



SURFACE VEHICLE RECOMMENDED PRACTICE

J2560™

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(R) Halogen Light Source Performance Requirements for Motor Vehicle Forward Lighting

RATIONALE

- a. Replaced wording “bulb” with “light source” throughout document except in legacy figures (graphics) that are no longer editable. In the following legacy figures, the reference “bulb” was not replaced by “light source”: Figures 2, 7A, 8A, 13B, 14B, 15, 16, 22B, 30A, 34, 35, and 37. Note that in Figures 36A and 39, the word “bulb” also appears, but in reference to the glass capsule (bulb), where a replacement does not apply.
- b. Changed title to “Halogen Light Source Performance Requirements for Motor Vehicle Forward Lighting.”
- c. Addition of Table 1 halogen light sources (bulbs) used for forward lighting (head lamp, fog lamp, AFS contributors) light sources.
- d. New halogen forward lighting light sources (Tables 1 and 2) added to this document are: HB3A, HB4A H8(B), H9(B), H10, H11(B), H12, H13, H15, H16(B), H18, H19, HIR1, and HIR2.
- e. Add reference to SAE J573 in 2.1.1
- f. Remove definition 3.10 (low beam) and 3.11 (high beam), which are defined in SAE J387.
- g. In 2.2.1, added SAE J387 and SAE J2442.
- h. Expanded scope to include reference to SAE J573.
- i. Incorporate reference to motorcycle application of H4 (footnote 5 in Table 1).
- j. The previous document had no requirement for life testing. This was added in 6.7.
- k. 6.7 was renumbered into 6.9.
- l. Renamed 2.2.3 to “UN Regulations and Resolutions.”
- m. Inserted reference in 2.2.3 to UN R.E.5.
- n. Included reference to UN R.E.5 in 3.9.
- o. Replaced references to UN Regulation 37 with references to UN R.E.5 in Table 2 and 6.9.1.

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- p. In Figures 18 and 26, corrected significant figure in dimension 2.9 mm (was incorrectly listed as 2.90 mm).
- q. Added additional descriptors to figures with light source specifications.
- r. Added sentence to the scope concerning the use of the terms high beam and low beam used throughout the document.

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1. SCOPE

This document establishes performance, material, and design requirements and design guidelines for halogen replaceable light sources used in road illumination devices for forward lighting. Non-halogen filament light sources suitable for forward lighting are specified in SAE J573. The terms “high beam filament” and “low beam filament” used throughout this document refer only to typical use, not to a mandatory, exclusive, or universal function of the filaments. This SAE Recommended Practice is periodically updated to keep pace with experience and technical advances.

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.

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 J567	Light Source Retention System
SAE J573	Signal and Marking Light Sources
SAE J575	Test Methods and Equipment for Lighting Devices for Use on Vehicles Less than 2032 mm in Overall Width
SAE J578	Color Specification
SAE J2739	Absorptive and Interference Coatings Applied on Replaceable Headlamp Bulbs

2.1.2 Code of Federal Regulations (CFR) Publications

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

CFR Title 49 Part 564	Replaceable Light Source Information
CFR Title 49 Part 571.108	Lamps, Reflective Devices and Associated Equipment

NOTE: CFR 49 Part 564 docket submissions can be viewed and downloaded at www.regulations.gov, under docket NHTSA-1998-3397.

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 Publication 60061	Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety
IEC Publication 60809	Lamps for Road Vehicles - Dimensional, Electrical and Luminous Requirements
IEC Publication 60810	Lamps 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.

IESNA Procedure LM-45-00 Electrical and Photometric Measurements of General Service Incandescent Filament Lamps

2.1.5 CIE Publications

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

CIE Publication 15.2 Colorimetry, 1986

2.2 Related Documents

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

2.2.1 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 J387 Terminology - Motor Vehicle Lighting

SAE J2442 Harmonized Provisions for Installation of Exterior Lamps and Retro-Reflecting Devices on Road Vehicles Except Motorcycles

2.2.2 CIE Publications

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

CIE Publication 13.3 Method of Measuring and Specifying Color Rendering Properties of Light Sources (TC3.2), 1995

2.2.3 UN Regulations and Resolutions

Available from United Nations Economic Commission for Europe, Palais des Nations, CH-1211, Geneva 10, Switzerland, Tel: +41-0-22-917-12-34, www.unece.org.

UN Regulation 37 Uniform Provisions Concerning the Approval of Filament Lamps for Use in Approved Lamp Units of Power-Driven Vehicles and of Their Trailers

UN R.E.5 Consolidated Resolution on the Common Specification of Light Source Categories (R.E.5) (ECE/TRANS/WP.29/1127 and Revisions)

3. DEFINITIONS

3.1 FORWARD LIGHTING

A lighting device (lamp) designed to provide illumination forward of the vehicle.

