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SURFACE VEHICLE RECOMMENDED PRACTICE

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Superseding J565 JUN1989

(R) Semiautomatic Headlamp Beam Switching Devices

RATIONALE

Complete document – all references to upper beam and lower beam revised to high beam and low beam per the directive of the SAE Lighting Coordinating Committee. Format revised to follow latest SAE guidelines.

1 Added text to indicate that these devices are intended to be used with stationary lamp systems (not AFS type systems). "Stationary lamp systems" removed per feedback from Frank Davis, Ford.

1.1.1 Added to reference the proper standard for proposed tail lamp test, electronically controlled lighting equipment, and plastic materials for use in optical parts.

3.1 Editorial change to reflect current technology (applies to all instances). System operation with tail lights to ensure safe response to preceding vehicles.

3.3 Editorial change for clarification.

3.4 Added definition for clarification of test descriptions.

5.1.2 States the standard to be used when implementing the test to prove ability to operate safely with preceding vehicles.

5.1.2.1 The color specification for white halogen light is defined as a 3250 K source with a tolerance band of approximate ±150 K. This color window represents typical variation in the field. The SAE J578 white color boundaries were not used to specify the color of the white light because the color variation possible is much larger than the typical color of a halogen light source. The other light sources specified in the document are sufficiently color constrained with the SAE J578 color boundary definitions.

5.1.2.2 Incandescent red light source added.

5.1.2.3 Discharge light source added.

5.1.2.4 LED red light source added.

5.2.1 Removed note addressing lamp intensity at different test distances. All light levels are now shown in illuminance.

5.4 Allows for test to be performed on standard, 24 V, and 42 V systems. Removed note regarding light levels because tests now reference illuminance on the sensor not intensity.

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http://www.sae.org/technical/standards/J565_201002

5.4.3.1 Allows for a system without sensitivity adjustment to account for implementation using currently available technology that should not require the need for this function to be provided. Additional text included to clarify the test procedure.

5.4.3.2 Allows for a system sensitivity adjustment to be implemented while ensuring the proper test of a system that does provide a sensitivity adjustment. Adjusting to the minimum sensitivity setting ensures that the system complies to the required illuminance levels in its least sensitive mode of operation. Additional text included to clarify the test procedure.

5.4.3.3 Test procedure clarification and simplification.

5.4.3.4 Only the H-V point of Table 1 is specified for this test because this test is intended to verify that the spectral characteristics of a Discharge Light Source does not cause a sensitivity failure. This is not intended to retest the angular sensitivity response of the system.

5.4.3.5 Only the H-V point of Table 2 is specified for this test because this test is intended to verify that the spectral characteristics of a LED Light Source does not cause a sensitivity failure. This is not intended to retest the angular sensitivity response of the system.

5.4.4 Voltage levels change to fall in line with currently typical OEM operating requirements for electronic devices.

5.4.5 Ensures the proper test of a vehicle level function of the system.

5.4.6 Editorial change to reflect current technology.

5.4.7 Reflects changes made in section 5.4.3.

5.4.8 Vibration test modified to the SAE standard for electronically controlled lighting devices.

5.4.9 Reflects changes made in section 5.4.3.

5.4.10 Reflects changes made in section 5.4.3 and input voltage change to nominal design voltage as in section 5.4.

5.4.11.2 Test added to verify that dimming occurs within a certain timeframe.

5.4.12 Section added to verify integrity of electronic components.

5.4.13 Section added to verify integrity of electronic components.

5.4.14 Section added to verify integrity of electronic components.

5.5 Section added to verify integrity of electronic system.

6.4.1 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure.

6.4.2 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure. Also added the requirements of SAE J2357 to ensure electrical integrity of the system.

