SAE International™ SURFACE VEHICLE STANDARD

SAE J1960

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Superseding J1960 OCT2004

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

1. Scope

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

This standard is limited to the models of xenon arc test apparatus specified in the Section on Apparatus.

All other models of xenon arc test apparatus must use SAE J2527 to perform the test conditions specified in SAE J1960. SAE J2527 is the performance standard based on the test parameters of SAE J1960. Use of xenon arc test apparatus to perform SAE J2527 must be agreed upon by contractual parties.

1.2 The sample preparation, test durations, and performance evaluation procedures are covered in material specifications of the different automotive manufacturers.

1.3 Rationale—The SAE Committee on Textiles and Flexible Plastics Specifications is cancelling SAE J1960 due to the fact it is equipment specific, and will be superseded by SAE J2527, on or about January 2008, per the policy outlined in TSB (Technical Standards Board) of SAE.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply

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

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

2.1.2 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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

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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.

3.1.1.1 This device provides an estimation of the maximum temperature a specimen might attain during exposure to natural or artificial light.

3.2 Center Wavelength, n—The specified wavelength for bandpass filters; the wavelength midway between the half power points (e.g., 340 nm ±2 nm).

3.3 Color Change, n—As used in fade-weathering testing, a change in color of any kind (whether a change in hue, saturation, or lightness).

3.4 Half Power Bandpass, n—The interval between wavelengths at which transmittance is 50% of peak. (It should not exceed 20 nm for a narrow bandpass filter.)

3.5 Irradiance, n. (E)—The incident radiant flux per unit area of a surface. (W m^{-2})

3.6 Irradiance, Controlled, n—The maintenance by closed loop feedback of a preselected irradiance throughout a designated exposure interval.

3.7 Irradiance, Spectral, n—(E_λ) Irradiance per wavelength interval. (Wm^{-2} nm^{-1}).

3.8 Irradiance, Total, n—(W m^{-2}) Irradiance integrated over all wavelengths of a light source on an exposed surface.

3.9 Irradiation, n—See radiant exposure.

3.10 Long-Arc Xenon, n—A xenon arc in which the length of the arc between electrodes is greater than the diameter of the envelope enclosing the arc.

3.11 Peak Wavelength, n—The wavelength of peak transmission (e.g., 340 nm).

3.12 Radiant Exposure, n—The time integral of irradiance (Jm^{-2}).

3.13 Radiant Exposure, Spectral, n—The time integral of spectral Irradiance (Jm^{-2} nm^{-1}).

3.14 Reference Plastic, n—A clear polystyrene plastic standard selected for exposure as a check on a test apparatus and operating conditions.

3.15 Sample, Laboratory, n—A portion of material taken to represent the lot sample, or the original material, and used in the laboratory as a source of test specimens.

3.16 Specimen, n—A specific portion of a material or a laboratory sample on which a test is performed or that is selected for that purpose.

3.17 Spectral Power Distribution, n—The relative power emitted by a source as a function of wavelength.

4. Significance and Use

4.1 This test method is designed to accelerate 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 weatherability of automotive materials.

5. Apparatus

5.1 A more complete description of the apparatuses listed below may be found in ASTM G 155.

5.2 The apparatus employed utilizes a water-cooled xenon arc lamp as the source of radiation and should be one of the following:

5.2.1 TYPE AH—A controlled irradiance apparatus in which the radiant energy source is vertically located at the central axis of a specimen rack. The specimen rack shall rotate at 1 rpm ±0.1 rpm and shall be of the three-tiered, inclined type having a center segment of 648 mm ±6 mm (25.5 in ±0.25 in) outside diameter centered on the xenon arc lamp. The top and bottom segments shall be 511 mm ±6 mm (20 in ±0.25 in) outside diameter, positioned 28 degrees ±2 degrees from the vertical. Each segment shall accommodate 152 mm (6 in) specimen holders. The apparatus shall provide for control of dry bulb and black panel temperature, relative humidity, and irradiance at 340 nm[1].

5.2.2 TYPE BH—A controlled irradiance apparatus in which the radiant energy source is vertically located at the central axis of one of the following two racks:

5.2.2.1 The specimen rack shall rotate at 1 rpm ±0.1 rpm and shall be of the three-tiered, inclined type having a center segment of 965 mm ±6 mm (38 in ±0.25 in) outside diameter centered on the xenon arc lamp. The top and bottom segments shall be 842 mm ±6 mm (33.16 in ±0.25 in) outside diameter, positioned 22 degrees ±2 degrees from the vertical. Each tier shall accommodate 152 mm (6 in) specimen holders. The apparatus shall provide for automatic control of temperature, relative humidity, and irradiance at 340 nm[1]. All specimen exposure openings may be used.

