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SAE International™

SURFACE VEHICLE STANDARD

SAE J2527

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Performance Based Standard for Accelerated Exposure of Automotive Exterior Materials Using A Controlled Irradiance Xenon-Arc Apparatus

1. Scope

1.1 This SAE Standard specifies the operating procedures for a controlled irradiance, xenon-arc apparatus used for the accelerated exposure of various exterior automotive materials**.**

1.2 This is a performance standard based on the test parameters of SAE J1960**.**

1.3 The sample preparation, test durations, and performance evaluation procedures 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 J1960 and those intending to perform SAE J2527. 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, this committee is developing a 'Protocol To Verify New Test Apparatus' identified as SAE J2413**.**

2. References

2.1 Applicable Publications

The following publication 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. www.sae.org

SAE J1545 – Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim, Recommended Practice

SAE J1960 - Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Water Cooled Xenon Arc Apparatus

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2.1.2 ASTM PUBLICATIONS

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. www.astm.org

ASTM G 113 Standard Terminology Relating to Natural and Artificial for Non-Metallic Materials
ASTM G 130 Standard Method for Calibration of Narrow and Broad-Band Ultraviolet Radiometers Using a Spectroradiometer
ASTM G 147 Standard Practice for conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests.
ASTM G 155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
ASTM G 151 Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use laboratory Light Sources.
ASTM G 156 Standard Practice for Selecting and Characterizing Reference Materials Used to Monitor Consistency of Operating Conditions in an Exposure Test.
ASTM D 859, Standard Test Method for Silica in Water
ASTM D 4517, Standard Test Method for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy
ASTM D 523, Standard Test Method for Specular Gloss
ASTM D 660, Standard Test Method for Evaluating Degree of Checking of Exterior Paints
ASTM D 714 Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D 2244, Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates

2.2 Related Publications

The following publications are for information purposes only and are not a required part of this document.

2.2.1 ISO PUBLICATIONS

Available from ANSI, 25 West 43rd Street, New York, NY 10036

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

3. Definitions

3.1 Black Panel Thermometer, n

3.1.1 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. This is referred to as an un-insulated Black Panel

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

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3.2 BST–Black Standard Thermometer- Insulated Black Panel Thermometer - Refer to ASTM G 151 Annex 2 for definition**.**

3.3 Other Definitions

Definitions applicable to this standard can be found in ASTM G 113.

4. Significance and Use

4.1 This test method is designed to simulate extreme environmental conditions encountered outside a vehicle such as sunlight, heat, and moisture (in the form of humidity, condensation, or rain) for the purpose of predicting the weathering performance of automotive 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 250-800 nm, (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 G 155 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 samples shall be mounted in a manner to expose the samples to the uniform conditions of the test chamber. The instrument must have the means to simultaneously and automatically control irradiance, black panel temperature, relative humidity and chamber temperature. Customer and supplier should agree upon the manufacturer and model of the cabinet before testing begins**.**

5.2.1 A more detailed description of the apparatus can be found in ASTM G 151 and ASTM G 155

5.3 The apparatus must have an un-insulated black panel thermometer as described in ASTM G 151 unless otherwise agreed upon by contractual parties**.**

NOTE—(For Information only): A Black Standard Thermometer – BST- is specified in some standards – A Definition can be found in ASTM G 151 Annex two for a BST. The temperature is to be agreed upon by contractual parties. The BST is typically 5C° higher than the un-insulated black panel.

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**.**

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5.4.1 Place specimens only in the exposure area where irradiance is at least 90% of the maximum irradiance level.

NOTE—The manufacturer of the equipment supplies verification of the irradiance level.

6. Apparatus Setup

6.1 To minimize variability, maintain and calibrate the apparatus to manufacturer's specifications. Appendix B describes the use of a reference material to help determine if the xenon-arc apparatus is operating properly**.**

6.2 The water for spray and 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. In certain cases some samples could exude materials into the chamber that can promote deleterious effects on other samples**.**

6.3 Fit the xenon-arc burner with the appropriate optical filters to meet the intended spectral power distribution (SPD). The filters should provide an SPD that falls within the respective ranges shown. Refer to Figure C1 or C2 and/or Table C1 or C2 in Appendix C for typical spectral power distribution ranges**.**

NOTE—Examples of the SPD of different filter and power intensity combinations are listed in Appendix C. CIE 85 in Figure C 1 and Figure C2 is the reference for Daylight. The values listed in tables C1 and C2 are an average of many readings from different pieces of equipment. One reading from one piece of equipment may not exactly match the values that are listed in the tables.

