BLACKWATER TESTING INC.

7341 Westport Pl Suite 1A, West Palm Beach, Fl. 33413

Phone: 561-508-2830 E-mail: Engdep@blackwatertesting.com

REPORT NO: BT-FWG-15-001 MIAMI-DADE CERTIFICATION #15-1026.02 08/15/2016

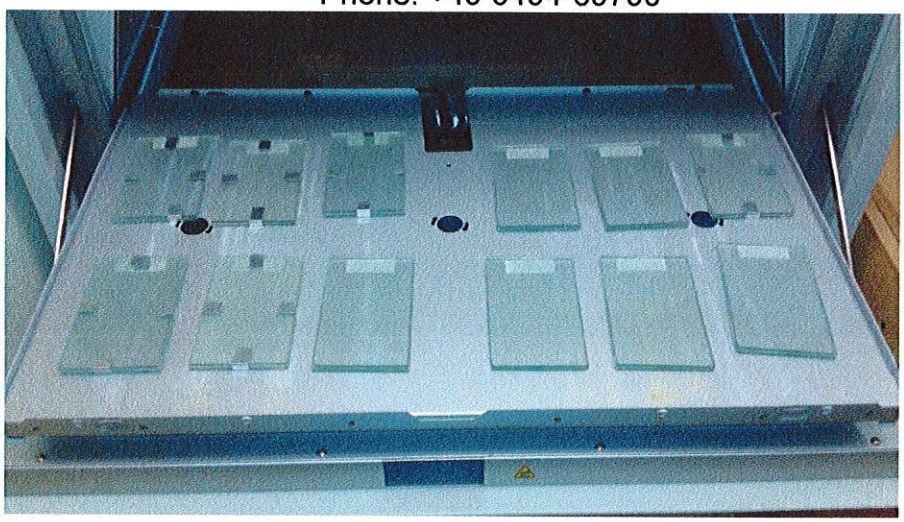
Test Dates: Start: 01/08/2015 End: 05/20/2015

TESTING FOR ASTM G155-05, ASTM D1003-11, ASTM E313-10, AND ASTM E308-12 PER ANSI Z97.1-09 FOR "LAMINATED GLASS WITH EVGUARD® AND HYBRID MPE INTERLAYERS"

Client:

Folienwerk Wolfen GmbH

Guardianstrasse 4, 06766 Bitterfeld-Wolfen
Germany
Phone: +49 3494-69790



Product Description of Units: Laminated Glass with Evguard® and Hybrid MPE Interlayers

Overall Sizes: 12 specimens each 3-1/8"wX5"h, made with two outer panes of clear glass of 3mm thick each.

Test Protocols:
ASTM G155-05a---ASTM D 1003-11---**ASTM E313-10**---ASTM E308-12 Per ANSI Z97.1-09

Disclaimer:

This is a general statement and does not supersede the specific product descriptions in this report. The specimens were provided by the manufacturer as is. Blackwater Testing Inc. does not take responsibility for performance and whose only purpose is to gather pertinent data for client in Test Report Format.

Witness To Testing:

Dennis Duffy, BT CEO
Erik Coppola, BT Lab Technician
Yamil G. Kuri, P.E. Test Engineer

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LAMINATED GLASS WITH EVGUARD® AND HYBRID MPE INTERLAYERS

Specimen Table			
Specimen	**Dimensions**	**Type of Interlayer**	**Interlayer(s) Thickness**
1	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.38mm-0.20mm-0.38mm (0.015"-0.008"-0.015")
2	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.38mm-0.20mm-0.38mm (0.015"-0.008"-0.015")
3	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.38mm-0.20mm-0.38mm (0.015"-0.008"-0.015")
4	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.76mm-0.20mm-0.76mm (0.030"-0.008"-0.030")
5	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.76mm-0.20mm-0.76mm (0.030"-0.008"-0.030")
6	3-1/8"wX5"h	Evguard® and Hybrid MPE	0.76mm-0.20mm-0.76mm (0.030"-0.008"-0.030")
7	3-1/8"wX5"h	Evguard® Film only	0.76mm (0.030")
8	3-1/8"wX5"h	Evguard® Film only	0.76mm (0.030")
9	3-1/8"wX5"h	Evguard® Film only	0.76mm (0.030")
10	3-1/8"wX5"h	Evguard® Film only	0.38mm (0.015")
11	3-1/8"wX5"h	Evguard® Film only	0.38mm (0.015")
12	3-1/8"wX5"h	Evguard® Film only	0.38mm (0.015")

