Artificial Weathering of Automotive Interior Trim Materials

1 Scope

This test method shall be used to determine the effects of weathering using a xenon-arc lamp source (artificial sunlight) to simulate extreme environmental conditions encountered inside a vehicle due to sunlight, heat and humidity. This method shall be used to evaluate the colorfastness, as well as being the artificial weathering method to evaluate degradation.

Note: Nothing in this test method supersedes applicable laws and regulations unless a specific exemption has been obtained.

Note: In the event of a conflict between the English and the domestic language, the English language shall take precedence.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 Normative.

ISO 105-A02

2.2 GM.

GMW6992

2.3 Additional.

Equipment Manufacturer's Operating Manuals

3 Test Equipment

3.1 Xenon-Arc Weathering Device. The weathering device shall consist of a climatic chamber made from corrosion resistant material, which contains the light source (xenon-arc lamp that is either air-cooled or water-cooled), the filter system and the frame holder for the test specimens. The apparatus must be equipped so that it can meet the following parameters and controls. To insure repeatability of tests, the apparatus must be maintained and calibrated to manufacturer's specification.

3.1.1 Filter System. Fit the xenon-arc burner with the appropriate optical filters to provide a spectral power distribution (SPD) that falls within the range indicated in Table 1 and similar to Figure 1. Examples of filter systems, that will provide this light spectrum distribution for a few machines, are listed in the Appendix.

3.1.2 Irradiance Measuring Device at a location representative of the test specimen location measuring irradiance at one of the following bandwidths.

- $W/m^2/nm$ at 420 nm (narrow bandwidth measurement)
- W/m^2 at 300 to 400 nm (wide bandwidth measurement)

3.1.3 Black Standard Thermometer (BST). The BST is an insulated temperature measuring device consisting of a metal panel, having a matte black coating which absorbs all wavelengths uniformly, with a thermal sensitive element firmly attached to the center of the surface opposite the radiant source. The BST shall measure (70 ± 5) x (40 ± 5) mm and have a thickness of (0.5 ± 0.1) mm and be fixed to a plastic plate so that it is thermally insulated. The BST is used to control an artificial weathering device and to provide an estimate of the maximum temperature of samples exposed to a radiant energy source.

3.1.4 Chamber Temperature (CT) Probe. The CT or the temperature of the air in the test chamber shall be measured and controlled.

3.1.5 Chamber Relative Humidity (RH) Measuring Device. The RH of the test chamber air shall be measured and controlled.

3.1.6 Purified Water. Water for humidification and lamp cooling must be purified so that it contains no more than 0.2 ppm of silica and has no more than 1.0 ppm total dissolved solids.

3.2 Gray Scale for assessing color change complying with the requirements of ISO 105-A02.

3.3 Color Machine (if applicable) – Spectrophotometer capable of CIELAB measurements, with a 10 degree standard observer, a D65 standard illuminant and an orifice size greater or equal to 20 mm. The acceptable machine geometries are: 45 degree/normal (45/0), normal/45 degree (0/45), diffused/normal (d/0), or normal/diffused (0/d). If a diffused geometry instrument is used, the specular component of reflectance shall be included in the measurement. The

angle between the sample normal and the illuminating beam in 0/d geometry, and the angle between the sample normal and the viewing beam in d/0 geometry, shall not exceed 10 degrees.

3.4 Suitable stamping dies, shears or cutting equipment for preparation of test specimens.

4 Test Material

4.1 White Cardboard. Back the textile test specimens with white opaque cardboard or card stock with sufficient weight to prevent warping. The material should have a low sulfur content and be free from fluorescent brightening agents.

4.2 Non-woven fleece (Atlas part # 56077020) or equivalent shall be used between textile test specimens and the white cardboard, if the test specimen is less than 8 mm thick.

4.3 Standard Reference Material (SRM). Blue Wool or Polystryene reference standards are to be used in determining whether the xenon-arc apparatus is operating within the desired range.

5 Test Method

5.1 Summary of Test Method. Test specimens are exposed in a xenon-arc weathering device to artificial weathering conditions, which simulate extreme environmental conditions, encountered inside a vehicle due to sunlight, heat and humidity. Test specimens are then evaluated for colorfastness (fade) or other modes of degradation.

5.2 Test Sample Preparation.

5.2.1 For colorfastness, cut at least one test specimen of a size that fits the test specimen holder frames for the equipment being used. Back each test specimen with the non-woven fleece, if required, and the white cardboard then insert and secure into the holder.

5.2.1.1 The test specimen shall include all variations of color and pattern or multiple test specimens must be taken so that all variations of color and pattern are included in the test.

5.2.1.2 When testing narrow textile materials or small parts, use as large a test specimen as possible and back it with white cardboard that fits the test specimen holder.

5.2.2 For degradation evaluations, cut the number and size of test specimens required for the degradation test. Back the exposure area with the white cardboard, then fold and secure any excess material behind the white cardboard.

