

TEST REPORT N°2014B VEC 20171-1a

Including 13 pages + 1 annex
Page 1/13

Mons, February 28th, 2014

REQUESTED BY : **AGC Glass Europe SA**
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REFERENCE OF THE REQUEST : Order n°450489024

CONCERNED MANUFACTURER : **AGC Glass Europe SA**
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1348 LOUVAIN-LA-NEUVE
BELGIUM


NUMBER OF SAMPLES AND IDENTIFICATION : **Lacobel T – DC993**

PURPOSE OF THE REQUESTED : Tests according to EOTA – ETAG 002
Mechanical Performances *

SAMPLES RECEIVED ON : 04/11/2013

TESTING DATE : From 07/11/2013

REMARKS : * Test under BELAC accreditation

 Notified body (Id.N°1174)
according to Regulation (EU) No 305/2011 - Construction products

TECHNICAL REPORT
ADHESION PERFORMANCES ACCORDING TO ETAG 002
GUIDELINE

SAMPLES

Samples were prepared by Dow Corning on 20/09/2013 (see annex 1)

Lacobel T Light Blue+ DC 993+ Lacobel T Royal Blue

Batch A/B : 0007488190/0007093867

Number of samples prepared : 100

RESULTS

The tests were conducted in compliance with the methods described in the "Guideline for European Technical Approval for Structural Sealant Glazing System (SSGS)" ETAG n° 002.

Définitions :

K_x = Stiffness of the sample at x% elongation in the initial state

$K_{x,c}$ = Stiffness of the sample at x% elongation after conditioning
 $= 100 \cdot \sigma_x / x$

$R_{u,5}$ = the characteristic breaking stress giving 75% confidence that 95% of the test result will be higher than this value
 $= X_{mean} - \tau_{\alpha\beta} \cdot S$

S = standard deviation of the serie under consideration

$X_{mean,n}$ = the average breaking stress, either under tension or shear in the initial state

$X_{mean,c}$ = the average breaking stress, either under tension or shear after conditioning

$\Delta X_{mean} = X_{mean,c} / X_{mean,n}$

Mechanical performances

5.1.4.1. INITIAL TESTS – INITIAL MECHANICAL STRENGTH

5.1.4.1.1. TENSION – RUPTURE*

a) Results for 10 samples conditioned at +23°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	603	0.12	0.32	0.45	0.54	0.62	1.39	96	100C
2	614	0.12	0.30	0.42	0.51	0.59	1.32	92	100C
3	607	0.19	0.36	0.47	0.56	0.63	1.39	97	100C
4	613	0.19	0.37	0.49	0.58	0.66	1.46	99	100C
5	598	0.12	0.32	0.45	0.54	0.62	1.38	96	100C
6	609	0.11	0.31	0.43	0.53	0.61	1.36	93	100C
7	596	0.19	0.35	0.46	0.54	0.62	1.16	73	100C
8	597	0.12	0.32	0.44	0.53	0.61	1.28	85	100C
9	603	0.19	0.35	0.46	0.55	0.62	1.37	95	100C
10	595	0.21	0.37	0.48	0.57	0.64	1.25	80	100C
Average	603	0.16	0.34	0.46	0.55	0.62	1.34	91	
Standard deviation	7	0.04	0.03	0.02	0.02	0.02	0.09	8	
Minimum	595	0.11	0.30	0.42	0.51	0.59	1.16	73	
Maximum	614	0.21	0.37	0.49	0.58	0.66	1.46	99	

(*) xC: x% cohesive

$$K_{12,5} = 3.17$$

$$R_{u,5} = 1.15$$

b) Results for 5 samples conditioned at -20°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	577	0.16	0.32	0.45	0.54	0.62	1.72	132	100C
2	598	0.19	0.37	0.48	0.57	0.65	1.39	94	100C
3	585	0.18	0.38	0.52	0.63	0.71	1.74	117	100C
4	593	0.15	0.32	0.44	0.54	0.62	1.62	122	100C
5	602	0.20	0.37	0.49	0.58	0.65	1.45	97	100C
Average	591	0.18	0.35	0.48	0.57	0.65	1.58	112	
Standard deviation	10	0.02	0.03	0.03	0.04	0.04	0.16	16	
Minimum	577	0.15	0.32	0.44	0.54	0.62	1.39	94	
Maximum	602	0.20	0.38	0.52	0.63	0.71	1.74	132	

