Trosifol® Clear/UltraClear	0.62	0.48	0.41	0.33	0.22	0.17	0.099					

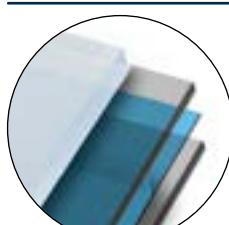
1 day	2 days	5 days	1 week	3 weeks	1 month	1 year	10 years	50 years
99 20	75 15	49 9.4	41 8.1	22 5.2	19 4.9	4.3 2.0	2.0 1.4	1.6 1.2
240 801 619	180 798 568	110 795 554	93 795 551	46 792 544	38 786 522	6.0 772 471	2.8 749 411	2.3 720 388
21 1.6	14 1.5	8.2 1.4	6.8 1.3	4.0 1.2	3.5 1.2	1.8 0.91	1.4 0.63	1.3 0.42
110 665 299	71 654 282	38 648 252	30 645 248	13 639 222	10 636 209	3.1 605 162	2.3 579 127	2.0 559 115
2.1 1.0	1.8 0.94	1.6 0.83	1.5 0.79	1.4 0.66	1.4 0.62	1.1 0.32	0.83 0.13	0.62
46 553 199	28 543 170	14 516 138	11 519 126	5.5 498 109	4.7 499 101	2.5 467 66.9	2.1 448 48.8	1.8 421 39.1
1.2 0.50	1.1 0.42	0.98 0.32	0.94 0.28	0.80 0.19	0.77 0.17	0.42	0.19	
5.4 428 118	4.0 406 109	3.1 380 87.3	2.9 368 79.6	2.5 336 62.8	2.4 330 54.4	1.9 282 32.9	1.6 256 19.8	1.4 223 14.9
0.86 0.30	0.77 0.23	0.65 0.16	0.60 0.14	0.46 0.080	0.42 0.072	0.17		
2.8 234 55.1	2.5 206 53.0	2.3 177 45.6	2.2 160 42.0	2.0 131 32.9	2.0 123 31.4	1.7 93.3 16.6	1.3 70.6 9.80	0.96 52.6 7.22
0.56 0.16	0.46 0.11	0.35 0.075	0.31	0.21	0.19			
2.0 146 26.6	1.9 105 24.7	1.8 72 21.1	1.7 66.0 18.3	1.6 38 16.4	1.5 35 15.3	1.1 20.3 9.09	0.62 15 5.86	0.35 11.9 4.47
0.31 0.081	0.24	0.17	0.15					
1.6 60.1 9.80	1.5 48.9 9.56	1.3 36.7 8.17	1.3 33.8 7.79	1.0 24.6 6.87	1.0 22.1 6.35	0.49 14.7 4.47	12.2 3.11	9.03 2.58
0.16								
1.1 13.5 5.51	1.0 12.3 5.45	0.81 11 4.65	0.75 10.9 4.11	0.54 10 3.52	0.49 9.9 3.28	9.3 2.07	8.84 1.39	6.86 1.10
0.4 8.4 3.11	0.29 8.01 2.96	7.2 2.72 2.20	7.26 2.20 1.81	6.5 1.81 1.59	6.5 1.59 1.27	6.3 1.27	6 0.68	5.46 0.50
3.8 1.72	3.78 1.27	3.6 1.18	3.54 1.13	3.3 0.92	3.3 0.84	3 0.53	2.9 0.36	2.22 0.27
1.8 0.71	1.74 0.59	1.6 0.49	1.62 0.41	1.5 0.36	1.5 0.32	1.4 0.21	1.3 0.15	1.05 0.12
0.8 0.06	0.87 0.03	0.7 0.03	0.75 0.03	0.6	0.8	0.6	0.5	0.48

TAB 2 E(t) was calculated according $E(t) = 2 \times G(t) \times (1+v)$ for isotropic materials with: $v = 0.47$ (Trosifol® Extra Stiff), $v = 0.49$ (Trosifol® Clear, Trosifol® SC Monolayer); $v = 0.48$ (SentryGlas®, SentryGlas® Xtra™). The Poisson ratio v was measured in accordance to EN ISO 527 (23°C, 30% r. H.). If numerical simulation tools (FEA) require $E(t)$ data for Trosifol® SC Multilayer, these data can be calculated using $E(t) = 2 \times G(t) \times (1+v)$ with: $v = 0.49$. This is the closest approximation available and validation tests did show that it gives conservative E modulus values.