6.4.3 Section becomes specific to a sensitivity test using a white test light source. The illuminance values in the table were derived by first calculating the distance required to project 0.5 lux onto an on-coming car from a pair of 75th percentile high beam head lamps (from UMTRI 2001-19) for each test position in the table. Once the distance was established, the amount of light projected back to the light sensor from a pair of 25th percentile low beam head lamps (from UMTRI 2001-19) was calculated and entered as the dim illuminance in the table. The value of 0.5 lux was chosen because it represents roughly a glare rating of 7 on the de Boer scale based on UMTRI 1993-10. If this dim illuminance is maintained for a set of high beams with the maximum allowable luminous intensity (75 000 cd), the light projected onto the on-coming car will be 0.88 lux or roughly a glare rating of 6 on the de Boer scale. It is recommended that the thresholds are above the disability glare level for on-coming traffic. The 75th percentile high beam and 25th percentile low beam are chosen to represent a brighter than normal high beam and a dimmer than normal low beam. This approach is taken to shift the requirement to a more conservative (less glaring) standard. The return illuminance maximum is maintained from the previous requirement. The minimum is removed to allow the manufacturer to tune the return to high beam to a desired level. The angular range of the table was increased both vertically and horizontally to better control the response of the system in curves and on hills.

6.4.3.5 Section is specific to a sensitivity test using a red test light source. Table 2 is added because glare on preceding vehicle should also be controlled. The illuminance values in the table were derived by first calculating the distance required to project 2.26 lux onto a preceding car from a pair of 75th percentile high beam head lamps (from UMTRI 2001-19) for each test position in the table. Once the distance was established, the amount of light projected back to the light sensor from a pair 13.5 candela tail lamps at H-V was calculated and entered as the dim illuminance in the table. The 13.5 candela intensity represents the SAE mean intensity for a tail lamp within the specified range of 2 cd (minimum) and 25 cd maximum. The light intensity of the tail lamp was scaled for the angular positions of the table according to the intensity requirements of SAE J585. The value of 2.26 lux was chosen based on UMTRI 2001-3 that showed center mirror glare from vehicles in the field were exposed to these glare levels from low beams of cars following at 25 m. The author is not aware of any study that shows a representative population of tail lamp intensity distributions on vehicles, so the median of the spec was used. The maximum intensity for the return value is calculated to represent twice the distance of the dim intensity.

6.4.4 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure.

6.4.7 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure.

6.4.8 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure. Also added the requirements of SAE J2357 to ensure electrical integrity of the system. The mechanical aim requirement not necessary in the context of the increased sensitivity requirements being proposed. The value of a mechanical aim variation requirement is lessened if the system is proven to meet sensitivity requirements. A way to measure with the accuracy stated to prove compliance to this would also be difficult to define.

6.4.9 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure.

6.4.10 System is now required to meet the H-V performance of Table 1 and Table 2. This ensures safe operation after the device under test has been put through the test procedure.

6.4.11 Requirement time increased to allow manufacturer to implement a more conservative performing system and to more reasonably ensure that the semi-automatic system will not cause unnecessary flashing of the high beam headlamps in certain traffic situations.

6.4.12 Requirements added for new electronic test. System is also required to meet the H-V performance of Tables 1 and 2 to ensure safe operation after the device under test has been put through the test procedure. Also required for sections 6.4.13, 14, 15.

6.5 Requirements added for new electronic test.

7.1 It is felt that stating requirements in the section pertaining to guidelines is not appropriate, nor is it necessary.

7.1.1 Editorial change to account for possible implementations with current technology.

7.1.4 Editorial change for clarification and simplification.

7.1.5 Editorial change for clarification and simplification.

7.1.6 Follows in allowing the implementation of a system with or without sensitivity adjustment.

7.2.1 Combined sections 6.2.1 and 6.2.3 of SAE J565 JUN89 for clarification.

7.2.2 Removed mounting height note because 7.1.2 addresses the mounting height. Added windshield wiper zone text to ensure that the sensor has an un-obstructed field of view in the case of inclement weather or a dirty windshield.

7.2.3 Added section to ensure that the sensor has an un-obstructed field of view in the case of inclement weather or a dirt build-up on the outer lens (cover) of the optical system.

