



SURFACE VEHICLE RECOMMENDED PRACTICE	J2591™	OCT2024
	Issued 2002-09 Revised 2017-05 Stabilized 2024-10	
Superseding J2591 MAY2017		
Limited Adaptive Forward Lighting System		

RATIONALE

The Technical Report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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1. SCOPE

This SAE Recommended Practice applies to motor vehicle Forward Illumination Devices which incorporate limited adaptive beam pattern capabilities. This document is to be used in conjunction with other forward lighting standards and/or recommended practices which define the base beam procedures, requirements, and guidelines.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 J575	Test Methods and Equipment for Lighting Devices for Use on Vehicles Less than 2032 mm in Overall Width
SAE J578	Color Specification
SAE J599	Lighting Inspection Code
SAE J759	Lighting Identification Code

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 J565	Semiautomatic Headlamp Beam Switching Devices
SAE J581	Auxiliary High Beam Lamps
SAE J583	Front Fog Lamp
SAE J852	Front Cornering Lamps for Use on Motor Vehicles
SAE J1383	Performance Requirements for Motor Vehicle Headlamps
SAE J2838	Full Adaptive Forward Lighting Systems

2.2.2 FMVSS Publication

Available from the Superintendent of Documents, U. S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320 or at www.ecfr.gov.

CFR Title 49 Part 571.108 Lamps, Reflective Devices and Associated Equipment (FMVSS 108)

CFR Title 49 Part 571.564 Replaceable Light Source Information (FMVSS 108)

2.2.3 CMVSS Publication

Available from Transport Canada, Motor Vehicle Safety Directorate, Ottawa, Ontario K1A 0N5, Canada, or at: <http://www.tc.gc.ca/eng/acts-regulations/regulations-crc-c1038.htm>

Canada Motor Vehicle Safety Standard 108 – Lighting System and Retroreflective Devices

2.2.4 United Nations Publications

Available from United Nations Economic Commission for Europe Information Office, Palais des Nations, CH-1211, Geneva 10, Switzerland, Tel: +41-0-22-917-12-34, <http://www.unece.org/trans/main/wp29/wp29regs.html>.

UNECE Regulation No. 123	Uniform Provisions Concerning the Approval of Adaptive Front-Lighting Systems (AFS) for Motor Vehicles
UNECE Regulation No. 48	Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices
UNECE Regulation No. 112	Uniform Provisions Concerning the Approval of Motor Vehicle Headlamps Emitting an Asymmetrical Passing Beam or a Driving Beam or Both and Equipped with Filament Lamps and/or Light-Emitting Diode (LED) modules
UNECE Regulation No. 98	Uniform Provisions Concerning the Approval of Motor Vehicle Headlamps Equipped with Gas-Discharge Light Sources
TRANS-WP29-GRE-48-inf30e	AFS History and Scientific Backup
TRANS-WP29-GRE-48-inf28e	Adaptive Front Lighting System (AFS)

3. DEFINITIONS

3.1 BASE BEAM

A lamp's beam pattern that meets the lighting function standard or recommended practice without adaptive functionality.

3.2 ADAPTIVE BEAM CONTRIBUTOR

A component of a lamp designed to add or subtract light from the base beam to provide adaptive capability.

3.3 AXIS OF REFERENCE

The characteristic axis of the beam used as the direction of reference ($H=0^\circ$, $V=0^\circ$) for photometric measurement angles.

3.4 NOMINAL POSITION

A lamp position where its axis of reference coincident with the vehicle longitudinal axis for front mounted lamps and perpendicular for side mounted lamps.

3.5 ADAPTIVE FORWARD LIGHTING SYSTEM (AFS)

A forward lighting system intended to adapt a forward lighting device's beam pattern to improve driver visibility. The system is comprised of one or more forward lighting devices and the entirety of components required to control and operate the devices.

3.6 SWIVEL

Automatic horizontal and/or vertical movement of the lamp's axis of reference relative to the vehicle longitudinal axis for the purpose of actively directing the beam pattern for improved visibility under driving conditions.

4. LIGHTING IDENTIFICATION CODE

A lamp with adaptive functionality may be identified by their original function(s) in accordance with SAE J759. If marked, the lamp shall be marked "X" directly before the original function(s) marking.

5. TESTS

5.1 All test procedures required by the applicable lighting function's standard or recommended practice shall be performed. In addition, the following tests shall be included, if applicable.

5.1.1 Vibration Test

If the vibration test is required by the standard or recommended practice for the specified device, any components with mechanical movement for adaptive functionality shall be at their nominal position.

