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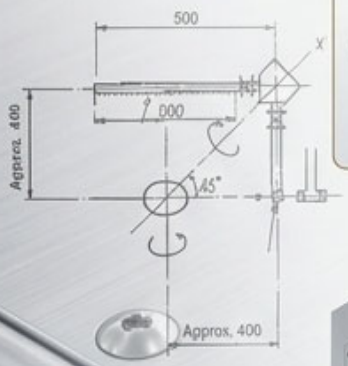

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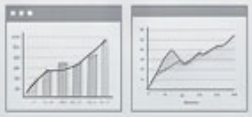

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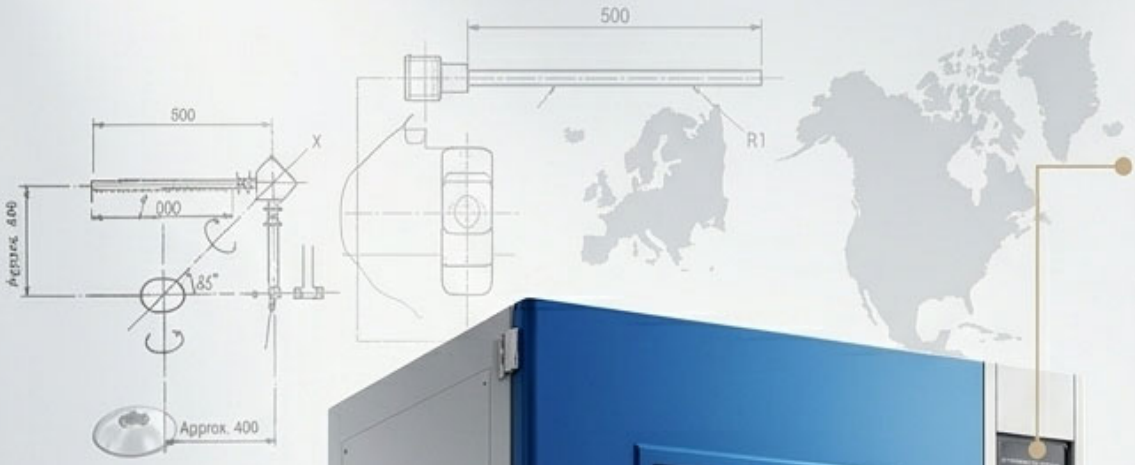

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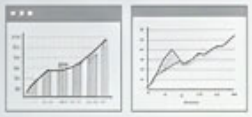

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SAE J575 DEC88

Tests for Motor Vehicle Lighting Devices and Components

SAE Recommended Practice
Reaffirmed December 1988

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Submitted for Recognition as an American National Standard

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HIGHWAY VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J575

Issued May 1942
Reaffirmed December 1988

Reaffirming J575 JUL83

TESTS FOR MOTOR VEHICLE LIGHTING DEVICES AND COMPONENTS

1. SCOPE:

This technical report provides standardized laboratory tests, test methods, and requirements applicable to many of the lighting devices and components covered by SAE technical reports.

2. SAMPLES FOR TESTS:

2.1 Lighting Devices: Samples submitted for test shall be representative of the devices as regularly manufactured and marketed, unless otherwise identified. Each sample shall be securely mounted on a test fixture in its designed operating position and shall include all accessory equipment necessary to operate the device in its normal manner.

2.2 Bulbs: Unless otherwise specified, bulbs (as listed in SAE J573) used in the tests shall be supplied by the test facility and shall be representative of bulbs in regular production. Where special bulbs are specified, they shall be submitted with the sample devices and the same or similar bulbs shall be used in the tests. Devices designed for use in both 6 V and 12 V systems shall be tested with 12 V bulbs.

2.3 Test Fixture: A device specifically designed to support the lighting device in its designed operating position during laboratory testing. This device with the test sample installed shall not have a resonant frequency in the 10-55 Hz range.

3. LABORATORY FACILITIES:

The test facility shall be equipped to test the sample in accordance with the requirements of the SAE technical report for the specific device.

