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TEST REPORT N°2013B VEC 17227a

Including 12 pages + 1 annex
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Mons, January 24th, 2013

REQUESTED BY : **AGC Glass Europe - R&D Centre**
2 rue de l'Aurore
B-6040 Jumet
Belgium

REFERENCE OF THE REQUEST : Offer 25/09/2012

CONCERNED MANUFACTURER : **AGC GLASS EUROPE**
Chaussée de la Hulpe, 166
1170 BRUXELLES
BELGIUM

NUMBER OF SAMPLES AND IDENTIFICATION : **Lacobel T – Cool White**


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

SAMPLES RECEIVED ON : 25/10/2012

TESTING DATE : From 23/11/2012

REMARKS : * Test under BELAC accreditation

This report cancel and replace report 2013B VEC 17227

 Notified body (Id.N°1174)
**according to ART.18 of the « Construction Products Directive » CPD
89/106/EEC**

TECHNICAL REPORT
ADHESION PERFORMANCES ACCORDING TO ETAG 002
GUIDELINE

SAMPLES

Samples were prepared by Dow Corning Belgium on 12/10/2012 (see annex 1)

Lacobel T – Cool White + DC-993 + Float Glass

Batch : A : N204051205 / B : 0006928019

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	628	0.26	0.43	0.53	0.61	0.68	1.17	69	100C
2	619	0.20	0.40	0.50	0.58	0.65	1.22	79	100C
3	620	0.21	0.41	0.53	0.61	0.68	1.31	84	100C
4	637	0.22	0.41	0.50	0.59	0.65	1.22	79	100C
5	614	0.23	0.42	0.53	0.61	0.68	1.21	73	100C
6	602	0.20	0.39	0.49	0.56	0.64	1.08	65	100C
7	627	0.24	0.40	0.51	0.59	0.66	1.07	70	100C
8	631	0.25	0.42	0.50	0.57	0.64	1.09	68	100C
9	649	0.28	0.44	0.53	0.61	0.68	1.23	83	100C
10	631	0.24	0.42	0.52	0.60	0.67	1.07	62	100C
Average	626	0.23	0.41	0.51	0.59	0.66	1.17	73	
Standard deviation	13	0.03	0.02	0.02	0.02	0.02	0.08	8	
Minimum	602	0.20	0.39	0.49	0.56	0.64	1.07	62	
Maximum	649	0.28	0.44	0.53	0.61	0.68	1.31	84	

(*) xC: x% cohesive / xA: x% adhesive

Ru,5 = 1.00

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	627	0.17	0.40	0.51	0.89	0.67	1.43	119	100C
2	579	0.19	0.42	0.55	0.63	0.70	1.55	108	100C
3	617	0.21	0.42	0.54	0.62	0.69	1.62	123	100C
4	626	0.16	0.39	0.52	0.60	0.67	1.60	123	100C
5	635	0.14	0.41	0.55	0.65	0.72	1.62	111	100C
Average	617	0.17	0.41	0.53	0.68	0.69	1.56	117	
Standard deviation	22	0.03	0.01	0.02	0.12	0.02	0.08	7	
Minimum	579	0.14	0.39	0.51	0.60	0.67	1.43	108	
Maximum	635	0.21	0.42	0.55	0.89	0.72	1.62	123	

(*) xC: x% cohesive / xA : x% adhesive

$$Ru,5 = 1.36$$

$$\Delta X_{mean} = 1.33$$

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	0.14	0.33	0.47	0.57	0.65	0.90	45	100C
2	623	0.15	0.34	0.48	0.57	0.65	1.04	57	100C
3	641	0.15	0.34	0.48	0.57	0.65	0.91	290	100C
4	616	0.14	0.33	0.46	0.55	0.63	0.88	47	100C
5	598	0.15	0.35	0.48	0.58	0.66	1.09	60	100C
Average	620	0.15	0.34	0.47	0.57	0.65	0.96	100	
Standard deviation	15	0.01	0.01	0.01	0.01	0.01	0.09	107	
Minimum	598	0.14	0.33	0.46	0.55	0.63	0.88	45	
Maximum	641	0.15	0.35	0.48	0.58	0.66	1.09	290	

(*) xC: x% cohesive / xA: x% adhesive

$$Ru,5 = 0.74$$

$$\Delta X_{mean} = 0.82$$

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	623	0.06	0.14	0.19	0.22	0.25	1.05	149	100C
2	618	0.07	0.15	0.19	0.22	0.25	0.76	129	100C
3	620	0.07	0.15	0.19	0.22	0.25	0.94	169	100C
4	605	0.04	0.09	0.14	0.18	0.22	0.88	169	100C
5	600	0.08	0.15	0.19	0.22	0.25	0.86	141	100C
6	602	0.06	0.13	0.18	0.21	0.24	0.86	151	100C
7	605	0.08	0.15	0.19	0.23	0.26	0.95	157	100C
8	598	0.06	0.14	0.19	0.22	0.25	0.90	160	100C
9	625	0.06	0.15	0.19	0.23	0.26	0.96	148	100C
10	618	0.12	0.18	0.22	0.25	0.28	1.01	144	100C
Average	611	0.07	0.14	0.19	0.22	0.25	0.92	152	
Standard deviation	10	0.02	0.02	0.02	0.02	0.02	0.08	13	
Minimum	598	0.04	0.09	0.14	0.18	0.22	0.76	129	
Maximum	625	0.12	0.18	0.22	0.25	0.28	1.05	169	

