SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2591 NOV2008

Issued 2002-09
Revised 2008-11

Superseding J2591 SEP2002

Adaptive Forward Lighting System

RATIONALE

Moved rationale to the beginning of the document as required in the template. The document was updated to include the Economic Commission for Europe (ECE) regulations which were not available during the last publication.

Section 2.1.4 • European Community web site and reference document titles added.

TABLE OF CONTENTS

SAENORM.COM : Click to view the full PDF of j2591_200811

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2008 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

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

1. SCOPE

This SAE recommended practice applies to motor vehicle Forward Illumination Devices which incorporate 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 Publications

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 724-776-4970 (outside USA), www.sae.org.

SAE J578 Color Specification

SAE J599 Lighting Inspection Code

SAE J759 Lighting Identification Code

2.2 Related Publications

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

SAENORM.COM : Click to view the full PDF of j2591_200811

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 724-776-4970 (outside USA), www.sae.org.

SAE J565 Semiautomatic Headlamp Beam Switching Devices

SAE J575 Test Methods and Equipment for Lighting Devices and Components for Use on Vehicles Less than 2032 mm in Overall Width

SAE J581 Auxiliary Upper Beam Lamps

SAE J582 Auxiliary Low Beam Lamps

SAE J583 Front Fog Lamp

SAE J852 Front Cornering Lamps for Use on Motor Vehicles

SAE J1383 Performance Requirements for Replaceable Bulb Motor Vehicle Headlamps

2.2.2 FMVSS Publications

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

Federal Motor Vehicle Safety Standard 49CFR 571.108

Federal Motor Vehicle Safety Standard 49CFR 564

2.2.3 CMVSS Publication

Available from Transport Canada, Road Safety and Motor Vehicle Regulation Directorate, P.O. Box 8880, Ottawa Post Terminal, Ottawa, Ontario, K1G.3J2, www.tc.gc.ca.

CMVSS 108 Canadian Motor Vehicle Safety Standard for Exterior Lighting

2.2.4 UNECE 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. 112 Motor Vehicle Headlamps Emitting an Asymmetrical Passing Beam or a Driving Beam or Both and Equipped with Filament Lamps

UNECE Regulation No. 98 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) Presentation to the 48th Session of GRE

SAENORM.COM : Click to view the full PDF of j2591_200811

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°, V=0°) 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 based on inputs such as vehicle speed, road geometry, and/or environmental conditions. 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. In addition, the lamp shall be marked "X" directly after 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.

SAENORM.COM : Click to view the full PDF of j2591_200811

5.1.2.4 If the base beam swivels, the lamp shall be additionally tested to the intended maximum range of vertical and horizontal movement. If any position(s) within the movement range of the lamp are expected to prevent the lamp from meeting the photometry requirements, these additional positions 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° and V=0°.

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 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.

SAENORM.COM : Click to view the full PDF of j2591_200811

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 can not 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 effects 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 can 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 than return to its base beam as defined in 6.3.1.1.

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

6.3.2 Installation

6.3.2.1 Adaptive beam contributors that are symmetrically mounted about the vertical centerline of the vehicle at the same height and only illuminated simultaneously shall be mounted such that their lighted edges are within 200 mm horizontally and 400 mm vertically of the nearest illuminated adaptive beam contributor or the base beam. Refer to Figure 1.

6.3.2.2 Beam contributors that do not comply with 6.3.2.1 shall be mounted such that their lighted edge is within 140 mm horizontally and 400 mm vertically of the lighted edge of the nearest adaptive beam contributor or the base beam. Refer to Figure 1.

SAENORM.COM : Click to view the full PDF of j2591_200811

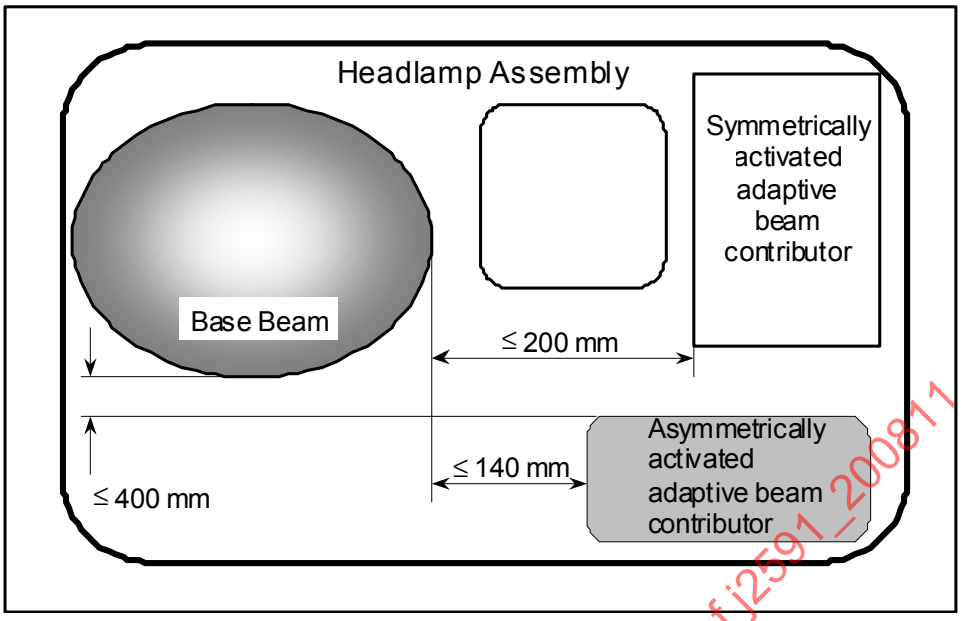

FIGURE 1 - ADAPTIVE BEAM CONTRIBUTOR SPACING HEADLAMP EXAMPLE

6.3.3 Vertical Lamp Swivel

6.3.3.1 The axis of reference for the lamp shall not automatically raise vertically beyond such limit that the maximum photometric values above the H-H line are exceeded when the lamp is tested in its raised state along the nominal vehicle longitudinal axis for forward mounted lamps and perpendicular for side mounted lamps.

6.3.3.2 Automatic vertical displacement that would not comply with 6.3.3.1 is allowed if provisions are included to automatically lower the lamp's axis of reference to comply with 6.3.1.1 when opposing traffic is present.

6.3.3.3 Automatic vertical displacement that would not comply with 6.3.3.1 is allowed if the vertical displacement is only to compensate for temporary changes in the vehicle longitudinal axis relative to the road due to loading or vehicle dynamics i.e. dynamic headlamp leveling.

6.3.4 Horizontal Lamp Swivel

6.3.4.1 The angular movement of each low beam headlamp's horizontal axis of reference (H = 0°) within the lamp's movement range shall not exceed the angle created between the vehicle longitudinal axis and a line originating at the front center of the vehicle and intersecting the vehicle's turn circle at 140 times the mounting height of the lamp. Refer to Figure 2.

6.3.4.2 Horizontal lamp swivel to the left of the vehicle longitudinal axis is only allowed when the vehicle is moving forward. When the vehicle is moving in reverse, the lamp shall be in its nominal position.

SAENORM.COM : Click to view the full PDF of j2591_200811