SAE International™

SURFACE VEHICLE STANDARD

SAE J2412

ISSUED NOV2003

Issued 2003-11

Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus

1. Scope

1.1 This test method specifies the operating procedures for a controlled irradiance, xenon arc apparatus used for the accelerated exposure of various automotive interior trim components**.**

1.2 This is a performance standard based on the test parameters of SAE J1885**.**

1.3 Test duration as well as any exceptions to the sample preparation and performance evaluation procedures contained in this document, are covered in material specifications of the different automotive manufacturers**.**

1.4 Equipment qualified to perform this test is determined by material test comparison between instruments approved for SAE J1885 and those intending to perform SAE J2412. A specific test protocol to compare new test equipment to those previously approved must be done by material test comparison by the contractual parties. The interested contractual companies shall identify details of the test protocol and the materials to be tested. At the time of publication of this test method, the committee is developing a 'Protocol To Verify New Test Apparatus' identified as SAE J2413**.**

1.5 Any deviations to this test method, such as filter combinations, is to be agreed upon by contractual parties**.**

2. References

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1767 Instrumental Color Difference Measurement for Colorfastness of Automotive Interior Trim Materials.
SAE J1885 Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Water Cooled Xenon-Arc Apparatus.

2.1.2 ASTM PUBLICATIONS

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA19428-2959.

ASTM D859 Standard Test Method for Silica in Water
ASTM D4517 Standard Test Method for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy
ASTM G113 Standard Terminology Relating to Natural and Artificial Weathering Tests of Non-Metallic Materials.
ASTM G130 Standard Test Method for Calibration of Narrow and Broad-Band Ultraviolet Radiometers Using Spectroradiometer
ASTM G147 Standard Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests.
ASTM G151 Standard Practice for Exposing Non-Metallic Materials in Accelerated Test Devices that use Laboratory Light Sources.
ASTM G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non Metallic Materials

2.1.3 RELATED PUBLICATIONS

American Association of Textile Chemists and Colorists (AATCC)
P.O. Box 12215, Research Triangle Park, North Carolina 27709
AATCC - Evaluation Procedure 1
AATCC - L-2 Blue Wool Lightfastness Standard
AATCC - L-4 Blue Wool Lightfastness Standard
Testfabrics, Inc., 415 Delaware Ave., P.O. Box 26, West Pittston, PA18643
Polystyrene Plastic Lightfastness Standard

3. Terminology

3.1 Black Panel Thermometer, n

A temperature measuring device, the sensing unit of which is coated with black enamel designed to absorb most of the radiant energy encountered in fade/weathering testing.

3.2 Black Standard Thermometer, n

See ASTM G 147 for definition.

NOTE—These devices provide an estimation of the maximum temperature a specimen might attain during exposure to natural or artificial light.

3.3 Definitions applicable to this standard can be found in ASTM G 151**.**

4. Significance and Use

4.1 This test method is designed to simulate extreme environmental conditions encountered inside vehicle due to sunlight, heat, and humidity for the purpose of predicting the performance of automotive interior trim materials**.**

5. Apparatus

5.1 The equipment manufacturer is responsible for the approval of the equipment and for providing the proof of compliance of the critical test parameters, including the different spectral power distributions (SPDs) that are required by contractual parties. Materials used for the compliance testing should include the approved lots of standard reference materials, such as the Testfabrics polystyrene and/or the AATCC L4 & L2 Blue Wools as appropriate. It is the responsibility of the instrument manufacturer to provide all necessary data to demonstrate compliance of each model type with this specification. At the minimum, the data should include (1) all the pertinent spectral power distribution (SPD) data for 250 nm - 800 nm, and (2) repeatability and reproducibility data for the current approved lots of standard reference materials. Contractual parties should agree upon the instrument model prior to testing**.**

NOTE—In normal practice, different instruments may give different results. The result depends on sample characteristics and instrument design. Refer to ASTM G155 Section 4.3 and 4.4 for more information.