7.3 Removed operating instruction section to stay consistent with other SAE lighting specifications.

TABLE OF CONTENTS

1. SCOPE

This SAE Standard provides test procedures, performance requirements, and guidelines for semiautomatic headlamp beam switching devices.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version 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 J575 Test Methods and Equipment for Lighting Devices and Components for Use on Vehicles Less than 2032 mm in Overall Width

SAE J576 Plastic Material or Materials for Use in Optical Parts Such as Lenses and Reflex Reflectors of Motor Vehicle Lighting Devices

SAE J578 Color Specification

SAE J1889 L.E.D. Signal and Marking Lighting Devices

SAE J2009 Discharge Forward Lighting System and Subsystems

SAE J2357 Application Guidelines for Electronically Driven and/or Controlled Exterior Automotive Lighting Equipment

3. DEFINITIONS

3.1 Semiautomatic Headlamp Beam Switching Device

A device that provides either automatic or manual control of beam switching at the option of the driver. When the control is automatic, the headlamps switch from the high beam to the low beam when a sensor detects the light from the headlamps of an approaching car and/or the light from the tail lamps of a preceding car. The headlamps will switch back to the high beam when the light from the road ahead is at an appropriate intensity. When the control is manual, the driver may obtain either beam manually regardless of other vehicle lighting present ahead of the vehicle.

3.2 Dim Sensitivity Illuminance Threshold

The illuminance projected onto the light sensor of the device under test at the time the device switches from high beam to low beam as the light level of the source is gradually increased.

3.3 Return Sensitivity Illuminance Threshold

The illuminance projected onto the light sensor of the device under test at the time the device switches from low beam to high beam as the light level of the source is gradually decreased.

3.4 System Detection Range

The angular range that the semiautomatic headlamp beam switching device is required to detect the light from the headlamps of an approaching car or the light from the tail lamps of a preceding car as defined by the angular extents of Table 1 and Table 2 of this document.

4. IDENTIFICATION CODE DESIGNATION

No applicable markings apply.

5. TESTS

5.1 Test Facilities and Environment

5.1.1 Laboratory Facilities

Refer to SAE J575.

5.1.2 Light Sources

5.1.2.1 White Light

The light sources used for white light sensitivity testing defined in Table 1 shall be of the halogen tungsten filament type operating at approximately 3250 K. The color of light from the white light source shall fall within the following boundaries according to the CIE (1931) standard colorimetric system when measured by the tristimulus or spectrophotometric methods:

x = 0.430 (yellow boundary)
y = 0.390 (purple boundary)
x = 0.410 (blue boundary)
y = 0.406 (green boundary)

5.1.2.2 Red Light

The light sources used for red light sensitivity testing defined in Table 2 shall be of the incandescent tungsten filament type filtered to meet the red color requirements specified in SAE J578.

5.1.2.3 Discharge Forward Light

The light source used for the Discharge Forward Lighting Sensitivity Test shall be a discharge source that is part of a Discharge Forward Lighting System that complies with SAE J2009. If a filter is required to reduce the light output of the discharge source, use a neutral density filter so the spectral characteristics of the source are maintained.

5.1.2.4 Red LED Light

The light source used for the red LED light sensitivity test shall be an LED or LED lighting device as define in SAE J1889. The color of the light source shall meet the red color requirements as specified in SAE J578.

5.1.2.5 Chromatic Stability

The light sources must be designed such that the color of the light complies with the standard above for each illuminance level listed in Table 1 and Table 2 of this document. Independent light sources for each required light level could also be used for this testing. Another option is to use a common light source and vary the distance to the device under test to achieve the desired illuminance required.

5.2 Equipment and Instrumentation

5.2.1 Testing Distance

The testing distance for sensitivity shall not be less than 3 m.

5.2.2 Aim

The device shall be mounted and operated on a fixture attached to a goniometric test stand (as per SAE J575) with all of the components that can affect the performance of the system i.e. windshield glass, grille work, covers, shields, lenses etc. The H-V position/axis of the sensor shall be coincident with the axis of the light source. The relationship of the all components to the sensor shall be maintained throughout all the angular movements of the sensor.

5.3 Test Samples

5.3.1 Test samples are defined by SAE J575.

5.4 Tests

The following sections describe individual tests, which need not be performed in any particular sequence unless otherwise specified. The completion of the tests may be expedited by performing the tests simultaneously on separately mounted samples. For all tests unless otherwise specified, the device shall be set up, adjusted, and operated in accordance with 5.4.3.1 or 5.4.3.2 and 5.2.2 in an ambient temperature of 25 °C ± 5 °C with input voltage set to nominal design voltage within the tolerance of the specified range.