6.4 Choose the program cycle which provides 120 minutes of light and 60 min of dark in the following cycle: 60 min of dark with both back and front-spray, 40 min of light followed by 20 min of light and front specimen spray, followed by 60 min of light, and repeating. The test sequence should follow the condition set up in Table 2.

TABLE 2—TEST SEGMENTS

Segment	Light	Dark	Spray
1	None.	60 min.	Front and back
2	40 min/ 1.32 kJ•m^{-2}•nm^{-1}	Not applicable	None
3	20 min/ 0.66 kJ•m^{-2}•nm^{-1}	Not applicable	Front
4	60 min./1.98 kJ•m^{-2}•nm^{-1}	Not applicable	None

* The radiant dosages (kJ•m^{-2}•nm^{-1}) listed are based on the J1960 method, which has an irradiance specification of 0.55 Wm^{-2} nm^{-1} at 340 nm. Equipment monitoring a broad band rather than a narrow band or operated at higher irradiance levels will have a different radiant dosages for the time intervals shown.

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6.5 Operate the apparatus to maintain the indicated range at the control panel as in Table 3. If the actual operating conditions at the control panel do not agree with the machine settings after the equipment has stabilized, discontinue the test and correct the cause of the disagreement before resuming the test**.**

TABLE 3—TARGET VALUES AT CONTROL PANEL SENSOR

Controls	Dark Segment 1 target,	tolerance	Light Segment 2,3,4 target	tolerance
Automatic irradiance	None		0.55 Wm^{-2} *	
Black panel temp.	38	±3 °C	70	± 3 °C
Chamber air temp. (Dry bulb)	38	± 3 °C	47	± 3 °C
Relative humidity	95	± 5%	50	± 5%
Radiant exposure	See applicable specification		See applicable specification	

NOTE—The tolerances do not apply during the spray portion of the segments.

* 0.55 Wm^{-2} nm^{-1} at 340 nm is the default irradiance for the equipment listed in J1960. Equipment monitoring a broad band rather than the narrow band will have different values. 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, as well as the radiant dosages listed in Table 2.

7. Test Procedure

7.1 Prepare a specimen to be exposed to fit the specimen holder being used. Refer to ASTM G 147 for conditioning and handling of panels**.**

7.2 Specimen sizes must conform to the size of the approved specimen holder. 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's guidelines to obtain uniform light exposure on the specimens**.**

NOTE—It is recommended to seal any cut edges on the test specimens. The corrosion by products from steel panels may stain the test specimens. Seal cut plastic specimen edges to avoid any by-products from the substrate. An air-dry primer has been found suitable for this work. Refer to ASTM G 147 for specimen preparation and handling.

7.3 Fill all unused slots with an inert non-reflective material to maintain desired airflow. Anodized aluminum panels are an example**.**

NOTE—High reflectance material may effect the operation of the equipment. Refer to the manufacturer's instructions for proper operation of the equipment.

7.4 After setting up the instrument to run for the required radiant exposure (($kJ \bullet m^{-2} \bullet nm^{-1}$). Start the test at the beginning of a dark cycle. See the applicable material specification**.**

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.

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7.5 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**.**

7.6 Report the change in property as agreed upon by contractual parties

8. Evaluation Report

8.1 Measure and record the property change of tested specimens at designated intervals as agreed upon by contractual parties. One or more of the following methods may be used**;**

Instrumental Measurements

SAE J1545 Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim, Recommended Practice

ASTM D523 Test method for Specular Gloss
ASTM D660 Test Method for Evaluating Degree of Checking of Exterior Paints
ASTM D714 Test Method for Evaluating Degree of Blistering of Exterior Paint
ASTM D2244, Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates

9. Exposure Report

9.1 The exposure report is as agreed upon by contractual parties**.**

9.2 The following are examples of information that may be contained in the report**.**

9.2.1 A copy of the exposure report (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.

9.2.2 The Exposure Control/Report form shall include the following additional information:

9.2.3 Laboratory Name

9.2.4 Type and serial number of exposure equipment

9.2.5 Month and Year of equipment operation represented by the control chart.

9.2.6 Test method

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9.2.7 Reference material (s) used. Include lot number.