5.2 The apparatus employed utilizes a xenon-arc lamp(s) as the source of radiation. The specimens shall be mounted in a manner to expose the specimens to the uniform conditions of the test chamber. The instrument must have the means to automatically control irradiance, Black Panel temperature, chamber temperature and relative humidity. Contractual parties shall agree upon the manufacturer and model of the instrument before testing begins**.**

5.2.1 A more complete description of the apparatus can be found in ASTM G151 and ASTM G155.

5.3 The apparatus must have an uninsulated black panel thermometer as described in ASTM G151 unless otherwise agreed upon by contractual parties**.**

5.4 Manufacturers of exposure devices shall assure that the irradiance at any location in the area used for specimen exposures is at least 70% of the maximum irradiance measured in this area**.**

5.4.1 If irradiance at positions farthest from the center of the exposure area is between 70% and 90% of that measured at the center, place specimens only in exposure area where irradiance is at least 90% of the maximum irradiance.

6. Apparatus Set-Up

6.1 To minimize variability maintain and calibrate the apparatus to manufacturer's specifications. Appendix B and C describe the use of reference materials to determine if the xenon-arc apparatus is operating within the desired range**.**

6.1.1 The water for humidification or other purposes shall leave no objectionable deposits or stains on the exposed specimens. The water cannot have more than 1 ppm solids and it must have less than 0.2 ppm silica. Silica levels should be determined using ASTM procedures D 859 or D 4517. A combination of deionization and reverse osmosis treatment can effectively produce water with the desired purity.

6.1.2 If applicable, to prevent accidental spraying of the test samples, turn off all water spray assemblies.

6.1.3 Fit the xenon-arc burner with an Extended UV Filter to provide a spectral power distribution (SPD) indicated in Appendix D, Table D1 and Figure D1.

6.1.4 The equipment manufacturer is responsible for the approval of the equipment and the SPD required by the different Original Equipment Manufacturers (OEM). The use of the approved lot of polystyrene and other materials provided by the OEM's as control materials will determine the approval of the equipment. It is also the responsibility of the instrument manufacturer to provide all the necessary data to demonstrate compliance of each model type with this specification. At the minimum, the data should include (1) all the pertinent spectral power distribution (SPD) data for 250 nm – 800 nm, and (2) repeatability and reproducibility data for the current approved lot of the polystyrene standard reference material.

6.1.5 Operate the equipment to alternating cycles as described in Table #1.

TABLE 1—TARGET VALUES AT CONTROL PANEL SENSOR

Controls	Dark Cycle		Light Cycle	
	Target	Tolerance	Target	Tolerance
Automatic Irradiance	None		Contractual Agreement (See Note 1)	± 0.02
Black Panel Temperature	38 °C	± 3 °C	70 °C	± 3 °C
Dry Bulb Temperature	38 °C	± 3 °C	47 °C	± 3 °C
Relative Humidity	95%	± 5%	50%	± 5%
Radiant Exposure	Not applicable		Contractual Agreement	
Cycle Duration	1 hour (See Note 2)	± 6 minutes	3.8 hours (See Note 2)	± 6 minutes

Note 1: 0 .55 Wm^{-2} nm^{-1} at 340 nm is the default irradiance for the equipment listed in J1885. Equipment monitoring a broad band rather than the narrow band will have different target values than those listed in Table 1. Other values, higher or lower, agreed upon by contractual parties can be used but they invalidate the values listed for the polystyrene reference material shown in Appendix B.

Note 2: Other cycle times may be used upon contractual agreement, if, for example, an irradiance different than the specified default value is specified.

7. Test Procedure

7.1 Prepare the specimens to be exposed to fit the specimen holder being used. Refer to ASTM G147 for conditioning and handling of specimens**.**

7.2 Specimen sizes must conform to the size of the approved specimen holder(s). Specimens that exceed these sizes may not give proper exposure results. The correct means of mounting odd sized specimens can be obtained from the contractual parties for which the material is being tested. Distance from the light source is a major factor on the amount of irradiance received and the surface temperature of the sample and hence the exposure results obtained from the test. It is important to follow the manufacturer guidelines to obtain uniform light exposure on the specimens**.**

7.3 Interior textiles shall be backed (body cloth, carpet, vinyl coated fabrics, etc.) with white cardboard[1]. Specimens other than interior textiles that do not completely fill the exposure area of the specimen holder shall be backed with white cardboard**.**

7.4 Fill all unused slots with an inert non-reflective material to maintain desired air flow. (e.g., white cardboard panels[1]). Cardboard blanks should be changed when noticeable physical distortion occurs**.**

7.5 Program the weathering device for the specified radiant exposure ***($kJ \cdot m^{-2} \cdot nm^{-1}$ @ 340nm for example)***, and ensure that the test begins at the beginning of the light cycle. See applicable material specification. This is to accommodate scheduling of reference materials**.**

7.6 For some instruments and/or materials, periodic repositioning of specimens during the exposure period may be needed to ensure that each receives an equal amount of radiant exposure. Reposition specimens as agreed upon by contractual parties if no data is available for that material**.**

NOTE—Care should be taken to avoid mixing potentially incompatible specimens in the same machine load, i.e., textiles should not be exposed together with foam backed textiles, foams, or plastics.

