

Test report

Number: 2017-04-4738-03

Client: Folienwerk Wolfen GmbH
Guardianstraße 4
06766 Bitterfeld-Wolfen

Commission: Determination of mechanical properties of laminated safety glass

Interlayer: evguard® laminating film

Number of pages: 6

Fundamental guidelines and test procedures:

prEN 16613 Laminated glass and laminated safety glass – determination of interlayer mechanical properties

Rohrbach, January 08th, 2018


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The test results in this test report exclusively refer to the test material as indicated in this report.

Reprinting this test report requires our written approval.

Publishing this test report – even only extracts – is strictly prohibited.

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1. Test material

Basic glass:	Float glass DIN EN 572-2
Processed to:	Laminated safety glass
Test specimen:	15 Glass panes 360 x 1100 mm
	Glass composition 4 Float / 0,38 EVA / 4 Float
	Interlayer evguard® laminating film
	Number of test specimen PK 1-15

Receipt of samples: May 22nd, 2017

2. Test equipment

- Digital calliper
- Digital micrometre
- Metal ruler
- Bending rig with temperature control

The test equipment is subject to test equipment surveillance.

The bending rig with temperature control consist of a thermally isolated chamber into which a bending rig had been mounted. The geometry of the test stand corresponds to DIN EN ISO 1288 part 3.

The load applied onto the test panes had been chosen taking into consideration the tensions provided. It had been applied shock-free by electromechanical device.

The flexion of the test panes had been monitored digitally.

