

Test report no.: 87434/09

Customer: NEOFLEX S. L.
Camino de Castilla Km. 5
03207 Elche (Alicante)
SPAIN

Order: Testing of weathering resistance and adhesion of film prior and after artificial weathering according to RAL-GZ 716/1 section I, part 7, edition March 2008 on window profiles made of PVC-U, laminated with film as proof of lamination for climate zone M.

email from: 2008-12-04

Ref: Mr. Pascual Escobar Coquillat

Sample receipt: 2009-10-12

Test period: 2009-11-04 to 2010-05-11

This test report comprises 7 pages.

Würzburg, 2010-05-28

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1. Order

By its email dated December 4, 2008 the company NEOFLEX S. L., Camino de Castilla Km. 5, 03207 Elche (Alicante), SPAIN, instructed SKZ - TeConA GmbH to test the weathering resistance and adhesion of film prior and after artificial weathering according to RAL-GZ 716/1 section I, part 7, edition March 2008 on window profiles made of PVC-U, laminated with film as proof of suitability for lamination for climate zone M.

2. Test material

On 12 October 2009 SKZ - TeConA GmbH received following samples for testing:

4 x 1 m pieces of window profile made of PVC-U with interrupted lamination.
(contact barrier).

4 x 1 m pieces of window profile made of PVC-U continuously laminated.

1 x 1 m pieces of window profile made of PVC-U without lamination (base profile).

Adhesive and primer were not available separately. Therefore an identity test was not carried out.

Profile designation:	Frame 67 mm, 101086
Color of basic profile:	white
Profile manufacturer:	VEKA
Marking of the profile:	Aeono 001/262 VEKA S I A E 8 DH 08 2701 UNE EN 12608 04:54 101086
Marking of foil:	---
Foil manufacturer:	Renolit AG, Worms, GERMANY
Foil manufacturer:	MBAS
Colour/design designation:	Golden Oak
Colour/design designation:	3.2178001
Place of lamination:	NACITEX S. L., SAX (Alicante), SPAIN
Adhesive manufacturer:	NEOFLEX S. L., Elche (Alicante), SPAIN
Adhesive :	Reactive PUR hot melt adhesive
Designation:	NEOFLEX PU-2774
Primer:	PRIMER 1822

3. Test procedure

The tests described below were carried out according to the quality and testing directive **“Plastic window profile systems, quality assurance guidelines, RAL-GZ 716/1, section I, plastic window profiles”**, test procedure and requirements, part 7, window profiles made of PVC-U, laminated with film (issue March 2008).

If not indicated otherwise, preconditioning and testing was carried out at a standard atmosphere of 23/50, class 1 in accordance with DIN EN ISO 291.

Usually we carry out tests according to standards for which we have an accreditation. The list of all standards for which we are accredited is shown on the homepage at www.skz.de.

3.1 Charpy V-notch impact strength

The Charpy V-notch impact strength test was carried out on double-notched samples according to item P.3.7 of the test procedure.

Requirement:

Arithmetic mean concerning wall thicknesses ≥ 2.8 mm shall be at least 40 kJ/m² and no individual value shall remain under 20 kJ/m².

In addition, the Charpy V-notch impact strength test was carried out on samples from the laminated outer sight surface, in the condition as delivered.

Requirement:

Not stipulated.

3.2 Adhesion of film, condition as delivered

The test was carried out according to item P.3.17 of the test procedure.

The drawing rate of the clamp was 10 mm/min.

Requirement:

In the condition as delivered, the peeling resistance shall not be less than 2.5 N/mm on any of the 4 samples.

3.3 Weathering resistance after artificial weathering

The weathering resistance test was carried out according to item P.3.12 of the test procedure. The procedure of the artificial weathering was carried out according to DIN EN 513, procedure 1, simulation of a moderate climate zone (M). The surface of the foil was exposed to irradiation.

Parameters of weathering device:

Type of weathering device:	Xenon test device 1200 CPS
Light source:	Xenon-arc source
Filter system:	Terrestrial daylight simulation
Black standard temperature:	60 ± 3 °C
White standard temperature:	40 - 45 °C
Relative humidity	65 ± 5 %
Spray cycle:	18 min water spray, 102 min dry cycle
Irradiation energy EUV (300 - 400) nm:	60 ± 2 W/m ²
Irradiation dose (300 – 800) nm:	8 GJ/m ²
Start:	2009-11-11
End:	2010-05-04

3.3.1 Adhesion of polyacrylate protective layer after weathering

The test was carried out following irradiation of 8 GJ/m² under the microscope in 20-fold magnification.