3.2 REPLACEABLE LIGHT SOURCE (LIGHT SOURCE)

A light source with related envelope and mounting base, which is removable from the forward lighting device for the purpose of replacement.

3.3 SEASONING

Process of energizing the filament of a light source at design voltage ± 0.1 VDC for a period of time equal to 1% of design life or 10 hours maximum, whichever is shorter.

3.4 DESIGN VOLTAGE

The voltage used for design purposes.

3.5 LIFE

Total time (expressed in hours) during which a light source has been operated before it becomes inoperable. For filament light sources, it is considered to be so according to one of the following criteria:

- a. The end of life is the time when the filament fails.
- b. The life of a dual-filament light source is the time until either filament fails, if the light source is tested in a switching cycle involving alternative operation of both filaments.

3.6 LIFE TEST VOLTAGE

The voltage used for laboratory life test on a light source filament.

3.7 TEST VOLTAGE

The specified voltage and tolerance to be used when conducting a test.

3.8 RATED VOLTAGE

The nominal circuit or vehicle electrical system voltage classification. (Example: 12 V headlamp light source.)

3.9 ACCURATE RATED LIGHT SOURCE (STANDARD LIGHT SOURCE)

A seasoned light source operated at design luminous flux shown in Table 1 and having its filament located within the tolerances indicated in the figures specified in Table 2. The determination of filament location may be made while the filament is cold (not energized) or hot (energized at 90 to 110% of design voltage).

In addition to the tables and methods indicated in this document, the procedures for determining filament location given in IEC 60809, UN Regulation 37, and UN R.E.5 are acceptable.

When testing double-filament light sources, separate specimens may be used for the high-beam and low-beam filament tests, but the untested filament in each specimen must be within production tolerances as specified in the applicable figures.

3.10 HIGH BEAM FILAMENT

Filament coil designed to provide high beam function.

3.11 LOW BEAM FILAMENT

Filament coil designed to provide low beam function.

3.12 FILAMENT DISTORTION

Any non-parallelism of either coil with respect to the centerline of the design nominal filament location or any additional width of the end view of the filament in excess of the outside diameter of the first full turn. This includes filament warping, crocking, bowing, and tilting.

3.13 RATED AVERAGE LAB LIFE

An average life in hours, which is obtained by laboratory life testing of light sources at the specified test voltage over a long period of production time. It is meant to partially describe a manufactured product recognizing that individual lifetimes vary greatly. It is not the same as service life, which is generally shorter due to environmental conditions such as vibration, voltage fluctuations, and temperature.

3.14 DESIGN LIFE

Design life is synonymous with rated average lab life. This performance claim is a minimum specification for the B50 value determined in a Weibull analysis of the life test failure times.

3.15 GAUGING STANDARD

A gauge to calibrate filament location measuring equipment produced for each light source type with all critical tolerances affecting filament location one-tenth the stated tolerances in the production light source design requirements.

4. IDENTIFICATION CODE DESIGNATION

4.1 Replaceable Light Source Marking Requirements

Light sources shall be marked with the following information:

- a. Manufacturer's name and/or trademark.
- b. Trade number and/or ANSI number.
- c. Voltage.
- d. Date code.
- e. Country of origin.