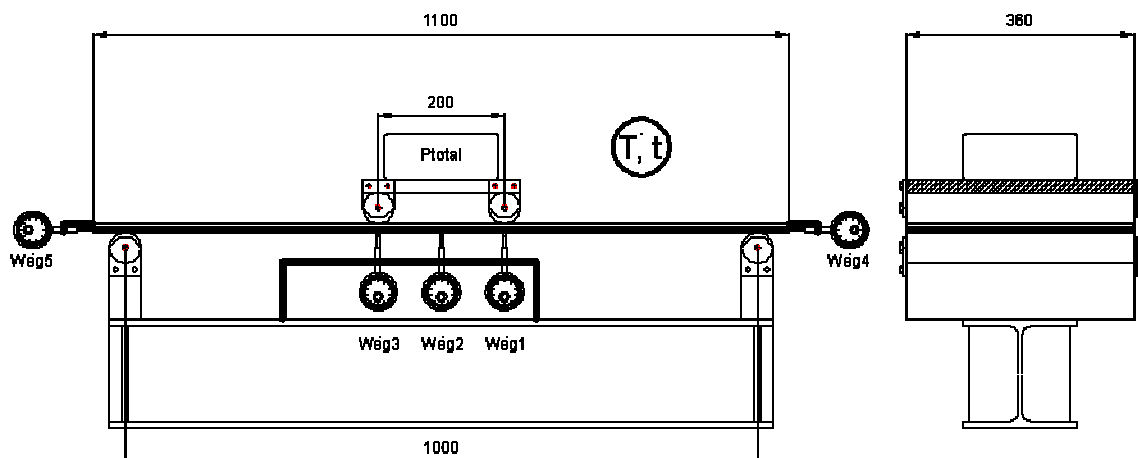


Fig. 1: Geometry bending rig

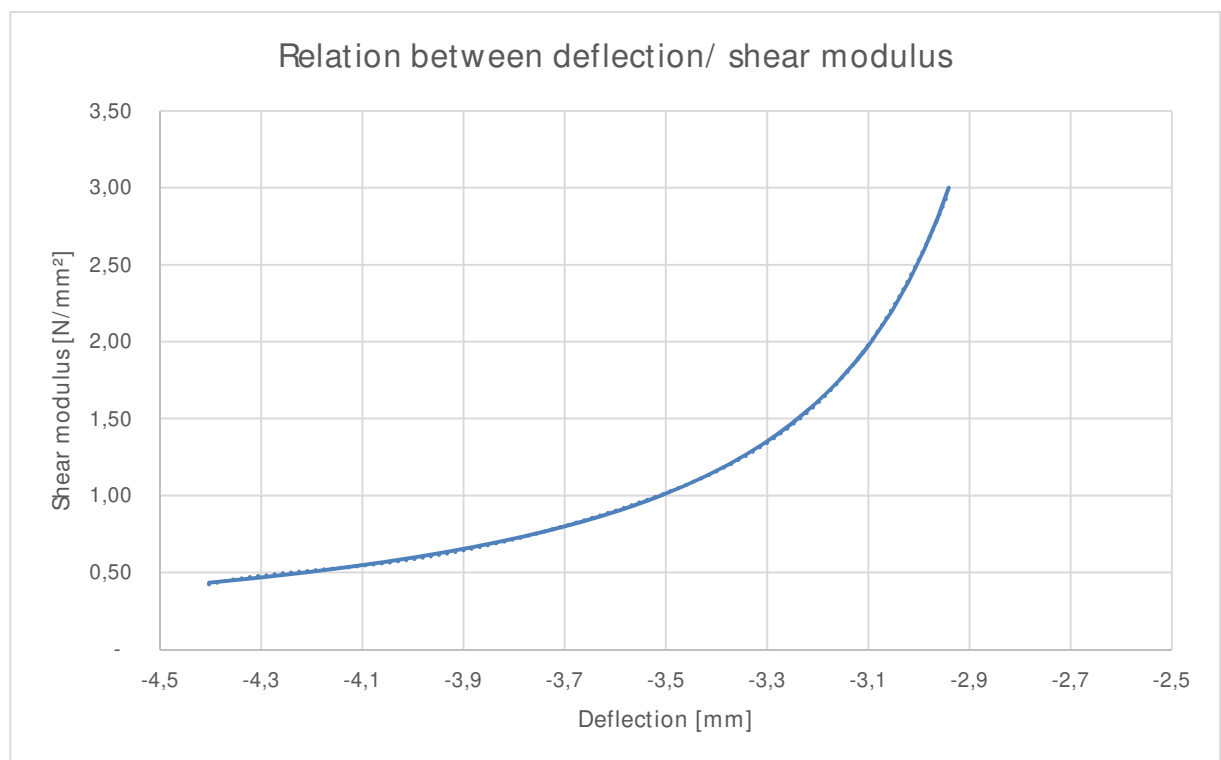
3. Tests and results

3.2 Determination of shear modulus

The test specimen had been loaded with 166 N. The examination had been carried out in short-term range at temperatures of 25 °C, 30 °C, 40 °C, 50 °C and 60 °C. The long-term examination had been carried out at 30 °C.

In short-term range, each single test specimen had been loaded in three intervals of one hour each. Between the loadings, relaxation intervals of 1,5 hours each had been observed. For the long-term examination, the loading period had been 4 days.

For determination of the shear modulus in view of the measured deflections, the relation between the shear modulus – deflection for the geometry and loading at hand had been determined by means of a FE-calculation.



With the relation evaluated that way, the related values of the shear modulus for discrete loadings had been determined from the characteristic values of the test series – which describe the 5% fractile of the maximum deflection at a level of confidence of 75%.

Regarding the long-term tests and due to the poorer amount of results, the average value based on the measurements of three test specimen had been used for evaluating the shear modulus.