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4. TESTS:

The following sections describe individual tests which need not be performed in any particular sequence. The completion of the tests may be expedited by performing the tests simultaneously on separately mounted samples.

4.1 Vibration Test:

4.1.1 Scope: This test evaluates the ability of the sample device to resist damage from vibration-induced stresses. This test is not intended to test the vibration resistance of bulbs or the internal components of sealed beam units.

4.1.2 Test Equipment: A vibration test machine capable of linear frequency variation at a constant uni-directional excursion shall be used. The vibrator table shall be of sufficient size to completely contain the test fixture base with no overhang. If this is not possible, a transition table shall be used to mechanically interface the large test fixture base to the smaller vibrator table. Precautions shall be taken to minimize the introduction of extraneous responses in the test setup. The vibration machine output wave form shall be sinusoidal with a maximum permissible harmonic distortion as shown in Fig. 1, when measured as follows:

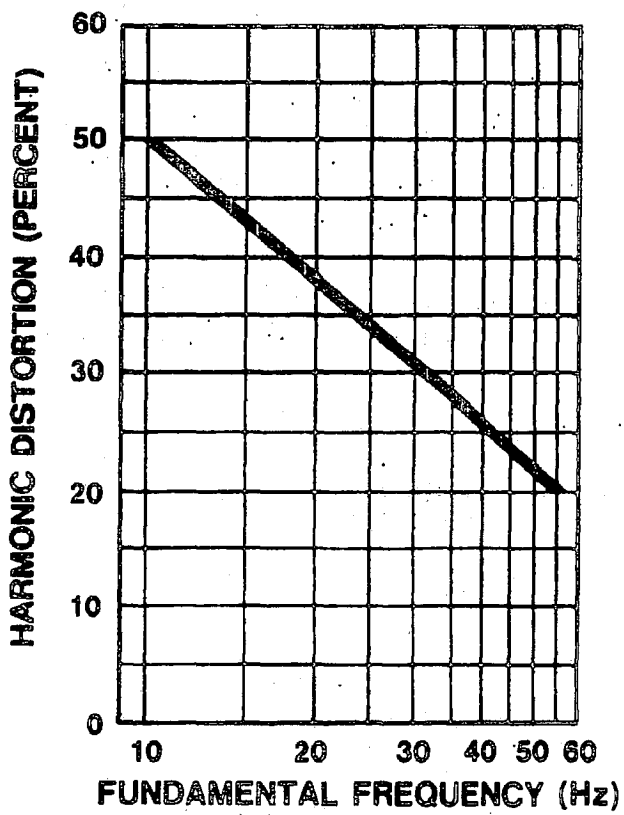

FIGURE 1 - Maximum Permissible Vibration Wave Form Harmonic Distortion

4.1.2.1 Distortion Measurement: The test machine output wave form shall be measured with an accelerometer, having a flat frequency response (±5%) from 5-2200 Hz, attached to the unloaded vibrator table or to the transition table, if used. The acceleration component measured shall be in the direction of table travel.

4.1.2.2 Harmonic Distortion Analysis: The percent distortion shall be measured directly or shall be computed by taking the ratio (x100) of the rms (root mean squared) voltage of the distortion components to the rms voltage of the total signal (distortion plus fundamental) of the accelerometer.

4.1.3 Test Procedure: A sample device as mounted on the test fixture defined in 2.1 and 2.3 shall be securely bolted to the table of the vibration test machine and subjected to vibration according to the following test parameters:

4.1.3.1 Frequency: Varied from 10-55 and return to 10 Hz at a linear sweep period of 2 min/complete sweep cycle.

4.1.3.2 Excursion: $1.0\ ^{+0.1}_{-0.0}$ mm peak to peak over the specified frequency range in 4.1.3.1.

4.1.3.3 Direction of Vibration: Vertical axis of the device as it is mounted on the vehicle.

4.1.3.4 Test Duration: $60\ ^{+1}_{-0}$ minutes.

4.1.3.5 Sample Evaluation: Upon completion of the vibration test, the sample device shall be visually examined for any rotation, displacement, cracking, or rupture of parts and the results recorded. If any of the above changes are observed that could result in failure of other tests contained in Section 4 of this technical report, the test(s) shall be performed on the vibration test sample and the results recorded.