Table 1 - Replaceable forward lighting halogen light sources

Designation	Alternate Design Designation	Number of Filaments	Power (W) at 12.8 V H.B./L.B. ⁽¹⁾	Maximum Power (W) at 12.8 V H.B./L.B. ⁽²⁾	Luminous Flux (Lumens) at 12.8 V H.B. L.B.	Design Life (Hours) at 14 V H.B./L.B. ⁽³⁾	Filament Type	Cap	Cap # ⁽⁴⁾
HB1	9004 (ANSI)	2	65/45	70/50	1200 ± 15% ⁽⁵⁾ 700 ± 15% ⁽⁵⁾	150/320	C6/C6	Axial	P29t
HB2	9003 (ANSI)	2	67/60.5	72/65	1500 ± 10% ⁽⁵⁾ 910 ± 10% ⁽⁵⁾	150/320	C8/C8	Axial	P43t
HB3	9005 (ANSI)	1	65	70	1700 ± 12%	150	C8	Right angle	P20d
HB3A	9005 XS	1	65	70	1700 ± 12%	150	C8	Axial	P20d
HB4	9006 (ANSI)	1	55	60	1000 ± 15% ⁽⁵⁾	320	C8	Right angle	P22d
HB4A	9006 XS	1	55	60	1700 ± 12%	320	C8	Axial	P22d
HB5	9007 (ANSI)	2	65/55	70/60	1350 ± 15% ⁽⁵⁾ 1000 ± 15% ⁽⁵⁾	150/320	C8/C8	Axial	-
H1		1	60.5	65	1410 ± 210	320	C8	Axial	P14.5s
H3	9200 (ANSI)	1	60.5	65	1310 ± 195	320	C6	Axial	PK22s
H4 ⁽⁷⁾		2	67/60.5	72/65	1500 ± 10% ⁽⁵⁾ 910 ± 10% ⁽⁵⁾	150/320	C8/C8	Axial	P43t
H7		1	53.5	55.6	1350 ± 12% ⁽⁵⁾	320	C8	Axial	PX26d
H8		1	38.5	41	730 ± 110 ⁽⁵⁾	320	C8	Right angle	PGJ19-1
H8B		1	38.5	41	730 ± 110 ⁽⁵⁾	320	C8	One-touch	PGJY19-1
H9		1	63	70	2000 ± 240	150	C8	Right angle	PGJ19-5
H9B		1	63	70	2000 ± 240	320	C8	One-touch	PGJY19-5
H10	9145 (ANSI)	1	45	48	800 ± 15% ⁽⁵⁾	1000	C8	Right angle	PY20d
H11		1	53	59	1250 ± 150 ⁽⁵⁾	320	C8	Right angle	PGJ19-2
H11B		1	53	59	1250 ± 150 ⁽⁵⁾	320	C8	One-touch	PGJY19-2
H12	9055 (ANSI)	1	55	59	925 ± 15% ⁽⁵⁾	1000	C6	Right angle	PZ20d
H13		2	55/65	60/70	1500 ± 15% ⁽⁵⁾ 1000 ± 15% ⁽⁵⁾	150/320	C8	Axial	P26.4t
H15		2	55/15	61/18	1230 ± 12% 235 ± 12% ⁽⁶⁾	150/2000	C8/C8	One-touch	PGJ23t-1
H16		1	19	25	450 +10%/-15% ⁽⁵⁾	980	C8	Right angle	PGJ19-3

Designation	Alternate Design Designation	Number of Filaments	Power (W) at 12.8 V H.B./L.B. ⁽¹⁾	Maximum Power (W) at 12.8 V H.B./L.B. ⁽²⁾	Luminous Flux (Lumens) at 12.8 V H.B. L.B.	Design Life (Hours) at 14 V H.B./L.B. ⁽³⁾	Filament Type	Cap	Cap # ⁽⁴⁾
H16B		1	19	25	450 +10%/-15% ⁽⁵⁾	980	C8	One-touch	PGJY19-3
H18		1	65	66	1530 ± 8% ⁽⁵⁾	320	C8	Axial	PY26d-1
H19		2	60/55	70/65	1600 ± 10% ⁽⁵⁾ 1100 ± 10% ⁽⁵⁾	150/320	C8/C8	Axial	PU43t-3
HIR1	9011 (ANSI)	1	65	70	2300 ± 15%	150	C8	Axial	PX20d
HIR2	9012 (ANSI)	1	55	60	1700 ± 15%	320	C8	Axial	PX22d

(1) Rated power.

(2) Maximum power as specified in 49 CFR 564 docket file or UN. R.E.5 category sheet.

(3) Guidelines.

(4) IEC-60061 cap designation.

(5) With opaque coating.

(6) For position light function energized at 7.5 V.

(7) For motorcycle lighting only.

Table 2 - Replaceable forward lighting light sources and related dimensional figures

Light Source Identification	Figures and References Relative to: Dimensional Specifications Standard Light Source	Figures and References Relative to: Specifications for Light Source Holders	Figures Relative to: Measurement Method - Light Source Filament Dimension and Tolerance	Figures Relative to: Dimensional Specifications for Accurate Rated Light Source (Standard Light Source)
HB1	Figures 7A/7B to 13A/13B 49 CFR 564 docket 98-3397-10, -44 IEC-60061-1 sheet 7004-66	Figure 12A and 12B 49 CFR 564 docket 98-3397-10, -44 IEC-60061-2 sheet 7005-66	Sections 8.1, 8.1.3, and 8.1.4	Figures 13A and 13B
HB2	Figures 35 to 40 49 CFR 564 docket 98-3397	49 CFR 564 docket 98-3397-11	Sections 8.4 and 8.4.2, and Figures 37 to 40	Figures 36A and 36B
HB3	Figures 14A/14B to 21 49 CFR 564 docket 98-3397-12, -19, -21 IEC-60061-1 sheet 7004-31	Figure 19 49 CFR 564 docket 98-3397-12, -19, -21 IEC-60061-2 sheet 7005-31	Sections 8.2, 8.2.1, 8.2.3, and 8.2.5	Sections 8.2, 8.2.1, 8.2.3, and 8.2.5, and Figure 21
HB3A	49 CFR 564 docket 98-3397-1, -21 IEC-60061-1 sheet 7004-31	49 CFR 564 docket 98-3397-1, -21 IEC-60061-2 sheet 7005-31	UN R.E.5	UN R.E.5