9.2.8 Frequency of operation verification, e.g. daily, three or seven day intervals.

9.2.9 Color change, target value, and tolerance in CIELAB color difference units for the reference material(s) used.

9.2.10 The monthly average color difference for the reference material(s).

9.2.11 Daily record of black panel temperature (BPT)

9.2.12 Daily record of dry bulb temperature or chamber temperature.

9.2.13 Daily record of Irradiance.

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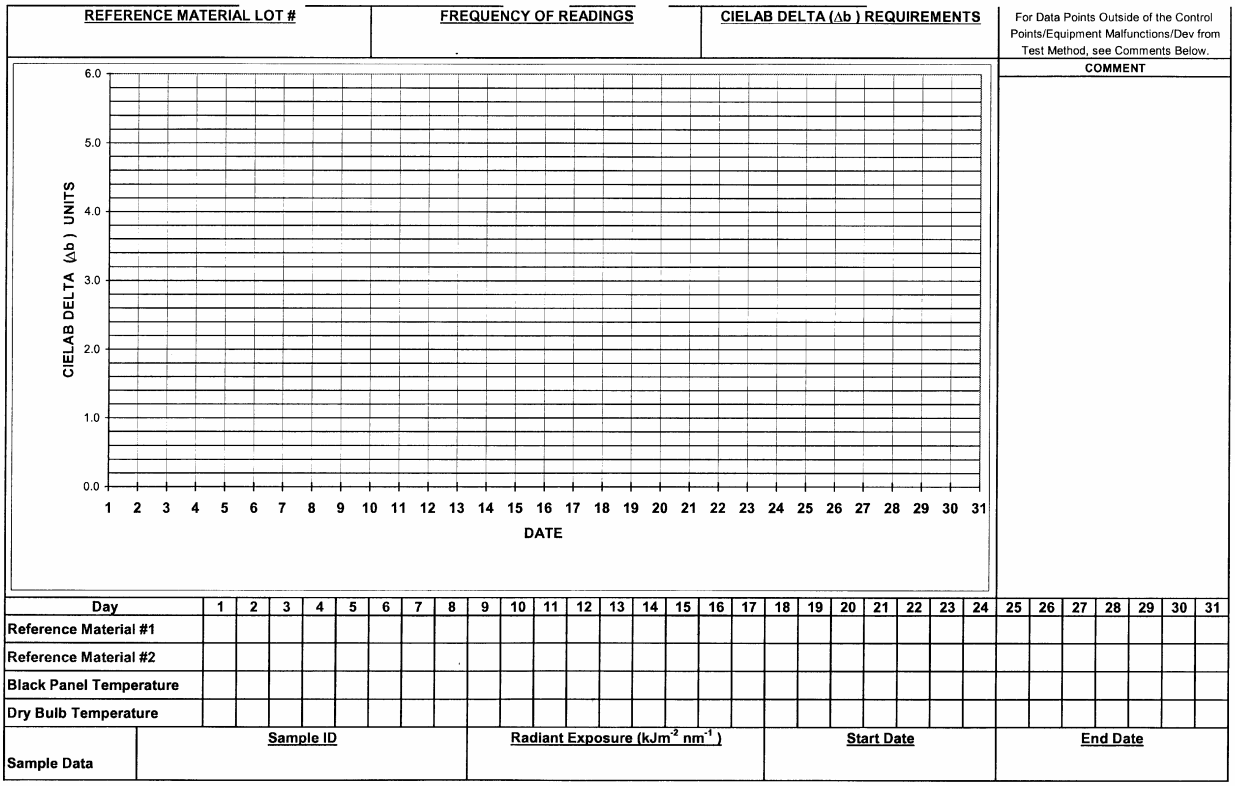


FIGURE 1

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APPENDIX A85

CABINET MAINTENANCE AND CALIBRATION

A.1 Maintenance

A.1.1 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. As mentioned in 6.2, in some cases samples could exude materials into the chamber that can promote deleterious effects on other samples. This decomposition of test samples may require more frequent cleaning of the test chamber**.**

