

Class. No.: 55126  
 Descriptors: Florida, Florida test, weathering, weather resistance, climate

**Non-Metallic Materials**

**Weathering in Moist, Hot Climate**

**Previous issues**

PV 3930: 1993-11, 1994-08, 2003-11

**Changes**

The following changes have been made as compared to Test Specification PV 3930: 2003-11:  
 – Two test devices removed, two added

**1 Scope**

This standard describes the procedure for testing the aging behavior (e.g., change in color and gloss) of plastics, elastomers and folding-top cloths as well as paintwork and similar coatings that are subjected to weather and daylight. Testing is carried out by means of artificial weathering in a moist hot climate (e.g., Florida).

The test is used for sample and standard production monitoring.

NOTE: For certain applications, the aging criteria may consist of changes in the mechanical properties or cracking. For this reason, additional tests may be required along with the visual evaluation and color and glossiness measurements. These tests may include tensile tests, determination of impact resistance, determination of hardness and microscopic examinations, for example.

**2 Description**

Weather resistance according to PV 3930

Check standard for current issue prior to usage.  
 The English translation is believed to be accurate. In case of discrepancies the German version shall govern.  
 Numerical notation acc. to ISO practice.  
 This electronically generated standard is authentic and valid without signature.

|   |  |
|---|--|
| Technical Responsibility                              | Standards                                    |
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### 3 Requirements

The number of required year cycles, as well as deviations from this test standard, are set out in the Technical Supply Specifications, Volkswagen standards and drawings depending on the component position or material.

### 4 Test Method

#### 4.1 Principle

Specimens shall be irradiated using Xenon arc light and periodically moistened. Filters shall be used to adapt the Xenon arc light to the global radiation with its spectral distribution of ultraviolet and visible radiation.

Testing shall be performed in devices according to DIN EN ISO 4892-2 and DIN EN ISO 11341.

The test conditions each describe a year cycle, referred to the average dose of UV radiation of (300 to 385) nm in moist, hot climate zones, e.g., Florida.

#### 4.2 Test equipment

Equipment according to DIN EN ISO 4892-2 and DIN EN ISO 11341 shall be used. To ensure that the test results of the suppliers and purchaser are comparable, the make to be used for the test must be agreed with the responsible laboratory of the Volkswagen Group.

#### 4.3 Weathering conditions

See Table 1. To comply with the test temperatures and, in particular, the black standard temperatures, it may be necessary to keep the laboratory space at a constant temperature or to connect a cooling unit to the test equipment.

**Table 1**

|  |   |   |   |   |   |
|--|---|---|---|---|---|
| Make   | Xenotest 1200 CPS   | Xenotest alpha<br>Xenotest beta LM  | Weather-O-Meter<br>Ci 3000<br>Ci 4000<br>Ci 5000                            | Suntest XXL+  | Q-Panel   |
| Filter   | 3 UV-Spezial Suprax<br>Replace according to<br>manufacturer's<br>specifications | Xenochrom 300<br>Replace according to<br>manufacturer's<br>specifications | Pyrex S/Pyrex S<br>Replace according to<br>manufacturer's<br>specifications | Coated quartz filter<br>and 300 nm daylight<br>filter | Coated quartz filter<br>and 300 nm daylight<br>filter |
| Rain cycle   | 102 : 18  |   |   |   |   |
| Specimen rotation  | Non-turning mode  |   |   | Flatbed equipment                                     |   |
| Black standard<br>temperature ( °C)                        | 65 ± 2  |   |   |   |   |
| Specimen chamber<br>temperature<br>in the dry phase ( °C)  | 35 to 45  |   |   |   |   |
| Relative humidity in the<br>dry phase (%)                  | 60 to 80  |   |   |   |   |
| Intensity of irradiation<br>(W/m <sup>2</sup> )<br>(nm)    | (Controlled)<br>60<br>300 to 400  |   | (Controlled)<br>0,5<br>340  | 300 to 400  |   |
| Test duration<br>(approximate value) (h)                   | Approx. 1 600   |   |   |   |   |
| Irradiation dose<br>(1 year cycle)<br>(MJ/m <sup>2</sup> ) | 350   |   | 2,9   | 350   |   |

## 4.4 Specimen

### 4.4.1 Specimen preparation

The specimens shall be taken from a representative portion of the finished part to be tested or of specimen sheets manufactured under standard production conditions. They shall be as flat as possible. As long as the apparatus-dependent specimen carrier size is not exceeded, complete components may also be tested. However, it is important to ensure that the surface to be tested does not project more than 10 mm over the specimen carrier plane. The specimen shall be secured on the specimen carrier. One half of the specimen's surface shall be covered with a sheet metal mask.

In order to test the change in mechanical properties, e.g., by means of tensile tests and determination of the impact resistance, the specimens shall be made in a size that is required for the respective test procedure or that is prescribed in standards.

Paintwork and similar coatings shall be tested always on the substrate to be used.

For the test of paint materials, sample coatings shall be produced under standard production conditions (application method, drying method, and coating thickness).

