



## 非金属材料 湿热气候下的光照试验

### Non-Metallic Materials Weathering in Moist, Hot Climate

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Technical Standardization Committee of SAIC Motor Technical Center

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## 前 言

为规范 SMTC 汽车零件非金属材料湿热气候下的光照试验，特制定本标准。

当中英文产生疑义时，以中文为准。

本标准由材料分标委提出。

本标准由 SMTC 技术标准化委员会批准。

本标准由标准化工作组归口管理。

本标准起草部门：车身部。

本标准主要起草人为：何玉松

本标准于 2010 年 4 月 13 日首次批准发布，  
2010 年 4 月 14 日实施。

## Foreword

To specify the Non-Metallic Materials Weathering in Moist, Hot Climate, we issued the standard.

This standard in Chinese and English have a doubt, the Chinese version should be criterion.

This standard was proposed and approved by Technical Committee of Standardization of SAIC Motor Technical Center.

This standard is under the management of Standardization working team.

The draft department of this standard: Body Dept.

The main drafters of this standard: He yusong.

This standard was first published on 13<sup>th</sup> Apr 2010 and implemented on 14<sup>th</sup> Apr 2010.



## 非金属材料

### 湿热气候下的光照试验

#### 1 范围

本标准规定了评定塑料, 橡胶, 可折叠车顶织物, 喷涂油漆以及类似涂层等在经历日光照射后老化行为(如颜色, 光泽的改变)的试验流程。

该试验通过在人为的湿热气候(如佛罗里达)下进行光照来完成。

该试验用于对试样与标准产品的监控。

注: 在一些特定的应用上, 老化标准可能还包括力学性能或破裂的变化。因这个原因, 除目视评定, 颜色与光泽度测试之外, 还需要额外的试验来对此进行评定。这些试验可能包括拉伸试验, 冲击阻力试验, 硬度测试以及金相微观等试验。

#### 2 规范性引用文件

下列文件中的条款通过本标准的引用而成为本标准的条款。凡是注日期的引用文件, 其随后所有的修改单(不包括勘误的内容)或修订版均不适用于本标准, 然而, 鼓励根据本标准达成协议的各方研究是否可使用这些文件的最新版本。凡是不注日期的引用文件, 其最新版本适用于本标准。

SMTC 30513 汽车用油漆涂层的色度评价

DIN 6167 纯白色或无色材料黄色的描述

DIN 6174 彩色坐标的色度评定和色彩差异的评定依照近似的 CIELAB 均匀色度空间

DIN 53230 油漆, 清漆以及类似涂层材料的测试, 测试评估的方法

DIN 67530 反射计作为塑料件和涂装的平面光泽评定的一种方法

DIN EN 20105-A02 纺织品-颜色牢固性的测试-A02 部分: 变色灰度级的评定

## Non-Metallic Materials

### Weathering in Moist, Hot Climate

#### 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 Normative references

The following normative documents contain provision which, through reference in this text, constitute provisions of this standard. For dated reference, subsequent amendments to, or revisions of, any of these publications do not apply (exclude the correction), but parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards. For undated references, the latest edition of the normative document referred to applies.

SMTC30513 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 纺织品—颜色牢固性的测试—A01部分：常规原理测定

DIN EN ISO 105-A01 Textiles – Tests for Colour Fastness – Part A01: General Principles of Testing

DIN EN ISO 4892-2 塑料体—对实验室光源的曝光方法—第2部分：氙弧光灯

DIN EN ISO 4892-2 Plastics – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-Arc Lamps

DIN EN ISO 11341 涂料和清漆—人造大气曝露试验和人造辐射的曝光—对氙弧光灯的辐射过滤后的曝光

DIN EN ISO 11341 Paints and Varnishes – Artificial Weathering and Exposure to Artificial Radiation— Exposure to Filtered Xenon-Arc Radiation

### 3 要求

试验所需要的年周期以及与本试验标准之间的偏差，视零部件所处的位置或材料将在供货技术要求、本公司的标准和图样上予以陈述。

### 3 requirements

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

### 4 试验方法

### 4 Test method

#### 4.1 原理

#### 4.1 Principle

采用氙弧光灯对试样进行照射，并定期使试样保持潮湿。滤光器应使氙弧光灯发射的紫外线和可见光光谱可对试样进行球面辐射。

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.

试验设备参照 DIN EN ISO 4892-2 和 DIN EN ISO 11341

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

试验条件为紫外线平均波长在(300 至 385) nm 的湿热气候地带，如佛罗里达。试验周期为一年。

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 试验设备

#### 4.2 Test equipment

根据 DIN EN ISO 4892-2 与 DIN EN ISO 11341 进行试验设备选择。为了确保供应商和客户的试验结果具有可比性，用于试验的设备必须经本公司职能实验室同意并认可。

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 SAIC Motor.

#### 4.3 光照试验条件

#### 4.3 Weathering conditions

为保持试验温度一致，特别是布莱克标准温度，有必要保持试验室恒温或为试验设备连接一个冷却单元。具体试验条件见表 1。

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.

