SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1889

REV. JUL2005

Issued 1988-06
Revised 2005-07

Superseding J1889 JUN1999

L.E.D. Signal and Marking Lighting Devices

1. Scope

This SAE Recommended Practice applies to functions of motor vehicle signalling and marking lighting devices which use light emitting diodes (L.E.D.'s) as light sources. This report provides test methods, requirements, and guidelines applicable to the special characteristics of L.E.D. lighting devices. This Recommended Practice is in addition to those required for devices designed with incandescent light sources. This report is intended to be a guide to standard practice and is subject to change to reflect additional experience and technical advances.

1.1 Rationale

The changes are as follows;

1. The foreword was removed because it only applied to the last revision.
2. The name of the document was changed to **L.E.D Signal and Marking Lighting Devices** from **L.E.D. Devices** to reflect the addition of a companion document SAE XJ2650 for forward lighting.
3. Removed SAE J576 from applicable documents because it is no longer referenced in the standard.
4. Added SAE J2139 to applicable publications.
5. Changed 3.2 definition of an L.E.D. to be the same as the definition in SAE XJ2650.
   (New) L.E.D.—An indivisible discrete light source unit, containing [a] semiconductor junction[s], in which visible light is produced when forward current flows as a result of applied voltage.
   (Old) L.E.D.—An indivisible, discrete light source unit containing a semiconductor junction in which visible light is non-thermally produced when a forward current flows as a result of applied voltage.
6. Expanded 3.3 the definition of a L.E.D. Lighting device.
7. Changed 3.4 the definition of an Incandescent lamp source to correspond with the definition of a filament bulb in J387.
8. Added 3.8. A definition for **Photometric Stability - the point at which the photometry is stable ±5% within the previous 15 minute period**.
9. Added section **4, Identification Codes, Markings and Notices**, to be consistent with other lighting J documents. This resulted in renumbering the rest of the document.
10. Added or J2139 to the paragraph with SAE J575, they are companion documents. **J2139 was also added anywhere else J575 was mentioned**.
11. Changed 5.1.3 Dust by and added the words **on the inside of the lens**.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: custsvc@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE 100 Leading Our World In Motion

12. Section 5.1.5 PHOTOMETRY TEST was changed to reference SAE J1330 photometry guidelines, which was updated to include some of the special considerations, needed for L.E.D. lighting.
13. Section 5.1.5 was broken up into two sections 5.1.5.1 and 5.1.5.2 that helps to clarify the testing procedure for the two different types of lamps previously identified as “steady burning” and “intermittent operating” lamp functions. The new wording provides clear instructions on how to perform the tests for each type. Included in this change was also the removal of the term heat saturation, which was replaced with the term photometric stability.
14. Added a sentence to section 5.3.3.1 to help clarify the minimum and maximum temperatures. The minimum temperature shall be -30 °C, and the maximum temperature shall be 50 °C.
15. Section 6.1.5 was changed to correspond with the changes made in 5.1.5.
16. Removed Section 6.4 because it is already in all of the individual photometric standards.
17. Removed Section 7.1 because Photometric design guidelines have been removed from corresponding documents.
18. Removed section 7.2.3 because this document is not an end user document.

2. References

2.1 Applicable Publications

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 or at www.sae.org.

SAE J575—Test Methods and Equipment for Lighting Devices and Components for Use on Vehicles Less than 2032 mm in Overall Width
SAE J759—Lighting Identification Code
SAE J1330—Photometry Laboratory Accuracy Guidelines
SAE J2139—Test for Signal and Marking Devices Used on Vehicles 2032 or More in Overall Width

2.2 Related Publications

The following publications are provided for information purposes only and is not a required part of this specification. The latest issue of SAE publications shall apply.

2.2.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or at www.sae.org.

SAE J387—Terminology—Motor Vehicle Lighting
SAE J578—Color Specification

3. Definitions

3.1 Semiconductor

A material whose resistivity lies in the broad range between conductors and insulators.

3.2 L.E.D.

An indivisible, discrete light source unit containing [a] semiconductor junction[s] in which visible light is produced when forward current flows as a result of applied voltage.

3.3 L.E.D. Lighting Device

A device in which light is produced by a single or an array of L.E.D. light source unit(s).

3.4 Incandescent Light Source

Device in which light is produced by means of one or more filaments heated to incandescence by the passage of an electric current.

3.5 L.E.D Light Source Center

For a single L.E.D. light source unit, the point that is located at the geometric center of the junction where the luminescence takes place, or the surface from which luminescence appears to originate.

