

LUMINOUS REFLECTANCE IN SAFETY GLAZING MATERIALS FOR ROAD VEHICLES

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

This SAE Recommended Practice provides a simple test procedure which may be used to measure reflectivity which films applied to safety glazing materials for road vehicles may enhance. The test procedure is closely harmonized with a test method, adopted in response to wide demand in the international community, by the International Organization for Standardization. (See ISO 3538-1978 (E).)

1. Scope—The scope of this SAE Recommended Practice is to provide a simple, practical, and broadly applicable test procedure for appraising luminous Illuminant A reflectance of enhanced reflecting safety glazing materials for road vehicles.

1.1 Field of Application—This procedure applies to conditions where feasibility, rather than accuracy of measurement, is of prime importance. Measurements can be made outside laboratories in a quality control environment and in similar applications, when glazings, instead of small test specimens, have to be tested.

2. References

2.1 Applicable Publication—The following publication forms a part of this specification to the extent specified herein.

2.1.1 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 3538—Road vehicles—Glazing materials—Test methods for optical properties

3. Definitions—For the purpose of this procedure, the following definitions apply.

3.1 CIE Standard Illuminant A—A radiant source $S_A(\lambda)$ whose relative spectral radiant power distribution in the visible spectrum (wavelength range: 380 to 780 nm) corresponds to a black body radiator at $2856 \text{ K} \pm 50 \text{ K}$.

3.2 CIE 1931 Standard Observer—The ideal colorimetric observer with color matching functions $x(\lambda)$, $y(\lambda)$, $z(\lambda)$ corresponding to a field of view subtending a 2-degree angle on the retina is commonly called the "2 degree standard observer."

3.3 Luminous Reflectance—The ratio of the reflected luminous flux to the incident luminous flux. Luminous reflectance depends on relative spectral power distribution of the light source.

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4. **Apparatus¹**

- 4.1 **Primary Instrument**—A highly accurate, integrating sphere, laboratory photometer, or spectrophotometer capable of determining the Illuminant A reflectance of small working standards.
- 4.2 **Secondary Instrument**—A less accurate, generally portable, instrument that is capable of determining the Illuminant A reflectance on safety glazing materials by applying the formula in Section 7 to this instrument's measured values.
- 4.3 **Light Trap**—A device that reduces to 1% or less the contribution of reflection from the transmitted source beam to the measured reflectance value. The light trap should also block the ambient transmitted light.

5. **Requirements**

- 5.1 The test conditions of temperature, pressure, and humidity must be such as not to affect the reflectance measurements.
- 5.2 Stray light must not be a part of the measured specimen reflectance and all measurements should be made with a light trap.
- 5.3 Primary standards are required to calibrate primary instruments. These are usually highly diffuse reflecting flat tiles with reflectance values traceable to an accredited standards supplier.
- 5.4 The total error of the primary instrument shall be within 1% absolute of the guaranteed primary standard value.
- 5.5 Secondary standards are required to calibrate secondary instruments. These standards shall be similar to the safety glazing materials to be measured. Their reflectance values shall have been determined from calibrated primary instruments.

6. **Procedure**

- 6.1 Calibrate primary instrument per the instrument manufacturer's instructions using a primary standard.
- 6.2 Measure a secondary standard with this primary instrument and light trap, noting its film side and curvature orientation according to the instrument manufacturer's recommendation.
- 6.3 Calibrate secondary instrument per the instrument manufacturer's instructions, using this secondary standard and light trap, noting its film side and curvature orientation.
- 6.4 Measure the test specimen in the secondary instrument with the specimen and light trap oriented as was the secondary standard during calibration. Measure the reflectance (Ca) according to the instrument manufacturer's instructions.
- 6.5 Obtain at least three separate measurements, spanning the flattest area of the test specimen.

1. Since environmental conditions within the scope of this document render primary instruments impractical, secondary instruments are used to obtain reflectance data comparable to primary instrument data.

7. Calculation of Corrected Illuminant A Reflectance Values

7.1 Calculate corrected Illuminant A reflectance values from secondary instrument data by using Equation 1:

$$A(\%) = B(\%) \times \frac{C_a}{C_b} \quad (\text{Eq. 1})$$

where:

A(%) = Corrected (A) secondary instrument specimen value (%)

B(%) = Measured (A) primary instrument, secondary standard value (%)

C_a = Measured (A,C,D,) secondary instrument specimen data

C_b = Measured (A,C,D,) measured secondary instrument, secondary standard data

NOTE 1—(A,C,D) are light sources.

NOTE 2—No calculation is made when calibration adjustments render secondary instrument readings equivalent to corrected values.

8. Expression of Results

8.1 The reflectance may be determined at any point on the test specimen of safety glazing material that is within the limits of the previous test procedure. Record the type, construction, and radius of curvature of the specimen, the primary and secondary instruments used, the type and orientation of the primary and secondary standards, the reflectance values of the secondary standard and test specimen.

PREPARED BY THE SAE GLAZING MATERIALS STANDARDS COMMITTEE