Trosifol® Extra Stiff and Trosifol® PVB combinations – Shear Relaxation Modulus G(t)/MPa

Combination	Temperature	Load duration								
		1 sec	3 sec	5 sec	10 sec	30 sec	1 min	5 min	10 min	
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.38 mm (15 mil) Trosifol® Extra Stiff 0.76 mm (30 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	370 220 98 23 4.3 1.5 0.76 0.62 0.51 0.41	330 180 65 12 2.4 1.1 0.69 0.57 0.44 0.33	310 160 51 8.4 1.9 0.99 0.67 0.54 0.41 0.29	280 130 36 5.5 1.5 0.88 0.63 0.50 0.36 0.24	240 92 19 2.9 1.1 0.77 0.58 0.44 0.29 0.17	210 71 12 2.1 0.95 0.73 0.55 0.45 0.24 0.13	140 33 4.5 1.2 0.77 0.65 0.45 0.45 0.28 0.14	120 22 3.0 1.0 0.77 0.61 0.45 0.41 0.23 0.10
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.38 mm (15 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	330 200 89 21 3.7 1.4 0.71 0.58 0.48 0.37	290 160 57 10 2.1 1.0 0.65 0.53 0.41 0.30	280 140 45 6.9 1.7 0.92 0.62 0.51 0.38 0.27	250 120 31 4.4 1.3 0.82 0.59 0.47 0.34 0.22	210 82 16 2.4 1.0 0.72 0.54 0.41 0.27 0.16	190 62 10 1.8 0.88 0.68 0.51 0.42 0.22 0.12	130 27 10 1.1 0.72 0.60 0.51 0.42 0.26 0.13	100 18 2.4 0.93 0.68 0.57 0.42 0.38 0.21 0.093
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.76 mm (30 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	290 110 35 6.7 1.9 1.1 0.66 0.55 0.43 0.32	260 77 18 3.5 1.3 0.86 0.61 0.50 0.37 0.25	240 63 13 2.7 1.2 0.80 0.59 0.47 0.33 0.22	210 47 8.6 2.0 1.0 0.73 0.55 0.43 0.29 0.17	170 27 4.4 1.4 0.83 0.66 0.50 0.36 0.21 0.11	150 17 3.0 1.1 0.75 0.63 0.46 0.32 0.17 0.079	93 6.3 1.5 0.83 0.64 0.55 0.46 0.37 0.21 0.16	73 4.2 1.2 0.75 0.61 0.52 0.37 0.32 0.21 0.16

Trosifol® Extra Stiff and Trosifol® PVB combinations – Young Relaxation Modulus E(t)/MPa