(*) xC: x% cohesive / xA: x% adhesive

Ru,5 = 0.75

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	602	0.13	0.20	0.24	0.27	0.29	1.36	183	100C
2	612	0.09	0.16	0.21	0.24	0.27	1.25	171	100C
3	601	0.07	0.16	0.21	0.25	0.28	1.21	166	100C
4	593	0.12	0.19	0.23	0.26	0.29	1.48	198	100C
5	602	0.09	0.15	0.20	0.24	0.27	1.23	190	100C
Average	602	0.10	0.17	0.22	0.25	0.28	1.31	181	
Standard deviation	7	0.02	0.02	0.02	0.01	0.01	0.11	13	
Minimum	593	0.07	0.15	0.20	0.24	0.27	1.21	166	
Maximum	612	0.13	0.20	0.24	0.27	0.29	1.48	198	

(*) xC: x% cohesive

$$R_{u,5} = 1.04$$

$$\Delta X_{\text{mean}} = 1.42$$

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	614	0.05	0.10	0.15	0.19	0.23	0.71	125	100C
2	639	0.03	0.07	0.12	0.17	0.21	0.72	127	100C
3	601	0.05	0.12	0.17	0.21	0.24	0.72	124	100C
4	600	0.06	0.12	0.17	0.21	0.24	0.70	119	100C
5	605	0.05	0.11	0.16	0.20	0.24	0.70	121	100C
Average	612	0.05	0.10	0.15	0.20	0.23	0.71	123	
Standard deviation	16	0.01	0.02	0.02	0.02	0.01	0.01	3	
Minimum	600	0.03	0.07	0.12	0.17	0.21	0.70	119	
Maximum	639	0.06	0.12	0.17	0.21	0.24	0.72	127	

(*) xC: x% cohesive

$$R_{u,5} = 0.69$$

$$\Delta X_{\text{mean}} = 0.77$$

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 : 45.0°C ± 0.5°C
- Conductivity of the water : 3.6 µs

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

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	613	0.23	0.36	0.44	0.50	0.55	1.18	133	100C
2	613	0.19	0.35	0.42	0.48	0.53	1.16	99	100C
3	629	0.22	0.35	0.42	0.48	0.53	1.08	96	100C
4	603	0.17	0.34	0.42	0.49	0.54	1.22	104	100C
5	630	0.21	0.34	0.42	0.47	0.52	1.10	96	100C
Average	617	0.20	0.35	0.42	0.48	0.53	1.15	106	
Standard deviation	12	0.02	0.01	0.01	0.01	0.01	0.06	15	
Minimum	603	0.17	0.34	0.42	0.47	0.52	1.08	96	
Maximum	630	0.23	0.36	0.44	0.50	0.55	1.22	133	

(*) xC: x% cohesive

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

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	605	0.15	0.30	0.37	0.43	0.48	1.08	107	100C
2	597	0.23	0.35	0.42	0.47	0.52	1.14	105	100C
3	616	0.18	0.32	0.40	0.45	0.50	1.08	101	100C
4	617	0.17	0.31	0.39	0.45	0.50	1.07	93	100C
5	636	0.17	0.32	0.40	0.46	0.51	1.10	127	100C
Average	614	0.18	0.32	0.40	0.45	0.50	1.09	107	
Standard deviation	15	0.03	0.02	0.02	0.01	0.01	0.03	12	
Minimum	597	0.15	0.30	0.37	0.43	0.48	1.07	93	
Maximum	636	0.23	0.35	0.42	0.47	0.52	1.14	127	

