The Engineering Society For Advancing Mobility Land Sea Air and Space®
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

MATERIALS PRACTICE

SAE J1885

Issued August 1987

Submitted for recognition as an American National Standard

ACCELERATED EXPOSURE OF AUTOMOTIVE INTERIOR TRIM COMPONENTS 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 interior trim components.

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

2. SIGNIFICANCE AND USE:

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

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

3.2 Blue Wool Lightfastness Standard, n.: One of a group of dyed fabrics used to determine the amount of light, or combined light and heat, to which a specimen is exposed during fade/weathering testing.

3.3 Center Wavelength, n.: The specified wavelength for bandpass filters; the wavelength midway between the half power points e.g. 340 nm + 2 nm.

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

3.5 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.)

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

3.7 Irradiance, Spectral, n.: The radiant energy within a specified wavelength interval that falls upon a unit area of exposed surface (Wm^2/nm).

3.8 Irradiance, Total, n.: Radiant energy integrated over all wavelengths falling upon a unit area of exposure at a point in time expressed in watts per square metre (W/m^2).

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 expressed in joules per square metre (J/m^2).

3.13 Radiant Exposure, Spectral, n.: The integration of spectral irradiance with respect to time.

3.14 Reference Fabric, n.: One or more blue wool lightfastness standards 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 upon which a test is performed or which is selected for that purpose.

3.17 Spectral Power Distribution, n.: The variation of energy due to the source over the wavelength span of the emitted radiation.

4. APPARATUS:

4.1 A more complete description of the apparatuses listed below may be found in ASTM G26 Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

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

4.2.1 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 ± 0.1 rpm; and shall be of the three-tiered, inclined type having a center segment of 648 ± 6 mm (25.5 ± 0.25 in) outside diameter centered on the xenon arc lamp. The top and bottom segments shall be 511 ± 6 mm (20 ± 0.25 in) outside diameter, positioned 28 ± 2 deg from the vertical. Each segment 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].

4.2.2 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:

4.2.2.1 The specimen rack shall rotate at 1 ± 0.1 rpm; and shall be of the three-tiered, inclined type having a center segment of 965 ± 6 mm (38 ± 0.25 in) outside diameter centered on the xenon arc lamp. The top and bottom segments shall be 842 ± 6 mm (33.16 ± 0.25 in) outside diameter, positioned 22 ± 2 deg 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.

4.2.2.2 The specimen rack shall rotate at 1 ± 0.1 rpm; and shall be of the two-tiered, inclined type, 965.2 ± 6 mm (38 ± 0.25 in) outside diameter in the center. The top and bottom segments shall be 872.5 ± 6 mm (34.35 ± 0.25 in) outside diameter positioned 11 ± 2 deg 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].

[1]The Ci35 Xenon-Arc Weather-Ometer® or equivalent with factory installed air heater meets the requirements of Type AH. The Ci65 Xenon-Arc Weather-Ometer® or equivalent with factory installed air heater meets the requirements of Type BH. These apparatuses are available from Atlas Electric Devices Company, 4114 North Ravenswood Avenue, Chicago, IL 60613.

4.2.2.2 (Continued:)

When using this two tiered specimen rack, test specimens shall not be placed in positions 1 and 8. (See Fig. 1)

Note 1: Type AH and Type BH apparatuses may not give the same results at the same radiant exposure (kilo-joules per square metric exposure level).

4.2.3 The xenon-arcs employed shall be of the "long-arc" water cooled type. They shall employ cylindrical inner and outer optical filters to direct the flow of cooling water and to provide a selected spectral power distribution.

4.2.4 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.

5. APPARATUS SET-UP:

5.1 To insure repeatability of tests, maintain and calibrate the apparatus to manufacturer's specifications, and as described in Annexes 1 and 2. Annex 1 contains additional maintenance instructions and replacement schedules and Annex 2 describes the use of reference fabrics to determine if the xenon arc apparatus is operating properly.

5.1.1 The input voltage must be between 215-250 volts.

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

5.1.3 Remove and cap the specimen spray unit. Turn off the rack spray unit with the valve provided.

Note 2: While the specimen spray can be turned off through a switch on the control panel, it is recommended that the specimen spray assembly be removed and the pipe capped to prevent accidental spraying of the test samples.

5.1.4 Fit the xenon-arc burner with quartz inner filter[2] and borosilicate outer filter[3].

[2]Atlas Electric Devices Company Part Number 20-6506 or equivalent.
[3]Atlas Electric Devices Company Part Number 20-2138 or equivalent.

