

TEST REPORT N°2014B VEC 20171-2a

Including 13 pages + 1 annex
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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**
4 avenue Jean Monnet
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 Deep Black+ DC 993+ Planibel Clear

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	596	0.15	0.33	0.45	0.55	0.62	1.47	109	100C
2	609	0.20	0.36	0.46	0.54	0.62	1.27	87	100C
3	607	0.19	0.34	0.45	0.53	0.60	1.11	74	100C
4	595	0.04	0.15	0.28	0.41	0.50	1.18	89	100C
5	603	0.19	0.35	0.46	0.55	0.62	1.30	87	100C
6	602	0.09	0.29	0.42	0.51	0.59	1.28	88	100C
7	608	0.18	0.35	0.46	0.55	0.63	1.41	98	100C
8	612	0.22	0.39	0.50	0.59	0.67	1.52	107	100C
9	609	0.19	0.35	0.46	0.54	0.61	1.28	90	100C
10	614	0.15	0.32	0.43	0.52	0.59	1.25	86	100C
Average	606	0.16	0.32	0.44	0.53	0.61	1.31	92	
Standard deviation	6	0.06	0.07	0.06	0.05	0.04	0.13	10	
Minimum	595	0.04	0.15	0.28	0.41	0.50	1.11	74	
Maximum	614	0.22	0.39	0.50	0.59	0.67	1.52	109	

(*) xC: x% cohesive

K_{12,5} = 3.04

Ru,5 = 1.04

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	589	0.19	0.37	0.48	0.57	0.64	1.58	118	100C
2	604	0.21	0.38	0.49	0.58	0.65	1.56	114	100C
3	593	0.16	0.37	0.49	0.57	0.65	1.74	137	100C
4	611	0.20	0.37	0.49	0.57	0.65	1.83	150	100C
5	609	0.17	0.36	0.48	0.56	0.64	1.48	104	100C
Average	601	0.19	0.37	0.49	0.57	0.65	1.64	125	
Standard deviation	10	0.02	0.01	0.01	0.01	0.01	0.14	18	
Minimum	589	0.16	0.36	0.48	0.56	0.64	1.48	104	
Maximum	611	0.21	0.38	0.49	0.58	0.65	1.83	150	

(*) xC: x% cohesive

$$R_{u,5} = 1.30$$

$$\Delta X_{\text{mean}} = 1.25$$

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	598	0.17	0.33	0.45	0.54	0.63	1.06	57	100C
2	Bad sample								
3	601	0.16	0.32	0.44	0.53	0.62	0.98	52	100C
4	595	0.14	0.32	0.45	0.54	0.63	0.91	47	100C
5	604	0.16	0.33	0.45	0.54	0.63	0.96	49	100C
Average	599	0.16	0.33	0.45	0.54	0.63	0.98	51	
Standard deviation	4	0.01	0.01	0.01	0.01	0.01	0.06	4	
Minimum	595	0.14	0.32	0.44	0.53	0.62	0.91	47	
Maximum	604	0.17	0.33	0.45	0.54	0.63	1.06	57	

(*) xC: x% cohesive

$$R_{u,5} = 0.83$$

$$\Delta X_{\text{mean}} = 0.75$$

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	581	0.07	0.12	0.16	0.19	0.22	0.87	140	100C
2	610	0.06	0.11	0.15	0.18	0.21	0.84	147	100C
3	607	0.03	0.08	0.13	0.16	0.19	0.82	134	100C
4	618	0.06	0.11	0.15	0.18	0.21	0.92	164	100C
5	594	0.02	0.06	0.12	0.16	0.19	0.82	144	100C
6	606	0.05	0.11	0.15	0.18	0.21	0.90	155	100C
7	585	0.04	0.10	0.14	0.18	0.21	0.92	150	100C
8	605	0.04	0.09	0.14	0.17	0.20	0.99	156	100C
9	621	0.03	0.10	0.14	0.18	0.21	0.93	168	100C
10	617	0.05	0.11	0.15	0.18	0.21	0.92	144	100C
Average	604	0.05	0.10	0.14	0.18	0.21	0.89	150	
Standard deviation	14	0.02	0.02	0.01	0.01	0.01	0.05	11	
Minimum	581	0.02	0.06	0.12	0.16	0.19	0.82	134	
Maximum	621	0.07	0.12	0.16	0.19	0.22	0.99	168	

(*) xC: x% cohesive

Ru,5 = 0.79

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	599	0.08	0.14	0.18	0.21	0.24	1.03	152	100C
2	604	0.04	0.10	0.15	0.18	0.21	1.12	178	100C
3	609	0.04	0.11	0.16	0.19	0.22	1.16	178	100C
4	597	0.07	0.14	0.18	0.21	0.24	1.02	157	100C
5	604	0.07	0.12	0.16	0.20	0.23	1.11	170	100C
Average	602	0.06	0.12	0.17	0.20	0.23	1.09	167	
Standard deviation	5	0.02	0.02	0.01	0.01	0.01	0.06	12	
Minimum	597	0.04	0.10	0.15	0.18	0.21	1.02	152	
Maximum	609	0.08	0.14	0.18	0.21	0.24	1.16	178	