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Light Source Identification	Figures and References Relative to: Dimensional Specifications Standard Light Source	Figures and References Relative to: Specifications for Light Source Holders	Figures Relative to: Measurement Method - Light Source Filament Dimension and Tolerance	Figures Relative to: Dimensional Specifications for Accurate Rated Light Source (Standard Light Source)
HB4	Figures 22A/22B to 28 49 CFR 564 docket 98-3397-13, -20, -22 IEC-60061-1 sheet 7004-32	Figure 27 49 CFR 564 docket 98-3397-13, -20, -22 IEC-60061-2 sheet 7005-32	Sections 8.2, 8.2.2, 8.2.4, and 8.2.5	Sections 8.2, 8.2.2, 8.2.4, and 8.2.5, and Figure 28
HB4A	49 CFR 564 docket 98-3397-1, -22 IEC-60061-1 sheet 7004-32	49 CFR 564 docket 98-3397-1, -22 IEC-60061-2 sheet 7005-32	UN R.E.5	UN R.E.5
HB5	Figures 29A/29B to 34 49 CFR 564 docket 98-3397-14	Figure 33A and 33B 49 CFR 564 docket 98-3397-14	Sections 8.3, 8.3.1, 8.3.2, 8.3.3, and 8.3.4	Sections 8.3, 8.3.3, and 8.3.4, and Figure 34
H1	49 CFR 564 docket 98-3397-9, -42, -45 IEC-60061-1 sheet 7004-46	49 CFR 564 docket 98-3397-9, -42, -45 IEC-60061-2 sheet 7005-46	IEC-60809-2310-2	IEC-60809-2310-2
H3	49 CFR 564 docket 98-3397-8, -42, -45 IEC-60061-1 sheet 7004-47	49 CFR 564 docket 98-3397-8, -42, -45 IEC-60061-2 sheet 7005-47	60809-IEC-2330-3	60809-IEC-2330-3
H4	Figures 35 to 40 IEC-60061-1 sheet 7004 39	IEC-60061-2 sheet 7005-39-4	Sections 8.4 and 8.4.2, and Figures 37 to 40 60809-IEC-2120-2	Figures 36A and 36B 60809-IEC-2120-2
H7	49 CFR 564 docket 98-3397-4, -5, -43 IEC-60061-1 sheet 7004-5	49 CFR 564 docket 98-3397-4, -5, -43 IEC-60061-2 sheet 7005-5	60809-IEC-2315-1	60809-IEC-2315-1
H8	49 CFR 564 docket 98-3397-32 IEC-60061-1 sheet 7004-110	49 CFR 564 docket 98-3397-32 IEC-60061-2 sheet 7005-110	UN R.E.5	UN R.E.5
H8B	49 CFR 564 docket 98-3397-58 IEC-60061-1 sheet 7004-146	49 CFR 564 docket 98-3397-58 IEC-60061-2 sheet 7005-146	UN R.E.5	UN R.E.5

Light Source Identification	Figures and References Relative to: Dimensional Specifications Standard Light Source	Figures and References Relative to: Specifications for Light Source Holders	Figures Relative to: Measurement Method - Light Source Filament Dimension and Tolerance	Figures Relative to: Dimensional Specifications for Accurate Rated Light Source (Standard Light Source)
H9	49 CFR 564 docket 98-3397-33 IEC-60061-1 sheet 7004-110	49 CFR 564 docket 98-3397-33 IEC-60061-1 sheet 7005-110	UN R.E.5	UN R.E.5
H9B	49 CFR 564 docket 98-3397-59 IEC-60061-1 sheet 7004-146	49 CFR 564 docket 98-3397-59 IEC-60061-1 sheet 7005-146	UN R.E.5	UN R.E.5
H10	UN R.E.5 IEC-60061-1 sheet 7004-31	IEC-60061-2 sheet 7005-31	UN R.E.5	UN R.E.5
H11	49 CFR 564 docket 98-3397-34 IEC-60061-1 sheet 7004-110	49 CFR 564 docket 98-3397-34 IEC-60061-1 sheet 7004-110	UN R.E.5	UN R.E.5
H11B	49 CFR 564 docket 98-3397-60 IEC-60061-1 sheet 7004-146	49 CFR 564 docket 98-3397-60 IEC-60061-1 sheet 7004-146	UN R.E.5	UN R.E.5
H11 C	49 CFR 564 docket 98-3397-81 IEC-60061-1 sheet 7004-110	49 CFR 564 docket 98-3397-81 IEC-60061-1 sheet 7004-110	UN R.E.5	UN R.E.5
H12	UN R.E.5 IEC-60061-1 sheet 7004-31	IEC-60061-2 sheet 7005-31	UN R.E.5	UN R.E.5
H13	49 CFR 564 docket 98-3397-50, -51 IEC-60061-1 sheet 7004-128	49 CFR 564 docket 98-3397-50, -51 IEC-60061-1 sheet 7004-128	UN R.E.5	UN R.E.5
H13 C	49 CFR 564 docket 98-3397-69 IEC-60061-1 sheet 7004-128	49 CFR 564 docket 98-3397-69 IEC-60061-1 sheet 7004-128	UN R.E.5	UN R.E.5
H15	49 CFR 564 docket 98-3397-83 IEC-60061-1 sheet 7004-155	49 CFR 564 docket 98-3397-83 IEC-60061-1 sheet 7005-155	UN R.E.5	UN R.E.5