4.1.4 Requirements: Upon completion of test procedure 4.1.3, there shall be no observed rotation, displacement, cracking, or rupture of parts of the test device (except bulb(s) and sealed beam unit internal components) which would result in failure of any other tests contained in Section 4 of this technical report. Cracking or rupture of parts of the device affecting its mounting shall also constitute a failure.

4.2 Moisture Test:

4.2.1 Scope: This test evaluates the ability of the sample device to resist moisture leakage from a water spray and determines the drainage capability of those devices with drain holes or other exposed openings in the device. This test is not intended to provide a complete test on the device seal. (See Dust Test 4.3.) The moisture test is not required for sealed beam units.

4.2.2 Selection of Test Procedures: Unless otherwise specified, a sample device as mounted on the test fixture (see 2.1), shall be tested according to either test 4.2.3 (water spray) or alternate test 4.2.4 (water submersion) as applicable. All sample devices may be tested only to the Water Spray Test (4.2.3). The purpose of the Water Submersion Test (4.2.4) is to significantly reduce the test time for those test devices without drain holes, vents, or other openings, and with seal designs which can comply with the requirements of 4.2.4. Devices which comply with requirements 4.2.4.2 are considered to have complied with all requirements of the Moisture Test.

If the device does not comply with the requirements of 4.2.4.2, the device may still comply with all requirements of the Moisture Test when subjected to the Water Spray Test (4.2.3) and when complying with the Water Spray requirements (4.2.3.3).

4.2.3 Water Spray Test:

4.2.3.1 Test Equipment (Water Spray): A water spray cabinet with a rotating test platform shall be used with the following characteristics:

4.2.3.1.1 Water Spray: The cabinet shall be equipped with a nozzle(s) which provides a solid cone water spray of sufficient angle to completely cover the sample device. The centerline of the nozzle(s) shall be directed downward at an angle of 45 ± 5 deg to the vertical axis of the rotating test platform.

4.2.3.1.2 Precipitation Rate: The precipitation rate of the water spray at the device shall be $2.5\ ^{+1.6}_{-0}$ mm/min as measured with a vertical, cylindrical collector centered on the vertical axis of the rotating test platform. The height of the collector shall be 100 mm and the inside diameter shall be a minimum of 140 mm.

4.2.3.2 Test Procedure (Water Spray): The mounted sample device shall be subjected to a water spray as follows:

4.2.3.2.1 Device Openings: All drain holes and other openings shall remain open. Devices which have a portion completely protected in service (such as trunk mounted lamps) shall have that part of the device covered to prevent moisture entry during the test. Drain wicks, when used, shall be tested in the device.

4.2.3.2.2 Rotational Speed: The device shall be rotated about its vertical axis at a rate of 4.0 ± 0.5 rpm.

4.2.3.2.3 Test Duration: The water spray shall continue for 12 hours.

4.2.3.2.4 Drain Period: The rotation and the water spray shall be turned off and the device allowed to drain for 1 hour, with the cabinet door closed.

4.2.3.2.5 Sample Evaluation: Upon completion of the drain period, the interior of the test device shall be observed for moisture accumulation. If a standing pool of water has formed, or can be formed by tapping or tilting the device, the accumulated moisture shall be extracted, measured, and the results recorded. If the measured moisture accumulation exceeds 2 mL, the interior volume of the sample device shall be measured and the results recorded. The volume of the moisture accumulation shall be calculated as a percent of the total interior volume and the results recorded.

4.2.3.3 Requirements (Water Spray): Upon completion of test procedure 4.2.3.2 above, the moisture accumulation in a test device with an interior volume of 7000 mL or less shall be 2 mL or less. For devices with an interior volume greater than 7000 mL, the maximum allowable moisture accumulation in the test device shall be 0.03% of the total interior volume of the test device.