(*) xC: x% cohesive

$$R_{u,5} = 1.19$$

$$\Delta X_{\text{mean}} = 1.18$$

c) Results for 5 samples conditioned at +80°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	590	0.14	0.32	0.44	0.54	0.62	1.06	57	100C
2	609	0.14	0.30	0.43	0.54	0.63	1.04	54	100C
3	606	0.16	0.33	0.45	0.55	0.63	1.05	56	100C
4	620	0.16	0.34	0.47	0.57	0.66	1.07	54	100C
5	593	0.15	0.33	0.45	0.55	0.64	1.01	51	100C
Average	604	0.15	0.32	0.45	0.55	0.64	1.05	54	
Standard deviation	12	0.01	0.02	0.01	0.01	0.02	0.02	2	
Minimum	590	0.14	0.30	0.43	0.54	0.62	1.01	51	
Maximum	620	0.16	0.34	0.47	0.57	0.66	1.07	57	

(*) xC: x% cohesive

$$R_{u,5} = 1.00$$

$$\Delta X_{\text{mean}} = 0.78$$

5.1.4.1.2. SHEAR – RUPTURE*

a) Results for 10 samples conditioned at +23°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	621	0.08	0.12	0.16	0.19	0.22	0.89	149	100C
2	618	0.03	0.09	0.13	0.17	0.20	0.78	165	100C
3	609	0.05	0.11	0.15	0.18	0.21	0.89	157	100C
4	604	0.05	0.11	0.15	0.18	0.21	0.91	167	100C
5	625	0.04	0.08	0.12	0.14	0.17	0.92	141	100C
6	627	0.06	0.12	0.16	0.19	0.22	0.84	131	100C
7	623	0.07	0.12	0.16	0.19	0.22	0.88	153	100C
8	606	0.07	0.13	0.17	0.21	0.24	0.82	134	100C
9	615	0.07	0.13	0.16	0.20	0.23	0.94	140	100C
10	620	0.06	0.12	0.16	0.20	0.23	0.94	139	100C
Average	617	0.06	0.11	0.15	0.19	0.22	0.88	148	
Standard deviation	8	0.02	0.02	0.02	0.02	0.02	0.05	12	
Minimum	604	0.03	0.08	0.12	0.14	0.17	0.78	131	
Maximum	627	0.08	0.13	0.17	0.21	0.24	0.94	167	

(*) xC: x% cohesive

Ru,5 = 0.78

b) Results for 5 samples conditioned at -20°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	622	0.09	0.15	0.19	0.22	0.25	1.21	169	100C
2	611	0.08	0.14	0.18	0.21	0.24	1.18	195	100C
3	622	0.06	0.12	0.17	0.20	0.23	1.10	173	100C
4	608	0.06	0.13	0.17	0.21	0.24	1.15	176	100C
5	606	0.05	0.12	0.16	0.20	0.23	1.06	157	100C
Average	614	0.07	0.13	0.17	0.21	0.24	1.14	174	
Standard deviation	8	0.02	0.01	0.01	0.01	0.01	0.06	14	
Minimum	606	0.05	0.12	0.16	0.20	0.23	1.06	157	
Maximum	622	0.09	0.15	0.19	0.22	0.25	1.21	195	

(*) xC: x% cohesive

$$R_{u,5} = 0.99$$

$$\Delta X_{\text{mean}} = 1.30$$

c) Results for 5 samples conditioned at +80°C

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	623	0.04	0.10	0.15	0.19	0.22	0.75	125	100C
2	611	0.05	0.11	0.15	0.19	0.22	0.67	111	100C
3	617	0.05	0.10	0.15	0.18	0.22	0.68	112	100C
4	618	0.03	0.07	0.12	0.16	0.19	0.69	121	100C
5	608	0.07	0.12	0.16	0.20	0.23	0.69	117	100C
Average	615	0.05	0.10	0.15	0.18	0.22	0.70	117	
Standard deviation	6	0.01	0.02	0.02	0.02	0.02	0.03	6	
Minimum	608	0.03	0.07	0.12	0.16	0.19	0.67	111	
Maximum	623	0.07	0.12	0.16	0.20	0.23	0.75	125	

(*) xC: x% cohesive

$$R_{u,5} = 0.63$$

$$\Delta X_{\text{mean}} = 0.80$$

5.1.4.2. RESIDUAL MECHANICAL STRENGTH AFTER ARTIFICIAL AGEING

5.1.4.2.1 IMMERSION IN WATER AT HIGH TEMPERATURE WITH SOLAR RADIATION*

a) *Conditioning :*

- Duration : 2 x 21 days
- Water temperature : 45°C ± 0.1°C
- Conductivity of the water : 18 µs

b) *Results of the traction test after the artificial ageing :*

Lacobel T Light Blue

After 21 days :