NOTE—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.

---

[1] Franklin, Grain long-felt side up 110/500 white index, Stock Number 06506 or 9016 White Bristol Card Stock have been found suitable for this purpose. Franklin white index is usually available from local office supply or art supply stores. Weight of card stock should be sufficient to prevent warping.

8. Evaluating and Reporting

8.1 The degree of fade should be evaluated and reported as specified between the contractual parties. One or more of the following methods may be specified**:**

8.1.1 INSTRUMENTAL MEASUREMENT

8.1.1.1 Color difference values in CIELAB units are obtained by instrumentally measuring the specimen before and after a specified amount of radiant exposure. The procedure used for specimen measurement will conform to that specified in Appendix B***.***

8.1.2 VISUAL ASSESSMENT

8.1.3 Assign colorfastness ratings using the AATCC Gray Scale for Color Change in accordance with AATCC Evaluation Procedure 1.

8.1.4 Using the viewing conditions specified in AATCC Evaluation Procedure 1, quantify the color change using the following terminology:

a. NONE - No change in hue, lightness or saturation.

b. SLIGHT - A change in lightness and/or saturation which can be determined only upon close examination but no change in hue.

c. NOTICEABLE - A change in lightness and/or saturation which can be easily seen and/or a change in hue.

d. SEVERE - An extreme change in lightness, saturation and/or hue.

9. Exposure Report

9.1 A copy of the Exposure Control/Report Form (Figure 1) indicating the color change of the exposed reference material in CIELAB color difference units must accompany each exposed specimen being submitted for approval. If any one of the color difference data points is outside the specified tolerance (control limits), the cause and corrective action must be indicated in the space provided**.**

9.2 The Exposure Control/Report Form shall include the following additional information**:**

1. Laboratory Name
2. Type and serial number of exposure equipment
3. Month and Year of equipment operation represented by the control chart
4. Test method
5. Reference material(s) used. Include lot number(s).
6. Frequency of operation verification, e.g., daily, three or seven day intervals
7. Color change, target value, and tolerance, in CIELAB color difference units for the reference material(s) used
8. The monthly average color difference for the reference material(s)
9. Measured color change, in CIELAB color difference units, for reference material 1.
10. Measured color change, in CIELAB color difference units, for reference material 2 (if more than one material is used)
11. Daily (except weekends and holidays) record of black panel temperature (BPT) or black standard temperature (BST). These readings should be taken after the machine has reached equilibrium in a partiular segment, example light/dark.
12. Daily (except weekends and holidays) record of dry bulb temperature or chamber temperature. These readings should be taken after the machine has reached equilibrium in a particular segment, example light/dark.
13. Irradiance control level.