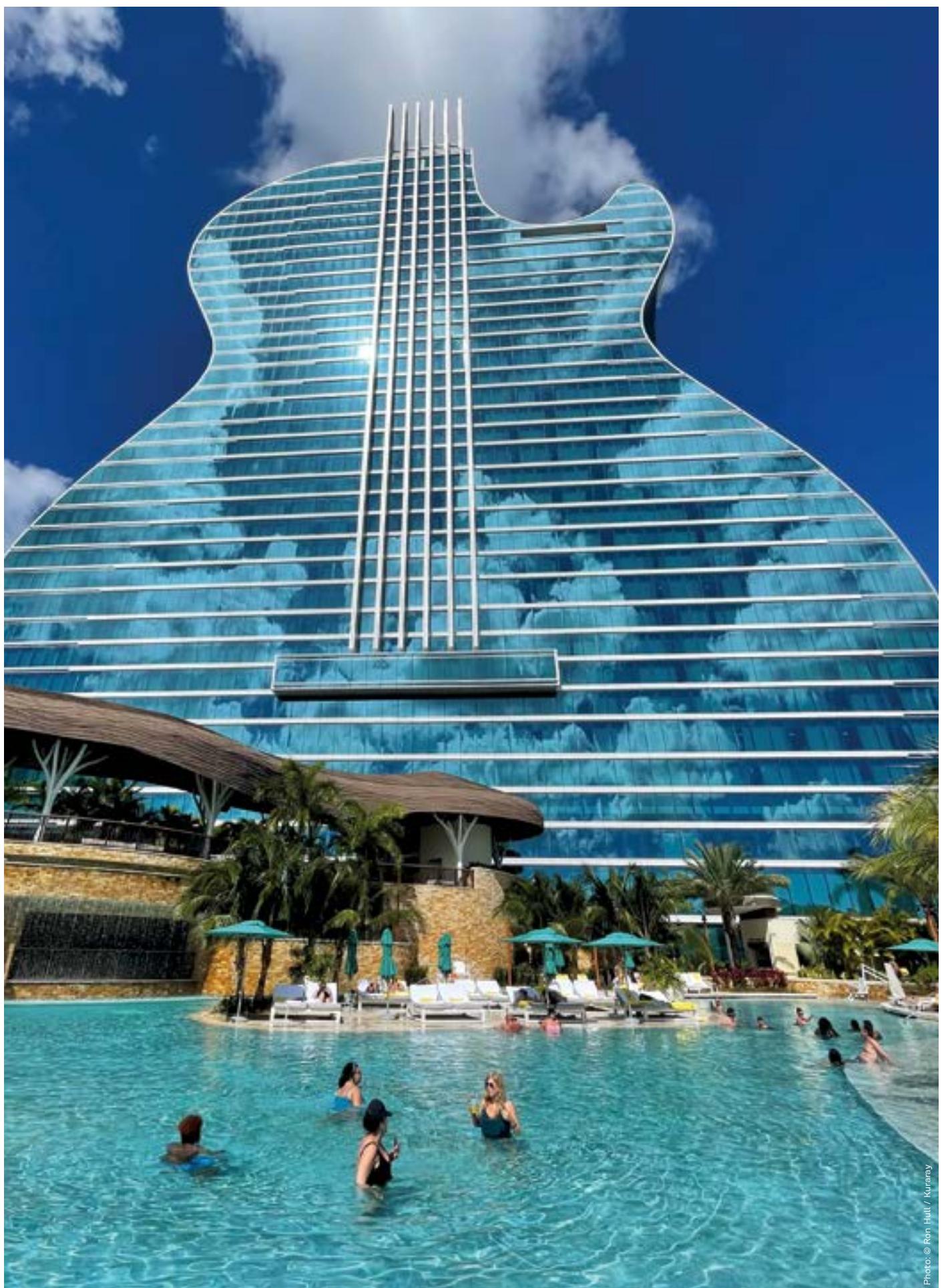
Combination	Temperature	Load duration								
		1 sec	3 sec	5 sec	10 sec	30 sec	1 min	5 min	10 min	
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.38 mm (15 mil) Trosifol® Extra Stiff 0.76 mm (30 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	1100 660 290 69 13 4.4 2.2 1.8 1.5 1.2	970 520 190 34 7.1 3.2 2.0 1.7 1.3 0.97	910 460 150 25 5.6 2.9 2.0 1.6 1.2 0.86	830 390 110 16 4.3 2.6 1.9 1.7 1.1 0.72	700 270 56 8.6 3.2 2.3 1.7 1.3 0.84 0.51	610 210 36 6.2 2.8 2.1 1.6 1.2 0.70 0.39	420 96 13 3.5 2.3 1.9 1.3 0.82 0.40 0.30	350 64 9.0 3.0 2.1 1.8 1.2 0.68 0.40 0.30
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.38 mm (15 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	970 590 260 60 11 4.0 2.1 1.7 1.4 1.1	860 480 170 29 6.2 3.0 1.9 1.6 1.2 0.89	810 420 130 20 5.0 2.7 2.0 1.6 1.1 0.79	740 350 91 13 3.9 2.4 1.9 1.7 1.1 0.66	620 240 46 7.1 3.0 2.6 2.1 1.6 0.78 0.46	540 180 29 5.3 2.6 2.1 1.8 1.2 0.65 0.35	370 79 10 7.1 3.2 2.1 1.8 1.2 0.76 0.37	300 52 7.1 2.7 2.0 1.7 1.1 0.63 0.37 0.27
	Trosifol® Extra Stiff 0.76 mm (30 mil) Trosifol® PVB 0.76 mm (30 mil)	10°C (50°F) 20°C (68°F) 25°C (77°F) 30°C (86°F) 35°C (95°F) 40°C (104°F) 50°C (122°F) 60°C (140°F) 70°C (158°F) 80°C (176°F)	860 320 100 20 5.7 3.1 1.9 1.6 1.3 0.95	750 230 54 10 4.0 2.5 1.8 1.5 1.1 0.73	700 190 39 7.9 3.4 2.4 1.7 1.4 0.98 0.63	620 140 25 5.8 2.9 2.2 1.6 1.3 0.84 	500 78 13 4.0 2.4 1.9 1.5 1.1 0.62 	430 51 8.8 3.3 2.2 1.8 1.4 1.1 0.61 	270 19 12 4.5 3.7 	210 12 3.7 2.2 1.8 1.5 1.1 0.95 0.48 0.23