(*) xC: x% cohesive

$$R_{u,5} = 0.94$$

$$\Delta X_{\text{mean}} = 1.22$$

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	618	0.06	0.11	0.15	0.19	0.22	0.71	125	100C
2	593	0.02	0.07	0.11	0.15	0.18	0.72	122	100C
3	596	0.05	0.11	0.15	0.18	0.21	0.66	119	100C
4	618	0.06	0.11	0.15	0.19	0.22	0.61	105	100C
5	610	0.03	0.07	0.12	0.16	0.19	0.67	124	100C
Average	607	0.04	0.09	0.14	0.17	0.20	0.67	119	
Standard deviation	12	0.02	0.02	0.02	0.02	0.02	0.04	8	
Minimum	593	0.02	0.07	0.11	0.15	0.18	0.61	105	
Maximum	618	0.06	0.11	0.15	0.19	0.22	0.72	125	

(*) xC: x% cohesive

$$R_{u,5} = 0.57$$

$$\Delta X_{\text{mean}} = 0.75$$

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 Deep Black

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	594	0.16	0.27	0.34	0.40	0.45	1.15	150	100C
2	587	0.13	0.25	0.33	0.39	0.45	1.21	134	100C
3	575	0.10	0.23	0.32	0.38	0.44	1.29	144	100C
4	597	0.16	0.27	0.34	0.40	0.45	0.98	132	100C
5	604	0.16	0.27	0.34	0.40	0.45	1.19	138	100C
Average	591	0.14	0.26	0.33	0.39	0.45	1.16	139	
Standard deviation	11	0.03	0.02	0.01	0.01	0.00	0.11	7	
Minimum	575	0.10	0.23	0.32	0.38	0.44	0.98	132	
Maximum	604	0.16	0.27	0.34	0.40	0.45	1.29	150	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.89$$

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	587	0.18	0.28	0.35	0.41	0.47	1.22	129	100C
2	603	0.17	0.29	0.37	0.43	0.49	1.32	139	100C
3	595	0.17	0.28	0.35	0.41	0.46	1.22	131	100C
4	595	0.16	0.27	0.35	0.41	0.46	1.16	136	100C
5	608	0.17	0.28	0.36	0.42	0.47	1.00	90	100C
Average	598	0.17	0.28	0.36	0.42	0.47	1.18	125	
Standard deviation	8	0.01	0.01	0.01	0.01	0.01	0.12	20	
Minimum	587	0.16	0.27	0.35	0.41	0.46	1.00	90	
Maximum	608	0.18	0.29	0.37	0.43	0.49	1.32	139	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.90$$

Planibel Clear

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	594	0.15	0.26	0.33	0.39	0.44	1.32	157	100C
2	612	0.11	0.24	0.32	0.38	0.43	1.14	123	100C
3	616	0.14	0.25	0.33	0.39	0.44	1.04	126	100C
4	600	0.07	0.18	0.27	0.35	0.40	1.18	135	100C
5	606	0.16	0.26	0.33	0.39	0.44	1.20	138	100C
Average	606	0.13	0.24	0.32	0.38	0.43	1.18	136	
Standard deviation	9	0.04	0.03	0.03	0.02	0.02	0.10	13	
Minimum	594	0.07	0.18	0.27	0.35	0.40	1.04	123	
Maximum	616	0.16	0.26	0.33	0.39	0.44	1.32	157	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.90$$

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	596	0.15	0.28	0.36	0.42	0.47	1.21	130	100C
2	587	0.17	0.28	0.35	0.40	0.45	1.18	131	100C
3	572	0.18	0.30	0.37	0.42	0.47	1.16	121	100C
4	601	0.15	0.26	0.33	0.40	0.45	1.19	132	100C
5	589	0.18	0.29	0.36	0.41	0.46	1.20	131	100C
Average	589	0.17	0.28	0.35	0.41	0.46	1.19	129	
Standard deviation	11	0.02	0.01	0.02	0.01	0.01	0.02	5	
Minimum	572	0.15	0.26	0.33	0.40	0.45	1.16	121	
Maximum	601	0.18	0.30	0.37	0.42	0.47	1.21	132	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.91$$