PREPARED BY THE SAE TEXTILES AND FLEXIBLE PLASTICS

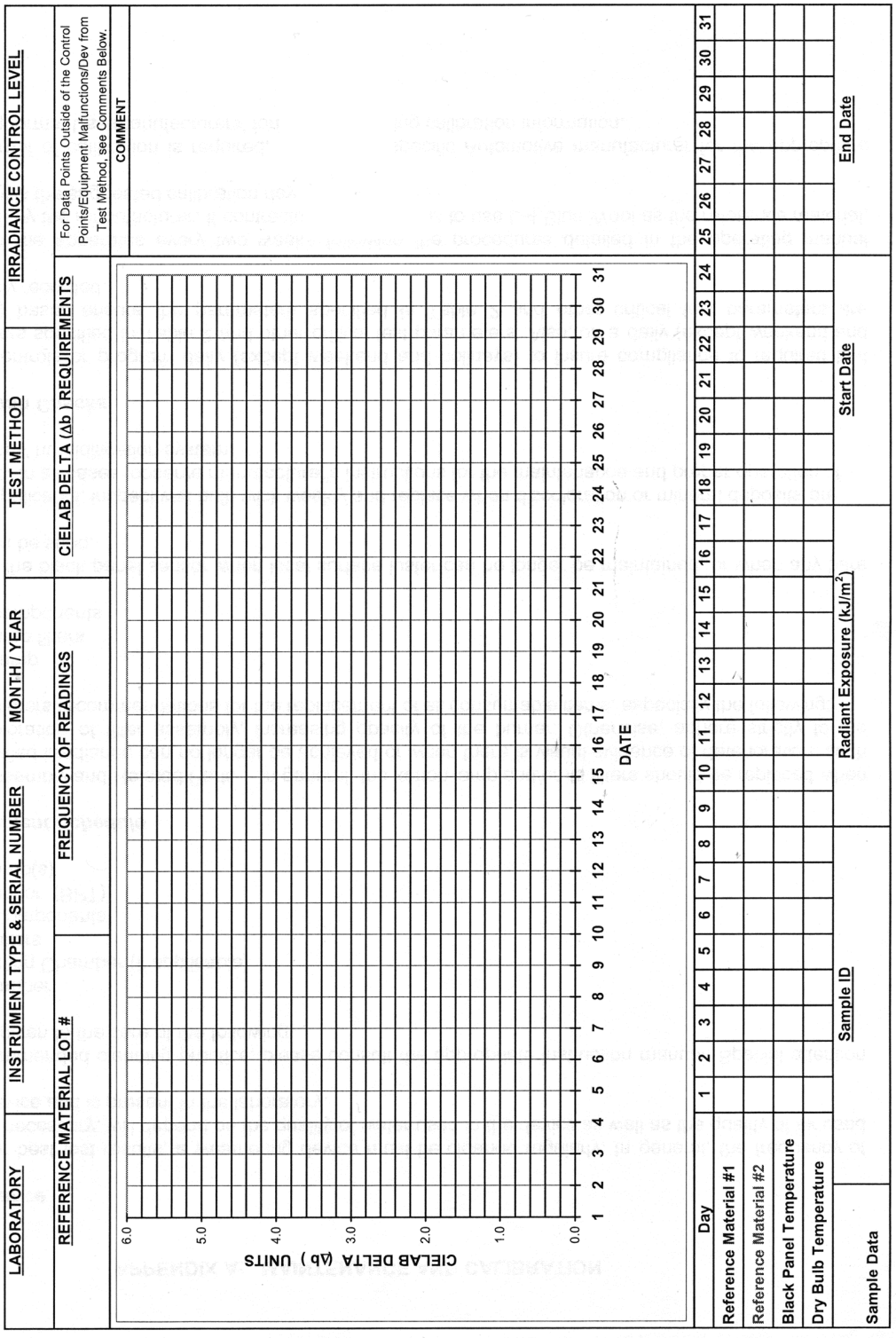

FIGURE 1—XENON ARC REFERENCE MATERIAL CONTROL CHART

APPENDIX A
MAINTENANCE AND CALIBRATION

A.1 Maintenance

A.1.1 NOTE—For best test results, a weathering device must be cleaned regularly. In general, the frequency of cleaning necessary, will depend on the quality of water used in the device as well as the quality of air used in the device and is present in the laboratory**.**

A.1.2 For recommended cleaning practice, please consult the appropriate instruction manual. Special attention must be given to the care of the following**:**

Test Chamber

Conditioning Chamber (if applicable)

Xenon Filters

Optical Components

Black Sensor (BPT)

Xenon lamp(s)

A.2 Replacement Schedule

A.2.1 Lamp Assembly and Related Parts

In general, the xenon lamp and/or its filters should be replaced when the specified irradiance can no longer be achieved or when there is visual evidence of deterioration, such as discoloration of filter assembly, increasing opacity of the burner. Otherwise, adhere strictly to the manufacturers recommendations for the replacement of all consumable items, especially the following:

Xenon Lamp

Xenon lamp filters

Optical components

A.2.2 Replace the Black Panel sensor when local surface luster can no longer be maintained, or when any bare metal can be seen**.**

A.2.3 Where applicable, inspect wet bulb wick weekly and replace when discoloration or mineral deposits are observed. In all cases, observe manufacturer's instructions for the maintenance and proper operation of the devices' humidification system**.**

A.3 Calibration Checks

A.3.1 Check controls or program daily (except weekend and holidays) to insure compliance to required test parameters specified in Table 2 and other critical test parameters. Also, on a daily (except weekend and holidays) basis, ensure the parameters specified in Table 2 and other critical test parameters are accurately recorded**.**