4.2.4. Water Submersion Test:

4.2.4.1 Test Procedure (Water Submersion):

4.2.4.1.1 Device Openings: This test procedure is applicable only to test samples without drain holes, vents, or other openings. If such openings exist in any part of the test device, it shall be subjected to the Water Spray Test (4.2.3).

4.2.4.1.2 Water Submersion: The device shall be completely submerged under laboratory ambient temperature (±5°C) water at a depth of 150-175 mm as measured from the top of the device.

4.2.4.1.3 Test Duration: The device shall be submerged for 1 hour.

4.2.4.1.4 Sample Evaluation: Immediately after the device is removed from submersion, the interior of the test device shall be observed for water accumulation. If a standing pool of water has formed or can be formed by tapping or tilting the device, the accumulated moisture shall be extracted, measured, and the results recorded.

4.2.4.2 Requirements (Water Submersion): Upon completion of test procedure 4.2.4.1, the water accumulation in the test device shall be 1 mL or less.

4.3 Dust Test:

4.3.1 Scope: This test evaluates the ability of the sample device to resist dust penetration which could significantly affect the photometric output of the sample device. This test is not intended to provide a complete test on the device seals and excludes drain holes (see Moisture Test 4.2). The dust test is not required for sealed beam units.

4.3.2 Selection of Test Procedures: Unless otherwise specified, a sample device, as mounted on the test fixture defined in 2.1 shall be tested to either test 4.3.3 (dust exposure) or 4.2.4 (water submersion), as applicable. All sample devices may be tested only to the Dust Exposure Test (4.3.3). The purpose of the alternate Water Submersion Test (4.2.4) is the same as explained in the Moisture Test (see 4.2.2). Devices which comply with the water submersion requirements of 4.2.4.2 are considered to have complied with all requirements of the Dust Test. If the device does not comply with the water submersion requirements of 4.2.4.2, the device may still comply to all requirements of the Dust Test when subjected to the Dust Exposure Test (4.3.3) and when complying to the Dust Exposure requirements (4.3.3.3).

4.3.3 Dust Exposure Test:

4.3.3.1 Test Equipment (Dust Exposure): The following equipment shall be used to test for dust exposure.

4.3.3.1.1 Dust Test Chamber: The interior of the test chamber shall be essentially cubical in shape with measurements of 0.9-1.5 m on a side. The bottom of the chamber may be "hopper shaped" to aid in collecting the dust. The internal chamber volume, not including a "hopper shaped" lower section, shall be 2 m^3 maximum and shall be charged with 3-5 kg of the test dust (4.3.3.1.2) and have the capability of agitating the test dust by means of compressed air or fan blower(s) in such a way that the dust is diffused throughout the test chamber.

4.3.3.1.2 Test Dust: The test dust used shall be fine powdered cement in accordance with ASTM C 150-77, Specification for Portland Cement.

4.3.3.2 Test Procedure (Dust Exposure): The mounted sample device shall be subjected to dust as follows:

4.3.3.2.1 Device Openings: All drain holes shall be closed. A device which has a portion completely protected in service (such as trunk mounted lamps) shall have that portion of the device covered to prevent dust entry during the dust exposure. All other device openings shall remain open.

4.3.3.2.2 Dust Exposure: The mounted sample device shall be placed in the dust chamber no closer than 150 mm from a wall. Devices with a length exceeding 600 mm shall be horizontally centered in the test chamber. The test dust shall be agitated as completely as possible by compressed air or blower(s) at intervals of 15 min for a 2-15 s period. The dust shall be allowed to settle between the agitation periods.

4.3.3.2.3 Test Duration: 5 hours.

4.3.3.2.4 Sample Evaluation: Upon completion of the dust exposure, the interior surfaces of the sample device shall be visually examined and the results recorded. If dust is found, the exterior optical surfaces of the device shall be cleaned and the maximum luminous intensity photometrically measured and recorded. The interior optical surfaces of the device shall then be cleaned and the maximum luminous intensity photometrically measured and recorded. (Note: An initial photometric measurement may be made prior to the dust exposure in 4.3.3.2.2 instead of the measurement made "after cleaning.")

