

Test report no.: 118483/15-I

Customer: LG Hausys Ltd.
One IFC
10 Gookjegeumyoong-Ro
Youngdeungpo-Gu
150-876 SEOUL
KOREA

Order: Testing of weathering fastness after artificial weathering according to Technical appendix "section II" to RAL-GZ 716, part II-a-3 (issue December 2013), on window profiles made of PVC-U laminated with film.

Artificial weathering according to DIN EN 513: 1999-10, procedure 1 (simulation of a moderate climate zone M) up to an irradiation dose equivalent of altogether 30 GJ/m² in the wave length range of 300 nm to 800 nm.

E-mail of: 2015-11-05
2017-02-28

from: Mr. K.T. Kang
Ms. Tanja Bruns

Test samples received on: 2015-11-06

Test period: 2015-11-17 to 2017-10-20

This test report consists of 7 pages.

Würzburg, 2017-11-08
Wk/km

i. V.



Dr. Anton Zahn



i. A.



M.Sc. Constantin Weck

The original language of the report is German. In case of doubt, the German version is obligatory.

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1. Order

The company LG Hausys Ltd., One IFC, 10 Gookjegeumyoong-Ro, Youngdeungpo-Gu, 150-876 SEOUL, KOREA, ordered the following test to be carried out at SKZ - Testing GmbH in their email dated 5 November 2015 and 28 February 2017 Testing of weathering fastness after artificial weathering on window profiles made of PVC-U laminated with film according to Technical appendix "section II" to RAL-GZ 716, part II-a-3 (issue December 2013). Artificial weathering was carried out according to DIN EN 513: 1999-10, procedure 1 (simulation of a moderate climate zone M) up to an irradiation dose equivalent of altogether 30 GJ/m² in the wave length range of 300 nm to 800 nm.

2. Test material

SKZ - Testing GmbH had the following test material at their disposal on 6 November 2015:

17 x 3 m window profile sections, foil-laminated.

Base profile: Quality assured profile made of PVC-U

Sample no.:	Colour/Design number
1	UK120
2	UK103
3	UJ301
4	UJ401
5	UR401
6	UQ901
7	YEL88
8	KDB75
9	UK120
10	UK103
11	UJ301
12	UJ401

Continuation of table

Sample no.:	Colour/Design number
13	UR401
14	UQ901
15	YEL88
16	KDB75
17	G8202

3. Execution of test

Following tests were carried out according to Technical appendix "section II" to RAL-GZ 716, part II-a-3: Films for laminating PVC-U-window profiles (issue December 2013).

Unless indicated otherwise, the tests were carried out at standard conditioning atmosphere 23/50, class 1 according to DIN EN ISO 291: 2008-08.

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 Weathering fastness

Procedure of artificial weathering is based on the requirements according to DIN EN 513: 1999-10, procedure 1, simulation of a moderate climate zone (M). Laminated outside surface was irradiated.

Parameter of the weathering device:

Type of exposure device:	XENOTEST® BETA LM
Light source:	Xenon arc source
Filter system:	Terrestrial daylight simulation
Operation:	non-alternating mode
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
Irradiance E_{UV} (300 - 400) nm:	60 ± 2 W/m ²
Total irradiation dose equivalent in the wave length range (300 - 800) nm:	30 GJ/m²
Exposure period:	15248 h
Start:	2015-12-15
End:	2017-10-20

3.1.1 Visual evaluation

Visual evaluation was carried out according to DIN EN 20105-A02: 1994-10 by using the grey scale for assessing change in colour.

Upon termination of artificial weathering after 30 GJ/m², the colour change must not be greater than allowed by grade 3 of the grey scale according to DIN EN 20105-A02.

Changes must not bring about stains, bubbles, streaks or cracks.

A peel-off of the coating between the polyacrylate protective layer and the base foil as well as between the base foil and the PVC-U-profile must not occur.

3.1.2 Colourimetric evaluation

The colourimetric evaluation was carried out via a spectrophotometer in the wavelength range from 360 to 750 nm, standard light type D65, gloss inclusion, 10° standard observation. The colour distance ΔE^*_{ab} according to DIN EN ISO 11664-4: 2012-06 was determined.

Each sample was measured before and after artificial weathering at the same measuring position on the sample, upon identical sample placement. Due to that, also in case of the not single-coloured foils with surface texture, a guide value for colour change can be determined in terms of colourimetry.

Requirements: None

4. Test results

4.1 Weathering fastness

4.1.1 Visual evaluation

Irradiation dose equivalent 30 GJ/m²:

Sample no.	Design no.	Grey scale value acc. to DIN EN 20105-A02
1	UK120	4 - 5
2	UK103	4 - 5
3	UJ301	4 - 5
4	UJ401	4 - 5
5	UR401	4 - 5
6	UQ901	4 - 5
7	YEL88	4 - 5
8	KDB75	4 - 5
9	UK120	4
10	UK103	4
11	UJ301	4 - 5
12	UJ401	4 - 5
13	UR401	4 - 5
14	UQ901	4 - 5
15	YEL88	4 - 5
16	KDB75	4 - 5
17	G8202	4

Neither stains, bubbles, streaks nor cracks were observed on sample surfaces.

No flake off was found on the polyacrylate protective layer of any sample. A peel-off of the base foil from PVC-U-profile did not occur.

4.1.2 Colourimetric evaluation

Irradiation dose equivalent 30 GJ/m²:

Sample no.	Design no.	Colour coordinates			
		ΔL^*	Δa^*	Δb^*	ΔE^*_{ab}
1	UK120	0.7	0.8	2.6	2.8
2	UK103	-0.2	0.2	1.4	1.4
3	UJ301	-0.7	-0.1	0.9	1.1
4	UJ401	-1.1	-0.1	0.6	1.3
5	UR401	-0.5	-0.3	0.5	0.8
6	UQ901	-1.0	-0.2	0.3	1.1
7	YEL88	-0.2	-0.1	0.0	0.2
8	KDB75	-1.1	0.0	0.1	1.1
9	UK120	2.0	3.0	4.8	6.0
10	UK103	0.5	1.2	2.3	2.6
11	UJ301	-1.1	0.6	1.6	2.0
12	UJ401	-0.5	0.2	1.0	1.1
13	UR401	0.1	-0.1	0.9	0.9
14	UQ901	-0.5	-0.2	0.4	0.7
15	YEL88	-0.1	0.0	0.0	0.1
16	KDB75	-0.3	-0.1	-0.1	0.3
17	G8202	0.8	2.2	3.4	4.1

5. Assessment of test results on the basis of RAL-GZ 716, issue December 2013

The requirements according to Technical annex „section II“ of RAL-GZ 716 Quality and Test Requirements for components and procedures. part II-a-3: Films for the lamination of window profiles made of PVC-U. for climate zone M and an total irradiation dose equivalent of altogether 30 GJ/m² are met from the tested foils. According to item 5.2-2.1.2. table 2 minimum requirement class M20, as well as the higher classification M30 was achieved.