Light Source Identification	Figures and References Relative to: Dimensional Specifications Standard Light Source	Figures and References Relative to: Specifications for Light Source Holders	Figures Relative to: Measurement Method - Light Source Filament Dimension and Tolerance	Figures Relative to: Dimensional Specifications for Accurate Rated Light Source (Standard Light Source)
H16	UN R.E.5 IEC-60061-1 sheet 7004-110	IEC-60061-2 sheet 7005-110	UN R.E.5	UN R.E.5
H16B	UN R.E.5 IEC-60061-1 sheet 7004-146	IEC-60061-2 sheet 7005-146	UN R.E.5	UN R.E.5
H18	49 CFR 564 docket 98-3397-116 IEC-60061-1 sheet 7004-171	IEC-60061-2 sheet 7005-171	UN R.E.5	UN R.E.5
H19	49 CFR 564 docket 98-3397-115 IEC-60061-1 sheet 7004-5	IEC-60061-2 sheet 7005-5	UN R.E.5	UN R.E.5
HIR1	49 CFR 564 docket 98-3397-2, -6, -7 IEC-60061-1 sheet 7004-31	49 CFR 564 docket 98-3397-2, -6, -7 IEC-60061-2 sheet 7005-31	UN R.E.5	UN R.E.5
HIR2	49 CFR 564 docket 98-3397-3, -25 IEC-60061-1 sheet 7004-32	49 CFR 564 docket 98-3397-3, -25 IEC-60061-2 sheet 7005-32	UN R.E.5	UN R.E.5

5. TESTS

Light sources used in the tests shall be representative of regular production. Testing to determine average lab life shall be conducted on lot sizes established by the manufacturer. The manufacturer shall retain and supply the data upon request.

5.1 Deflection Test

Applies to replaceable headlamp light sources.

5.1.1 Light source Mounting

The light source shall be rigidly mounted in a fixture in a manner indicated in Figure 1.

5.1.2 Force Definition

A force of $18.0 \text{ N} \pm 0.4 \text{ N}$ shall be applied for a maximum of 5.0 seconds at the locations shown in Figure 1 using a rod with a hard rubber tip with a minimum radius of 1.0 mm.

5.1.3 Test Angles

A separate light source shall be used for each load application at 0 degrees, 90 degrees, 180 degrees, and 270 degrees.

5.2 Seal Test

Applies to light sources designed for an air tight fit to the forward lighting device.

5.2.1 Light Source Fixturing

The light source shall be inserted into a fixture as shown in Figure 2 and retained by the same method intended for application, or equivalent.

5.2.2 Test Description

The chamber shall be gradually pressurized to $70.0 \text{ kPa} \pm 1.0 \text{ kPa}$ gage while the fixture and terminal end of the light source are completely submerged in water. The 70 kPa gage pressure shall be held for 60 seconds.

5.2.3 Test Duration

The light source shall be observed for the presence of air bubbles during the 60 second time period.

5.3 Color Test

SAE J578 is a part of this report.

5.3.1 Preparation

5.3.1.1 Light Source Selection

Measurements shall be made on finished replaceable light sources.

5.3.1.2 Test Temperature

Tests shall be made at an ambient temperature of $23 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$.

5.3.1.3 Test Voltage

Tests shall be made at design voltage $\pm 20 \text{ mV}$.

5.3.1.4 Detector-Light Source Set-up

For the initial measurement of a replaceable light source, the detector shall be positioned perpendicular to the light source reference axis and perpendicular to the filament axis. In the case where the filament axis is parallel to the light source axis, the light source shall be rotated about the light source axis to a position where the measurements can be made without interference of internal light source structures coming between the energized filament and the detector.

5.3.1.5 Double Filament Test Set-up

In case of replaceable light sources with two filaments, it is sufficient to evaluate the high beam filament only. Therefore, the center of the high beam filament shall be used as the vertex of measurement direction angles.

5.3.1.6 Stabilization

Before starting a test, the stabilization of the temperature of the light source shall be obtained by operating at test voltage for 10 minutes.

5.3.2 Color Measurement

5.3.2.1 Measuring System Accuracy

Color tests shall be made with a measuring system that determines CIE trichromatic co-ordinates of the received light with an accuracy of 0.005.