The ratio of the recorded maximum luminous intensities of the condition with the exterior only cleaned to the condition with both the exterior and interior cleaned shall be calculated and recorded.

4.3.3.3 Requirements (Dust Exposure): Upon completion of test procedure 4.3.3.2 above, the test device shall be considered to have met all the requirements of the dust test when complying with either of the following requirements:

4.3.3.3.1 No dust shall be found on the interior surface of the test device, or

4.3.3.3.2 The ratio of the maximum luminous intensities (exterior only cleaned to exterior and interior cleaned) shall be a minimum of 0.9.

4.4 Corrosion Test:

4.4.1 Scope: This test evaluates the ability of the sample device to resist salt corrosion which would impair the functional characteristics of the device.

4.4.2 Test Equipment: A salt spray (fog) cabinet, operating at the conditions specified by ASTM B 117-73, Method of Salt Spray (Fog) Testings, shall be used.

4.4.3 Test Procedure: A sample device as mounted on the test fixture defined in 2.1 shall be subjected to salt spray (fog). If a portion of the device is completely protected in service (such as trunk mounted lamps), that portion shall be covered to prevent salt fog entry during the salt exposure.

4.4.3.1 Salt Exposure: The mounted sample device shall be placed in the salt spray (fog) cabinet for a period of 48 hours.

4.4.3.2 Sample Evaluation: After removal from the salt spray (fog) cabinet and after a 1 hour drying period, the sample device shall be visually examined for corrosion which could affect other tests contained in section 4 of this technical report and the results recorded.

If such corrosion is found, the affected test(s) shall be performed on the corrosion test sample and the results recorded.

4.4.4 Requirements: Upon completion of test procedure 4.4.3, there shall be no observed corrosion which would result in the failure of any tests contained in section 4 of this technical report.

4.5 Reserved in order that paragraph numbers remain consistent with other related Lighting Committee documents.

4.6 Photometry Test;

4.6.1 Scope: This test measures luminous intensities at test points throughout the light distribution pattern as specified by the applicable SAE technical report for the sample device.

4.6.2 Test Equipment: The following equipment shall be used to make the photometric measurements:

4.6.2.1 Positioner: The recommended goniometer configuration, which shall be used to position the sample device when making the photometric measurements at specific angular test points, is horizontal rotation over elevation (Fig. 2). The vertical axis of the goniometer in Fig. 2 shall correspond to the design position vertical axis of the sample device which is vertical and perpendicular to the longitudinal axis of the vehicle. Other systems may be used to achieve equivalent positioning, but it will be necessary at compound angles greater than 5 deg from H-V to calculate the position which is equivalent to that of the recommended goniometer. (See 4.6.3.3)

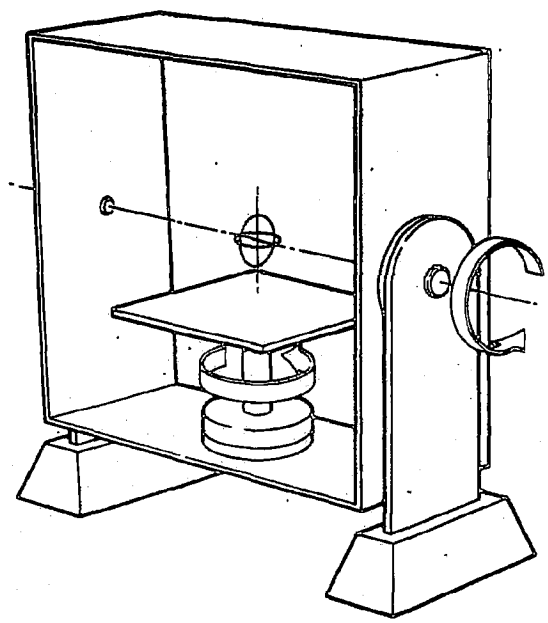

FIGURE 2 - Recommended Goniometer Configuration
(Horizontal Rotation Over Elevation)

