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**SAE J594 MAY89**

## **Reflex Reflectors**

SAE Standard  
Revised May 1989

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Ø REFLEX REFLECTORS

1. SCOPE:

This SAE technical report provides test procedures, requirements, and guidelines for reflex reflectors.

2. DEFINITIONS:

- 2.1 Reflex reflectors are devices that are used on vehicles to give an indication of presence to an approaching driver by reflected light from the headlamps on the approaching vehicle.
- 2.2 The observation angle is the angle between a line from the observation point to the center of the reflector and a second line from the center of the reflector to the source of illumination.
- 2.3 The entrance angle is the angle between the axis of the reflex reflector and a line from the center of the reflector to the source of illumination.

3. IDENTIFICATION CODE:

Reflex reflectors may be identified by the Code "A" in accordance with SAE J759 DEC87, Lighting Identification Code.

4. TESTS:

- 4.1 SAE J575 DEC88, Tests for Motor Vehicle Lighting Devices and Components is a part of this report. The following tests are applicable with the modifications as indicated.
  - 4.1.1 Vibration Test:
  - 4.1.2 Moisture:
  - 4.1.3 Dust Test:

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#### 4.1.4 Corrosion Test:

#### 4.1.5 Photometry: In addition to the test procedures in SAE J575, the following apply:

- 4.1.5.1 Test Setup: Photometric measurement shall be made at a distance of at least 30 m with the reflex reflector setup for testing as shown in Fig. 1. The reflex reflector shall be mounted in a goniometer with the center of the reflex area at the center of rotation and at the same horizontal level as the source of illumination.

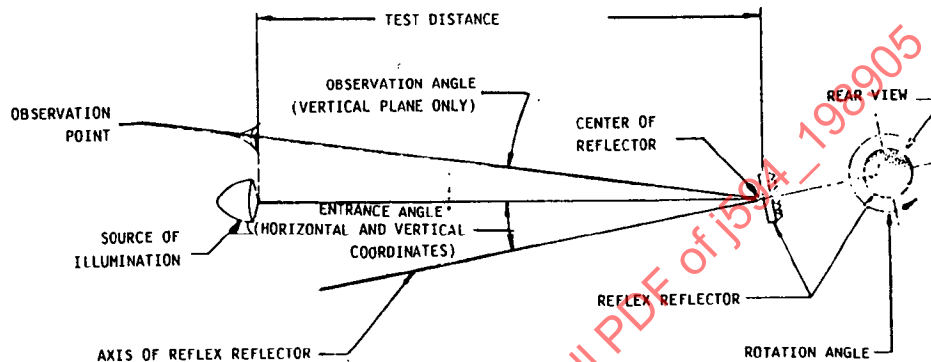


FIGURE 1 - Setup for Testing

- 4.1.5.2 Light Source and Sensor: The source of illumination shall be a projector with a  $50 \pm 5$  mm effective diameter and a lamp filament operating at 2856 K (nominal) color temperature. In making photoelectric measurements, the opening to the photo cell shall not be more than 13 mm vertical by 25 mm horizontal with the observation point above (geometrically) the source of illumination.

- 4.1.5.3 Measurements: Reflex reflectors shall be photometered at the observation and entrance angles shown in Table 1. The entrance angle shall be designated left, right, up, and down in accordance with the position of the source of illumination with respect to the axis of the reflex reflector as viewed from behind the reflector. The H-V axis of reflex reflectors shall be taken parallel to the longitudinal axis of the vehicle for rear reflectors and perpendicular to a vertical plane parallel to the longitudinal axis of the vehicle for side reflectors.

Photometric measurements shall be made photoelectrically. The recorded value for each test point shall be the quotient of luminous intensity of the reflected light expressed as millicandela (candela<sup>1</sup>) divided by the illumination on the reflector measured in lux (foot candle). Also, the illumination on the reflex reflector from the source of illumination shall be measured in lux (foot candle). Reflex reflectors may have any linear or area dimension; but, for the photometric test, a maximum projected area of 7740 mm<sup>2</sup> contained within a 254 mm diameter circle shall be exposed.

<sup>1</sup>"Candela" is used rather than "candlepower" as the preferred term in either metric or English units.

- 4.1.5.4 Rotational Position: Reflex reflectors that do not have a fixed rotational position with respect to the vehicle shall be rotated 360 deg about their axis to find the minimum millicandela per incident lux (candela per incident foot candle), which shall be reported for each test point. If the output falls below the minimum requirement at any test point, the reflector shall be rotated  $\pm 5$  deg about its axis from the angle where the minimum output occurred; and the maximum millicandela per lux (candela per foot candle) within the angular range reported as a tolerance value.

Reflex reflectors that, by their design or construction, permit mounting on the vehicle in fixed rotational position shall be tested in this position. A visual locator, such as the word TOP, shall not be considered adequate to establish a fixed rotational position on the vehicle.

- 4.1.5.5 Uncolored Reflections: If uncolored reflections from the front surface interfere with photometric readings at any test point, the operator shall check 1 deg above, below, right, and left of the test point, and report the lowest reading and location. The latter must meet the minimum requirement for the test point.