5.3.2.2 Colorimetric Detector Description

The trichromatic co-ordinates shall be measured with a colorimetric detector integrating over a right circular cone subtending an angle of minimum 5 degrees and maximum 15 degrees, having its vertex at the center of the filament (see Figure 3).

5.3.2.3 Measuring Directions

5.3.2.3.1 Measuring Directions

Measurements shall not be taken when structural components within the light source are aligned between the filament and the detector.

5.3.2.3.2 Measuring Points

The light source shall be rotated around its reference axis to angles 0 degrees, ± 15 degrees, and ± 30 degrees, and at each rotation angle color shall be measured at angles 0 degrees, ± 15 degrees, and ± 30 degrees in the plane that passes through the reference axis of the lamp and the detector reference axis. A grid consisting of these 25 points is illustrated in Figure 4.

5.4 Power (Wattage) Test

5.4.1 Test Voltage

The power (wattage) of each filament shall be determined at design voltage ± 20 mV DC.

5.4.2 Seasoning

Each filament shall be seasoned prior to measurement in accordance with 3.3.

5.5 Luminous Flux Test

5.5.1 Seasoning

Each filament shall be seasoned prior to measurement in accordance with 3.3.

5.5.2 Photometry

Each filament shall be photometered at design voltage ± 20 mV DC.

5.5.3 Test Definition

The tests shall be conducted in accordance with IESNA LM-45-00.

5.6 Luminous Flux Maintenance Test

5.6.1 Luminous Flux Measurement

The luminous flux for each filament shall be determined in accordance with 5.5.

5.6.2 Mounting

The light source shall then be energized in a horizontal or its normal burning position in the test enclosure shown in Figure 5, or an equivalent enclosure, or a forward lighting device designed for the light source-type to be tested.

5.6.3 Test Voltage

The test voltage shall be at "life test voltage" ± 0.1 VDC. On two-filament light sources, each filament shall be tested separately. A new light source shall be used for each filament life test.

5.6.4 Measurement

The luminous flux of the filament shall be measured after burning for 70% of the design life.

5.7 Laboratory Life Test

5.7.1 Test Set Up

Life test voltage for the light sources in Table 3. The filament shall be energized at $14 \text{ VDC} \pm 0.1 \text{ VDC}$ in a horizontal burning position in the standard enclosure shown in Figure 5, or an equivalent enclosure, or a forward lighting device designed for the light source-type to be tested.

5.7.2 Light Source Energizing

The filament shall be de-energized a minimum of 15 minutes for each 24 hours of testing. The de-energized time is not part of the test time of the filament being tested.

5.7.3 Filament subject to Test

Each filament shall be tested separately and a different light source shall be used for each filament.

5.7.4 Test Termination Condition

The test may be terminated at 150% of design life.

Table 3 - Replaceable halogen light source life test voltage

Design Designation	Alternate Design Designation	Design Voltage (V)	Life Test Voltage (V)
HB1	9004 (ANSI)	12.8	14
HB2	9003 (ANSI)	12	
HB3	9005 (ANSI)	12.8	
HB3A	9005 XS	12.8	
HB4	9006 (ANSI)	12.8	
HB4A	9006 XS	12.8	
HB5	9007 (ANSI)	12.8	
H1		12	
H3	9200 (ANSI)	12	
H4		12	
H7		12	
H8		12	
H8B		12	
H9		12	
H9B		12	
H10	9145 (ANSI)	12.8	
H11		12	
H11B		12	
H12	9055 (ANSI)	12.8	
H13		12	
H15		12	
H16		12	
H16B		12	
H18		12	
H19		12	
HIR1	9011 (ANSI)	12.8	
HIR2	9012 (ANSI)	12.8	

5.8 Vibration Test

The methods described in IEC 60810 wide band vibration test shall be used to assess the vibration performance of the light source.

6. PERFORMANCE REQUIREMENTS

A light source, when tested in accordance with the test procedures specified in Section 5, shall meet the following requirements:

6.1 Deflection Requirement

After the load application, for each of the positions in 5.1.3, the permanent deflection of the glass envelope of the light source shall not exceed 0.13 mm.

6.2 Seal Requirement

While the fixture and terminal end is submerged, no bubble(s) shall develop outside the test fixture within 60 seconds.

6.3 Color Requirement (SAE J578)

For a headlamp light source:

- a. Each measured value of the color of light emitted shall lie within the white color boundary defined in SAE J578;

AND

- b. The measured values shall not deviate more than 0.020 units in the x and/or y direction from a point of choice on the Planckian locus (CIE Publication 15.2).

SAE J2739 shows an illustration how these requirements are applied.

6.4 Power (Wattage) Requirement

Measured power (wattage) for each filament shall not exceed the maximum listed in Table 1.

6.5 Luminous Flux Requirement

Measured luminous flux for each filament shall be within the tolerance listed in Table 1.