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 or BST)

Xenon Lamp(s)

A.1.3 Check Spray Nozzles daily for signs of clogging. If continual clogging occurs, additional filters may be necessary in the water lines supplying the instrument. Replace the nozzles following the manufacturer's recommendation**.**

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A.2 Replacement Schedule

A.2.1.1 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. Otherwise, adhere strictly to the manufacturer's recommendations for the replacement of all consumable items, especially the following:

Xenon lamp(s)

Xenon lamp filters

Optical components

A.2.2 Replace the black panel sensor when 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 weekends and holidays) to insure compliance to required test parameters**.**

A.3.2 Calibrate the apparatus every two weeks following the procedures detailed in the operating manual provided by the manufacturer. It is suggested that the calibration be performed on the same day of the week**.**

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APPENDIX B
PROCEDURE FOR DETERMINING COLORFASTNESS TO LIGHT

B.1 Scope

B.1.1 Appendix B describes the procedure for using a polystyrene lightfastness standard as a reference plastic to assist in determining whether the xenon-arc apparatus is operating properly**.**

B.1.2 Run the polystyrene standard after every calibration (every two weeks) for the specified amount of kilojoules per hours**.**

B.1.3 The color difference values in CIELAB units are obtained by instrumentally measuring the reference plastic before and after a specified amount of radiant exposure**.**

B.1.4 The polystyrene lightfastness standard may be exposed to a radiant dosage (kJ m^{-2} nm^{-1} @ 340 nm for example), which is equivalent to a period ranging from two to seven days**.**

NOTE—The Delta b values provided with the standard are based on the J1960 test method. They do not apply to tests that use higher or lower irradiance levels or that use different filter combinations other than the enhanced UV filters. Weathering instruments that monitor UV on 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 to 400 nm) equivalent of 0.55 Wm^{-2} nm^{-1} at 340 nm is approximately 60 Wm^{-2}).

B.2 Procedure

B.2.1 Instruments used to determine color difference for this procedure require a capability for operation, which includes the specular component and providing CIELAB color values using illuminant D-65, 10 degrees observer data. No substitutions are permitted. Measurements in either a transmittance or a reflectance mode may be used. Only use apertures of 20 mm or greater**.**

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

B.2.3 Reference Material Measurement

B.2.3.1 REFLECTANCE MODE

B.2.3.1.1 Place a piece of unexposed reference plastic backed with the white tile used for calibration against the sample port of the instrument.

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

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.

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B.2.3.1.2 Take an initial reading. Save this reading and store it as your standard reading. Go to step B.2.4

B.2.3.2 TRANSMITTANCE MODE

B.2.3.2.1 Place a piece of unexposed reference plastic in the proper location as instructed by the manufacturer. If there is no specific recommendation, then place the chips as close to the detector as possible.

B.2.3.2.2 Place the white tile used for calibration against the outer sample port of the instrument.

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

B.2.3.2.3 Take an initial reading. Save this reading and store it as your standard reading.

B.2.4 Place a piece of reference plastic in a specimen holder and attach the spring-loaded holding device**.**

B.2.5 Secure it on the specimen rack adjacent to the black panel thermometer**.**

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

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

B.2.8 Examine the surfaces for water spotting. If spotting is found, carefully remove it using a piece of water-saturated white cheesecloth. Thoroughly dry the reference plastic using another piece of white cheesecloth. Spotting is usually an indication of inadequate water quality. The spotting problem must be investigated and corrected immediately**.**

B.2.8.1 Care must be taken not to scratch the surface of the reference plastic as the measurement could be affected.

B.2.9 Repeat the color measurement steps specified in B2.3.1 or. B2.3.2 on the exposed area of the reference plastic and determine the delta b* color difference value**.**

B.2.10 Compare the delta b* reading to the graph chart for the cycle used**.**

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B.2.11 The Standard Reference Material supplier is to provide graph charts with each purchase of the polystyrene chip**.**

B.2.12 If the delta b* value does not fall within the predetermined value, as established by the standard reference committee, immediately run another polystyrene per section B2.3 – B2.11. If the polystyrene reference standard continues to be out of specification, discontinue testing until the problem is corrected**.**