3.6 L.E.D. Lighting Device Light Center

The geometric center of all the single L.E.D. light source centers within the L.E.D. array(s) used to illuminate the device function, or the geometric center of the illuminated area if the light output is produced indirectly.

3.7 Optically Combined L.E.D. Light Source

The definition of “Optically Combined” in SAE J387 shall also apply to a lamp using L.E.D. light sources by substituting “L.E.D.” for the term “filament” in the definition.

3.8 Photometric Stability

The point at which the photometry value is stable to within ±5% of the measured value over the previous 15 minute period.

4. Lighting Identification Code

4.1 The device shall be marked in accordance with SAE J759. Refer to specific device standards for possible additional marking requirements at the discretion of the manufacturer.

5. Tests

The following section describes individual tests which need not be performed in any particular sequence. Testing may be expedited by performing two or more tests simultaneously on separate samples.

5.1 SAE J575 or J2139 is a part of this document. Unless otherwise specified, the following tests are applicable with modifications as indicated.

5.1.1 VIBRATION TEST

The evaluation of the sample at the completion of the test shall also include a functional lighting check. If a partial outage is observed, a photometry test (see 5.1.5) shall be performed and the results recorded.

5.1.2 MOISTURE TEST

5.1.3 DUST TEST

If dust is found on the inside of the lens, the change in the maximum photometric intensity of the sample shall be determined by using the photometric procedures in 5.1.5.

5.1.4 CORROSION TEST

5.1.5 PHOTOMETRY TEST

All photometry tests should be performed in accordance with SAE J1330. Because the photometric output (luminous intensity) of a L.E.D. lighting device typically decreases as the temperature of the L.E.D. light source increases, the following stabilization and measurement methods are required.

5.1.5.1 Steady-Burning Lamp Functions (such as tail lamps and side marker lamps)

Energize the applicable test device function and record the H-V photometric value after 1 minute. Continue to energize the test device for 30 minutes or photometric stability which ever occurs first. Record the photometric values at all the required test points, including maximums. Calculate the ratio between the 1 minute H-V reading and the 30 minute (or photometric stability) H-V reading and apply It to all of the required test points, including maximums.

5.1.5.2 Intermittent Operating Lamp Functions (such as stop lamps and turn signal lamps)

Energize the applicable test device function and record the H-V photometric value after 1 minute and then again after 10 minutes. Continue to energize the test device for 30 minutes or photometric stability, whichever occurs first. Record the photometric values at all the required test points, including maximums. Calculate the ratio between the 10 minute H-V reading and the 30 minute HV reading and apply it to all of the test points. Calculate the ratio between the 1 minute H-V reading and the 30 minute (or photometric stability) H-V reading and apply it to the test points.

NOTE—Other test methods which yield equivalent results may be used. Examples include eliminating the ratio calculation and directly measuring the maximum photometric value at one minute (for a typical L.E.D. device where photometric values decrease with on-time) or directly measuring values at the specified on-time when the photometric measurement equipment can record near simultaneous readings at all test points. Readings at shorter on-times may also be used when the photometric output vs. time performance of the device is known.

5.1.6 WARPAGE TEST ON DEVICES WITH PLASTIC COMPONENTS

Not required.

5.2 Color Test

The color shall be tested as specified in the SAE report of the applicable device function.

5.3 Thermal Cycle Test

5.3.1 SCOPE

This test evaluates the ability of the sample device to resist optical, electrical, or physical malfunctions due to exposures to repeated changes from hot to cold temperature extremes. Devices installed in vehicle locations that could produce temperatures outside the test range specified may necessitate special test requirements.

5.3.2 TEST EQUIPMENT

A thermal cycle chamber capable of providing the temperature extremes and rates of change of temperature in the temperature-time profile specified in Figure 1.

5.3.3 TEST PROCEDURE

The sample device, mounted on a test fixture shall be subjected to thermal cycles as follows:

5.3.3.1 Thermal Cycle

The device shall be tested to the thermal cycle profile shown in Figure 1. The minimum temperature shall be -30 °C, and the maximum temperature shall be 50 °C.

5.3.3.2 Device Operation

The device shall be energized at design voltage commencing at point “A” of Figure 1 and de-energized at point “B” of each cycle. When energized, the lighting function(s) shall be cycled as specified by the cycle times in SAE J575, Warpage Test.

5.3.3.3 Test Duration

8 complete cycles of the thermal cycle profile shown in Figure 1 shall be completed.