5.1.5 Set the operation switches as follows:

Wattage Adjustment	Automatic
Countdown Switch	Irradiation
Lamp Ignition	On
Fixed Air Valve	Off
Humidifier	On
Water Heater	On
Air Heater	On
Specimen Spray	Off
Rack Spray	Off

5.1.6 Set the thumb wheel controls as follows:

	Light Cycle	Dark Cycle
Automatic Irradiance	.55 w/m^2/340 nm	--
Black Panel Temperature[5]	89°C	38°C
Wet Bulb Depression	13°C	0°C
Conditioning Water	63°C	40°C

Note 3: The air heater on cycle selector switch under the circuit breakers/mode switches cover should be set to light/dark cycle.

5.1.7 Install a #60[4] cam which provides 3.8 h light and 1.0 h dark.

5.1.8 Operate the apparatus to maintain the following conditions. If the actual operating conditions do not agree wth the machine settings after the equipment has stabilized, discontinue the test and identify the cause of the disagreement before continuing:

	Light Cycle	Dark Cycle
Automatic Irradiance	0.55 w/m^2/340 nm	--
Black Panel Temperature[5]	89 + 3°C	38 + 2°C
Dry Bulb Tolerance	63 ∓ 4°C	38 ∓ 2°C
Relative Humidity	50 ∓ 10%	100 + 0; -10%
Conditioning Water	63 ∓ 4°C	40 + 4°C
Radiant Exposure	See Applicable Specification	

5.1.9 Adjust the temperature of the lamp cooling water to provide sufficient cooling, but prevent condensation from forming on the lamp assembly. Suggest 60°C for cooling water, and 70°C for high temperature cut-out.

[4]Atlas Electric Devices Company, Part Number 19-4509 or equivalent.
[5]As measured by the Atlas Electric Devices Company Black Panel Sensor, Part Number 19-9140 or equivalent.

6. TEST PROCEDURE:

6.1 Reference fabric(s) must be used for this procedure, and exposed as specified in Annex 2.

6.2 Cut samples to fit the specimen holder being used.

6.3 Back samples with white cardboard[6], place in specimen holders and secure on specimen rack.

6.4 Fill all unused slots with specimen holders filled with white cardboard[6] to maintain desired air flow. Cardboard blanks should be changed when noticeable physical distortion occurs.

6.5 Expose samples for the required radiant exposure (kilo-joules per square metre [kJ/m^2]) at the central wavelength of 340 nanometers. See applicable material specification.

7. REPORT: See Fig. 2.

7.1 The report shall include the following:

7.1.1 Laboratory

7.1.2 Material

7.1.3 Test Method

7.1.4 Type of exposure instrument

7.1.5 Serial Number of exposure instrument

7.1.6 Operating Cam number

7.1.7 Type of filters

7.1.8 Light/dark cycle

7.1.9 Operating irradiance

[6]Franklin, Grain long-felt side up, 110/500 white index, Stock Number 06506 or equivalent made by Union Camp or 9016 White Bristol Card Stock or equivalent has been found suitable for this purpose. Franklin white index is usually available from local office supply or art supply stores. Bristol card stock is available from Atlas Electric Devices Company as sample mounting cards, Part Number 20-1952-00.

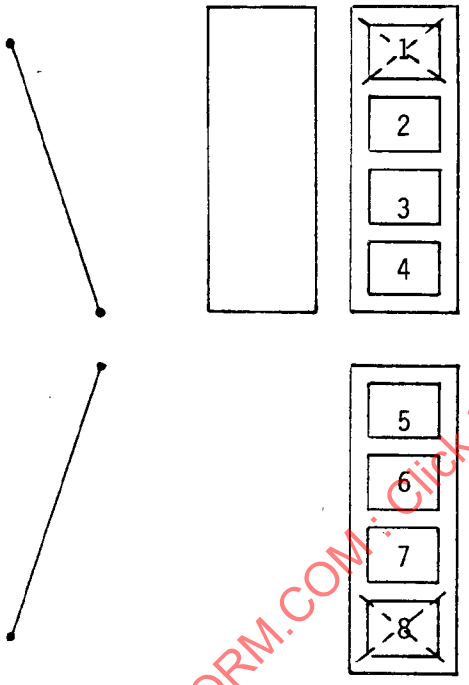
7.1.10 Operating black panel temperature