B.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**.**

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APPENDIX C
REPRESENTATIVE SPECTRAL POWER DISTRIBUTION FOR EXTENDED UV FILTER & DAYLIGHT FILTER

TABLE C1- EXTENDED UV FILTERS (J1960 SPECTRA)

Irradiance in Wm^{-2} based on 81 SPD's for xenon-arcs with Extended UV Filters Normalized to Exactly 0.55 Wm^{-2} at 340 nm						
Bandpass	Mean	Std Dev	Min	Max	Lower 95%	Upper 95%
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

SPD table for 400-800 nm at 50 nm bandpasses						
			Suggested Spec			
Bandpass	Average	Std dev	Min	Max	Lower 95%	Upper 95%
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

NOTE1—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 to 800 nm (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.

NOTE2—Extended UV spectrum, lamp is calibrated and operated at 0.55 W m^{-2} nm^{-1} @ 340 nm. Wide band, 300-400 nm, equivalence is approximately 60 W m^{-2}.

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NOTE3—The SPD data contained in Table C1 was developed using the "rectangular" integration technique. The data is based on 81 spectra for the 250 to 400 nm bandpass and the same 37 spectra used for the 400-800 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

$$I_{x,y} = 2 \times \sum_{n=x}^{n=y} i_n \qquad \text{(Eq. 1)}$$

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 C1, the same integration technique, rectangular, should be applied.

