International Standard ISO 5740

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Road vehicles — Rear view mirrors — Test method for determining reflectance

Véhicules routiers — Rétroviseurs — Méthode d'essai pour la détermination du facteur de réflexion

Second edition — 1982-02-15

UDC 629.11.018.1 : 535.346.1 **Ref. No. ISO 5740-1982 (E)**

Descriptors : road vehicles, driving mirrors, optical tests, reflectance.

Price based on 4 pages

ISO 5740-1982 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5740 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in November 1980.

It has been approved by the member bodies of the following countries :

Austria	Italy	South Africa, Rep. of
Belgium	Japan	Spain
Brazil	Korea, Dem. P. Rep. of	Sweden
China	Korea, Rep. of	Switzerland
Egypt, Arab Rep. of	Netherlands	United Kingdom
France	New Zealand	USSR
Germany, F.R.	Poland	
Iran	Romania	

No member body expressed disapproval of the document.

This second edition cancels and replaces the first edition (i.e. ISO 5740-1978).

Road vehicles — Rear view mirrors — Test method for determining reflectance

1 Scope and field of application

This International Standard specifies a test method for determining the reflectance of rear view mirrors for road vehicles.

It applies to flat and convex surface mirrors intended for internal and external mounting.

2 References

IEC Publication 50(45), *International Electrotechnical Vocabulary, Group 45 : Lighting.*

CIE — Publication N° 17 (1970), *International lighting vocabulary* — Vol. 1 (published by the Central Office of the International Commission on Illumination).

NOTE — The texts of the above are identical.

3 Definitions

3.1 CIE standard illuminant A [as defined in 45.15.145 of IEC Publication 50(45)] : (Colorimetric illuminant), representing the full radiator at T_{68} = 2 855,6 K.

3.2 CIE standard source A [as defined in 45.15.150 of IEC Publication 50(45)] : Gas filled tungsten filament lamp operating at a correlated colour temperature of T_{68} = 2 855,6 K.

3.3 CIE 1931 standard colorimetric observer [as defined in 45.15.050 of IEC Publication 50(45)] : Receptor of radiation whose colorimetric characteristics correspond to the spectral tristimulus values $\bar{x}(\lambda)$, $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ adopted by the International Commission on Illumination in 1931. (See 3.4 and the annex.)

3.4 CIE spectral tristimulus values [as defined in 45.15.035 of IEC Publication 50(45)] : Tristimulus values of the spectral components of an equi-energy spectrum in the CIE (XYZ) system.

NOTES

1 Formerly CIE distribution coefficients.

2 In the CIE 1931 standard colorimetric system, applicable to observing fields of angular subtense between 1° and 4° (0,017 rad and 0,07 rad), these tristimulus values $\bar{x}(\lambda)$ $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ are so chosen that the values of $\bar{y}(\lambda)$ are identical with the spectral luminous efficiencies $V(\lambda)$. (See annex.)

3.5 photopic vision [as defined in 45.25.055 of IEC Publication 50(45)] : Vision by the normal eye when it is adapted to levels of luminance of at least several candelas per square metre.

NOTE — The cone receptors of the retina are considered to be the principal active elements under these conditions and the spectrum appears coloured.

3.6 reflectance : The ratio of reflected luminous flux to the incident luminous flux (ϱ).

NOTE — Where mixed reflectance occurs the total reflectance may be divided into two parts, regular reflectance (ϱ_r) and diffused reflectance (ϱ_d), hence the equation $\varrho = \varrho_r + \varrho_d$.

4 Apparatus

4.1 General

The apparatus shall consist of a light source, a holder for the test sample, a reflectometer with a photodetector and an indicating meter (see figure 1), and means for eliminating the effects of extraneous light.

The reflectometer in figure 1 measures the regular component of reflectance.

The reflectometer may incorporate a light integrating sphere to facilitate measuring the reflectance of non-flat (convex) mirrors (see figure 2).

In this case the reflectometer measures the total reflectance, i.e. the sum of the regular and diffused components.