5.3.3.4 Sample Evaluation

During the final thermal cycle, the sample lighting function(s) shall be continuously checked for permanent or intermittent outages while energized from Point "A" (cold temperature) to Point "B" (hot temperature) in Figure 1 and the results recorded. If partial outage occurred, a photometry test (5.1.5) with the remaining functional L.E.D. segments lighted shall be performed and the results recorded. Upon completion of the thermal cycle exposure the sample device shall be visually examined for any cracking, rupture, or warpage of parts and the results recorded. If changes are observed that could result in failure of the other tests contained in Section 5, those test(s) shall be performed on the same sample used for the thermal cycle test and the results recorded.

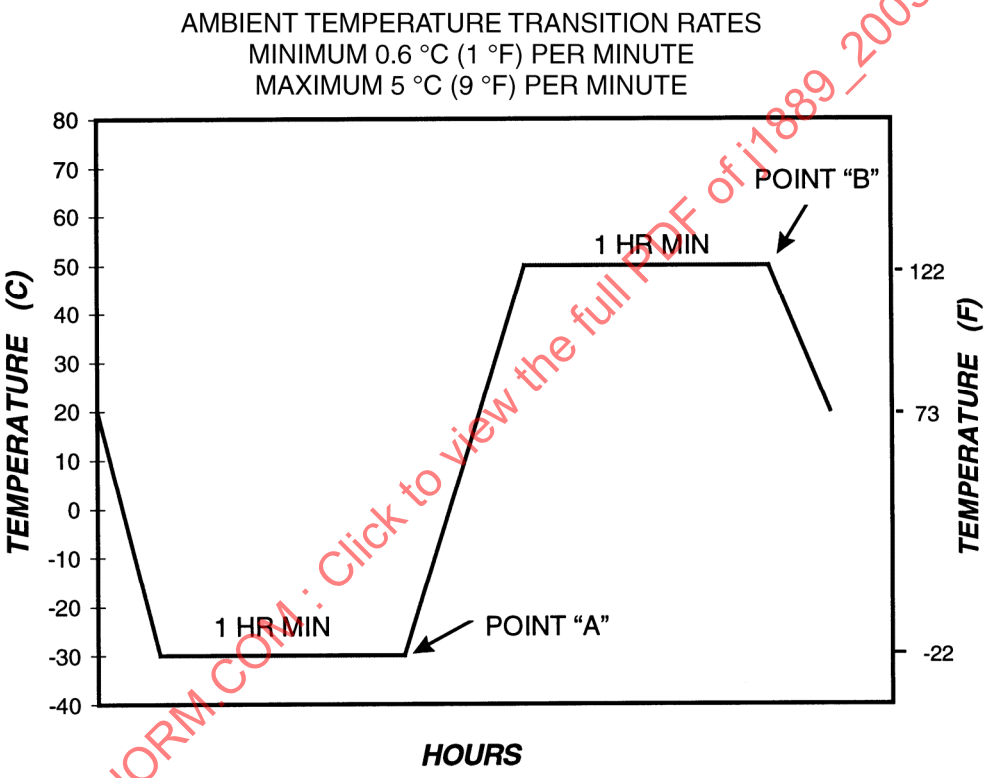

FIGURE 1—THERMAL CYCLE PROFILE

6. Requirements

6.1 Performance Requirements

A L.E.D. lighting device, when tested in accordance with the test procedures specified in Section 5, shall meet the following requirements.

6.1.1 VIBRATION

SAE J575 or J2139. In addition, the following requirements also apply:

6.1.1.1 After completion of test procedure 5.1.1, all L.E.D. light sources contained within the device shall function or the device shall comply with the photometric requirements in 6.1.5 of this document.

6.1.2 MOISTURE

SAE J575 or J2139.

6.1.3 DUST

SAE J575 or J2139.

6.1.4 CORROSION

SAE J575 or J2139.

6.1.5 PHOTOMETRY

The photometric performance requirements in the applicable SAE technical report for the lighting function being tested shall be met under the following conditions.

6.1.5.1 Steady-burning Lamp Functions

All photometry test point requirements including maximums shall be met after the 30-minute (or photometric stability) stabilization time and at the 1 minute time, applying the 1 minute/30 minute (or photometric stability) H-V ratio.

6.1.5.2 Intermittent Operating Lamp Functions

All photometry test point requirements including maximums shall be met after energized 10 minutes applying the 10 minute/30 (or photometric stability) minute H-V ratio. And at the 1 minute time, applying the 1 minute/30 minute (or photometric stability) H-V ratio.

6.1.5.3 Lighted Sections

Photometric requirements specified in the appropriate SAE technical reports which are based on the number of lighted sections shall be applied based on the total projected luminous area for the function being tested. The area shall be equivalent to the number of lighted sections in Table 1.