6.6 Luminous Flux Maintenance Requirement

The luminous flux value for single filament light sources or for each filament of two-filament light sources after burning for 70% of design life shall be no less than 70% of the initial luminous flux value.

6.7 Laboratory Life Requirements

Measured average laboratory life for a filament shall not be less than the design life specified for that filament in Table 1.

6.8 Vibration Requirements

The light source shall meet the vibration requirement per IEC 60810.

6.9 Design Requirements

6.9.1 Light Source Dimensional Interchangeability Requirements

Light sources and light source holders shall meet the dimensional requirements referenced in references 1, 2, and 3 below.

1. 49 CFR 564 docket 98-3397.
2. UN R.E.5.
3. IEC-60809, IEC-60061-1, and IEC-60061-2.

For purposes of ensuring interchangeability, reference 1 takes precedence over reference 2 and 3, and reference 2 precedence over reference 3. 49 CFR 564 docket 98-3397, includes all the dimensions and specifications necessary to ensure interchangeability. The illustrations shown in this document may not include all dimensions that are shown in 49 CFR 564. For illustration, typical light source drawings are included as Figures 7 to 40. These drawings are not mandatory.

6.9.2 Accurate Rated Light Sources (Standard Light Sources)

Accurate rated light sources shall meet the dimensional requirements referenced in Table 2.

6.9.3 Light Source Specifications

Typical replaceable light sources used in road illumination devices for forward lighting are listed in Table 1.

7. GUIDELINES

7.1 Replaceable Light Source Filament End Coil Definition

The filament end is the center of the filament wire located as shown in Figure 6.

7.2 Dimensional Guidelines

Guidelines for dimensions of replaceable light sources are shown in Table 2 and Figures 7 to 40.

7.3 Filament Rated Average Lab Life Guideline

Rated average lab life shall approximate design life. The design life for the filament(s) of each light source type is shown in Table 1.

7.4 Daytime Running Lamp Light Source Luminous Flux Maintenance Guideline and Life Durability Guideline

The luminous flux maintenance test cycle and life durability test cycle are described in 7.4.1, 7.4.2, and 7.4.3. They are established to verify the performance of halogen light sources used at reduced voltages for daytime running lamps.

Testing shall be conducted:

- a. At room temperature.
- b. With the appropriate number of light sources.
- c. At 6.4 VDC for reduced voltage high beam and 9.6 VDC for reduced voltage low beam by light source manufacturers; all other organizations, such as lighting device and vehicle manufacturers, are to use production DRL electronic modules, or equivalent, if one is required in the DRL mechanization.
- d. With electrical system supply voltages as shown in 7.4.1, 7.4.2, and 7.4.3.
- e. In vehicle position in a 100 x 165 mm size headlamp assembly, or equivalent.
- f. Using seasoned light sources.

Measure the initial luminous flux output of the filament(s) (LHBI and LLBI) in a spherical photometer at 12.8 VDC. (See Equation 1.)

The test cycles as defined in 7.4.1, 7.4.2, and 7.4.3 shall be used. The test cycle shall be initiated from the same starting point in each cycle.

Following the completion of Phase 1, measure the final luminous flux output of the filament(s) in a spherical photometer at 12.8 VDC (see Equation 1). Equation 1 applies to the end of Phase 1.

$$\text{LHBF/LHBI} \geq 90\%, \text{LLBF/LLBI} \geq 90\% \quad (\text{Eq. 1})$$

where:

LHBF = lumens high beam, final

LHBI = lumens high beam, initial

LLBF = lumens low beam, final

LLBI = lumens low beam, initial

7.4.1 Double Filament Light Sources - High Beam DRL

If an electronic module is used to reduce the voltage for high beam, the current for DRL high beam shall be directed through the module ignition switch mode and the headlamp low beam current shall be directed through the module headlamp switch mode.

Where the high beam filament is used for DRL at a reduced voltage:

Phase 1	Hours
High beam filament on at reduced voltage (6.4 V)	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
Low beam filament on at 14.0 V	1.0
Everything off	0.25
High beam filament on at 14.0 V	0.50
Everything off	0.25
Total 24 hours	
Repeat previous for a total of 408 hours (17 days)	
End of Phase 1 (measure LHBF and LLBF) (see Equation 1)	

Continue testing the same light sources on the following test cycle:

Phase 2	Hours
Low beam filament on at 14.0 V	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
High beam filament on at 14.0 V	1.0
Everything off	0.25
High beam filament on at reduced voltage (6.4 V)	0.50
Everything off	0.25
Total 24 hours	
Continue Phase 2 until the low beam filament no longer functions	
Requirements:	
Equation 1 ratios are satisfied, Phase 1 only	
Design life, low beam and high beam filaments shall not be adversely affected,	
Phases 1 and 2	

7.4.2 Double Filament Light Source - Low Beam DRL

If an electronic module is used to reduce the voltage for low beam, the current for DRL low beam shall be directed through the module ignition switch mode and headlamp high beam current shall be directed through the module headlamp switch mode.