A.3.2 Calibrate the apparatus every two weeks following the procedures detailed in the operating manual provided by the manufacturer. If contractual agreement is to use L-4 Blue Wool as the reference material, Thursday is the suggested calibration day**.**

A.3.3 When proof of calibration is required, contact the specific Automotive manufacturer for the appropriate reporting forms. Use manufacturers' forms for recording calibration information**.**

APPENDIX B
PROCEDURE FOR DETERMINING COLORFASTNESS TO LIGHT
(AATCC BLUE WOOL LIGHTFASTNESS STANDARDS)

B.1 Scope

B.1.1 This Appendix describes the procedure for using AATCC Blue Wool Lightfastness Standards as reference fabrics for the purpose of determining whether the xenon-arc apparatus is operating within the desired range**.**

B.1.2 Color difference values in CIELAB units are obtained by instrumentally measuring the reference fabrics before and after a specified amount of radiant exposure**.**

B.1.3 AATCC L-2 Blue Wool Lightfastness Standards shall be exposed daily and/or an AATCC L-4 Blue Wool Lightfastness Standard shall be used to monitor a continuous three day operating cycle. AATCC L-4 Blue Wool may be used exclusively if agreed upon between contractual parties**.**

B.2 Procedure

B.2.1 Instruments used to determine color difference for this procedure require capability for providing CIELAB color values using illuminant D-65, 10 degree observer data. If an instrument with diffuse geometry is used, the specular component of reflectance shall be included in the measurement. (Refer to SAE J1767, for details)**.**

B.2.2 Calibrate the instrument to be used for the color measurements to the manufacturer's recommendations**.**

B.2.3 Back the reference fabric to be measured with white cardboard. Condition the backed reference fabric in a standard atmosphere (relative humidity 50 RH ± 5% and temperature 22 ± 3°C) for a minimum of 2 h. Insert one layer of unexposed material of the same lightfastness standard between the reference fabric and cardboard backing prior to measurement**.**

NOTE—The reference fabrics are light sensitive. Therefore, the piece used as the backing layer during measurement will need to be replaced when noticeable color change has occurred (after approximately 50 uses).

B.2.4 Place the reference fabric against the sample port of the instrument in such a way that a smooth surface of the face of the fabric is presented for measurement**.**

B.2.5 After taking an initial reading in CIELAB units, rotate the reference fabric 90 degrees and take a second reading. Average the readings and store as the standard measurement for the identified piece of reference fabric. REMOVE THE BACKING FABRIC AND PLACE IN A LIGHT TIGHT CONTAINER FOR LATER USE**.**

NOTE—The measurement obtained in B.2.5 cannot be used for different pieces of reference fabric. Each individual piece must be conditioned and measured prior to exposure.

B.2.6 Place the cardboard backed reference fabric (single layer) in a specimen holder and secure on the specimen rack adjacent to the Black Panel thermometer**.**

B.2.7 Always start the exposure apparatus at the end of the dark cycle. Expose the L-2 reference fabric and/or the L-4 reference fabric as agreed upon by contractual parties**.**

B.2.8 After the specified radiant exposure, remove the reference fabric and the white cardboard backing and allow them to condition at (relative humidity 50 RH ± 5% and temperature 22 ± 3°C) for a minimum of 1 hour**.**

B.2.9 Repeat the color measurements steps specified in B.2.2 through B.2.5 on the exposed reference fabric(s) and using the previously stored pre-exposed measurement, determine the Delta L*, a*, b* and E* values**.**

B.2.10 Compare the Delta E* value determined to that specified in the AATCC chart supplied**.**

NOTE—The supplier (AATCC) is to provide the determined values with each purchase of reference fabric as furnished to them by IFAI Transportation Division.

B.2.11 If the Delta E* value does not fall within the limits specified, do not resume the test until the reason has been determined and resolved**.**

B.2.12 As each group of test specimens completes its specified radiant exposure, record and report the color change information in terms of Delta E*, values of the reference fabric piece(s) used during the test period on the Exposure Control/Report Form (Figure 1)**.**

APPENDIX C
POLYSTYRENE LIGHTFASTNESS STANDARDS

C.1 Scope

C.1.1 This Appendix describes a procedure for using a Polystyrene Lightfastness Standard as a reference standard for assisting in determining whether the xenon-arc apparatus is operating properly**.**

NOTE—The Delta B values provided with the standard are based on the J1885 test method. They do not apply to tests that use higher or lower irradiance levels or that use different filter combinations other than the extended UV filters. Weathering instruments that monitor UV in a broadband rather than a narrowband should apply the equivalent broadband radiant dosages in order to use the target values supplied. Note that the broadband (300 nm – 400 nm) equivalent for 0.55 Wm^{-2} nm^{-1} at 340 nm is approximately 60 Wm^{-2}) .