4.2 Spectral characteristics of light source and reflectometer

The light source shall consist of a CIE standard source A and associated optics to provide a near-collimated light beam. A voltage stabilizer is recommended to maintain a fixed lamp voltage during instrument operation.

The reflectometer shall have a photodetector with a spectral response proportional to the photopic luminosity function of the CIE (1931) standard colorimetric observer (see the annex).

Any other combination of illuminant-filter-receptor giving the overall equivalent of CIE standard illuminant A and photopic vision may be used. When an integrating sphere is used in the reflectometer, the interior surface of the sphere shall be coated with a matt (diffusive) spectrally non-selective white coating.

4.3 Geometric conditions

The angle of the incident beam (θ_i) should preferably be 25° ± 5° (0,44 ± 0,09 rad) from the perpendicular to the test surface and shall not exceed the upper limit of the tolerance (i.e. 30° or 0,53 rad). The axis of the receptor shall make an angle (θ_i) with the perpendicular equal to that of the incident beam (see figure 1).

The incident beam upon arrival at the test surface shall have a diameter of not less than 19 mm (0.75 in). The reflected beam shall be narrower than the sensitive area of the photodetector, shall not cover less than 50 % of such area, and as nearly as possible shall cover the same area segment as used during instrument calibration. (If the beam width is the same as the sensitive area, problems with vignetting may occur.)

When an integrating sphere is used in the reflectometer the sphere shall have a minimum diameter of 127 mm (5 in). The sample and incident beam apertures in the sphere wall shall be of such a size as to admit the entire incident and reflected light beams. The photodetector shall be so located as not to receive direct light from either the incident or reflected beams, and should be screened from any scattered light which might pass directly from the sample (see figure 2).

4.4 Electrical characteristics of the photodetector-indicator unit

The detector output as read on the indicating meter shall be a linear function of the light intensity on the photo-sensitive area. Means (electrical and/or optical) shall be provided to facilitate zeroing and calibration adjustments. Such means shall not affect the linearity or the spectral characteristics of the instrument. The accuracy of the receptor-indicator unit shall be within ± 2 % of full scale, or ± 10 % of the magnitude of the reading, whichever is the smaller.

4.5 Sample holder

The mechanism shall be capable of locating the test sample so that the axes of the source arm and receptor arm intersect at the principle reflecting surface. The reflecting surface may lie within or at either face of the mirror sample, depending on whether it is a first surface, second surface, or prismatic "flip" type mirror.

5 Procedure

5.1 Direct calibration method

In the direct calibration method, the incident flux is used as the reference standard. This method is applicable for those instruments which are so constructed as to permit calibration at the 100 % point by swinging the receiver to a position directly on the axis of the light source (see figure 1).

It may be desired in some cases (such as when measuring low-reflectance surfaces) to use an intermediate calibration point (between 0 and 100 % on the scale) with this method. In these cases, a neutral density filter of known transmittance shall be inserted in the optical path, and the calibration control can then be adjusted until the meter reads the percentage transmission of the neutral density filter. This filter shall be removed before making measurements on the sample.

To expand the scale when dealing with low reflectance samples, it may be desirable to set a full scale reading with the calibrated filter and multiply the apparent measured reflectance by the transmittance of the filter.

5.2 Indirect calibration method

The indirect calibration method is applicable for those instruments with fixed source and receiver geometry. A properly calibrated and maintained reflectance standard is required. This reference standard should preferably be a flat mirror with a reflectance value as near as possible to that of the test samples.

5.3 Flat mirror measurement

The reflectance of flat mirror samples can be measured on instruments employing either the direct or indirect calibration method. The reflectance value is read directly from the indicating meter.

5.4 Non-flat (convex) mirror measurement

The measurement of the reflectance of non-flat (convex) mirrors requires the use of instruments which incorporate an integrating sphere (see figure 2). If the instrument indicating meter indicates n_E divisions with a reference standard mirror of E % reflectance, then with a mirror of unknown reflectance. n_X divisions will correspond to a reflectance of X % given by the formula :

$$X = E \frac{n_X}{n_E}$$