

Test report no.: 81169/08-I

Customer: EGE-Profil A. S
Atatürk Organize Sanayi Bölgesi
1003 Sokak No.: 5
35510 Cigli-Izmir
TURKEY

Order: Testing of resistance to weathering, classification S,
plus testing material characteristics according to EN 12608:
2003, window profiles made of PVC-U "Unplasticized poly-
vinylchloride (PVC-U) profiles for the fabrication of windows
and doors - Classification, requirements and test methods".

E-mail from: 2008-02-08 **by:** Mrs. Sebnem Vergote

Test samples received on: 2008-01-08

Test period: 2008-02-11 to 2009-03-10

This test report consists of 7 pages.

Würzburg, 2009-03-10
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1. Order

By its e-mail of February 8, 2008 the company EGE-Profil A. S., Atatürk Organize Sanayi Bölgesi, 1003 Sokak No.: 5, 35510 Cigli-Izmir, TURKEY instructed SKZ - TeConA GmbH to test resistance to weathering, classification S, according to EN 12608: 2003 "Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - Classification, requirements and test methods".

2. Test material

On January 8, 2008 SKZ - TeConA GmbH received following samples:

6 x 1 m window profile made of PVC-U, colour white

Profile manufacturer:	EGE-Profil A. S., 35510 Cigli-Izmir, TURKEY
Profile designation:	Window sash
Profile marking:	DECEUNINCK SIB 12602 1 05 12 07 EN 12608 TS 5358
Formulation:	Ana profil compoundu - TPX
Stabilization:	CaZn

3. Test procedure

The resistance to weathering was tested according to (DIN) EN 12608 "window profiles made of PVC-U "Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors - Classification, requirements and test methods": 2003 item 5.8, climate zone S. The testing of the material properties according to EN 12608 was carried out according to the specifications of Annex A.

Unless otherwise noted all tests were carried out at standard atmosphere 23/50, class 1, according to 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 Resistance to weathering

Testing of resistance to weathering (Impact strength after artificial weathering and colour fastness) was performed according to DIN EN 513. Procedure of artificial weathering is based on the requirements according to DIN EN 513, procedure 2, simulation of a severe climate zone (S). Surface outside was irradiated.

Parameters of weathering device:

Type of weathering device:	XENOTEST BETA LM
Light source:	Xenon-arc source
Filter:	terrestrial daylight simulation
Black standard temperature:	65 ± 3 °C
White standard temperature:	45 - 50 °C
Relative humidity:	65 ± 5 %
Spray cycle:	6 min water spray, 114 min dry cycle
Irradiation energy EUV (300 - 400) nm:	60 ± 2 W/m ²
Irradiation dose (300 – 800) nm:	12 GJ/m ²
Exposure period:	6101 h
Start:	2008-02-13
End:	2008-11-14

3.1.1 Impact strength after artificial weathering

Impact strength was tested on double notched samples according to DIN EN ISO 179-1/1fA, (notch base radius 0.25 mm), but with a residual width of (3 ± 0.1) mm on samples of the dimensions 50 x 6 mm x wall thickness. The test was carried out subsequent to artificial weathering on reference samples, which have been stored in the dark, as well as on weathered samples. During this test the weathered surface was subjected to tensile stress.

Requirement:

After artificial weathering impact strength of weathered samples shall not drop more than 40 % compared to the value of the unweathered samples.

3.1.2 Colour fastness

3.1.2.1 Visual assessment

Visual assessment was carried out according to ISO 4582 by using grey scale according to ISO 105-A03 and additionally the grey scale according to ISO 105-A02.

3.1.2.2 Colourimetric assessment

The sample colour was measured by means of a spectrophotometer of a wave length area from 360 to 750 nm, standard light type D65, gloss inclusion, 10° normal inspection. It was determined colour distance ΔE^*_{ab} according to ISO 7724-3.

Requirement:

After artificial weathering colour distance ΔE^*_{ab} between unweathered and weathered samples shall not be larger than 5 and colour distance Δb^* shall not be larger than 3.