7.1.11 Operating Dry Bulb range

7.1.12 Operating relative humidity

7.1.13 Radiant exposure, kJ/m^2

7.1.14 Elapsed exposure time, h



Note: Do Not Expose Samples in Positions 1 or 8

FIG. 1 - 2 TIER INCLINE SPECIMEN RACK Ci65

FIG. 2 - EXPOSURE REPORT FORM

Laboratory ..... : _____

Material ..... : _____

Test Method ..... : _____

Instrument Type ..... : _____

Instrument Serial Number ..... : _____

Type Filters ..... : _____ Inner _____ Outer

Cam Number _____ ..... : _____ Hours Light _____ Hours Dark

Irradiance ..... : _____ $W/m^2/340$ nm

Black Panel Temperature ..... : _____ °C Light _____ °C Dark

Dry Bulb Range ..... : _____ °C Light _____ °C Dark

Wet Bulb Depression ..... : _____

Relative Humidity ..... : _____ % Light _____ % Dark

Radiant Exposure (kJ/m^2) ..... : _____ $kJ/m^2/340$ nm

Elapsed Exposure Time, h ..... : _____ Light _____ Dark

Remarks ..... : _____

_____

_____

_____

_____

_____

Operator: _____

Date: _____

ANNEX 1

1. MAINTENANCE:

1.1 Test Chamber: The frequency of cleaning will vary with water quality. However, the chamber must be cleaned at least once a month with a stainless steel cleaning agent and flushed with deionized water. Do NOT use cleaning agents containing chlorine.

1.2 Conditioning Chamber: The frequency of cleaning will vary with water and air quality in the laboratory. However, the chamber must be drained once a month and flushed with deionized water to remove sediment.

1.3 Lamp Assembly: Frequency of cleaning will vary with water quality. However, at least once each week wipe the outer surface of the outer filter with alcohol and a soft cloth. If deposits cannot be removed, replace the filter.

1.4 Quartz Light Rod: Clean weekly the end of the light rod with alcohol and a soft cloth.

1.5 Black Panel Sensor: Polish monthly using a good quality automotive polish.

2. REPLACEMENT SCHEDULE:

2.1 Lamp Assembly and Related Parts:

2.1.1 Replace the inner filter when the specified irradiance level can no longer be achieved or after a maximum of 1000 h of operation, and also whenever the burner tube is replaced.

2.1.2 Replace the outer filter when the specified irradiance level can no longer be achieved or after a maximum of 1000 h of operation, and also whenever the burner tube is replaced.

2.1.3 Replace the burner tube when the specified irradiance level can no longer be achieved even after the outer filter has been replaced.

2.1.4 Replace the interference filter located in the light monitoring system after 9000 light-on hours or 18 months of use, whichever comes first. The interference filter may require replacement sooner if the wattage level does not return to "normal" after the burner tube and outer filter have been replaced.

2.2 Replace the black panel sensor when local surface luster can no longer be maintained, or when bare metal can be seen.

2.3 Inspect wet bulb wick weekly and replace when discoloration or mineral deposits are observed.

3. CALIBRATION CHECKS:

3.1 Every week check the calibration of the exposure chamber as instructed by the manufacturer.

3.2 Voltage checks.

3.3 Temperature thumbwheel switches.

3.4 Automatic irradiance thumbwheel switch.

3.5 Temperature control.

3.5.1 Black panel temperature.

3.5.2 Dry bulb temperature.

3.5.3 Wet bulb temperature.

3.5.4 Wet bulb depression.

3.5.5 Conditioning water temperature.

3.6 Xenon lamp control.

3.6.1 Xenon lamp OFF.

3.6.2 Xenon lamp ON in manual.

3.6.3 Xenon lamp ON in automatic.

ANNEX 2

1. SCOPE:

1.1 This annex describes the procedure for using AATCC and ISO blue wool lightfastness standards as reference fabrics for the purpose of determining whether the xenon arc apparatus is operating properly.

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.

1.3 AATCC L-2[1] Blue Wool Lightfastness Standards shall be exposed daily. An AATCC L-4[1] Blue Wool Lightfastness Standard shall be used over weekend periods for those laboratories which do not operate on a 7-day per week basis. ISO 3[2] Blue Wool Lightfastness Standards shall be exposed at least one day per week. ISO 3 Standards are more heat sensitive than the AATCC L-2 and L-4 Standards and serve as a check on both the irradiance and heat experienced by the test specimens.

2. PROCEDURE:

2.1 Instruments used to determine color difference for this procedure require capability for providing CIELAB illuminant D-65, 10° observer, specular excluded readings.

Note 1: Instruments which have CIE illuminant C, 2 deg observer may be used if mutually agreed upon by buyer and seller prior to conducting the test.

2.2 Calibrate the instrument to be used for the color measurements to the manufacturers recommendations.

2.3 Back the reference fabric to be measured with white cardboard[3]. Insert one layer of unexposed material of the same lightfastness standard between the reference fabric and cardboard backing prior to measurement.

[1]AATCC L-2 and L-4 Blue Wool Lightfastness Standards may be obtained from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709.