5.3 Test Procedure.

5.3.1 Mount the test specimen holders in the weathering device with the face side of the test specimen no closer to the lamp than the front side of the specimen holder.

5.3.2 Fill all unused places with specimen holders filled with dummy textile blanks to maintain desired airflow. Blanks should be changed when noticeable physical distortion and/or degradation occur.

5.3.3 Expose test specimens in the xenon-arc weathering device, meeting the following parameters, for the specified exposure cycle and duration defined in the relevant material specification.

5.3.3.1 Exposure Cycles.

5.3.3.1.1 Light/Dark Exposure Cycle (Cycle A). This cycle alternates between light and dark periods. The light periods will last 3.8 h ± 6 minutes and the dark periods will last 1 h ± 6 minutes. Initiate each new test before the start of a light period.

5.3.3.1.2 Light Only Exposure Cycle (Cycle B). This alternate cycle could be used for colorfastness evaluations only, of material proven to show equal results with the light/dark cycle above. For Textiles, this is 100 % polyester fabrics only. This cycle will only have the light period and eliminate the dark period. All other parameters and exposure level will remain the same as the light/dark cycle.

5.3.3.2 Irradiance Level. Irradiance measured at a location representative of the test specimen location must meet one of the following equivalent levels.

- (2.2 ± 0.02) W/m^2/nm measured at 420 nm (narrow bandwidth measurement)
- (95 ± 2) W/m^2/nm measured at 300 to 400 nm (wide bandwidth measurement)

5.3.3.3 Black Standard Thermometer (BST) Temperature. The BST temperature shall be maintained at (105 ± 3) °C for the light period.

5.3.3.4 Chamber Temperature (CT). The CT or the temperature of the air in the test chamber shall be measured and controlled at (65 ± 2) °C for the light period and at (38 ± 2) °C for the dark period. Temperature equilibrium shall be reached within 20 minutes.

5.3.3.5 Chamber Relative Humidity (RH). The RH of the test chamber air shall be measured and controlled at (25 ± 5) % RH for the light period and at (95 ± 5) % RH for the dark period.

5.3.4 Once exposure has been initiated, equipment operation should not be interrupted more than once daily. Additional interruptions, e.g., opening the

chamber door during the course of daily operation, may cause variation in test results.

Note: Care should be taken to avoid mixing potentially incompatible materials in the same machine load.

5.3.5 Take care to avoid condensation on the lamp filter system which can alter its light output. Refer to manufacturer's operating manual on tips to avoid condensation on lamps.

6 Evaluation and Rating

6.1 Visual assessment for colorfastness to be made by a person with a trained eye, use the following rating scale. Compare the test specimen to a control sample and the gray scale, under standard lighting defined in GMW6992. All comparisons shall be made with like sized evaluation areas.

10 = No change. No hue or pattern change. No value change with a gray scale reading of 5.

8 = Slight Change. No hue or pattern change. Slight value change with a gray scale reading of 4 or better.

6 = Noticeable Change. Slight hue and/or pattern change. Noticeable value change with a gray scale reading of 3 or better.

4 = Objectionable Change. Noticeable hue and/or pattern change. Excessive value change with a gray scale reading of 2 or better.

2 = Severe Change. Excessive hue and/or pattern change. Severe value change with a gray scale reading of 1 or better.

6.2 Perform color and gloss measurements, if applicable. Calculate the differences between the unexposed control sample or the start of test values of the unexposed sample and the exposed test specimen.

6.3 Degradation evaluations to be completed and reported according to the methods defined in the relevant material specification.

7 Report

7.1 Report the color change rating from visual assessment at each required exposure level. Note any appearance or degradation changes seen that are not included on the color change rating scale.

7.2 If required, report the color machine measurements for color change using the CIELAB measurements for DE, DL, DC, DH, Da, Db at each required exposure level.

7.3 Note the exposure cycle (see 5.3.3.1) used if not defined in the relevant material specification.

7.4 Provide Standard Reference Material (SRM) data for the days the test specimen was being tested.

7.5 Deviations from this Test Method. Deviations from the conditions of this test method shall have been agreed upon between supplier and vehicle manufacturer. All deviations shall be specified on component drawings, material specifications, etc. and shall be indicated on test certificates, reports, etc.

8 Safety

This method may involve hazardous materials, operations and equipment. This method does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

9 Coding System

This test method shall be referenced in other documents, drawings, VTS, CTS, etc. as follows:

Test to: GMW3414-A

Where:

GMW	=	Validation Area (GM Worldwide)
3414	=	Continuous Number
A	=	Exposure Cycle (see 5.3.3.1)

10 Release and Revisions

10.1 Release. This specification was first approved in May 2001 and published in April 2002.

This test method was developed by the WW Fabric Specification Team to create a common method for evaluating Artificial Weathering. The current methods used are SAE J1885 (NA, GMB, Holden); GME60292 (ITDC); ISC-C93-001 (Isuzu Motors); STD3159 (Saab Automotive).