C.1.2 Color difference values in CIELAB units are obtained by instrumentally measuring the reference plastic before and after a specified amount of radiant exposure**.**

C.1.3 The polystyrene lightfastness standard may be exposed to a radiant dosage ***(kJ·m^{-2}·nm^{-1} for example***), which is equivalent to a period of 2 to 7 days**.**

C.2 Procedure

C.2.1 Instruments used to determine color difference for this procedure require a capability for operation which includes the specular component and provides CIELAB color values using illuminant D-65, 10 degree observer data. No substitutions are permitted. Measurements in either the transmission or reflectance mode may be used**.**

C.2.2 Calibrate the instrument to be used for the color measurements in accordance with the manufacturer's recommendations**.**

C.2.3 Reflectance Mode

C.2.3.1 Place a piece of unexposed reference plastic, backed with a white calibration tile against the sample port of the instrument.

NOTE—Take precautions to avoid any interference from ambient light.

C.2.3.2 Take an initial reading and store it as the standard measurement for the identified piece of reference plastic.

NOTE—In order to preserve the surface of the White Calibration Tile, it is recommended that a second calibration tile be purchased for these measurements.

C.2.3.3 Place the pre-measured piece of reference plastic in a specimen holder and secure on the specimen rack adjacent to the black panel thermometer.

C.2.4 Transmission Mode

C.2.4.1 Place a piece of unexposed reference plastic in the proper location for measuring transmittance as recommended by the manufacturer of the instrument in use. If there is no specific recommendation, then place the chip as close to the detector as possible.

C.2.4.2 Place the white tile used for calibration against the outer sample port of the instrument.

C.2.4.3 Take an initial measurement and store it as the standard measurement for the identified piece of reference plastic.

C.2.5 Place the pre-measured piece of reference plastic in a specimen holder and secure on the specimen rack adjacent to the black panel thermometer**.**

C.2.6 Always start the exposure apparatus at the end of the dark cycle and expose the reference plastic to a radiant exposure (***kJ·m^{-2}·nm^{-1} @ 340nm for example***) for an equivalent period of two to seven days**.**

C.2.7 After the radiant exposure, remove the reference plastic from the apparatus**.**

C.2.8 Repeat the color measurement steps specified in C.2.3 or C.2.4 on the exposed reference plastic and using the previously stored pre-exposure measurement, determine the Delta b* values**.**

C.2.9 Compare the Delta b* reading to the chart for the cycle used**.**

C.2.9.1 The supplier (Testfabrics) of the reference plastic is to provide the charts as supplied by IFAI Transportation Division with each purchase of the polystyrene standard.

C.2.10 If the Delta b* value does not fall within the predetermined value, as established by the supplier, immediately run another polystyrene standard per section 2.12**.**

C.2.11 As each group of test specimens completes its specified radiant exposure, record and report the color change information in terms of Delta b* values of the reference plastic piece(s) used during the test period**.**

C.2.12 Run the polystyrene standard after every calibration (every two weeks) for the specified amount of kilojoules. If the reference material is out of specification, run another polystyrene standard at the shortest time interval (for example: 75.2 kJ/m2 or 112.8 kJ/m2 for a three day weekend). If the polystyrene reference standard continues to be out of specification, discontinue testing until the problem is corrected**.**

NOTE—In order to preserve the surface of the White Calibration Tile, it is recommended that a second calibration tile be purchased for these measurements.

C.2.13 The intent of the Polystyrene is to monitor the performance of the test. It is for Statistical Process Control (SPC) purposes. A point outside of the range does not necessarily invalidate the test**.**

