GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW3414

Artificial Weathering of Automotive Interior Trim Materials

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

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

1.1 Purpose. This test procedure 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 procedure shall be used to evaluate the colorfastness as well as being the artificial weathering method to evaluate degradation.

1.2 Applicability. The conditions in this procedure have been established for 100% polyester seating fabrics.

1.3 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ISO 105-A02 ASTM D523 SAE J1545 SAE J1767

2.2 GM Standards/Specifications.

GMW6992

2.3 Additional References.

- Equipment manufacturer's operating manuals.

3 Resources

3.1 Facilities. Refer to Equipment manufacturer's instruction manuals.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment. Refer to Equipment manufacturer's instruction manuals.

3.2.1 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 ensure repeatability of tests, the apparatus must be maintained and calibrated to manufacturer's specification.

3.2.1.1 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 A1 in Appendix A and similar to Figure A1 and Figure A2 in Appendix A. Examples of filter systems that will provide this light spectrum distribution for a few machines are listed in Appendix A.

3.2.1.2 Irradiance Measuring Device. At a location representative of the test specimen location measuring irradiance at one (1) of the following bandwidths:

- $W/m^2/nm$ at 420 nm (narrow bandwidth measurement).

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

3.2.1.3 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 mm ± 5 mm x 40 mm ± 5 mm and have a thickness of 0.5 mm ± 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.

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

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

3.2.1.6 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.

3.2.2 Gray Scale. For assessing color change complying with the requirements of ISO 105-A02.

3.2.3 Color Machine (if applicable). SAE J1545, SAE J1767: Spectrophotometer capable of CIELAB measurements with a 10 degree standard observer, a D65 standard illuminant and an orifice size ≤ 25 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 illuminated 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.

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

3.3 Test Vehicle/Test Piece.

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

3.3.2 Non-woven Fleece. Shall be used between textile test specimens and the white cardboard, if the test specimen is < 8 mm thick.

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

3.4 Test Time. As defined by the duration of exposure level in the relevant material specification.

Calendar time:	As defined by the duration of exposure level in the relevant material specification
Test time:	As defined by the duration of exposure level in the relevant material specification
Coordination time:	Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Personnel trained in accordance with the laboratory accreditation and Standard Operating Procedure requirements.

4 Procedure

4.1 Preparation. 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.

4.1.1 Test Sample Preparation.

4.1.1.1 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.

4.1.1.2 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.

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4.1.1.3 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.

4.1.1.4 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.

4.2 Conditions.

4.2.1 Environmental Conditions. As defined by the relevant material specification.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 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.

4.3.2 Fill all the 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 occurs.

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

4.3.3.1 Exposure Cycles.

4.3.3.1.1 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.

4.3.3.1.2 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 preceding light/dark cycle. 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.

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

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

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

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

4.3.3.5 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.

4.3.4 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.

4.3.5 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.

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