Appendix A

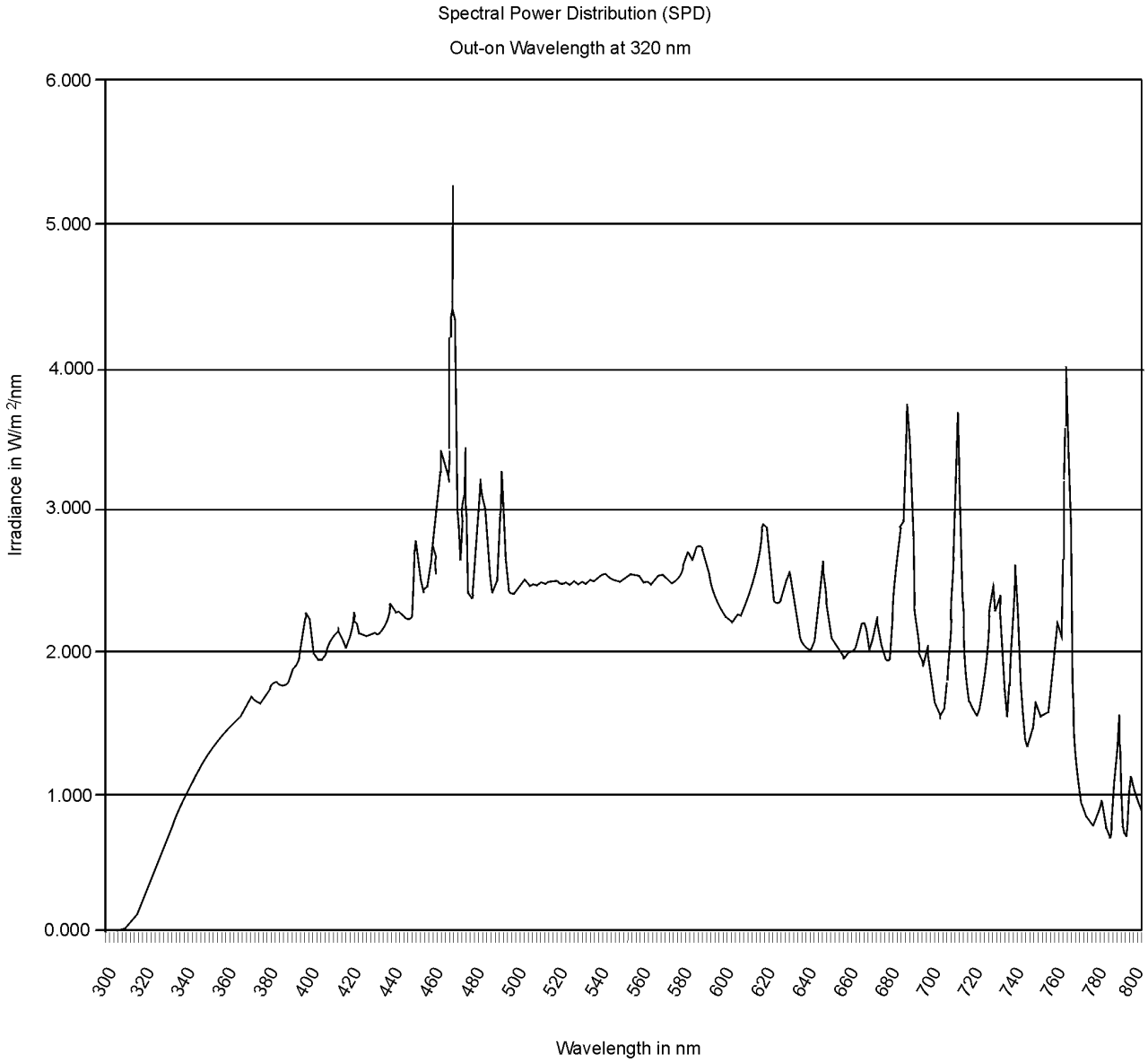
Filter System Examples:

- Infrared Reducing Filter (CIRA) inner, Soda Lime outer and a Float Glass Lantern for water-cooled equipment.
- Suprax Cyclinder and Window Glass lantern for the Xenotest Alpha LM air-cooled equipment.
- Suprax Cylinder and Xenochrome 320 Lantern for the Xenotest Beta LM air-cooled equipment.

Table 1:

Wavelength Range (nm)	Irradiance as a % of 300 to 800 nm (%)	Tolerance (%)
< 300	< 0.05	± 0.0
280 to 320	< 0.1	± 0.0
320 to 360	3.0	± 0.85
360 to 400	5.7	± 2.0/-1.3
400 to 520	32.2	± 3.0/-5.0
520 to 640	30.0	± 3.0
640 to 800	29.1	± 6.0
< 800	100	± 0.0

Figure 1:



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