30 min	1 hour	6 hours	12 hours	1 day	2 days	5 days	1 week	3 weeks	1 month	1 year	10 years	50 years
81	61	23	15	10	6.4	3.7	3.1	1.7	1.5	0.82	0.66	0.58
11	7.0	2.5	1.8	1.4	1.2	0.97	0.92	0.80	0.77	0.63	0.52	0.42
1.8	1.4	0.93	0.84	0.78	0.73	0.68	0.67	0.62	0.60	0.46	0.31	0.19
0.86	0.79	0.68	0.64	0.61	0.58	0.53	0.51	0.45	0.43	0.25	0.11	
0.67	0.64	0.55	0.51	0.47	0.43	0.36	0.34	0.26	0.24	0.09		
0.56	0.52	0.41	0.36	0.32	0.27	0.20	0.18	0.12	0.11			
0.33	0.28	0.16	0.12	0.093								
0.16	0.12											
68	50	17	11	7.0	4.5	2.7	2.3	1.5	1.3	0.78	0.64	0.56
8.3	5.2	2.0	1.5	1.2	1.0	0.86	0.82	0.72	0.70	0.58	0.46	0.37
1.5	1.2	0.83	0.76	0.71	0.67	0.63	0.61	0.56	0.55	0.41	0.27	0.17
0.78	0.73	0.62	0.59	0.57	0.53	0.49	0.47	0.41	0.39	0.22	0.094	
0.62	0.59	0.50	0.47	0.43	0.39	0.33	0.31	0.24	0.22	0.081		
0.52	0.49	0.38	0.33	0.29	0.25	0.19	0.17	0.11	0.096			
0.31	0.26	0.15	0.11	0.083								
0.15	0.11											
45	32	11	6.8	4.6	3.1	2.0	1.8	1.3	1.2	0.74	0.61	0.53
2.3	1.8	1.0	0.91	0.82	0.75	0.68	0.66	0.61	0.60	0.47	0.33	0.22
1.0	0.86	0.68	0.65	0.61	0.58	0.54	0.52	0.47	0.45	0.29	0.14	0.068
0.67	0.64	0.55	0.52	0.49	0.45	0.39	0.37	0.30	0.28	0.12		
0.56	0.53	0.43	0.39	0.35	0.30	0.24	0.22	0.15	0.13			
0.46	0.42	0.30	0.26	0.21	0.17	0.12	0.10					
0.25	0.20	0.098	0.070									
0.10	0.075											

TAB 3 •

30 min	1 hour	6 hours	12 hours	1 day	2 days	5 days	1 week	3 weeks	1 month	1 year	10 years	50 years
240	180	68	44	29	19	11	9.1	4.9	4.3	2.4	1.9	1.7
32	21	7.3	5.4	4.2	3.5	2.9	2.7	2.3	2.3	1.9	1.5	1.2
5.4	4.2	2.7	2.5	2.3	2.2	2.0	2.0	1.8	1.8	1.4	0.90	0.57
2.5	2.3	2.0	1.9	1.8	1.7	1.6	1.5	1.3	1.3	0.74	0.33	
2.0	1.9	1.6	1.5	1.4	1.2	1.1	1.00	0.77	0.71	0.28		
1.6	1.5	1.2	1.1	0.93	0.78	0.60	0.54	0.36	0.31			
0.98	0.83	0.47	0.36	0.27								
0.47	0.36											
200	150	51	32	21	13	7.8	6.7	4.3	3.9	2.3	1.9	1.7
25	15	5.7	4.4	3.6	3.0	2.5	2.4	2.1	2.1	1.7	1.4	1.1
4.5	3.6	2.4	2.2	2.1	2.0	1.8	1.8	1.7	1.6	1.2	0.78	0.49
2.3	2.1	1.8	1.7	1.7	1.6	1.4	1.4	1.2	1.1	0.65	0.28	
1.8	1.7	1.5	1.4	1.3	1.1	0.98	0.91	0.70	0.65	0.24		
1.5	1.4	1.1	0.98	0.86	0.72	0.55	0.49	0.32	0.28			
0.90	0.77	0.43	0.33	0.24								
0.44	0.33											
130	95	31	20	14	9.2	5.9	5.2	3.7	3.4	2.2	1.8	1.6
6.9	5.2	3.0	2.7	2.4	2.2	2.0	1.9	1.8	1.7	1.4	0.97	0.65
2.8	2.5	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	0.85	0.41	0.20
2.0	1.9	1.6	1.5	1.4	1.3	1.2	1.1	0.88	0.82	0.35		
1.7	1.6	1.3	1.1	1.0	0.89	0.70	0.64	0.43	0.39			
1.4	1.2	0.89	0.75	0.63	0.49	0.34	0.30					
0.73	0.59	0.29	0.21									
0.31	0.22											

TAB 4 •



➤ Seminole Hard Rock Hotel & Casino, Hollywood, Florida

Contact



FOR FURTHER INFORMATION

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You can find further information on our Trosifol® and SentryGlas® products at www.trosifol.com.

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