5.2.2.2 The specimen rack shall rotate at 1 rpm ±0.1 rpm and shall be of the two-tiered, inclined type, 965.2 mm ± 6 mm (38 in ±0.25 in) outside diameter in the center. The top and bottom segments shall be 872.5 mm ±6 mm (34.35 in ±0.25 in) outside diameter positioned 11 degrees ±2 degrees from the vertical. The rack shall be positioned so that the exposure area is centered on the xenon lamp. Each tier shall accommodate 254 mm (10 in) long specimen holders. The apparatus shall provide for automatic control of temperature, relative humidity, and irradiance at 340 nm[1]. When using this two-tiered specimen rack, the test specimens shall not be placed in positions 1 and 8 (see Figure 1).

5.2.3 The xenon arc employed shall be of the “long-arc” water-cooled type. It shall employ cylindrical inner and outer optical filters to direct the flow of cooling water and to provide a selected spectral power distribution.

5.2.4 Distilled or deionized water shall be recirculated past the burner at a flow rate sufficient to remove excess heat. Passing water through a cartridge demineralizer installed in the recirculation line just ahead of the lamp minimizes contamination of the quartz envelope of the burner. A heat exchange unit shall be used to cool the recirculated lamp water.

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1. The Ci35, Ci35A Xenon Arc Weather-Ometer® or equivalent with factory installed air heater meets the requirements of Type AH. The Ci65 and Ci65A Xenon Arc Weather-Ometer® or equivalent with factory installed air heater meets the requirements of Type BH.

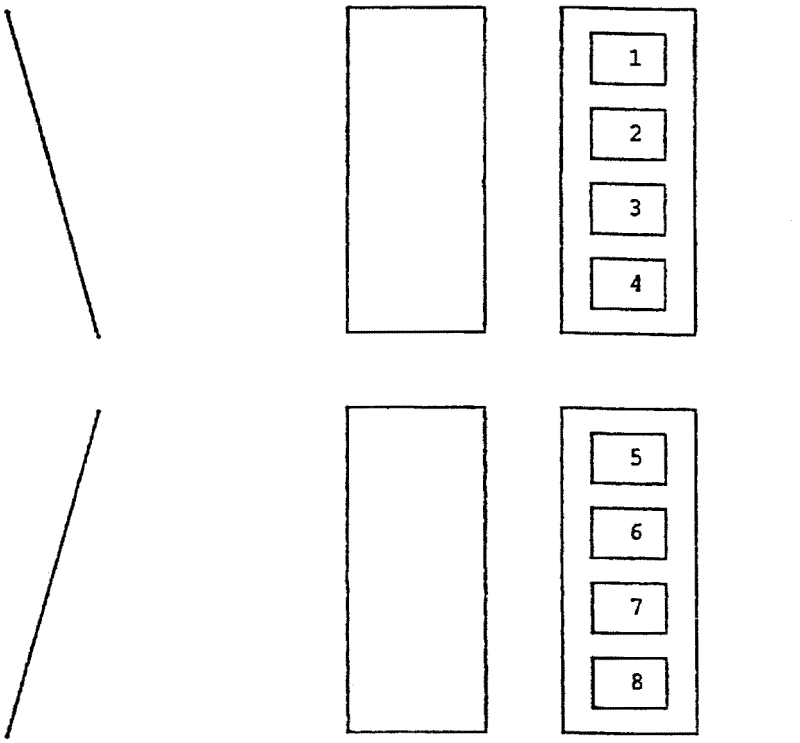

FIGURE 1—TWO-TIERED INCLINE SPECIMEN RACK

6. Apparatus Setup

6.1 To insure repeatability of tests, maintain and calibrate the apparatus to manufacturer's specifications and as described in Appendix A and B. Appendix A contains additional maintenance instructions and replacement schedules, and Appendix B describes the use of a reference plastic to determine if the xenon arc apparatus is operating properly within the desired range.

6.1.1 The input voltage must be between 215 to 250 V.

6.1.2 Water for lamp cooling must be purified so that it is free of silica and has no more than 20 ppm total dissolved solids.

6.1.2.1 Water used for the specimen spray and humidification system shall leave no objectionable deposits or stains on the exposed specimens. It is strongly recommended that the water contain a maximum of 1-ppm solids and a maximum of 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.

6.1.3 Install the specimen spray and the rack spray units.