4.6.2.2 Photometer: The photometer shall be capable of providing the luminous intensity readings (candela) of the output of the photometer sensor for the illumination level at the test distance specified (See 4.6.3.2)

4.6.2.3 Photometer Sensor: The photometer sensor used to make the photometric measurements shall have the following characteristics:

4.6.2.3.1 Maximum Size: Unless otherwise specified, the maximum effective area of the photometer sensor shall fit within a circle whose diameter is equal to 0.009 times the actual test distance from the light source of the sample device to the sensor. The sensor effective area is defined as the actual area of intercepted light striking the detector surface of the photometer. For sensor systems with lens(es) that change the diameter of the intercepted light beam before it reaches the actual detector surface, the maximum size requirements shall apply to the total area of the light actually intercepted by the lens surface. The sensor shall be capable of intercepting all direct illumination from the largest illuminated dimensions of the sample device at the test distance.

4.6.2.3.2 Photopic Response: The color response of the photometer sensor shall be corrected to that of the 1931 C.I.E. Standard Observer (2 deg) Photopic Response Curve.

4.6.3 Test Procedure: The sample device shall be mounted on the test fixture as defined in 2.1 and luminous intensity measurements made according to the following test procedures.

4.6.3.1 Bulbs: Unless otherwise specified, accurate rated bulbs shall be used. They shall be selected for accuracy as specified in SAE J387 and shall be operated at their rated luminous flux output. Where special bulbs are used, they shall be operated at their rated luminous flux output. When a rated luminous flux output is not available, or is not applicable, the device shall be operated at the following test voltage:

4.6.3.1.1 If the rated luminous flux output is not available, operate the bulb at its specified design voltage.

4.6.3.1.2 If the luminous flux output of the bulb is intentionally modified from specification for a particular device design through internal or external circuitry, operate the bulb with the voltage modification circuitry attached and with the specified design voltage applied to the input of the modification circuitry.

4.6.3.2 Test Distance: The luminous intensity measurements shall be made at equal to, or greater than, the minimum test distance between the center of the light source (or the face of a reflex reflector) and the photometer sensor, as specified in the SAE technical report applicable to the function of the sample device. If no test distance is specified, the distance shall be at least ten times the largest illuminated dimension of the sample device.

4.6.3.3 Test Point Positions: The locations of test point angles and area positions specified in the applicable SAE technical report shall be defined by the positioner of the configuration specified in 4.6.2.1. The following nomenclature shall also apply: The letters "V" and "H" designate the vertical and horizontal planes intersecting both the device light source (or center of a reflex reflector) and the photometer axis. (A device using a bulb with a major and minor light source may be oriented with respect to its major light source.) "H-V" designates the zero test point angle at the intersection of the H and V planes. Unless otherwise specified, this intersection shall be parallel to the longitudinal axis of the vehicle in the case of the designed operating position of front or rear device functions and shall be horizontal and perpendicular to the longitudinal axis of the vehicle in the case of side device functions. The letters "U," "D," "L," and "R" (up, down, left, and right respectively) designate the angular position in degrees from the H and V planes to the photometer as viewed from a lamp, or to the source of illumination as viewed from a reflex reflector. This angular direction is defined as follows:

Horizontal Angle (L and R): The angle between the vertical plane and the projection of the light ray from the device onto the horizontal plane (plan view angle).

Vertical Angle (U and D): The true angle between the horizontal plane and the light ray from the device.

The direction can be visualized where an observer stands behind the device and looks in the direction of the emanating light beam toward the photometer sensor when the device is properly aimed with respect to H-V. It should be noted that when rotating the sample device on a goniometer, it is necessary to move the aim of the device from the H-V point in the opposite direction of the test point being measured. For example, to read a test point 5U-V, the goniometer should tilt the aim of the device 5 deg in a downward direction. A similar reversal applies to the down (D), left (L), and right (R) test points.

