



SURFACE VEHICLE RECOMMENDED PRACTICE

J2938™

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(R) LED Light Sources Tests and Requirements Standard

RATIONALE

ANSI/IES LM-80, ANSI/IES TM-21, and ANSI/IES LM-85 are normative references for this document. With ANSI/IES documents being updated, this SAE document shall be reviewed and updated accordingly.

Document changes include:

- Added section 2.1.5 reference ASTM E230/E230M-17.
- Revised section 3.5 definition for luminous flux maintenance.
- Removed previous section 3.6, based on the latest version of ANSI/IES LM-80 document. The content is moved to section 5.3.7.
- Revised section 3.7 definition for temperature measurement point (TMP).
- Added section 4.4 Sample Handling.
- Section 5 Tests has been rearranged without changing the overall contents. The flow of the section is: 5.1 Environmental Conditions, 5.2 Electrical Conditions, 5.3 Maintenance Test and Measurement Procedures, and 5.4 Test Report. The section rearrangements aid in making the document easier to understand.

1. SCOPE

This SAE Recommended Practice provides the methods of measurements for electrical and photometric characteristics of LED packages. It provides procedures, requirements, and guidelines for the methods of the measurement of luminous flux and color maintenance of LED devices (packages, arrays, and modules) for ground vehicle lighting applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

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https://www.sae.org/standards/content/J2938_202405

Documents
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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J573 Signal and Marking Light Sources

SAE J1889 LED Signal and Marking Lighting Devices

SAE J2650 Performance Requirements for Road Illumination Devices Using Light Emitting Diode (LED) Sources

2.1.2 CIE Publications

Available from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at.

CIE 127:2007 Measurement of LEDs (2nd ed.)

2.1.3 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

IEC 62707 LED-binning – Part 1: General requirements and white colour grid intended for automotive applications

IEC 60810 Lamps, light sources and LED packages for road vehicles – Performance requirements

2.1.4 IES Publications

Available from Illuminating Engineering Society, 120 Wall Street, Floor 17, New York, NY 10005-4001, Tel: 212-248-5000, www.ies.org.

ANSI/IES LM-85-23 Approved Method: Optical and Electrical Measurements of LED Sources

ANSI/IES LM-80-21 Approved Method: Measuring Maintenance of Light Characteristics of Solid-State Light Sources

ANSI/IES LS-1-22 Lighting Science: Nomenclature and Definitions for Illuminating Engineering

ANSI/IES TM-21-21 Projecting Long-Term Luminous, Photon, and Radiant Flux Maintenance of LED Light Sources

2.1.5 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E230/E230M-17 Standard Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

Buonarosa, M.L., Sayer, J.R., and Flannagan, M.J. (2008). *Real-world frequency of use of lighting equipment* (Report No. UMTRI-2008-14). The University of Michigan Transportation Research Institute.

Schoettle, B., Sivak, M., and Fujiyama, Y. (2008). *LEDs and power consumption of exterior automotive lighting: Implications for gasoline and electric vehicles* (Report No. UMTRI-2008-48). The University of Michigan Transportation Research Institute.

3. DEFINITIONS

3.1 DUT

Device(s) Under Test (LED packages, arrays, and modules).

3.2 LED LIGHT SOURCE (REFER TO SAE J573)

A light source where the visible radiation is emitted from one or more LEDs. An LED light source may or may not require an additional electronic control unit (gear) and may or may not require additional provisions for thermal management.

3.3 LED MODULE (REFER TO ANSI/IES LS-1, FORMERLY IES RP-16)

An assembly of LED packages (components) or dies, on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical interfaces that are intended to connect to the load side of a LED driver. Power source and ANSI standard base are not incorporated into the device.

3.4 LED PACKAGE (REFER TO ANSI/IES LS-1, FORMERLY IES RP-16)

An assembly of one or more LED dies that includes wire bond or other type of electrical connections, possibly with an optical element and thermal, mechanical, and electrical interfaces. Power source and ANSI standardized base are not incorporated into the device.

3.5 LUMINOUS FLUX MAINTENANCE (REFER TO ANSI/IES LM-80-21)

The remaining luminous flux as a function of elapsed operating time.

NOTE: Luminous flux is typically measured at selected operating time points. The remaining luminous flux is typically expressed as a percentage of the initial luminous flux. In other documents, lumen maintenance is often used. Luminous flux maintenance is the converse of luminous flux depreciation (or lumen depreciation).

3.6 MAXIMUM JUNCTION TEMPERATURE, $T_{j, \max}$

$T_{j, \max}$ is the maximum junction temperature for operating LEDs specified by the manufacturer of the LED package.

3.7 TEMPERATURE MEASUREMENT POINT (TMP) TEMPERATURE, T_s (REFER TO ANSI/IES LM-80-21)

The measured temperature value for the DUT is measured at the temperature measurement point (TMP). In previous versions of ANSI/IES LM-80, TMP temperature was called case temperature.

4. TEST PREPARATION

4.1 DUT Tracking

Each DUT that undergoes a maintenance test shall be identified and tracked throughout the test. Extra DUTs may be useful in the event some samples are determined to be failures under the guidelines listed in section 5.3.7. All samples tested shall be included in the report.

4.2 Sample Selection

Sample DUTs shall be selected to be sufficiently representative of the overall population being tested. The sampling method and sample size used shall be reported.