APPENDIX D
REPRESENTATIVE SPECTRAL POWER DISTRIBUTION (SPD) FOR EXTENDED UV FILTER

D.1 Scope

D.1.1 This appendix consists of reference tables and a figure**.**

TABLE D1 (PART 1)—IRRADIANCE IN W/m^2 BASED ON 81 SPD's FOR XENON-ARCS WITH EXTENDED UV FILTERS NORMALIZED TO EXACTLY 0.55 W·m^{-2} AT 340 nm

bandpass	average	standard deviation	min	max	lower 95% confidence limit	upper 95% confidence limit
250-260	0.00	0.00	0.00	0.02	0.00	0.01
261-270	0.00	0.00	0.00	0.03	0.00	0.01
271-280	0.04	0.02	0.01	0.10	0.00	0.08
281-290	0.22	0.08	0.09	0.42	0.07	0.38
291-300	0.73	0.16	0.36	1.16	0.41	1.04
301-310	1.60	0.20	1.04	2.19	1.19	2.00
311-320	2.72	0.19	2.13	3.26	2.34	3.10
321-330	3.91	0.14	3.48	4.29	3.63	4.18
331-340	5.06	0.04	4.95	5.18	4.97	5.15
341-350	6.10	0.10	5.91	6.33	5.90	6.30
351-360	7.06	0.22	6.48	7.67	6.61	7.51
361-370	7.97	0.33	7.19	8.83	7.32	8.62
371-380	8.65	0.48	7.55	9.77	7.68	9.62
381-390	9.17	0.59	7.99	10.57	8.00	10.34
391-400	10.67	0.70	9.17	13.29	9.26	12.08
300-400	63.10	1.97	58.30	68.17	59.16	67.04

NOTES: 1. The ultraviolet irradiance for Extended UV Filters is 11% and the visible to near infrared irradiance is 89% relative to the irradiance in the wavelength range 290 nm - 800nm (as given in CIE Publication No.85:1989). These values measured on specimen plane will vary by as much as 30% when performing a test due to the reflectance properties and number of samples.

2. For Extended UV spectrum, lamp is operated at 0.55 W.m^{-2} @340 nm. Wide band, 300 nm - 400 nm, equivalence is approximately 60.0 W.m^{-2}.

3. The SPD data contained in Table D1 was developed using the "rectangular" integration technique. The data is based on 81 spectra for the 250 nm - 400 nm bandpass and the same 37 spectra used for the 400 nm - 800 nm region. The formula for the rectangular method is shown below.

   Formula used for calculating irradiance using rectangular integration in indicated bandpass when spectra at 2 nm increments are used

$$I_{x,y} = 2 \times \sum_{n=x}^{n=y} i_n$$

Where:

$I_{x,y}$ = total irradiance in bandpass with lower wavelength x and upper wavelength y

x = lower wavelength limit

y = upper wavelength limit

i_n = irradiance at wavelength n within the indicated bandpass between x and y

Other integration techniques can be used to evaluate SPD data but may give different results.

When comparing spectral power distribution data to Table D1, the same integration technique, rectangular, should be applied.

TABLE D1 (PART 2)—SPD TABLE FOR 400 nm - 800 nm AT 50 nm BANDPASSES BASED ON 37 SPDs

			suggested spec			
bandpass	**average**	**std dev**	**min**	**max**	**lower 95% confidence limit**	**upper 95% confidence limit**
400-450	57.47	5.13	47.20	67.74	47.20	67.74
451-500	73.71	6.22	61.28	86.15	61.28	86.15
501-550	66.26	7.40	51.46	81.06	51.46	81.06
551-600	67.61	7.43	52.75	82.48	52.75	82.48
601-650	64.85	7.69	49.46	80.24	49.46	80.24
651-700	60.52	6.14	48.25	72.80	48.25	72.80
701-750	57.06	6.17	44.72	69.40	44.72	69.40
751-800	48.44	7.39	33.66	63.22	33.66	63.22