3.2 Results shear modulus

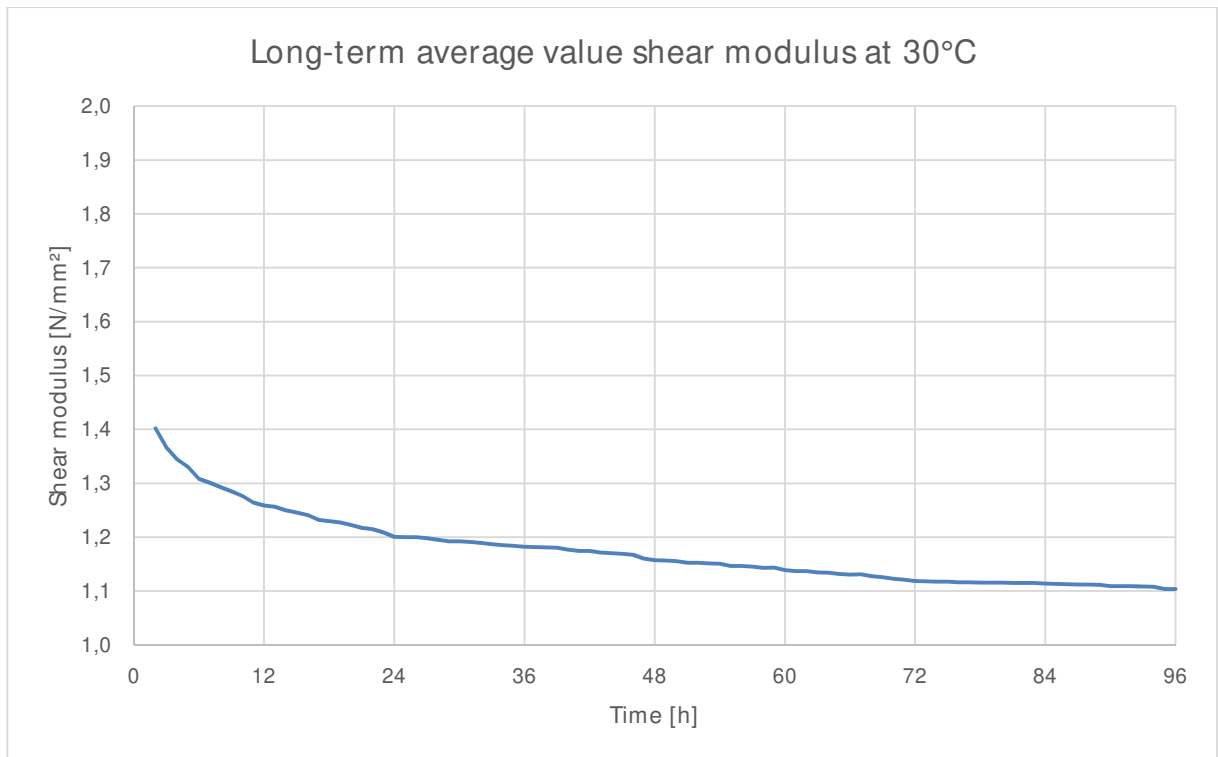
Deflections					
Glass composition:		4 Float / 0,38 EVA / 4 Float			
Test temperature:		25 °C			
Test load:		166 N			
Time	Number of values	Average deflection	Coefficient of variation	Characteristic deflection	Shear modulus
[s]	[-]	[mm]	[%]	[mm]	[N/mm ²]
3	6	3,050	0,12	3,058	2,172
60	6	3,096	0,15	3,106	1,947
600	6	3,123	0,19	3,137	1,825
3600	6	3,153	0,15	3,165	1,725

Deflections					
Glass composition:		4 Float / 0,38 EVA / 4 Float			
Test temperature:		30 °C			
Test load:		166 N			
Time	Number of values	Average deflection	Coefficient of variation	Characteristic deflection	Shear modulus
[s]	[-]	[mm]	[%]	[mm]	[N/mm ²]
3	11	3,102	0,75	3,150	1,775
60	11	3,154	0,83	3,208	1,589
600	11	3,188	0,84	3,244	1,488
3600	11	3,217	1,06	3,288	1,381

Deflections					
Glass composition:		4 Float / 0,38 EVA / 4 Float			
Test temperature:		40 °C			
Test load:		166 N			
Time	Number of values	Average deflection	Coefficient of variation	Characteristic deflection	Shear modulus
[s]	[-]	[mm]	[%]	[mm]	[N/mm ²]
3	9	3,222	0,30	3,243	1,492
60	9	3,278	0,28	3,297	1,360
600	9	3,326	0,35	3,351	1,249
3600	9	3,381	0,48	3,416	1,136

Deflections					
Glass composition:		4 Float / 0,38 EVA / 4 Float			
Test temperature:		50 °C			
Test load:		166 N			
Time	Number of values	Average deflection	Coefficient of variation	Characteristic deflection	Shear modulus
[s]	[-]	[mm]	[%]	[mm]	[N/mm ²]
3	9	3,433	0,46	3,467	1,060
60	9	3,510	0,41	3,541	0,961
600	9	3,573	0,28	3,595	0,898
3600	9	3,651	0,29	3,673	0,823

Deflections					
Glass composition:		4 Float / 0,38 EVA / 4 Float			
Test temperature:		60 °C			
Test load:		166 N			
Time	Number of values	Average deflection	Coefficient of variation	Characteristic deflection	Shear modulus
[s]	[-]	[mm]	[%]	[mm]	[N/mm ²]
3	9	3,738	1,05	3,822	0,701
60	9	3,852	1,16	3,948	0,616
600	9	3,985	0,82	4,055	0,563
3600	9	4,176	2,09	4,362	0,451



4. Summary

The Folienwerk Wolfen GmbH commissioned the Friedmann & Kirchner GmbH with the determination of mechanical properties of laminated safety glass with an evguard® laminating film as interlayer material.

Examination in view of shear modulus had been carried out under variation of temperatures.

The results had been summed up in this test report at hand.