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TESTING DETAIL ASTM G155-05a:

Test Equipment: Q-SUN Xenon Test Chamber Model SE-3-HSC

Products: Laminated Glass With Interlayer(s)

Procedure: **Specimens** (Laminated Glass With Interlayer(s)) twelve specimens (1-12) were placed in the Q-SUN Xenon test chamber and tested with the following parameters:

- Filter: Daylight
- Irradiance: 0.35 W/m^2
- Calibration Wavelength: 340 nm
- Cycle: light 63(+/-2.5)°C Black panel temperature and 50% Relative Humidity
- Exposure time: 3,000 hrs

TESTING DETAIL ASTM D 1003-11:

Test Equipment: Macbeth Color-Eye 2180

Procedure: **Specimens** (Laminated Glass With Interlayer(s)) twelve specimens (1-12) tested the Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

TESTING DETAIL ASTM E313-10:

Test Equipment: Macbeth Color-Eye 2180

Procedure: **Specimens** (Laminated Glass With Interlayer(s)) twelve specimens (1-12) tested the Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates

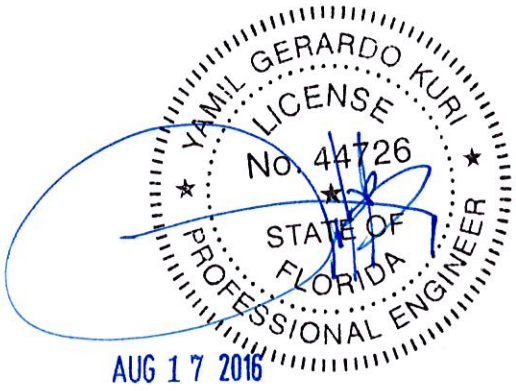
TESTING DETAIL ASTM E308-12:

Test Equipment: Macbeth Color-Eye 2180

Procedure: **Specimens** (Laminated Glass With Interlayer(s)) twelve specimens (1-12) tested the Standard Practice for Computing the Colors of Objects by Using the CIE Systems.

TEST PROCEDURE:

Specimens 1-12 were tested for Haze and Luminous Transmittance, Yellowness, and Color change. Specimens 1-12 were tested for accelerated weathering with above mentioned parameters and after the exposure time the samples were tested for Haze and Luminous Transmittance, Yellowness, and Color change.



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Test Results
Visible Light Transmission ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial L value	After Weathering L value	Change in Units
1	3-1/8"wX5"h	0.015"-0.008"-0.015"	95.1	96.1	1.0
2	3-1/8"wX5"h	0.015"-0.008"-0.015"	94.8	95.5	0.70
3	3-1/8"wX5"h	0.015"-0.008"-0.015"	94.81	95.6	0.79
Average	3-1/8"wX5"h	0.015"-0.008"-0.015"	**94.90**	**95.73**	**0.83**

Units Change ≤ 5 PASS

Test Results
Overall Color Change ASTM E308-12

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	E Units Change
1	3-1/8"wX5"h	0.015"-0.008"-0.015"	1.35
2	3-1/8"wX5"h	0.015"-0.008"-0.015"	1.31
3	3-1/8"wX5"h	0.015"-0.008"-0.015"	1.28
Average	3-1/8"wX5"h	0.015"-0.008"-0.015"	**1.31**

E Units Change ≤ 5 PASS

Test Results
Haze ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
1	3-1/8"wX5"h	0.015"-0.008"-0.015"	0.74	1.20	0.46
2	3-1/8"wX5"h	0.015"-0.008"-0.015"	0.78	1.25	0.47
3	3-1/8"wX5"h	0.015"-0.008"-0.015"	0.77	1.2	0.43
Average	3-1/8"wX5"h	0.015"-0.008"-0.015"	**0.76**	**1.22**	**0.45**

Units Change ≤ 0.5 PASS

Test Results
Yellowness Index ASTM E313-10

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
1	3-1/8"wX5"h	0.015"-0.008"-0.015"	4.8	5.22	0.42
2	3-1/8"wX5"h	0.015"-0.008"-0.015"	4.75	5.20	0.45
3	3-1/8"wX5"h	0.015"-0.008"-0.015"	4.68	5.15	0.47
Average	3-1/8"wX5"h	0.015"-0.008"-0.015"	**4.74**	**5.19**	**0.45**