5.1.2 Photometry Test

5.1.2.1 The lamp to be tested shall be mounted on a fixture as specified in the standard or recommended practice for each device. Mounting hardware, the test stand, and components shall be those necessary to operate the lamp over all intended adaptive conditions.

5.1.2.2 The lamp to be tested shall be located on the photometer axis as specified in the standard or recommended practice for each device positioned at its nominal position. The lamp aim shall not be adjusted during the test other than for any re-aim allowed by the lighting function's standard or recommended practice.

5.1.2.3 The base beam for the lamp shall be tested with the lamp's axis of reference positioned according to 5.1.2.2.

5.1.2.4 If the base beam swivels and/or if some of the light in the beam pattern is actively redirected, such that the base beam pattern is changed, the lamp shall be additionally tested to the intended maximum range of vertical and/or horizontal movement and to the extents of the base beam pattern changes. If any position(s) within the movement range of the lamp along with any beam pattern changes are expected to prevent the lamp from meeting the photometry requirements, these additional positions and/or beam pattern changes shall also be tested.

When the axis of reference for the lamp is moved relative to the vehicle longitudinal axis, the goniometer shall be compensated to locate the axis of reference to $H=0^\circ$ and $V=0^\circ$.

5.1.2.5 If adaptive beam contributor(s) are utilized with a non-swiveling base beam, the base beam with the contributor(s) shall be additionally tested in each operational mode.

If any adaptive beam contributor is designed to swivel, the non-swiveling base beam with the contributor(s) at their extreme positions shall be additionally tested in each operational mode.

If any position(s) within the movement range of the adaptive beam contributor is expected to prevent the lamp from meeting the photometry requirements, these additional positions shall also be tested.

5.1.2.6 If the base beam swivels and/or some of the light in the beam pattern is actively redirected, such that the base beam pattern is changed, and adaptive beam contributor(s) are utilized, the lamp shall be additionally tested with each adaptive beam contributor(s) activated and positioned according to 5.1.2.5 with the base beam's axis of reference positioned as intended for each operational mode according to 5.1.2.4.

5.1.3 Heat Test

If light source(s) are required to be activated during heat testing, the following tests shall apply.

5.1.3.1 Adaptive beam contributor(s) that are only energized during turns are to be energized at the rate of 3 minutes on and 12 minutes off with the function being tested for each operational mode.

5.1.3.2 Adaptive beam contributor(s) that do not comply with 5.1.3.1 shall be energized with the function being tested as specified by the lighting functions standard or recommended practice.

5.1.3.3 Adaptive beam contributors that are only energized independently shall be energized independently during heat testing.

5.1.3.4 Any swiveling component(s) shall be positioned at their nominal position.

5.1.4 Color Test

SAE J578 applies for this standard.

6. REQUIREMENTS

6.1 Test Requirements

The following requirements are in addition to those specified in the standard or recommended practice for each applicable device.

6.1.1 Vibration

Vibration requirements outlined in each lighting function's standard or recommended practice shall be met when tested according to 5.1.1.

6.1.2 Photometry

Photometric requirements outlined as specified in the standard or recommended practice applicable to the device shall be met with the device in all intended positions and/or adaptive modes specified in 5.1.2.

6.1.3 Heat

Heat requirements outlined in each lighting function's standard or recommended practice shall be met when tested according to 5.1.3.

6.1.4 Color

6.1.4.1 The color of the light from the base beam shall be white within the limits specified in SAE J578.

6.1.4.2 The color of each adaptive beam contributor shall be white within the limits specified in SAE J578.

6.2 Lamp Aim Requirements

If aiming provisions are specified in the standard or recommended practice for the applicable device, all adaptive beam contributors shall comply with the provisions. Adaptive beam contributors cannot be aimed independently of the base beam.

6.3 Vehicle System Requirements

6.3.1 Operation

6.3.1.1 Deactivation

A means shall be provided for the driver to deactivate the adaptive functionality of a lamp which swivels such that it provides the ability to static aim the lamp according to SAE J599. The lamp beam pattern shall then return to its base beam positioned at its nominal position. This may be accomplished by deactivating the adaptive functionality when the vehicle ignition switch is in the "off" position or by some other switching mechanism available to the driver.

6.3.1.2 A means for the driver to deactivate the adaptive functionality of a lamp other than defined in 6.3.1.1 is allowed. The lamp shall then return to its base beam.

6.3.1.3 Other than deactivation, AFS control shall be automatic without additional driver control.