



SURFACE VEHICLE STANDARD

J1796™

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Spectral Transmission Test

RATIONALE

This document is revised to update references and edited to conform to SAE style conventions.

1. SCOPE

The scope of this SAE performance standard is to define the test method by which the direct solar and visible transmittance of safety glazing materials for road vehicles shall be measured. Adherence to this performance standard will facilitate writing, use, and referencing of reports by government, industry, and other organizations.

1.1 Purpose

The purpose of this performance standard is to determine the direct solar and visible and color transmittance of safety glazing materials for road vehicles.

1.2 Application

This performance standard applies to monolithic or laminated, clear, or tinted samples of safety glazing materials. Essentially flat sections of glazing parts may be used in this test, as well as flat samples of the same materials.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 13837:2008(E)	Road Vehicles - Safety Glazing Materials - Method for the Determination of Solar Transmittance
ISO 9845-1:1992(E)	Solar Energy - Reference Solar Spectral Irradiance at the Ground at Different Receiving Conditions - Part 1: Direct Normal and Hemispherical Solar Irradiance for Air Mass 1.5 - Table 1 - Spectral Solar Irradiance (Column 5)

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Documents

Document Sharing Hub

2.1.2 CIE Publications

Available from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at.

CIE Publication No. 85 Technical Report - Solar Spectral Irradiance

CIE 015:2018 Colorimetry, 4th Edition.

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM E308-18 Standard Practice For Computing The Colors Of Objects By Using The CIE System

IEEE/ASTM SI 10-2016 IEEE/ASTM American National Standard For Metric Practice, Annex B

3. DEFINITIONS

3.1 STANDARDIZE

To adjust an instrument output to correspond to a previously established calibration using one or more homogeneous specimens or reference materials.

3.2 TRANSMITTANCE

The ratio of transmitted flux to incident flux, under specified geometric and spectral conditions.

3.3 AIR MASS

The ratio of the mass of atmosphere in the actual observer-sun path to the mass that would exist if the observer were at sea level, at standard barometric pressure, and the sun were directly overhead.

3.4 SOLAR UV TRANSMITTANCE (T_{UV})

The transmittance weighted, interval by interval, derived from modified ISO 9845-1:1992(E), Table 1, column 5, $E_{\lambda,i}$ (with air mass = 1.5 global)¹ distribution from 300 through 400 nm at 5 nm intervals (Table 1).

3.5 SOLAR DIRECT TRANSMITTANCE (T_{DS})

The transmittance weighted, interval by interval, derived from modified ISO 9845-1:1992(E), Table 1, column 5, $E_{\lambda,i}$ (with air mass = 1.5 global)² distribution from 300 through 2500 nm at 5 nm, 10 nm, and 50 nm intervals (Table 2).

3.6 VISIBLE LUMINOUS TRANSMITTANCE (LT_A)

Illuminant A spectral power distribution (2856 K correlated color temperature) multiplied by the spectral luminous efficiency function for photopic vision ($V(\lambda)$). The transmittance weighted, interval by interval, according to ASTM E308-18, 7.1.1 and 7.2.1 (Abridged Calculation Procedure), and Table 5.1, column (y). This is nearly equivalent to CIE 015:2018, (Table 1.1, A) times (Table 2.1, $\bar{Y}(\lambda)$) distribution from 380 through 780 (nm) at 10 nm intervals.

NOTE: $V(\lambda) = \bar{Y}(\lambda)$ (refer to Note 3, page 20 of CIE 015:2018). See 4.2.3.4.

¹ The T_{UV} in modified ISO 9845-1:1992(E) Table 1, column 5 is equivalent to the T_{UV} in ISO 13837:2008(E), Table 1, $E_{\lambda,i}$.

² The T_{DS} in modified ISO 9845-1:1992(E) Table 1, column 5 is equivalent to the T_{DS} in ISO 13837:2008(E), Table 2, $E_{\lambda,i}$.

3.7 COLOR TRANSMITTANCE (X, Y, Z)

Illuminant D₆₅ spectral power distribution (6500 K correlated color temperature) multiplied by the CIE 1964 supplementary standard colorimetric observer (refer to ASTM E308-18). The transmittance is weighted, interval by interval, according to ASTM E308-18, Table 5.19. This is equivalent to CIE 015:2018 (Table 1.1, D₆₅) times (Table 2.2, $\bar{x}_{10}(\lambda)$, $\bar{y}_{10}(\lambda)$, $\bar{z}_{10}(\lambda)$) distribution from 380 through 780 (nm) at 10 nm intervals. See 4.2.3.5.

4. TEST METHOD

4.1 Apparatus - Measuring Instrument

This method requires spectral transmittance data to be obtained from samples of glazing materials using a scanning spectrophotometer. This instrument, preferably equipped with an integrating sphere, must be capable of measuring transmittance over that part of the electromagnetic spectrum in which the sun's energy is transmitted to the earth's surface. Required wavelength range is 300 to 2300 nm. Preferred wavelength range is 300 to 2500 nm.

4.2 Procedure

4.2.1 Sample Preparation

Cut, if necessary, and clean the flattest area of curved test specimens with distilled water and reagent grade methanol or use an alternate procedure appropriate to the material if necessary. Cut and clean flat samples similarly.

4.2.2 Measurement

Standardize the spectrophotometer according to the manufacturer's instructions. Place a clean sample normal to the measuring beam in the transmittance sample position. Note its film side and curvature orientation if applicable. Record the sample spectral data according to the instrument manufacturer's recommendation.

4.2.3 Calculation

Compute direct solar transmittance by integration using the solar weight data in Tables 1 and 2.

4.2.3.1 Transmittance (T) for the solar range (λ_1 to λ_n) is determined by Equations 1 and 2.

$$\%T_{UV}(400) = \sum_{300}^{400} \%T_{\lambda} \times E'_{\lambda}(n) \quad (\text{see Table 1 for } E'_{\lambda}(n)) \quad (\text{Eq. 1})$$

$$\%T_{DS}(1.5) = \sum_{300}^{2500} \%T_{\lambda} \times E'_{\lambda}(n) \quad (\text{see Table 2 for } E'_{\lambda}(n)) \quad (\text{Eq. 2})$$

where:

$E'_{\lambda}(n)$ = the normalized trapezoidal solar energy in wavelength interval ($\Delta\lambda_v$)

$\%T_{UV}(400)$ = the ultraviolet transmittance to 400 nm

$\%T_{DS}(1.5)$ = the visible and near-infrared transmittance for air mass 1.5

4.2.3.2 Measure transmittance at intervals of 5 nm from 300 to 400 nm, 10 nm from 400 to 800 nm, and 50 nm from 800 to 2500 nm. Transmittance must be measured to at least 2300 nm. If it is not possible to measure transmittance to 2500 nm, the last value must be multiplied by the remaining ($E'_{\lambda} \times \Delta\lambda$) weight values.

4.2.3.3 This standard defines the determination of the direct solar transmittance of safety glazing materials.