Requirement:

Peeling-off of the polyacrylate protective layer from the base foil must not be detectable.

3.3.2 Charpy V-notch impact strength after weathering

The test of the Charpy V-notch impact strength was carried out on double-notched samples, in line with DIN EN ISO 179-1/1fC, however, with a remaining width of (3 ± 0.1) mm between the notches and sized 50 mm x 6 mm x wall thickness.

The test was carried out subsequent to weathering, on the reference samples stored in darkness and on the weathered samples. During the test, the weathered surface (foil) was exposed to tensile stress.

Requirement:

After irradiation of 8 GJ/m², arithmetic mean value of Charpy V-notch impact strength must not fall below the value of 24 GJ/m².

There shall not be any separation between PVC-U base profile and foil.

In addition, the Charpy V-notch impact strength was performed on 6 weathered test pieces of which after the artificial weathering the PMMA protective layer was stripped by means of grinding.

3.3.3 Foil adhesion after artificial weathering

The test was carried out according to item P.3.17 of the test procedure.

Requirement:

The peeling resistance shall not be less than 2.0 N/mm on any of the 4 weathered samples.

4. Test results

4.1 Charpy V-notch impact strength

PVC-U profile without foil, condition as delivered

Charpy V-notch impact strength [kJ/m ²]	
\bar{x}	s
60.2	1.8
10 x partial break (P)	

\bar{x} = mean value s = standard deviation

minimum single value: 57.1 kJ/m²

PVC-U profile laminated, condition as delivered

Charpy V-notch impact strength [kJ/m ²]	
\bar{x}	s
51.9	1.4
10 x partial break (P)	

\bar{x} = mean value s = standard deviation

4.2 Adhesion of film, condition as delivered

Sample no.	Peel strength [N/mm]	Remark
1	3.0	Break of foil without peel-off from base profile
2	3.2	Break of foil without peel-off from base profile
3	2.6	Break of foil without peel-off from base profile
4	2.9	Break of foil without peel-off from base profile

4.3 Weathering resistance after artificial weathering

4.3.1 Adhesion of polyacrylate protective layer after weathering

A peel-off of the polyacrylate protective layer from the base foil was not found.

4.3.2 Charpy V-notch impact strength after weathering

Charpy V-notch impact strength [kJ/m ²]				
Reference samples (un-weathered)		weathered samples		change in %
\bar{x}	s	\bar{x}	s	
51.9	1.9	43.3	4.0	-16.6
10 x partial break (P)		10 x partial break (P)		

\bar{x} = mean value s = standard deviation

No separation between the PVC base profile and the foil was found.

Test of weathered test pieces with removed PMMA layer

Charpy V-notch impact strength/1fC in [kJ/m ²]	
\bar{x}	s
55.5	2.2
6 x partial break (P)	

\bar{x} = mean value s = standard deviation

4.3.3 Foil adhesion after artificial weathering

Samples after artificial weathering with an irradiation dose of 8 GJ/m²

Sample no.	Peel strength [N/mm]	Remark
1	3.9	Break of foil without peel-off from base profile
2	2.4	Peel-off of foil without break of foil (stop after about 10 mm peel-off)
3	3.6	Break of foil without peel-off from base profile
4	2.5	Peel-off of foil without break of foil (stop after about 35 mm peel-off)

5. Assessment of test results

The requirement of the quality guideline RAL-GZ 716/1, section I, part 7, edition march 2008 concerning item 2.14 adhesion of film to the carrier profile prior and after artificial weathering, has been met.

The requirement of the quality guideline, item 2.8 and 2.13.2 Charpy V-notch impact strength, prior and after artificial weathering, has been met.

The mean value of Charpy V-notch impact strength after artificial weathering of 43.3 kJ/m², is higher than the required value of at least 24 kJ/m².

In addition, the Charpy V-notch impact strength test was carried out on weathered samples from which the polyacrylate layer had been removed. The mean value of the Charpy V-notch impact strength of these samples was 55.5 kJ/m².

Therefore the requirements in respect of weathering resistance, as determined in the actual edition from March 2008 of the revised quality guideline RAL-GZ 716/1 under section I, part 7, are met.