3.2 Material properties

3.2.1 Determination of the Vicat softening temperature

The Vicat softening temperature VST was determined according to DIN EN ISO 306, method B/50 on the window profile sections. The samples were taken from the window profile, the tip of the indenter was placed onto the outer sight surface. The mean value is based on 3 individual values.

Requirement:

The Vicat softening temperature VST shall not be less than 75 °C.

3.2.2 Charpy notched impact strength

The Charpy notched impact strength a_{cN} was tested on simple-notched samples sized (80 x 10 x 4) mm according to DIN EN ISO 179-1/1eA. The notch radius was 0.25 mm. The samples were taken from pressed plates by milling. The mean value is based on 10 individual values.

Requirement:

Charpy notched impact strength a_{cN} shall not be less than the nominal value specified by the manufacturer with 20 kJ/m².

Production of calendered sheet and pressed plates:

The production of calendered sheet and pressed plates was carried out according to ISO 1163-2.

Production of calendered sheet:

Temperature of roll: 175 °C
Duration: 5 min

Production of pressed plates:

Pressing temperature: 180 °C
Pressing temperature: 10 min
Thickness of pressed plates: 4 mm

3.2.3 Flexural modulus of elasticity

The flexural modulus of elasticity (E_b) was determined according to EN ISO 178. The samples were taken from pressed plates by milling.
(For parameters for calendered sheet and pressed plate production, please see item 3.2.2.)

Requirement:

The flexural modulus of elasticity (E_b) at 23°C shall not be less than 2,200 N/mm².

3.2.4 Tensile impact strength

The tensile impact strength test was carried out according to EN ISO 8256, on samples of type 5. The samples were taken from the outer sight surface of the window profiles, in the direction of extrusion, by milling. The mean value is based on 10 individual values.

Requirement:

The mean tensile impact strength shall not be less than 600 °C.

4. Test results

4.1 Resistance to weathering

4.1.1 Impact strength after artificial weathering

Sash profile, sample along the lines of 179-1/1fA (notch base radius 0.25 mm)				
reference sample (not weathered)		weathered samples		amendment in %
\bar{x}	s	\bar{x}	s	
83.1	0.6	80.0	0.7	-3.7
10 x P (partial break)		10 x P (partial break)		

\bar{x} = mean value

s = standard deviation

4.1.2 Colour fastness

4.1.2.1 Visual assessment

Time of exposure	Dose of irradiation	Colour fastness according to ISO 105		Remark
		A02	A03	
4086 h	8 GJ/m ²	4	4 - 5	lighter, more blue, duller
6101 h	12 GJ/m ²	4	4 - 5	lighter, duller

On the surface neither stains, blisters, strips nor crack formations or anything that significantly damages the appearance were observed.

4.1.2.2 Colourimetric assessment

Absolute value before artificial weathering: $L^* = 94.8$ $a^* = -1.0$ $b^* = 2.1$
 Absolute value after artificial weathering: $L^* = 95.2$ $a^* = -0.8$ $b^* = 0.5$

Time of exposure	Dose of irradiation	Colour coordinates			Colour distance E*ab
		L^*	Δa^*	Δb^*	
4086 h	8 GJ/m ²	0.5	0.2	-1.6	1.7
6101 h	12 GJ/m ²	0.4	0.2	-1.6	1.7

4.2 Material properties

	Characteristics / test method	Unit	Requirement	Result
4.1	Vicat softening temperature EN ISO 306, B/50	°C	≥ 75	82
4.2	Charpy notched impact strength a_{cN} EN ISO 179/1eA	kJ/m ²	≥ 20	21 P ^{*)}
4.3	Flexural modulus of elasticity EN ISO 178	N/mm ²	≥ 2,200	3054
4.4	Tensile impact strength EN ISO 8256	kJ/m ²	≥ 600	939

*) P = partial break

5. Assessment of test results

The requirement according to EN 12608: 2003 resistance to weathering, classification according to climate zone S (severe climate) is fulfilled.

Furthermore the tested material for extrusion of window profiles has met the requirements according to EN 12608, annex A.

With respect of the classification of Charpy notched impact strength, the requirement of at least 20 kJ/ m² was met.