Units Change ≤ 0.5 PASS

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Test Results
Visible Light Transmission ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial L value	After Weathering L value	Change in Units
4	3-1/8"wX5"h	0.030"-0.008"-0.030"	96.2	98.3	2.1
5	3-1/8"wX5"h	0.030"-0.008"-0.030"	96.8	97.8	1
6	3-1/8"wX5"h	0.030"-0.008"-0.030"	95.8	97.1	1.3
Average	3-1/8"wX5"h	0.030"-0.008"-0.030"	**96.27**	**97.73**	**1.46**

Units Change ≤ 5 PASS

Test Results
Overall Color Change ASTM E308-12

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	E Units Change
4	3-1/8"wX5"h	0.030"-0.008"-0.030"	1.25
5	3-1/8"wX5"h	0.030"-0.008"-0.030"	1.21
6	3-1/8"wX5"h	0.030"-0.008"-0.030"	1.15
Average	3-1/8"wX5"h	0.030"-0.008"-0.030"	**1.20**

E Units Change ≤ 5 PASS

Test Results
Haze ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
4	3-1/8"wX5"h	0.030"-0.008"-0.030"	0.85	1.25	0.40
5	3-1/8"wX5"h	0.030"-0.008"-0.030"	0.87	1.32	0.45
6	3-1/8"wX5"h	0.030"-0.008"-0.030"	0.75	1.19	0.44
Average	3-1/8"wX5"h	0.030"-0.008"-0.030"	**0.82**	**1.25**	**0.43**

Units Change ≤ 0.5 PASS

Test Results
Yellowness Index ASTM E313-10

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
4	3-1/8"wX5"h	0.030"-0.008"-0.030"	4.9	5.31	0.41
5	3-1/8"wX5"h	0.030"-0.008"-0.030"	4.87	5.27	0.40
6	3-1/8"wX5"h	0.030"-0.008"-0.030"	4.78	5.15	0.37
Average	3-1/8"wX5"h	0.030"-0.008"-0.030"	**4.85**	**5.24**	**0.39**

Units Change ≤ 0.5 PASS

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Test Results
Visible Light Transmission ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial L value	After Weathering L value	Change in Units
7	3-1/8"wX5"h	0.030"	96.5	98.5	2
8	3-1/8"wX5"h	0.030"	97.4	99.5	2.1
9	3-1/8"wX5"h	0.030"	95.8	98.1	2.3
Average	3-1/8"wX5"h	0.030"	**96.56**	**98.7**	**2.13**

Units Change ≤ 5 PASS

Test Results
Overall Color Change ASTM E308-12

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	E Units Change
7	3-1/8"wX5"h	0.030"	1.31
8	3-1/8"wX5"h	0.030"	1.25
9	3-1/8"wX5"h	0.030"	1.32
Average	3-1/8"wX5"h	0.030"	**1.29**

E Units Change ≤ 5 PASS

Test Results
Haze ASTM D1003-11

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
7	3-1/8"wX5"h	0.030"	0.75	1.05	0.3
8	3-1/8"wX5"h	0.030"	0.76	0.98	0.22
9	3-1/8"wX5"h	0.030"	0.68	0.97	0.29
Average	3-1/8"wX5"h	0.030"	**0.73**	**1**	**0.27**

Units Change ≤ 0.5 PASS

Test Results
Yellowness Index ASTM E313-10

LAMINATED GLASS WITH INTERLAYER(S)

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
7	3-1/8"wX5"h	0.030"	4.68	5.12	0.44
8	3-1/8"wX5"h	0.030"	4.55	4.95	0.40
9	3-1/8"wX5"h	0.030"	4.61	4.93	0.32
Average	3-1/8"wX5"h	0.030"	**4.61**	**5**	**0.39**

Units Change ≤ 0.5 PASS

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LAMINATED GLASS WITH INTERLAYER(S)

Test Results
Visible Light Transmission ASTM D1003-11

Specimen	Dimensions	Interlayer(s) Thickness	Initial L value	After Weathering L value	Change in Units
10	3-1/8"wX5"h	0.015"	93.2	95.7	2.5
11	3-1/8"wX5"h	0.015"	94.5	97.7	3.2
12	3-1/8"wX5"h	0.015"	95.7	97.5	1.8
Average	3-1/8"wX5"h	0.015"	**94.47**	**96.97**	**2.5**
Units Change ≤ 5 PASS					

LAMINATED GLASS WITH INTERLAYER(S)

Test Results
Overall Color Change ASTM E308-12

Specimen	Dimensions	Interlayer(s) Thickness	E Units Change
10	3-1/8"wX5"h	0.015"	1.15
11	3-1/8"wX5"h	0.015"	1.25
12	3-1/8"wX5"h	0.015"	1.18
Average	3-1/8"wX5"h	0.015"	**1.19**
E Units Change ≤ 5 PASS			