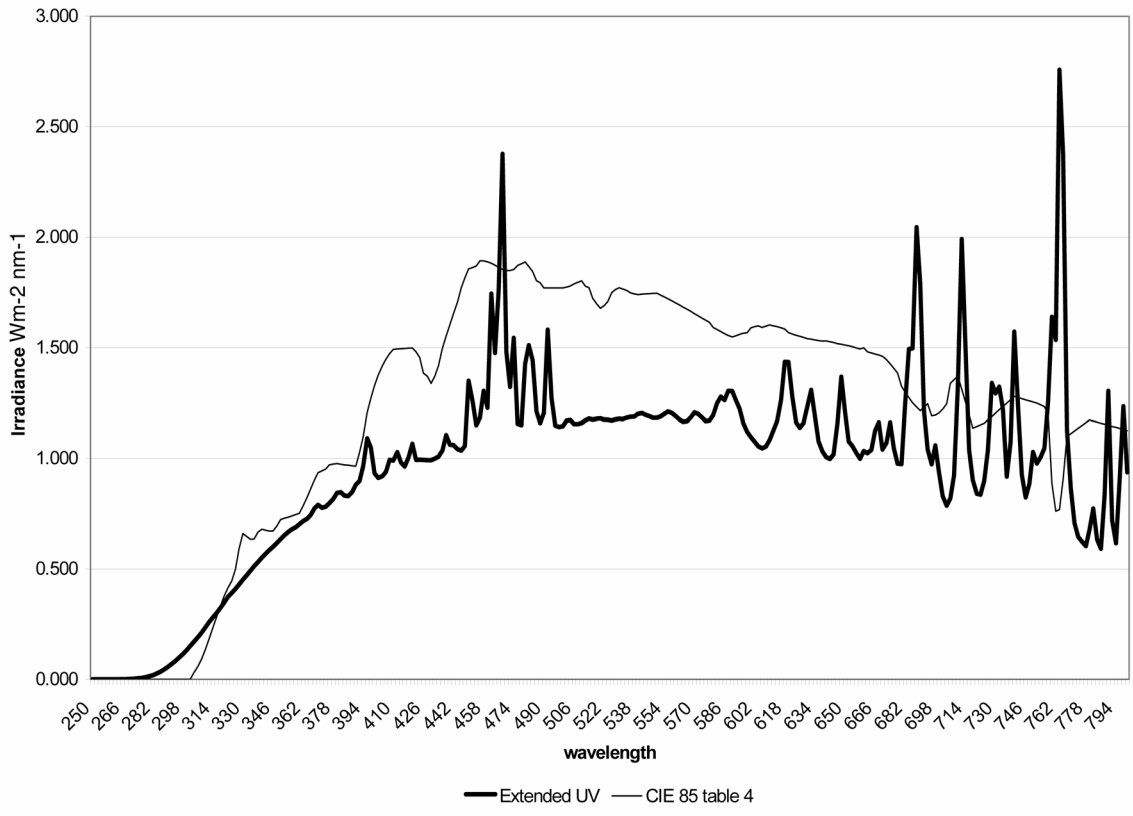


FIGURE C1—GRAPH OF EXTENDED UV AND SUNLIGHT SPD

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TABLE C2—DAYLIGHT FILTERS

Irradiance in Wm^{-2} based on 111 SPD's for Xenon-Arcs with Daylight Filters Normalized to Exactly 0.55 Wm^{-2} at 340 nm						
Bandpass	Mean	Std Dev	Minimum	Maximum	Lower 95%	Upper 95%
250-260	0.00	0.00	0.00	0.00	0.00	0.00
261-270	0.00	0.00	0.00	0.00	0.00	0.00
271-280	0.00	0.00	0.00	0.01	0.00	0.00
281-290	0.02	0.02	0.00	0.11	0.00	0.06
291-300	0.19	0.10	0.03	0.55	0.00	0.38
301-310	0.77	0.21	0.32	1.46	0.35	1.18
311-320	1.91	0.21	1.31	2.68	1.49	2.33
321-330	3.39	0.13	2.96	3.97	3.12	3.65
331-340	4.92	0.06	4.68	5.11	4.80	5.03
341-350	6.24	0.09	5.80	6.40	6.06	6.43
351-360	7.40	0.22	6.66	7.82	6.97	7.84
361-370	8.58	0.41	7.56	9.82	7.76	9.39
371-380	9.25	0.60	8.09	11.36	8.04	10.45
381-390	9.92	0.89	8.39	13.71	8.15	11.69
391-400	11.88	1.44	9.64	18.57	8.99	14.76
300-400	64.31	3.57	57.79	78.96	57.16	71.45

SPD table for 400 to 800 nm in 50 nm bandpasses						
			suggested spec			
bandpass	average	std dev	min	max	lower 95%	upper 95%
400-450	64.3	8.4	47.5	81.0	47.5	81.0
451-500	86.3	16.4	53.4	119.2	53.4	119.2
501-550	74.4	12.5	49.4	99.5	49.4	99.5
551-600	73.5	10.3	52.9	94.2	52.9	94.2
601-650	68.0	8.1	51.9	84.2	51.9	84.2
651-700	63.8	9.4	44.9	82.6	44.9	82.6
701-750	58.2	11.8	34.6	81.7	34.6	81.7
751-800	55.6	9.9	35.8	75.4	35.8	75.5

NOTE1—There can be small, but significant irradiance below 290 nm for xenon arc lamps with Daylight Filters. The amount of this short wavelength UV radiation depends on the transmission and age of the filters used.

NOTE2—Xenon arc data—The ranges given are based on 111 spectral power distribution measurements made for xenon arc devices with various lots and ages of Daylight Filters. The ranges given are based on two sigma limits from the averages of this data. Xenon arc filters that provide a spectral power distribution closer to sunlight than those that are shown in these tables are considered to meet the requirements of this standard.

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NOTE3—The SPD data contained in Table C2 was developed using the "rectangular" integration technique. The data is based on 111 spectra for the 250-400 nm bandpass and 86 spectra used for the 400-800 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

$$I_{x,y} = 2 \times \sum_{n=x}^{n=y} i_n \qquad \text{(Eq. 2)}$$

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 C1, the same integration technique, rectangular, should be applied.