表 1/Table 1

试验设备 make	Xenotest 1200 CPS	Xenotest alpha Xenotest Beta LM	Weather-O-Meter Ci 3000 Ci 4000 Ci 5000	Suntest XXL+	Q-Panel
滤光器 Filter	3 UV-Spezial Suprax 可根据生产商的技术规范替换 Replace according to manufacturer's specifications	Xenochrom 300可 根据生产商的技术规范替换Replace according to manufacturer's specifications	Pyrex S / PyrexS 可根据生产 商技术规范的 Replace according to manufacturer's specifications	涂上一层石英与 300 nm 日光滤光器 Coated quartz filter and 300 nm daylight filter	涂上一层石英与300 nm 日光滤光器Coated quartz filter and 300 nm daylight filter
雨天周期 Rain cycle	102: 18				
试样的旋转 Specimen rotation	非交变模式 Non-turning mode			交变模式 Flatbed equipment	
布莱克标准 温度Black standard temperature (°C)	65±2				
干燥状态下试样的温度 Specimen chamber temperature in the dry phase (°C)	35~45				
干燥状态下相对湿度 Relative humidity in the dry phase (%)	60~80				
辐射强度 Intensity of irradiation (W/m²) (nm)	(受控) 60 300~340		(受控) 0.5 340	300~400	
试验时间 (近似值) Test duration (approximate value) (h)	1 600				
辐射量 (一年为周期) Irradiation dose(1 year cycle) (MJ/m²)	350		2.9	350	

## 4.4 试验样品

## 4.4.1 试样制备

试样应选取零件具有代表性的区域或标准生产条件下制造的样片。试样应尽量保持平整。只要整个零部件尺寸不超过试验设备试样台的尺寸均可进行测试。但必须保证试样台上面向辐射光源照射方向的试样表面凸出不能超

## 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,



面向辐射光照射方向的试样表面凸出不能超过10mm。试样应在试样台上受到保护，一半以上的试样表面应被金属膜片覆盖。

为测试力学性能的变化，如，通过拉伸试样和冲击阻力测试。如，通过拉伸试样和冲击阻力试验。试样应按照各自的试验程序或标准上的定义制备。

喷涂油漆以及类似的涂层应采用最底层进行试验。

对于油漆材料的试验，应采用标准生产条件（应用方法，烘干方法以及涂层厚度）下生产的涂层试样。

#### 4.4.2 试样尺寸

样品尺寸应与原始样品台夹具的最大测试面积一致。因此，可用以下尺寸：

Xenotest 1200 CPS	(175×60) mm
Xenotest alpha	(140×40) mm
Weather-O-meter Ci 3000	(130×45) mm
Weather-O-meter Ci 3000 and Ci4000	(1450×70) mm
Suntest XXL+	(135×45) mm
Q-Panel	(135×45) mm

选择的样品的尺寸应足够大，以确保能使用指定的程序来完成正确的评定。

#### 4.4.3 试样台

仅适用于 Xenotest 1200 CPS：为使试样台三个平面均获得均匀的辐射强度，倾向于采用不能旋转的试样台。

对Suntest XXL+ 和 Q-Panel Xenotest 设备，应采用能每200小时按顺时针旋转的试样架，以确保试验获得均匀的光照。

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	(140 x 40) mm
Weather-O-meter Ci 3000	(130 x 45) mm
Weather-O-meter Ci 3000, Ci4000	(1450 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 光照试验

### 4.5.1 滤光器的清洗

过滤系统应定期的检查与清洗。

### 4.5.2 辐照器的替换

对于不可调整型设备,辐照器的最长操作时间为1500h。但是,可调整型设备的操作时间可延长至设备的可控极限。

### 4.5.3 喷射水

为避免试样沉积而导致评定变得复杂,应采用电导率 $\leq 0.2\mu\text{S}$ ,蒸发残渣 $< 1\text{ ppm}$ 的蒸馏水或去离子水以及不含硅酸盐的水对试样进行冲洗。

### 4.5.4 光照周期

在经过规定试验后(推荐值见表1),当达到规定的UV辐射强度/辐射量后,大气暴露周期结束。为确保获得均匀的辐射强度,应使用Atlas生产的Xenocal设备,每周检查一次。Q-Panel设备应采用合适的传感器进行检查。

## 4.6 试样的评定

### 4.6.1 目视评定

颜色与光泽上的变化,通过与先前覆盖的表面或一个未经光照的参考试样进行对比,根据DIN EN 20105-A02采用灰度级评定“颜色上的变化”。在照明条件下根据DIN EN ISO 105-A01评定或间接的照明下,通过几位具有经验但普通视力的专家进行评定(至少2位)。

并不需要根据DIN EN ISO 4628-1中所描述的测试方法来评定发生的变化。

### 4.6.2 色度的评定

除了目视评定之外,应根据SMTC 30513定义的流程,根据CIELAB (DIN 6174)定义的分光光度计进行除光泽度值外其他色度的评定。

在必要时,应根据DIN EN 20105-A02将试验结果转换为灰度级。根据DIN 6167进行泛黄至黄的评定。

对于单一颜色和同质表面,至少使用三种测量法以取平均值。对于多种颜色,结构或非均质

## 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 1500 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 EN ISO 4628-1.

### 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 SMTC 30513.

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.

For single-color and homogenous surfaces, at least three measurements shall



的试样，应增加测量的方法来获得平均值。

#### 4.6.3 光泽的评定

光泽可根据 DIN 67530 通过反射计值进行评定。光照后的光泽改变采用%表示。

#### 4.7 试验报告

若是相应的技术供货条件/本公司标准/图样所必须的，与本试验标准有关的以下信息应在试验报告中指定出来：

- a) 试验设备。
- b) 总的试验周期。
- c) 颜色变化：灰度级/dE/dL/da/db。
- d) 任何颜色的改变。
- e) 根据 DIN 6167 评定的黄色值。
- f) 光泽的变化。
- g) 额外的观测报告和变化，比如裂纹，污点，渗出物，粉化等。
- h) 任何与本试验规范有偏差，但取得一致意见的条件。

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 shall be expressed in %.

#### 4.7 Test report

If required in the corresponding Technical Supply Specification/SAIC Motor 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) Additional observations and changes such as cracks, spotting, exudations, chalking, etc.
- h) Any agreed upon conditions that deviate from this Test Specification.