5.4.1 Dust Test

The Semiautomatic Headlamp Switching Device shall be subjected to the dust test of SAE J575. The device shall not be operated during the dust test.

5.4.2 Corrosion Test

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.3 Sensitivity Test

The sensitivity test defines the dim and return sensitivity thresholds for the semiautomatic headlamp switching device under test.

5.4.3.1 Systems without Adjustability

With the device in the design position and facing the test light source, system sensitivity shall be verified at each stated test position and light level in Table 1 and Table 2. To determine the dim sensitivity illuminance threshold, the light level shall be gradually increased until the system switches the headlamp state from high beam to low beam. The light level at which the headlamp state switched shall be recorded for each angle in the tables. For the return sensitivity illuminance threshold, the light level shall be gradually decreased until the system switches the headlamp state from low beam to high beam. The light level at which the headlamp state switched shall be recorded for each angle in the tables.

5.4.3.2 Systems with Adjustability

With the device in the design position and facing the test light source, the sensitivity control shall be adjusted to the minimum sensitivity setting, and system sensitivity shall be verified at each stated test position and light level in Table 1 and Table 2. To determine the dim sensitivity illuminance threshold, the light level shall be gradually increased until the system switches the headlamp state from high beam to low beam. The light level at which the headlamp state switched shall be recorded for each angle in the tables. For the return sensitivity illuminance threshold, the light level shall be gradually decreased until the system switches the head lamp state from low beam to high beam. The light level at which the headlamp state switched shall be recorded for each angle in the tables.

5.4.3.3 Sensitivity Voids

This test is designed to detect any sensitivity voids that may exist within the system detection range. The following steps shall be followed to complete this test.

1. Set up device in the design position facing the test light source. The color of the light source shall be white as defined in 5.1.2.1. If the device under test has a sensitivity adjustment, set the sensitivity to the highest setting.
2. Rotate device to 3D-9L.
3. Using the white light source, gradually increase light level from 0 lux until system indicates a switch for high beam to low beam.
4. Maintain this light level.
5. Scan horizontally in one degree increments stopping at each increment for sufficient time (6 s) to account for any time delay in the device under test. Continue the scan to the to V-V line.
6. If the device indicates a return to high beam then a void exists. Note the void.
7. Rotate the device to 3D-9R.
8. Repeat steps 3-6.
9. Repeat for steps 2-8 for 2D, 1D, H, 1U, 2U, 3U.
10. If the device has a sensitivity adjustment, set sensitivity to lowest setting. Repeat steps 2-9.

5.4.3.4 Discharge Forward Lighting Sensitivity Test

With the device in the design position and aimed per 5.2.2 facing the Discharge Forward Lighting test light source, the system shall be verified at H-V of Table 1.

5.4.3.5 Red LED Lighting Sensitivity Test

With the device in the design position and aimed per 5.2.2 facing the red LED test light source, the system shall be verified at H-V of Table 2.

5.4.4 Voltage Regulation

The "dim" sensitivity at H-V shall be determined with the voltage input to the device at 9 V ± 0.1 V and 16 V ± 0.1 V for a 12 V system, at 18 V ± 0.1 ° and 32 V ± 0.1 V for a 24 V system.

5.4.5 Manual Override of Automatic Control

The test light shall be turned on to cause the device to operate in low beam mode. The manufacturer's instructions shall be followed to cause the device to override the low beam mode caused by test light and switch to high beam. In a similar manner the test light shall be turned off to cause the device to operate in high beam mode. Again the manufacturer's instructions shall be followed to cause the device to switch to the low beam. This functionality shall be verified at a vehicle level by the manufacturer.

5.4.6 Initialization Test

The device shall be aimed per 5.2.2 facing a light source that impresses 0.027 lux ± 0.001 lux on the lens surface of the device under test.

