

Test Report B 08 0486.1 E

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Customer: Kuraray Europe GmbH
Division TROSIFOL
Mühlheimer Str. 26
53840 Troisdorf

date of order: 2006-04-05 order-No. / your reference: 4510004714

subject: Evaluation of conformity for laminated safety glass (VSG)

INITIAL TYPE TEST according to EN 14449: 2005(D), paragraph 5.2.2

- **High temperature test**
according to EN ISO 12543-4: 1998(D), paragraph 4
- **Humidity test (with condensation)**
according to EN ISO 12543-4: 1998(D), paragraph 5.3.1
- **Humidity test (without condensation)**
according to EN ISO 12543-4: 1998(D), paragraph 5.3.2
- **Radiation test**
according to EN ISO 12543-4: 1998(D), paragraph 6

test object: Laminated safety glass "TROSIFOL® BG R10/15 0,76 clear"
Specimens according to paragraph 1, page 2

sampling: Not official, by customer

receipt of samples: 2006-04-10

Darmstadt, 2008-04-02

our reference: B/Hos

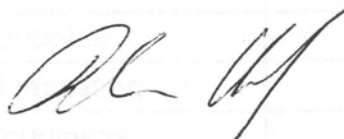
Pages : 4

Tables : 5

Enclosures : /

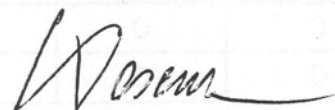
The Management

i.A.
(by order)



(Dr.-Ing. P. Hof)

Official in Charge



(Dipl.-Ing. H.-J. Hosemann)

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1. Test material (according to manufacturer specification)

Glass product: Laminated safety glass

Product name: TROSIFOL® BG R10/15 0,76 clear

Construction: 4 mm Floatglass / 0,76 mm PVB film / 4 mm Floatglass

Edge working: none (cut edge)

Size in mm: 305 x 107

manufacturer:

Kuraray Europe GmbH

Division TROSIFOL

Mülheimer Strasse 26

53840 Troisdorf

Germany

2. Test procedure and test results

2.1 High temperature test according to EN ISO 12543-2, paragraph 4.1

According to EN ISO 12543-2 the high temperature test is carried out in compliance with the method given in paragraph 4 of EN ISO 12543-4 and evaluated according to paragraph 4.4 of EN ISO 12543-4. Therefore, 3 test specimens are stored in a heating cabinet for 2 hours at a temperature of $(100 \pm 0/-3)$ °C. The test specimens are stored horizontal without any covered edge.

Evaluation after high temperature test:

The visual inspection of the test specimens with unarmred eyes at a distance between 30 cm and 50 cm in front of a white diffuse background led to the following result:

Table 1

Kind of defects	Number of permissible defects	Number of defects at test specimen		
		1	2	3
Bubbles	0	0	0	0
Delamination	0	0	0	0
Cloudiness	0	0	0	0

2.2 Humidity test (with condensation) according to EN ISO 12543-2, paragraph 4.2

According to EN ISO 12543-2 the humidity test with condensation is carried out in compliance with the method given in paragraph 5.3.1 of EN ISO 12543-4 and evaluated according to paragraph 5.4 of EN ISO 12543-4. Therefore 3 test specimens are stored vertically for two weeks over water in a closed container with a temperature of $(50 +2/-0)$ °C. These conditions give a relative humidity of about 100% and will lead to water condensation on the surface of the test specimens.

Evaluation after humidity test with condensation:

The visual inspection of the test specimens with unarmred eyes at a distance between 30 cm and 50 cm in front of a white diffuse background led to the following results:

Table 2

Kind of defects	Number of permissible defects	Number of defects at test specimen		
		4	5	6
Bubbles	0	0	0	0
Delamination	0	0	0	0
Cloudiness	0	0	0	0

2.3 Humidity test (without condensation) according to EN ISO 12543-2, paragraph 4.2

According to EN ISO 12543-2 the humidity test without condensation is carried out in compliance with the method given in paragraph 5.3.2 of EN ISO 12543-4 and evaluated according to paragraph 5.4 of EN ISO 12543-4. Therefore 3 test specimens are stored vertically for two weeks into a climate chamber with a temperature of $(50 +2/-0)$ °C and a relative humidity of (80 ± 5) %.