Where the low beam filament is used for DRL at a reduced voltage:

Phase 1	Hours
Low beam filament on at reduced voltage (9.6 V)	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
Low beam filament on at 14.0 V	1.0
Everything off	0.25
High beam filament on at 14.0 V	0.50
Everything off	0.25
Total 24 hours	
Repeat previous for a total of 408 hours (17 days)	
End of Phase 1 (measure LHBF and LLBF) (see Equation 1)	

Continue testing the same light sources on the following test cycle:

Phase 2	Hours
Low beam filament on at 14.0 V	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
High beam filament on at 14.0 V	1.0
Everything off	0.25
Low beam filament on at reduced voltage (9.6 V)	0.50
Everything off	0.25
Total 24 hours	
Continue Phase 2 until the low beam filament no longer functions	
Requirements:	
Equation 1 ratios are satisfied, Phase 1 only	
Design life, low beam, and high beam filaments shall not be adversely affected,	
Phases 1 and 2	

7.4.3 Single Filament Light Source

If an electronic module is used to reduce the voltage, the current for the DRL mechanization (reduced voltage) shall be directed through the module ignition switch mode and the headlamp (full voltage) shall be directed through the module headlamp switch mode.

Low beam or high beam filament, used for DRL at a reduced voltage:

Phase 1	Hours
Filament on at reduced voltage (6.4 V H.B.; 9.6 V L.B.)	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
Everything off	0.50
Filament on at 14.0 V	1.0
Everything off	0.50
Total 24 hours	
Repeat previous for a total of 408 hours (17 days)	
End of Phase 1 (measure LHBF and LLBF) (see Equation 1)	

Continue testing the same light sources on the following test cycle:

Phase 2	Hours
Filament on at 14.0 V	1.75
Everything off	0.25
One cycle = 2 hours, repeat for 11 cycles	
Everything off	0.50
Filament on at reduced voltage (6.4 V H.B.; 9.6 V L.B.)	1.0
Everything off	0.50
Total 24 hours	
Continue Phase 2 until the low beam filament no longer functions.	
Requirements:	
Equation 1 ratios are satisfied, Phase 1 only	
Design life shall not be adversely affected, Phases 1 and 2	

7.4.4 Additional DRL Guidelines

On a regular basis, random light sources shall be selected for testing. The following results shall be recorded: test hours to filament loss of function, DRL time and headlamp time to filament loss of function, which filament did not function, and number of light sources tested.

8. REPLACEABLE LIGHT SOURCE FILAMENT DIMENSIONS AND LOCATION DETERMINATION

8.1 HB1 Replaceable Light Source

Filament locations relative to the light source base (with O-ring removed) shall be determined for both production and accurate rated light sources (standard light sources), as outlined in the following paragraphs. For the actual conduct of these measurements, gauging standards shall be used for equipment calibration purposes.

8.1.1 Low Beam Filament Location Determination

The location shall be determined by measuring from the midpoint of the smallest rectangle which encloses the filament image to the axial centerline of the base (see Figures 13A and 13B):

- a. Axially: In the right side view.
- b. Vertically: In the right side view.
- c. Transversely: In the plan view.

8.1.2 High Beam Filament Location Determination

The location shall be determined as indicated in 8.1.1.

8.1.3 Low Beam Filament Location

Production light sources (see Figures 7A and 7B).

Accurated rated (standard) light sources (see Figures 13A and 13B).

8.1.3.1 Axial

The low beam filament axial or fore/aft location shall be measured in the right side view from the reference plane of the base to the center of the smallest rectangle which encloses the low beam filament image.

8.1.3.2 Vertical

The low beam filament vertical or up/down location shall be measured in the side view from a horizontal plane through the base centerline to the center of the smallest rectangle which encloses the low beam filament image.

8.1.3.3 Transverse

The low beam filament transverse or left/right location shall be measured in the plan view from the vertical plane through the center of the base to the midpoint of the smallest rectangle which encloses the low beam filament image.

8.1.4 High Beam Filament Location

Production light sources (see Figures 7A and 7B).

Accurate rated (standard) light sources (see Figures 13A and 13B).

8.1.4.1 Axial

The high beam filament axial location shall be measured in the right side view from the centerline of the low beam filament to the centerline of the smallest rectangle which encloses the high beam filament image.

8.1.4.2 Vertical

The high beam filament vertical location shall be measured in the right side view from the centerline of the low beam filament to the centerline of the smallest rectangle which encloses the high beam filament image.

8.1.4.3 Transverse

The high beam filament horizontal location shall be measured in the plan view from the midpoint of the low beam filament to the midpoint of the smallest rectangle which encloses the high beam filament image.