LAMINATED GLASS WITH INTERLAYER(S)

Test Results
Haze ASTM D1003-11

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
10	3-1/8"wX5"h	0.015"	0.68	0.95	0.27
11	3-1/8"wX5"h	0.015"	0.65	0.89	0.24
12	3-1/8"wX5"h	0.015"	0.64	0.93	0.29
Average	3-1/8"wX5"h	0.015"	**0.66**	**0.92**	**0.27**
Units Change ≤ 0.5 PASS					

LAMINATED GLASS WITH INTERLAYER(S)

Test Results
Yellowness Index ASTM E313-10

Specimen	Dimensions	Interlayer(s) Thickness	Initial value	After Weathering value	Change in Units
10	3-1/8"wX5"h	0.015"	4.51	4.94	0.43
11	3-1/8"wX5"h	0.015"	4.84	4.95	0.11
12	3-1/8"wX5"h	0.015"	4.75	4.89	0.14
Average	3-1/8"wX5"h	0.015"	**4.7**	**4.93**	**0.23**
Units Change ≤ 0.5 PASS					

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Test Dates: Start: 01/08/2015 End: 05/20/2015

SUMMARY OF TESTING FOR "LAMINATED GLASS WITH EVGUARD® AND HYBRID MPE INTERLAYERS"

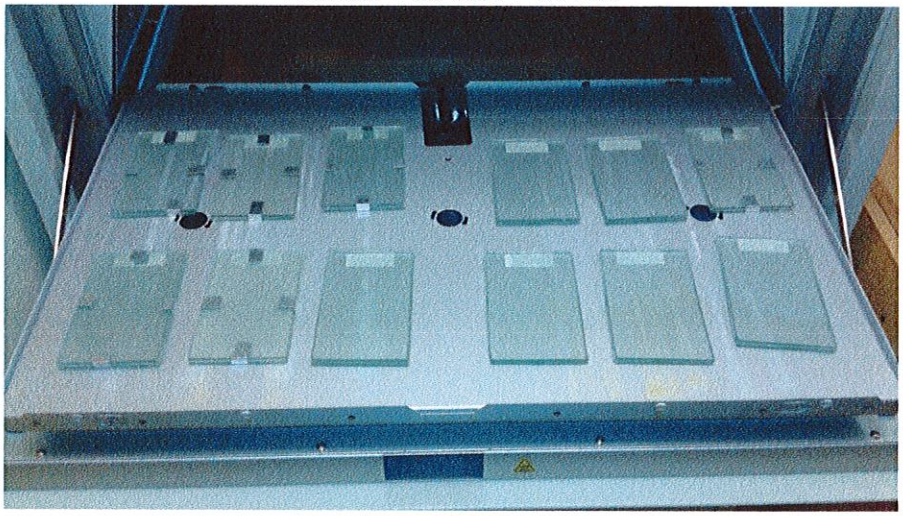
Client:

Folienwerk Wolfen GmbH

Guardianstrasse 4, 06766 Bitterfeld-Wolfen

Germany

Phone: +49 3494-69790



ASTM G155-05a: Specimens 1-12 were subjected to accelerated weathering. The specimens were tested for Visible light transmission, Haze, Overall color change, and Yellowness after weathering test was completed.

ASTM D 1003-11: Specimens 1-12 were tested for Visible Light Transmission prior to accelerated weathering test and after accelerated weathering test was completed. Specimens 1-12 were tested for Haze prior to accelerated weathering test and after accelerated weathering test was completed.

ASTM E313-10: Specimens 1-12 were tested for Yellowness Index prior to accelerated weathering test and after accelerated weathering test was completed.

ASTM E308-12: Specimens 1-12 were tested for Overall color change.

CONCLUSION: No failures were observed in the testing criteria for Specimens 1-12 for **"LAMINATED GLASS WITH INTERLAYER(S)"** product per ASTM G155-05a, ASTM D 1003-11, ASTM E313-10,ASTM E308-12, and ANSI Z97.1-09 testing criteria.

Respectfully submitted,

BLACKWATER TESTING INC.

(Miami-Dade Certification #15-1026.02)

BLACKWATER MIAMI DADE CERTIFIED BLACKWATER #12-0703.01 TESTING INC.

AUG 15 2016

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Dennis Duffy, CEO Yamil Kuri, P.E. Engineer

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