

## Saflex® and Vanceva® interlayer durability – EN ISO 12543-2

International Organization for Standardization (ISO) 12543-2:2011 *Glass in building - Laminated glass and laminated safety glass - Part 2: Laminated safety glass*, specifies performance requirements for laminated safety glass, as defined in ISO 12543-1. These performance requirements comprise a classification for breakage characteristics related to safety and durability requirements. The text of ISO 12543-2:2011 has been approved by Central European Norms (CEN) as EN ISO 12543-2:2011 without any modification.

The durability requirements for laminated safety glass that do not include plastic glazing materials according to EN ISO 12543-2 are:

- 1) A high temperature test as described in ISO 12543-4:2011, paragraph 5, and evaluated in accordance with ISO 12543-4:2011, 5.4.
- 2) A high humidity test according as described in 12543-4:2011, paragraph 6, and evaluated in accordance with ISO 12543-4:2011, 6.4, and
- 3) A UV radiation test as described in ISO 12543-4:2011, paragraph 7, and evaluated in accordance with ISO 12543-4:2011, 7.5.1

Saflex Clear (R-series), Saflex Acoustic (Q-series) Saflex Structural (DG), Saflex Storm (DM/HP) and Vanceva interlayers can meet the durability requirements as set forth in EN ISO 12543-2.

The determination of the characteristic performances section of prEN 14449:2017 *Glass in building – Laminated glass and laminated safety glass - Evaluation of conformity/product standard* specifies that the appropriate test for durability should be executed in accordance with EN ISO 12543-2 or 12543-3. With regards to the UV-radiation test, it is further specified that “the necessity for undertaking the radiation test can be overcome if appropriate test reports are supplied by the interlayer supplier” (4.2.2.15). Similar wording is present in EN 14449:2005.

As it is recognized that the high temperature and humidity tests can only be executed in a meaningful way on laminated glass as prepared by the laminated glass manufacturer, Eastman establishes the potential for compliance of Saflex and Vanceva interlayers on a product family basis. Vanceva interlayers, including Vanceva Colors, Vanceva Earth Tones and Vanceva Illusion White as well as Saflex Clear are Saflex R-series formulations. Therefore, the test results for ISO 12543 are provided for Saflex R-series formulations and cover these materials. Saflex Acoustic (QS or Q-series), Saflex Structural (DG) and Saflex Storm (DM/HP) are tested separately.

As it is recognized that the outcome of the UV radiation test is driven by the interlayer component, Eastman establishes the compliance of Saflex and Vanceva interlayer formulations based on testing at an independent laboratory. Interlayers are tested in laminated configuration with two pieces of 3 mm clear glass, in the minimum interlayer thickness available and appropriate for the product.

### UV radiation test (ISO 12543-4:2011 – paragraph 7)

Criteria:

A laminated glass passes this test, if the following criteria apply:

1. The luminous transmittance (or (visible) light transmittance) of three irradiated test specimens has not changed by more than:
  - a)  $\pm 3$  % of their value before exposure for initial light transmittances of greater than 65 %, or
  - b)  $\pm 2$  % of their absolute value for initial light transmittances of less than or equal to 65 %.
2. When visually inspected, no fault (i.e. bubbles, delamination, haze or cloudiness) was found in the three irradiated test specimens. If faults were found in only one test specimen, three new test specimens would have to be prepared for testing in accordance with ISO 12543-4:2011, paragraph 7, and evaluated in accordance with ISO 12543-4:2011, 7.5.1. No fault shall be found in any of these three repeated test specimens.

**Methodology:**

1. Samples of laminated glass (30 cm x 30 cm in size) were prepared from 3 mm clear float glass using a Saflex or Vanceva interlayer of appropriate thickness.
2. The samples were submitted to an independent laboratory where a radiation test was performed according to the specifications of EN 12543-4 using 16 OSRAM ULTRAVITALUX 300 W lamps, for 2000 hours, at a temperature of 45+/-5°C.
3. The transmittance values of the samples were measured and calculated as specified by EN 410 *Glass in building - Determination of luminous and solar characteristics of glazing*.

The test results are summarized in Table 1.