(*) xC: x% cohesive / xA: x% adhesive

$\Delta X_{\text{mean}} = 0.93$

5.1.4.2.2 HUMIDITY AND NaCl ATMOSPHERE*

a) *Conditioning :*

- Duration : 480 hours
- NaCl concentration : 48.4 g/l
- pH : 6.6

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	614	0.12	0.35	0.45	0.52	0.58	1.31	106	100C
2	626	0.24	0.39	0.48	0.54	0.60	1.38	115	100C
3	593	0.20	0.33	0.45	0.53	0.59	1.25	93	100C
4	619	0.24	0.39	0.48	0.54	0.60	1.20	88	100C
5	620	0.21	0.37	0.45	0.52	0.58	1.04	75	100C
6	616	0.22	0.39	0.47	0.54	0.60	1.15	80	100C
7	624	0.21	0.37	0.46	0.53	0.59	1.23	97	100C
8	654	0.20	0.36	0.45	0.52	0.58	1.05	75	100C
9	616	0.17	0.27	0.40	0.49	0.55	1.18	88	100C
10	623	0.21	0.37	0.46	0.53	0.59	1.17	86	100C
Average	620	0.20	0.36	0.46	0.53	0.59	1.20	90	
Standard deviation	15	0.04	0.04	0.02	0.02	0.02	0.11	13	
Minimum	593	0.12	0.27	0.40	0.49	0.55	1.04	75	
Maximum	654	0.24	0.39	0.48	0.54	0.60	1.38	115	

(*) *x*C: *x*% cohesive / *x*A: *x*% adhesive

$$\Delta X_{\text{mean}} = 1.03$$

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	607	0.26	0.41	0.50	0.57	0.63	1.15	78	100C
2	631	0.26	0.39	0.47	0.54	0.60	0.95	73	100C
3	631	0.18	0.32	0.42	0.50	0.57	1.17	95	100C
4	655	0.15	0.35	0.45	0.52	0.58	1.20	90	100C
5	624	0.22	0.38	0.48	0.55	0.61	1.06	71	100C
6	629	0.25	0.41	0.50	0.57	0.63	1.13	75	100C
7	618	0.21	0.38	0.47	0.54	0.60	1.06	78	100C
8	596	0.24	0.39	0.48	0.55	0.62	1.19	88	100C
9	626	0.17	0.32	0.43	0.51	0.58	1.27	100	100C
10	659	0.21	0.38	0.48	0.55	0.62	1.17	80	100C
Average	628	0.22	0.37	0.47	0.54	0.60	1.14	83	
Standard deviation	19	0.04	0.03	0.03	0.02	0.02	0.09	10	
Minimum	596	0.15	0.32	0.42	0.50	0.57	0.95	71	
Maximum	659	0.26	0.41	0.50	0.57	0.63	1.27	100	

(*) xC: x% cohesive / xA: x% adhesive

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

5.1.4.2.4 Facade cleaning product*

a) *Conditioning :*

- Duration : 21 days
- Temperature : 44.0°C ± 0.6°C
- 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	607	0.20	0.32	0.40	0.45	0.51	1.08	103	100C
2	592	0.24	0.37	0.45	0.51	0.56	1.30	117	100C
3	609	0.28	0.39	0.46	0.51	0.56	1.13	97	100C
4	647	0.24	0.38	0.45	0.51	0.56	1.11	119	100C
5	609	0.14	0.32	0.41	0.47	0.52	1.14	92	100C
6	595	0.19	0.34	0.43	0.49	0.55	1.14	91	100C
7	600	0.24	0.38	0.45	0.51	0.56	1.22	100	100C
8	655	0.18	0.36	0.45	0.51	0.56	1.29	113	100C
9	623	0.21	0.37	0.45	0.52	0.57	1.28	107	100C
10	649	0.12	0.33	0.42	0.49	0.55	1.14	89	100C
Average	619	0.20	0.36	0.44	0.50	0.55	1.18	103	
Standard deviation	24	0.05	0.03	0.02	0.02	0.02	0.08	11	
Minimum	592	0.12	0.32	0.40	0.45	0.51	1.08	89	
Maximum	655	0.28	0.39	0.46	0.52	0.57	1.30	119	

(*) *x*C: *x*% cohesive / *x*A: *x*% adhesive

$$\Delta X_{\text{mean}} = 1.01$$

SUMMARY

ETAG GUIDELINE TEST NUMBER	TEST	TEST CONDITIO NS	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	1.17	-	$\sigma_{12.5} = 0.43$ $K_{12.5} = 3.45$	1.00	100C
		-20°C	1.56	1.33		1.36	100C
		+80°C	0.96	0.82		0.74	100C
5.1.4.1.2	Shear	+23°C	0.92	-		0.75	100C
		-20°C	1.31	1.42		1.04	100C
		+80°C	0.71	0.77		0.69	100C
5.1.4.2.1	H ₂ O + UV SMART- 50 face at 45°C	500 h	1.15	0.98			100C
		1000 h	1.09	0.93	$\sigma_{12.5,c} = 0.33$ $K_{12.5,c} = 2.65$ $K_{12.5,c}/K_{12.5} = 0.77$		100C
5.1.4.2.2	H ₂ O + NaCl	480h	1.20	1.03			100C
5.1.4.2.3	H ₂ O + SO ₂	20 cycles	1.14	0.97			100C
5.1.4.2.4	Cleaning product	21 days	1.18	1.01			100C

(*) xC: x% cohesive

D. LIBERT
Head of Department

Glazing and Components - INISMa