4.6.3.4 Photometric Measurements: Prior to photometry measurements, all light sources shall be seasoned at their design voltage for 1% of their design average life or 10 hours, whichever is less. Unless otherwise specified, photometric measurements shall be made with the bulb(s) steadily burning. The luminous intensity measurements in candela shall be recorded for each of the test points and areas specified for the function of the sample device being tested. Also, determine if the luminous intensity values between the specified test points are less than the lower of the specified minimum values for the two closest adjacent test points on a horizontal or vertical line.

4.6.4 Requirements: After the sample device has been photometrically measured according to test procedure 4.6.3, the following test requirements shall apply.

4.6.4.1 The luminous intensities at the test points and areas shall be within the limits specified in the applicable SAE technical report for the function being tested.

4.6.4.2 Unless otherwise specified in the applicable SAE technical report, the minimum luminous intensity requirements between the test points specified shall be the lower of the specified minimum values for the two closest adjacent test points on a horizontal or vertical line.

4.7 Reserved in order that paragraph numbers remain consistent with other related Lighting Committee documents.

4.8 Warpage Test on Devices with Plastic Components:

4.8.1 Scope: This test evaluates the ability of the plastic components of the sample device to resist damage due to ambient and light source heat.

4.8.2 Test Equipment: A circulating air oven having a predominant air flow direction shall be used with the air flow inlet on one side of the interior test chamber and the exhaust air outlet on the opposite side of the chamber.

4.8.3 Test Procedure: A sample device as mounted on the test fixture as defined in 2.1 shall be placed in the circulating air oven and tested according to the following test procedures:

4.8.3.1 Oven Temperature: The circulating air oven temperature shall be controlled between 46-49°C.

4.8.3.2 Sample Position: The sample device shall be positioned at the center of the oven with the predominant direction of oven air flow perpendicular to the axis of the device that is parallel to the vehicle longitudinal axis.

4.8.3.3 Bulb Operation: Unless otherwise specified, the light source(s) shall be operated at design voltage and cycled as specified in Table 1.

4.8.3.4 Test Duration: 60 minutes.

4.8.3.5 Sample Evaluation: Upon completion of the warpage test, the sample device shall be visually examined for warpage of the plastic components and the results recorded. If warpage is observed that could result in failure of other tests contained in section 4 of this technical report, the test(s) shall be performed on the warpage test sample and the results recorded.

4.8.4 Requirements: Upon completion of test procedure 4.8.3, there shall be no observed warpage of plastic components of the test device which would result in the failure of any other tests contained in section 4 of this technical report.

TABLE 1 - Cycle Times (Min)

Device	Steady Burn	5 On / 5 Off	3 On / 12 Off	Steady[a] Flash
License	X			
Clearance & Identification	X			
Side Marker	X			
Tail, Fog Tail	X			
Park	X			
Stop		X		
Back-Up, Rear Cornering		X		
Cornering			X	
Turn Signal				X
Illuminating (Fog Lamp, Driving Lamp, etc.)	X			

[a]Flash rate -- 90 ± 10 flashes per minute with a 50 ± 2% on time.

NOTE: Devices with multiple function combinations shall be tested with all functions simultaneously operating as specified, except for back-up functions. Back-up functions shall be tested separately. Stop-Turn Signal Functions which are optically combined shall be tested as a stop function only.

APPENDIX

As a matter of information, attention is called to the following:

1. SAE Technical Paper 790747, SAE Vibration Test for Motor Vehicle Lighting Devices and Components, for additional information on 4.1.
2. SAE J1330 JUN88, Photometry Laboratory Accuracy Guidelines, for additional information on 4.6.

RATIONALE:

Not applicable.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

REFERENCE SECTION"

SAE J387 OCT88, Terminology--Motor Vehicle Lighting

SAE J573 DEC76, Lamp Bulbs and Sealed Beam Headlamp Units

SAE J1330 JUN88, Photometry Laboratory Accuracy Guidelines

SAE Technical Paper 790747, SAE Vibration Test for Motor Vehicle Lighting Devices and Components, for additional information on 4.1.

ASTM B 117-73

ASTM C 150-77

APPLICATION:

This technical report provides standardized laboratory tests, test methods, and requirements applicable to many of the lighting devices and components covered by SAE technical reports.

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