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	622	0.10	0.23	0.31	0.38	0.44	1.19	131	100C
2	605	0.10	0.22	0.31	0.37	0.42	1.12	127	100C
3	627	0.11	0.21	0.29	0.35	0.40	1.09	128	100C
4	572	0.15	0.26	0.33	0.40	0.45	1.23	134	100C
5	608	0.08	0.18	0.27	0.34	0.40	1.13	135	100C
Average	607	0.11	0.22	0.30	0.37	0.42	1.15	131	
Standard deviation	22	0.03	0.03	0.02	0.02	0.02	0.06	3	
Minimum	572	0.08	0.18	0.27	0.34	0.40	1.09	127	
Maximum	627	0.15	0.26	0.33	0.40	0.45	1.23	135	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.86$$

After 42 days :

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	593	0.10	0.22	0.33	0.38	0.43	1.13	129	100C
2	583	0.14	0.24	0.31	0.37	0.42	1.10	192	100C
3	578	0.17	0.28	0.35	0.41	0.46	1.18	137	100C
4	599	0.12	0.23	0.32	0.38	0.44	1.19	133	100C
5	597	0.12	0.25	0.33	0.38	0.43	1.12	137	100C
Average	590	0.13	0.24	0.33	0.38	0.44	1.14	145	
Standard deviation	9	0.03	0.02	0.01	0.02	0.02	0.04	26	
Minimum	578	0.10	0.22	0.31	0.37	0.42	1.10	129	
Maximum	599	0.17	0.28	0.35	0.41	0.46	1.19	192	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.85$$

Lacobel T Royal Blue

After 21 days :

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	608	0.12	0.22	0.30	0.37	0.42	1.10	127	100C
2	608	0.12	0.23	0.31	0.37	0.43	1.20	138	100C
3	591	0.10	0.21	0.30	0.37	0.43	1.21	138	100C
4	606	0.12	0.22	0.31	0.37	0.43	1.13	124	100C
5	629	0.12	0.25	0.33	0.40	0.45	1.17	142	100C
Average	609	0.12	0.23	0.31	0.38	0.43	1.16	134	
Standard deviation	13	0.01	0.02	0.01	0.01	0.01	0.05	8	
Minimum	591	0.10	0.21	0.30	0.37	0.42	1.10	124	
Maximum	629	0.12	0.25	0.33	0.40	0.45	1.21	142	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.87$$

After 42 days :

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	593	0.11	0.22	0.30	0.36	0.41	1.09	122	100C
2	589	0.17	0.26	0.33	0.38	0.43	1.17	134	100C
3	570	0.15	0.25	0.31	0.37	0.42	1.14	137	100C
4	603	0.10	0.21	0.30	0.36	0.42	1.18	136	100C
5	583	0.16	0.25	0.32	0.37	0.42	1.15	148	100C
Average	588	0.14	0.24	0.31	0.37	0.42	1.15	135	
Standard deviation	12	0.03	0.02	0.01	0.01	0.01	0.04	9	
Minimum	570	0.10	0.21	0.30	0.36	0.41	1.09	122	
Maximum	603	0.17	0.26	0.33	0.38	0.43	1.18	148	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.86$$

5.1.4.2.2 HUMIDITY AND NaCl ATMOSPHERE*

a) *Conditioning :*

- Duration : 480 hours
- NaCl concentration : 48.4 g/l
- pH : 6.5

b) *Results of the traction test after the artificial ageing :*

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	591	0.12	0.28	0.38	0.46	0.53	1.29	100	100C
2	609	0.14	0.30	0.40	0.48	0.55	1.29	100	100C
3	601	0.12	0.28	0.38	0.46	0.53	1.32	107	100C
4	604	0.14	0.30	0.40	0.48	0.55	1.34	103	100C
5	599	0.13	0.29	0.39	0.47	0.54	1.25	94	100C
6	594	0.15	0.28	0.38	0.46	0.53	1.18	89	100C
7	595	0.13	0.29	0.40	0.48	0.55	1.37	106	100C
8	601	0.13	0.30	0.40	0.48	0.55	1.35	107	100C
9	591	0.13	0.29	0.39	0.47	0.54	1.33	102	100C
10	599	0.12	0.29	0.40	0.48	0.55	1.29	96	100C
Average	599	0.13	0.29	0.39	0.47	0.54	1.30	100	
Standard deviation	6	0.01	0.01	0.01	0.01	0.01	0.06	6	
Minimum	591	0.12	0.28	0.38	0.46	0.53	1.18	89	
Maximum	609	0.15	0.30	0.40	0.48	0.55	1.37	107	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.97$$