**Table 1.** Results of EN12543-4 UV radiation testing

Brand	Subtypes	Color code if applicable*	EN12543-4 UV radiation test result
Saflex Clear	RB11, RB41, RB61, RB71		Pass
Saflex Structural	DG41, DG41 XC		Pass
Saflex Acoustic	QS21, QS31, QS41, QS71		Pass
Saflex Storm	DMJ1		Pass
Vanceva Colors	Coral Rose, Aquamarine, Smoke Grey, Sahara Sun, Ruby Red, Sapphire, Evening Shadow, Golden Light	807800, 827800, 837800, 817800, 805000, 82500, 835000, 818600	Pass
Vanceva Colors (specialty)	Deep Red, True Blue, Tangerine, Ocean Grey	851500, 841400, 864100, 876100	Pass
Vanceva Colors (translucent)	Cool White, Arctic Snow, Polar White, Absolute Black	218000, 216500, 220700, 830000	Pass
Vanceva Earth Tones	Grey, Medium Blue grey, Light Bronze, Medium Bronze, Bronze, Cool Blue, Sky Blue, Light Blue Green, Light neutral Brown, Medium Neutral Brown, Dark Neutral Brown	654400, 082800, 555800, 642800, 645200, 637600, 755800, 377300, 365500, 362800, 360900	Pass

\*some colors are available in 0.38 (RB17) and 0.76 mm thickness (RB47). See product offering for details.

As a gradient product, Vanceva Illusion White cannot be tested in an unambiguous way according to the standard. For the clear part, reference can be made to Saflex RB11, and for the translucent part to Saflex RB17 216500.

EN ISO 12543 does not require the evaluation of color changes. Eastman is using the procedure of ANSI Z97.1-2015 for this characteristic for Saflex and Vanceva interlayers. The method in this standard comprises the determination of yellowness index, haze and delta E before and after accelerated weathering. Delta E is a measure of color stability. All interlayers above pass these requirements as well. A separate statement is available.

**High temperature and humidity tests (ISO 12543-4:2011 – paragraphs 5&6)**

**Criteria:**

1. A laminated glass passes these tests, if the following criteria apply:
  - a. No fault (i.e. bubbles, delamination, haze or cloudiness) was found in three test specimens after the test. If faults were found in only one test specimen, three new test specimens would have to be tested. No fault shall be found in any of these three re-test specimens.

Methodology for the high temperature test:

1. Samples of laminated glass (30 cm x 30 cm in size) were prepared from 3 mm clear float glass using a Saflex or Vanceva interlayer of 0.76 mm thickness.
2. The three test specimens were heated to a temperature of 100°C in an oven.
3. The test temperature was maintained for 16h, excluding the time required for heating of the samples. The test specimens were taken out and allowed to cool to room temperature by storing them vertically under natural convection.
4. The assessment of the test samples was carried out when the glass surface temperature was lower than 30°C.

Methodology for the humidity test:

1. Samples of laminated glass (30 cm x 30 cm in size) were prepared from 3 mm clear float glass using a Saflex or Vanceva interlayer of 0.76 mm thickness.
2. The three test specimens were kept vertically over water in a closed container for two weeks. The temperature of the air in the container was maintained between 50 and 55°C. Adequate spacing between the test specimens was provided.
3. The samples were removed from the container and inspected at a distance between 300 mm and 500 mm in front of a white diffuse background.

The test results are summarized in Table 2.

**Table 2.** Results of EN12543-4 UV high temperature and humidity testing

Formulation type	Brands	EN12543-4 High temperature	EN12543-4 Humidity test result
Saflex R-series	Saflex Clear, Vanceva Colors, Vanceva Earth Tones	Pass	Pass
Saflex Structural		Pass	Pass
Saflex Acoustic		Pass	Pass
Saflex Storm	Saflex HP	Pass	Pass

It is recommended that compliance with the high temperature and humidity requirements is verified by the laminated glass manufacturer on different product types as offered.

Apart from and above the requirements derived from standards, Eastman executes additional natural or accelerated exposure testing on Saflex and Vanceva interlayers. Details can be provided in a separate statement.

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