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	594	0.12	0.27	0.38	0.46	0.54	1.25	92	100C
2	609	0.15	0.31	0.41	0.49	0.56	1.29	97	100C
3	591	0.12	0.28	0.39	0.48	0.55	1.39	110	100C
4	617	0.17	0.34	0.45	0.53	0.60	1.30	88	100C
5	592	0.14	0.30	0.40	0.48	0.54	1.31	105	100C
6	616	0.12	0.25	0.37	0.45	0.52	1.48	129	100C
7	614	0.10	0.26	0.38	0.47	0.54	1.14	84	100C
8	603	0.14	0.29	0.41	0.49	0.56	1.30	95	100C
9	600	0.11	0.28	0.40	0.49	0.56	1.25	91	100C
10	595	0.15	0.32	0.42	0.50	0.57	1.36	108	100C
Average	603	0.13	0.29	0.40	0.48	0.55	1.31	100	
Standard deviation	10	0.02	0.03	0.02	0.02	0.02	0.09	13	
Minimum	591	0.10	0.25	0.37	0.45	0.52	1.14	84	
Maximum	617	0.17	0.34	0.45	0.53	0.60	1.48	129	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 1.00$$

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	597	0.12	0.26	0.36	0.44	0.51	1.15	95	100C
2	606	0.13	0.26	0.37	0.44	0.51	1.20	103	100C
3	601	0.14	0.29	0.38	0.46	0.53	1.29	110	100C
4	598	0.16	0.30	0.40	0.47	0.54	1.26	105	100C
5	603	0.14	0.28	0.38	0.46	0.53	1.27	103	100C
6	600	0.14	0.29	0.38	0.46	0.52	1.34	120	100C
7	605	0.11	0.25	0.36	0.44	0.50	1.17	99	100C
8	600	0.16	0.30	0.39	0.47	0.53	1.26	109	100C
9	616	0.15	0.28	0.38	0.46	0.53	1.25	104	100C
10	588	0.16	0.29	0.38	0.46	0.52	1.26	107	100C
Average	601	0.14	0.28	0.38	0.46	0.52	1.25	105	
Standard deviation	7	0.02	0.02	0.01	0.01	0.01	0.06	7	
Minimum	588	0.11	0.25	0.36	0.44	0.50	1.15	95	
Maximum	616	0.16	0.30	0.40	0.47	0.54	1.34	120	

(*) 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	605	0.10	0.27	0.36	0.43	0.49	1.33	128	100C
2	619	0.09	0.22	0.32	0.40	0.46	1.36	145	100C
3	606	0.10	0.24	0.34	0.41	0.47	1.29	127	100C
4	595	0.08	0.24	0.34	0.40	0.46	1.29	129	100C
5	599	0.14	0.28	0.36	0.43	0.48	1.25	118	100C
6	599	0.09	0.26	0.35	0.42	0.48	1.42	143	100C
7	589	0.09	0.25	0.35	0.41	0.47	1.20	139	100C
8	599	0.08	0.24	0.33	0.40	0.46	1.41	150	100C
9	608	0.11	0.24	0.33	0.40	0.46	1.08	100	100C
10	608	0.10	0.26	0.36	0.42	0.48	1.28	120	100C
Average	603	0.10	0.25	0.34	0.41	0.47	1.29	130	
Standard deviation	8	0.02	0.02	0.01	0.01	0.01	0.10	15	
Minimum	589	0.08	0.22	0.32	0.40	0.46	1.08	100	
Maximum	619	0.14	0.28	0.36	0.43	0.49	1.42	150	

(*) xC: x% cohesive

$$\Delta X_{\text{mean}} = 0.98$$

SUMMARY

ETAG GUIDELINE TEST NUMBER	TEST	TEST CONDI- TIONS	CRITERIA				
			X _{mean} Mpa	ΔX_{mean} ≥ 0.75	K _{12.5} For $0 \leq x\% \leq 12.5$ $0.5 \leq K_{x,c}/K_x \leq 1.10$	Ru,5	TYPE OF BREAKAGE ($\geq 90\% C$)
5.1.4.1.1	Tension	+23°C	1.31	-	$\sigma_{12.5} = 0.38$ $K_{12.5} = 3.04$	1.04	100C
		-20°C	1.64	1.25		1.30	100C
		+80°C	0.98	0.75		0.83	100C
5.1.4.1.2	Shear	+23°C	0.89	-		0.79	100C
		-20°C	1.09	1.22		0.94	100C
		+80°C	0.67	0.75		0.57	100C
5.1.4.2.1	H ₂ O at 45°C + UV Lacobel T Deep Black	500 h	1.16	0.89			100C
		1000 h	1.18	0.90	$\sigma_{12.5,c} = 0.32$ $K_{12.5,c} = 2.54$ $K_{12.5,c}/K_{12.5} = 0.84$		100C
5.1.4.2.1	H ₂ O at 45°C + UV Planibel Clear	500 h	1.18	0.90			100C
		1000 h	1.19	0.91	$\sigma_{12.5,c} = 0.32$ $K_{12.5,c} = 2.54$ $K_{12.5,c}/K_{12.5} = 0.84$		100C
5.1.4.2.2	H ₂ O + NaCl	480h	1.31	1.00			100C
5.1.4.2.3	H ₂ O + SO ₂	20 cycles	1.25	0.95			100C
5.1.4.2.4	Cleaning product	21 days	1.29	0.98			100C

$xC = x\%$ cohesive

D. LIBERT
Head of Department

Glazing and Components - INISMa