5.1.4.2.3 HUMIDITY AND SO₂ ATMOSPHERE*

a) *Conditioning :*

- Duration : 20 cycles
- 0.2l SO₂

b) *Results of the traction test after the artificial ageing :*

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	595	0.14	0.28	0.38	0.45	0.52	1.28	112	100C
2	609	0.12	0.26	0.36	0.43	0.50	1.30	118	100C
3	605	0.10	0.25	0.35	0.43	0.49	1.29	114	100C
4	595	0.13	0.28	0.38	0.45	0.52	1.22	97	100C
5	592	0.10	0.25	0.35	0.43	0.49	1.29	114	100C
6	608	0.12	0.27	0.36	0.44	0.51	1.27	109	100C
7	593	0.15	0.31	0.40	0.47	0.54	1.19	93	100C
8	610	0.14	0.29	0.39	0.47	0.54	1.36	113	100C
9	604	0.16	0.30	0.40	0.48	0.55	1.25	97	100C
10	602	0.15	0.31	0.40	0.48	0.54	1.22	93	100C
Average	601	0.13	0.28	0.38	0.45	0.52	1.27	106	
Standard deviation	7	0.02	0.02	0.02	0.02	0.02	0.05	10	
Minimum	592	0.10	0.25	0.35	0.43	0.49	1.19	93	
Maximum	610	0.16	0.31	0.40	0.48	0.55	1.36	118	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.95$$

5.1.4.2.4 Facade cleaning product*

a) *Conditioning :*

- Duration : 21 days
- Temperature : 45.0°C ± 0.1C
- Cleaning product : Extran (5% on water)

b) *Results of the traction test after the artificial ageing :*

Sample number	Section (mm ²)	Limited to 5% stretch. (N/mm ²)	Limited to 10 % stretch. (N/mm ²)	Limited to 15% stretch. (N/mm ²)	Limited to 20% stretch. (N/mm ²)	Limited to 25% stretch. (N/mm ²)	Limit of breakage (N/mm ²)	Stretch on breaking (%)	Type of breakage (*)
1	617	0.11	0.26	0.34	0.41	0.47	1.42	152	100C
2	591	0.08	0.24	0.33	0.40	0.45	1.27	127	100C
3	627	0.07	0.24	0.34	0.42	0.48	1.28	115	100C
4	608	0.13	0.25	0.34	0.40	0.46	1.20	117	100C
5	589	0.08	0.24	0.33	0.39	0.45	1.24	125	100C
6	602	0.05	0.14	0.24	0.34	0.41	1.27	130	100C
7	603	0.06	0.17	0.28	0.36	0.43	1.39	141	100C
8	591	0.03	0.09	0.18	0.27	0.35	1.22	129	100C
9	614	0.09	0.22	0.31	0.38	0.44	1.28	145	100C
10	600	0.08	0.23	0.32	0.39	0.45	1.29	126	100C
Average	604	0.08	0.21	0.30	0.38	0.44	1.29	131	
Standard deviation	13	0.03	0.06	0.05	0.04	0.04	0.07	12	
Minimum	589	0.03	0.09	0.18	0.27	0.35	1.20	115	
Maximum	627	0.13	0.26	0.34	0.42	0.48	1.42	152	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.96$$

SUMMARY

ETAG GUIDELINE TEST NUMBER	TEST	TEST CONDI- TIONS	CRITERIA				
			X _{mean} Mpa	ΔX_{mean} ≥ 0.75	K _{12.5} For $0 \leq x\% \leq 12.5$ $0.5 \leq K_{x,c}/K_x \leq 1.10$	R _{u,5}	TYPE OF BREAKAGE ($\geq 90\% C$)
5.1.4.1.1	Tension	+23°C	1.34	-	$\sigma_{12.5} = 0.40$ $K_{12.5} = 3.17$	1.15	100C
		-20°C	1.58	1.18		1.19	100C
		+80°C	1.05	0.78		1.00	100C
5.1.4.1.2	Shear	+23°C	0.88	-		0.78	100C
		-20°C	1.14	1.30		0.99	100C
		+80°C	0.70	0.80		0.63	100C
5.1.4.2.1	H ₂ O at 45°C + UV Lacobel T Light Blue	500 h	1.15	0.86			100C
		1000 h	1.14	0.85	$\sigma_{12.5,c} = 0.29$ $K_{12.5,c} = 2.29$ $K_{12.5,c}/K_{12.5} = 0.72$		100C
5.1.4.2.1	H ₂ O at 45°C + UV Lacobel T Royal Blue	500 h	1.16	0.87			100C
		1000 h	1.15	0.86	$\sigma_{12.5,c} = 0.28$ $K_{12.5,c} = 2.20$ $K_{12.5,c}/K_{12.5} = 0.69$		100C
5.1.4.2.2	H ₂ O + NaCl	480h	1.30	0.97			100C
5.1.4.2.3	H ₂ O + SO ₂	20 cycles	1.27	0.95			100C
5.1.4.2.4	Cleaning product	21 days	1.29	0.96			100C

*x*C = *x*% cohesive

D. LIBERT
Head of Department

Glazing and Components - INISMa