[2]ISO 3 Blue Wool Lightfastness Standards may be obtained from Beuth-Vertrieb GmbH, Burggrafenstrasse 4-7, D-1000 Berlin 30, Federal Republic of Germany.

[3]Franklin, Grain long-felt side up, 110/500 white index, Stock Number 06506 made by Union Camp 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. Bristol card stock is available from Atlas Electric Devices Company as sample mounting cards, Part Number 20-1952-00.

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

2.5 After taking an initial reading in CIELAB units, rotate the reference fabric 90 deg and take a second reading. Average the readings and store them as standards and/or record on a daily report. REMOVE THE BACKING FABRIC AND PLACE IN A LIGHT TIGHT CONTAINER FOR LATER USE.

2.6 Place the cardboard backed reference fabric in specimen holder(s) and secure on specimen rack adjacent to the black panel thermometer. See Figs. 1 and 2.

2.7 Always start the exposure apparatus at the end of the dark cycle. Monday through Thursday expose the L-2 reference fabric for 37.6 kJ/m^2/340 nm. On Friday the L-4 reference fabric is to be exposed for 112.8 kJ/m^2/340 nm in order to span the week-end. The ISO 3 reference fabric is to be exposed a minimum of once per week for 37.6 kJ/m^2/340 nm as a check on both the irradiance and heat experienced by the test specimens.

2.8 After the specified radiant exposure, remove the reference fabric and the white cardboard backing and allow them to condition for one hour at 21 + 2°C and 50 ± 5% relative humidity. Repeat the color measurement steps specified in paragraph 2.2 through 2.5 on the exposed area of the reference fabric(s) and determine the delta L* a* b* and E*. If the delta values do not fall within the following tolerances, do not resume the test until the reason has been determined and resolved.

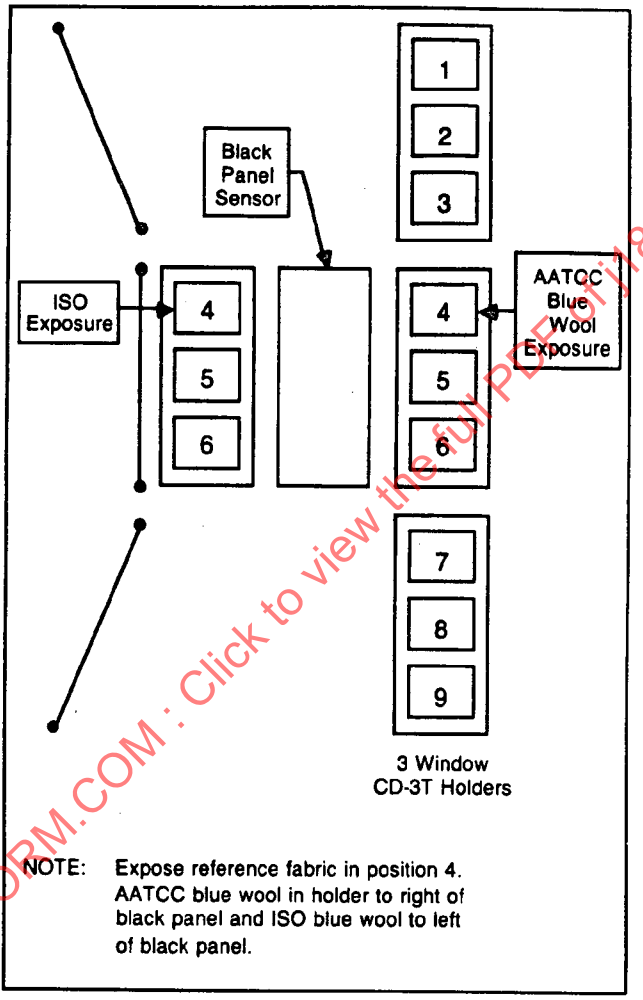
Lightfastness Standard	Delta E
AATCC L-2	9.0 ± 5%
AATCC L-4	6.7 ± 5%
ISO 3[4]	___ ± ___

Note 2: These delta E values and tolerances were established from measurements made on instruments with CIE illuminant D65, 10 deg observer. Different results may be obtained when using CIE illuminant C, 2 deg observer.

2.9 Record daily the amount of color change in the exposed reference fabrics. A control chart for individual readings is recommended for this purpose.

2.10 As each group of test specimens completes its specified radiant exposure, record and report as required by the customer, the daily color change, mean and standard deviation of the reference fabric(s) used during the test period.

[4]Tolerances to be added as data becomes available.



ANNEX 2 - FIG. 1 - 3 TIER INCLINE SPECIMEN RACK