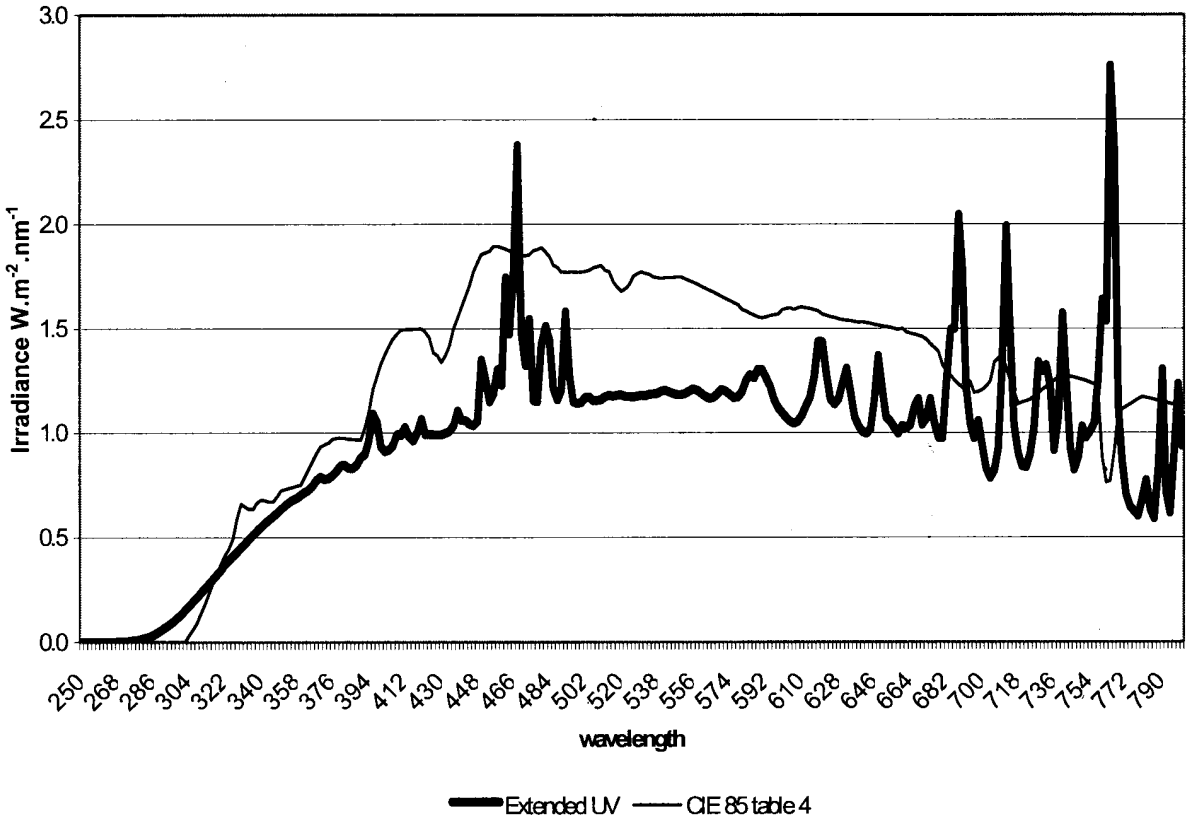

FIGURE D1—EXTENDED UV FILTER VS. SUNLIGHT SPECTRAL POWER DISTRIBUTION (SPD)

SAE J2412 Issued NOV2003

Rationale

Not applicable.

Relationship of SAE Standard to ISO Standard

ISO 4892-1, Plastics - Methods of exposure to laboratory light sources, Part 1, General guidelines.
ISO 4892-2, Plastics - Methods of exposure to laboratory light sources, Part 2 Xenon arc sources.

Application

This test method specifies the operating procedures for a controlled irradiance xenon arc apparatus used for the accelerated exposure of various automotive interior trim components.

Test duration, as well as any exceptions to the sample preparation and performance evaluation procedures contained in this SAE Recommended Practice, are covered in materials specifications of the different automotive manufacturers.

Neither repeatability nor reproducibility tolerances for test materials have been established for this test method. Performance evaluation procedures should account for variability within a test apparatus, and variability for each class of materials tested.

Reference Section

SAE J1767 - Instrumental Color Difference Measurement for Colorfastness of Automotive Interior Trim Materials.

SAE J1885 - Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Water Cooled Xenon-Arc Apparatus.

ASTM D859, Standard Test Method for Silica in Water

ASTM D4517, Standard Test Method for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy

ASTM G113 Terminology Relating to Natural and Artificial Weathering Tests of Non-Metallic Materials.

ASTM G130 Standard Test Method for Calibration of Narrow and Broad-Band Ultraviolet Radiometers Using Spectroradiometer

ASTM G147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests.

ASTM G151 Practice for Exposing Non-Metallic Materials in Accelerated Test Devices that use Laboratory Light Sources.

ASTM G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non Metallic Materials

American Association of Textile Chemists and Colorists (AATCC) - Evaluation Procedure 1

American Association of Textile Chemists and Colorists (AATCC) - L-2 Blue Wool Lightfastness Standard

American Association of Textile Chemists and Colorists (AATCC) - L-4 Blue Wool Lightfastness Standard

Testfabrics, Inc., Polystyrene Plastic Lightfastness Standard

Developed by the SAE Textiles and Flexible Plastics Committee