Evaluation after humidity test without condensation:

The visual inspection of the test specimens with unarmred eyes at a distance between 30 cm and 50 cm in front of a white diffuse background led to the following result:

Table 3

Kind of defects	Number of permissible defects	Number of defects at test specimen		
		7	8	9
Bubbles	0	0	0	0
Delamination	0	0	0	0
Cloudiness	0	0	0	0

2.4 Radiation test according to EN ISO 12543-2, paragraph 4.3

According to EN ISO 12543-2 the radiation test is carried out in compliance with the method given in paragraph 6 of EN ISO 12543-4 and evaluated according to paragraph 6.5 of EN ISO 12543-4. The purpose of this test is to determine whether exposure of laminated glass or laminated safety glass to radiation over an extended period of time produces any appreciable change in its properties. The change in its properties is judged by a change in luminous transmittance and the occurrences of bubbles, delamination and cloudiness.

Therefore 3 test specimens are exposed to a defined radiation for 2000 hours.

- Test conditions according to EN ISO 12543-4, paragraph 6.2.2
- Arrangement of test equipment according to EN ISO 12543-4, annex A

Evaluation before and after radiation:

Table 4

Specimen-number	Light transmittance according to EN 410 in %		Difference before/after in %	
	before radiation	after radiation	result	requirement ¹⁾
10	87	87	0	± 10
11	88	87	1	
12	87	87	0	

¹⁾ Requirement according to EN ISO 12543-2, paragraph 4.3 for initial light transmittance > 20%

The visual inspection of the test specimens after radiation with unarmmed eyes at a distance between 30 cm and 50 cm in front of a white diffuse background led to the following result:

Table 5

Kind of defects	Number of permissible defects	Number of defects at test specimen		
		10	11	12
Bubbles	0	0	0	0
Delamination	0	0	0	0
Cloudiness	0	0	0	0

3. Summary

The tested specimens are fulfilling the requirements for the durability of laminated safety glass according to EN ISO 12543-2.

Test Report B 08 0486.2 E

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Customer: Kuraray Europe GmbH
Division TROSIFOL
Mühlheimer Str. 26
53840 Troisdorf
Germany

date of order: 2007-07-03 order-No. / your reference: 4510013234 / IT2

subject: Evaluation of conformity for laminated safety glass (VSG)
INITIAL TYPE TEST according to EN 14449: 2005(D), paragraph 5.2.2

- **Radiation test**
according to EN ISO 12543-4: 1998(D), paragraph 6

test object: Laminated safety glass "TROSIFOL® BG R15 0,38 clear"
Specimens according to paragraph 1, page 2

sampling: Not official, by customer

receipt of samples: 2007-07-05

Darmstadt, 2008-04-02
our reference: B/Hos

Pages : 3
Tables : 2
Enclosures : /

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1. Test material (according to manufacturer specification)

Glass product: Laminated safety glass

Product name: TROSIFOL® BG R15 0,38 clear

Construction: 4 mm Floatglass / 0,38 mm PVB film clear / 4 mm Floatglass

Edge working: none (cut edge)

Size in mm: 300 * 300

manufacturer:

Kuraray Europe GmbH

Division TROSIFOL

Mülheimer Strasse 26

53840 Troisdorf

Germany

2. Test procedure and test results

Radiation test according to EN ISO 12543-2, paragraph 4.3

According to EN ISO 12543-2 the radiation test is carried out in compliance with the method given in paragraph 6 of EN ISO 12543-4 and evaluated according to paragraph 6.5 of EN ISO 12543-4. The purpose of this test is to determine whether exposure of laminated glass or laminated safety glass to radiation over an extended period of time produces any appreciable change in its properties. The change in its properties is judged by a change in luminous transmittance and the occurrences of bubbles, delamination and cloudiness.

Therefore 3 test specimens are exposed to a defined radiation for 2000 hours.

- Test conditions according to EN ISO 12543-4, paragraph 6.2.2
- Arrangement of test equipment according to EN ISO 12543-4, annex A

Evaluation of light transmittance before and after radiation:

Table 1

Specimen-number	Light transmittance according to EN 410 in %		Difference in %	
	before radiation	after radiation	result	requirement ¹⁾
1	87	87	0	± 10
2	87	87	0	
3	87	87	0	

¹⁾ Requirement according to EN ISO 12543-2, paragraph 4.3 for initial light transmittance > 20%

The visual inspection of the test specimens after radiation with unarmed eyes at a distance between 30 cm and 50 cm in front of a white diffuse background led to the following result:

Table 2

Kind of defects	Number of permissible defects	Number of defects at test specimen		
		1	2	3
Bubbles	0	0	0	0
Delamination	0	0	0	0
Cloudiness	0	0	0	0

3. Summary

The tested specimens are fulfilling the requirements for the durability of laminated safety glass according to EN ISO 12543-2.