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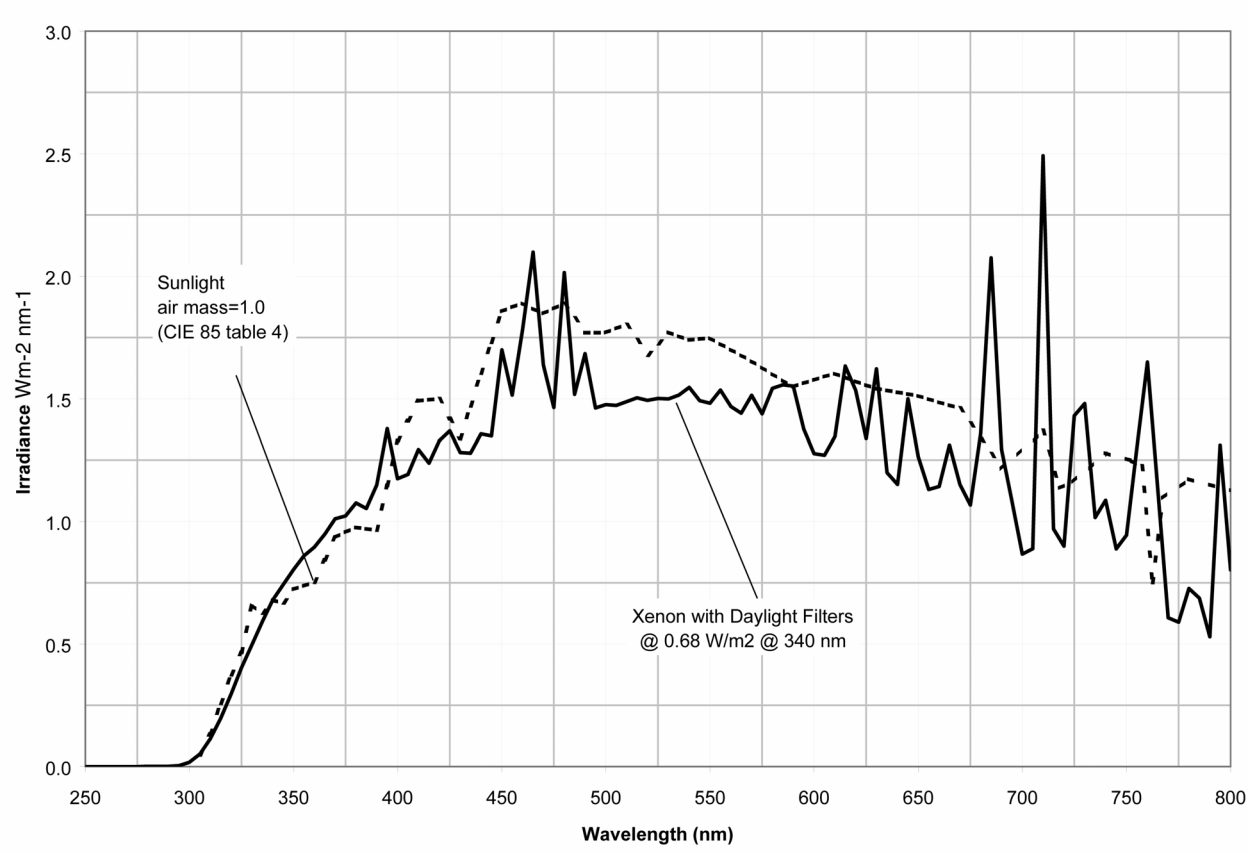


FIGURE C2—DAYLIGHT FILTER VS. SUNLIGHT SPECTRAL POWER DISTRIBUTION

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SAE J2527 Issued FEB2004

Rationale

Not applicable.

Relationship of SAE Standard to ISO Standards

Not applicable.

Application

This test method specifies the operating procedures for a controlled irradiance, xenon-arc apparatus used for the accelerated exposure of various automotive materials.

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 between test apparatus and for each class of material tested

Reference Section

ASTM D 523 Test method for Specular Gloss

ASTM D 660 Test Method for Evaluating Degree of Checking of Exterior Paints

ASTM D 714 Test Method for Evaluating Degree of Blistering of Exterior Paint

ASTM D 859 Standard Test Method for Silica in Water

ASTM D 2244 Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates

ASTM D 4517 Standard Test Method for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy

ASTM G 113 Standard Terminology Relating to Natural and Artificial for Non-Metallic Materials

ASTM G 130 Standard Method for Calibration of Narrow and Broad-Band Ultraviolet Radiometers Using a Spectroradiometer

ASTM G 155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

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ASTM G 147 Standard Practice for conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests

ASTM G 156 Standard Practice for Selecting and Characterizing Reference Materials Used to Monitor Consistency of Operating Conditions in an Exposure Test

ISO 4892-2, Plastics - Methods of Exposure to laboratory light sources, Part 2 Xenon arc sources

SAE J1545 – Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim, Recommended Practice

SAE J1960 - Accelerated Exposure of Automotive Exterior Materials Using A Controlled Irradiance Water Cooled Xenon Arc Apparatus

Developed by the SAE Textiles and Flexible Plastics Committee