5.4.7 Temperature Regulation

The device shall not be operated while being exposed for 1 h to an ambient temperature of 98 °C ± 2 °C if the device is mounted in the passenger or engine compartment, or 65 °C ± 2 °C if mounted elsewhere. After the high temperature exposure, the device shall be operated per 5.4.3.1 or 5.4.3.2 in ambient temperatures of –30 °C ± 2 °C, 25 °C ± 5 °C, and 40 °C ± 2 °C for 1 h each.

5.4.8 Vibration

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.9 Sunlight Exposure

The device shall not be operated while being exposed for 1 h in bright noonday sunlight (54 000 lux minimum illumination with a clear sky) with the light sensor aimed as it would be on a car and facing an unobstructed portion of the horizon in the direction of the sun. After resting for 1 h in normal room temperature, the device shall be operated per 5.4.3.1 or 5.4.3.2.

5.4.10 Durability

The device shall be subjected to the following test:

a. The light sensor shall be actuated by a light source which impresses 0.07 lux ± 0.01 lux on the lens surface and which is cycled ON and OFF with a duty cycle of 50% ON time at a rate of four times per minute..

b. The device shall be operated with the input voltage set to nominal design voltage within the tolerance of the specified range for 90 min on and 30 min off for 200 h total time.

After resting for 2 h at room temperature in a lighted area of 500 to 1500 lux, the device shall be operated per 5.4.3.1 or 5.4.3.2.

5.4.11 Beam Switching Response Time

5.4.11.1 Return to High Beam Response Time

An illumination of 1000 lux ± 100 lux shall be impressed on the lens of the device for 10 s ± 1 s. The light shall then be extinguished.

5.4.11.2 High Beam Dimming Response Time

The device shall be exposed to dark ambient conditions (0 lux) for 10 s ± 1 s. An illumination of 1000 lux ± 100 lux shall then be impressed on the lens of the device.

5.4.12 Thermal Cycle

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.13 Thermal Shock

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.14 Humidity Test

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.15 Chemical Resistance Test

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.4.16 Electromagnetic Compatibility

The Semiautomatic Headlamp Beam Switching Device shall be tested to SAE J2357.

5.5 Plastic Materials

Plastic materials used in optical parts shall be tested in accordance with the procedures in SAE J576.

6. REQUIREMENTS

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

6.4.1 Dust

After the dust test, the device shall be wiped clean. The device shall be in the design position and aimed per section 5.2.2 facing the test light source. The H-V dim and return sensitivity illuminance thresholds shall meet the H-V requirements in Table 1 and Table 2

6.4.2 Corrosion

After the test, the device shall be operated at the same conditions as initially adjusted. The H-V dim and return sensitivity illuminance thresholds shall meet the H-V requirements in Table 1 and Table 2. The device shall also meet the requirements stated in SAE J2357.

6.4.3 Sensitivity

The dim and return sensitivity illuminance thresholds for white light shall be within the limits of Table 1 and the dim and return sensitivity illuminance thresholds for red light shall be within the limits of Table 2.

TABLE 1 - OPERATING LIMITS FOR WHITE LIGHT

Test Positions (deg)	Dim Illuminance (lux)	Return Illuminance (lux)
H-V	2.51E-02 max	4.04E-03 max
H-3L	2.12E-02 max	4.04E-03 max
H-6L	3.54E-02 max	4.04E-03 max
H-9L	3.21E-02 max	4.04E-03 max
H-3R	5.37E-02 max	4.04E-03 max
H-6R	3.63E-02 max	4.04E-03 max
H-9R	2.99E-02 max	4.04E-03 max
3D-V	9.20E-03 max	4.04E-03 max
3U-V	6.22E-01 max	4.04E-03 max

TABLE 2 - OPERATING LIMITS FOR RED LIGHT

Test Positions (deg)	Dim Illuminance (lux)	Return Illuminance (lux)
H-V	7.18E-04 max	7.53E-05 max
H-3L	1.46E-03 max	7.53E-05 max
H-6L	2.74E-03 max	7.53E-05 max
H-9L	3.82E-03 max	7.53E-05 max
H-3R	8.01E-04 max	7.53E-05 max
H-6R	1.53E-03 max	7.53E-05 max
H-9R	1.50E-03 max	7.53E-05 max
3D-V	5.25E-03 max	7.53E-05 max
3U-V	6.08E-03 max	7.53E-05 max