- 4.2 Color Test: SAE J578, Color Specification is a part of this report. Additionally, the test sample may be either the reflex reflector or a disc of the same material, technique of fabrication, and dye formulation as the reflex reflector. If a disc is used for color determination by the transmission technique, the thickness should be twice the thickness of the reflector as measured from the face of the lens to the apexes of the reflecting elements. For either sample, a Source "A" illumination shall be used for color measurement.

## 5. REQUIREMENTS:

- 5.1 Performance Requirements: A reflex reflector, when tested in accordance with the test procedures specified in Section 4, shall meet the following requirements:

- 5.1.1 Vibration: SAE J575

- 5.1.2 Moisture: SAE J575, except that in the case of sealed units the alternate water submersion test (4.2.4) is required.

- 5.1.3 Dust: SAE J575

- 5.1.4 Corrosion: SAE J575

- 5.1.5 Photometry: SAE J575

- 5.1.5.1 The reflex reflectors under test shall meet the photometric performance requirement contained in Table 1 or Table 1A.

TABLE 1 – Minimum Millicandelas Per Incident  
Lux for a Red Reflex Reflector<sup>a</sup>

Observation Angle (deg)	Entrance Angle (deg)				
	0 deg	10 deg Up	10 deg Down	20 deg Left	20 deg Right
0.2	420	280	280	140	140
1.5	6	5	5	3	3

TABLE 1A – Minimum Candlepower Per Incident Footcandle –  
Red Reflex Reflector<sup>a</sup>

Observation Angle (deg)	Entrance Angle (deg)				
	0 deg	10 deg Up	10 deg Down	20 deg Left	20 deg Right
0.2	4.5	3.0	3.0	1.5	1.5
1.5	0.07	0.05	0.05	0.03	0.03

<sup>a</sup>Yellow values shall be 2.5 times indicated red values and white values shall be 4 times indicated red values.

5.1.6 Color: The color of the light from a reflex reflector shall be red, yellow, or white as defined in SAE J578.

5.2 Material Requirements: Plastic materials used in the optical portion of each reflex reflector unit shall meet the requirements of SAE J576 SEP86, Plastic Materials for Use in Optical Parts Such as Lenses and Reflectors of Motor Vehicle Lighting Devices.

5.3 Photometric Design Requirements:

5.3.1 If a reflex reflector is optically combined with signalling or marking bulb type devices, it shall be photometered independently by masking from the other functions and shall meet the performance values contained in Table 1 or 1A.

5.4 Installation Requirements: When installed on a vehicle, the visibility of the reflector to the front, side, or rear shall not be obstructed by any part of the vehicle throughout the photometric test angles of the device, unless designed to perform with the obstruction in place.

6. GUIDELINES:

6.1 Photometric Design Guidelines: Reflex reflectors, when tested in accordance with 4.1.5, should be designed at least equal to the values contained in Table 1 or 1A.

6.2 Installation Guidelines: The following guidelines apply to reflex reflectors as used on the vehicle and shall not be considered a part of this report:

6.2.1 Reflex reflectors when used on the exterior of vehicles should be mounted to minimize the accumulation of dirt, grime, and/or snow so that adequate illumination is maintained from the low beam headlamps of approaching vehicles.

6.2.2 If reflex reflectors must perform in severe environments; such as, periodic total immersion in water, the user should specify reflex reflector designs suitable for such use.

The phi ( $\phi$ ) symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

RATIONALE:

PURPOSE FOR REVISIONS

1. To separate test procedures from design objectives and performance requirements as required by SAE J1159.

EDITORIAL CHANGES

1. The format has been changed to agree with that proposed by the Editorial Advisory Committee and further revised at the February 23 and 24, 1983, Signalling and Marking Devices Subcommittee meeting. "Standardized" paragraphs and phrases compiled by Subcommittee Chairman, R. J. Love, as a result of this meeting, have been used wherever applicable. The format change is extensive, while Fig. 1 and Table 1/1A remains unchanged.
2. Metric dimensions have been used throughout this document, but Table 1A has been retained.
3. Optic performance requirements have been retained as a minimum for the guideline values.
4. The lighting identification code specified for reflex reflectors in SAE/J759 has been included in this report.

CONTENT CHANGES

1. The definition has been changed for improved clarity. Definitions for entrance angle and observation angle have been added.
2. Fig. 1 was revised to delete test distance as this detail has been moved to 4.1.5.1.
3. "Nominal" was added (4.1.5.2) to the operating filament temperature for the illumination source to indicate that this is not monitored during the test.
4. The descriptions of the observation and entrance angles (4.1.5.3) were moved to the definitions section.
5. The recorded value for each test point wording (4.1.5.3) was improved and "candela" is used in place of "candlepower" as the preferred term.
6. Editorial changes from the October 25, 1984 ballot have been made to assign subsection titles, and rearrange requirements to become a part of their appropriate sections. The goniometer mounting description was moved to 4.1.5.1 (test setup) from 4.1.5.2 (light source and sensor); and the sentence (The H-V axis of reflex reflectors shall be taken - - -) was moved to 4.1.5.3 (measurements) from 4.1.5.2.
7. Color test procedure was modified to specify the light source illuminate, which was not included in the past.
8. Installation guidelines, which are not currently included, have been added in this revised report. These are intended as information to the reflex reflector designer or purchaser and are not requirements.