### 4.4.2 Specimen size

The specimen size shall be in accordance with the maximum clampable test surfaces in the original specimen carriers. Thus, the following would apply:

|                                       |                 |
|---------------------------------------|-----------------|
| – Xenotest 1200 CPS                   | (175 x 60) mm   |
| – Xenotest alpha                      | (130 x 40) mm   |
| – Weather-O-meter Ci 3000             | (130 x 45) mm   |
| – Weather-O-Meter Ci 4000 and Ci 5000 | (1 450 x 70) mm |
| – Suntest XXL+                        | (135 x 45) mm   |
| – Q-Panel                             | (135 x 45) mm   |

The selected specimen size shall be sufficiently large to ensure that proper evaluation can be performed with the designated procedures.

### 4.4.3 Specimen carriers

Only for Xenotest 1200 CPS: Bent non-turning carriers shall be used in order to achieve an even intensity of irradiation over all three specimen carrier planes.

For the Suntest XXL+ and Q-Panel Xenotest equipment types, it shall be ensured that the specimen frames are rotated clockwise every 200 h in order to achieve uniform weathering of the specimens.

## 4.5 Weathering test

### 4.5.1 Cleaning the filters

The filter systems shall be checked and cleaned at regular intervals.

#### **4.5.2 Replacing the irradiator**

The maximum operating time of the irradiator for non-adjustable equipment types is 1 500 h. However, the operating time for adjustable equipment types may be extended up to the control limit.

#### **4.5.3 Spray water**

To avoid deposits on the specimen, which can complicate the evaluation, distilled or deionized, silicate-free water with a conductance of  $\leq 0,2 \mu\text{S}$  and an evaporation residue of  $< 1 \text{ ppm}$  shall be used.

#### **4.5.4 Weathering cycle**

The end of a weathering cycle is reached for a specified intensity of UV irradiation and radiation dose after a specific test duration (approximate value; see Table 1). To ensure even intensity of irradiation, this shall be checked weekly with the Xenocal made by Atlas. In the Q-Panel equipment, this is checked with appropriate sensors.

### **4.6 Evaluating the specimens**

#### **4.6.1 Visual evaluation**

Changes in color and gloss shall be compared against the previously covered surface or an unexposed reference specimen with the gray scale to evaluate the "change in color" according to DIN EN 20105-A02 under lighting according to DIN EN ISO 105-A01 or indirect daylight by several proficient normal-sighted people (at least two).

Changes that need not be evaluated by means of measurements are described according to DIN 53230.

#### **4.6.2 Colorimetric evaluation**

In addition to the visual evaluation, a colorimetric evaluation using a spectrophotometer according to CIELAB (DIN 6174), excluding the gloss value, shall be conducted according to a procedure specified in VW 50195.

If required, the result shall be converted to gray-scale levels according to DIN EN 20105-A02, and for yellowing to yellow values according to DIN 6167.

In the case of painted specimens, it is preferable to perform a colorimetric evaluation.

For single-color and homogenous surfaces, at least three measurements shall be averaged. For multicolored, structured or anisotropically scattering specimens, the number of measurements to be averaged shall be increased.

#### **4.6.3 Evaluation of gloss**

Gloss shall be measured as a reflectometer value according to DIN 67530, and the change after weathering is expressed in %.

#### 4.7 Test report

If required in the corresponding Technical Supply Specification/Volkswagen standard/drawing, the following information shall be specified in the test report with reference to this test standard:

- a) Test equipment
- b) Total test duration
- c) Color change: gray-scale level/dE/dL/da/db
- d) Any color shift
- e) Yellow value according to DIN 6167
- f) Change in gloss
- g) Further tested properties and test methods of the appropriate test standard
- h) Additional observations and changes such as cracks, spotting, exudations, chalking, etc.
- i) Any agreed upon conditions that deviate from this Test Specification.

#### 5 Referenced documents

The following documents cited in this standard are necessary for application.

In this Section, terminological inconsistencies may occur as the original titles are used.

|                    |   |
|--------------------|---|
| VW 50195           | Colorimetric Evaluation of Automobile Paint Coatings  |
| DIN 6167           | Description of Yellowness of Near-White or Near-Colourless Materials  |
| DIN 6174           | Colorimetric Evaluation of Colour Coordinates and Colour Differences according to the Approximately Uniform CIELAB Colour Space |
| DIN 53230          | Testing of Paints, Varnishes and Similar Coating Materials, Scheme for the Evaluation of Tests                                  |
| DIN 67530          | Reflectometer as a Means for Gloss Assessment of Plane Surfaces of Paint Coatings and Plastics                                  |
| DIN EN 20105-A02   | Textiles – Tests for Colour Fastness – Part A02: Grey Scale for Assessing Change in Colour                                      |
| DIN EN ISO 105-A01 | Textiles – Tests for Colour Fastness – Part A01: General Principles of Testing  |
| DIN EN ISO 4892-2  | Plastics – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-Arc Lamps  |
| DIN EN ISO 11341   | Paints and Varnishes – Artificial Weathering and Exposure to Artificial Radiation – Exposure to Filtered Xenon-Arc Radiation    |