INTERNATIONAL STANDARD

ISO 105-J01

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Textiles — Tests for colour fastness —

Part J01:
General principles for measurement of surface colour

Textiles — Essais de solidité des teintures —
Partie J01: Principes généraux du mesurage de la couleur de surface

Reference number
ISO 105-J01:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 105-J01 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 1, *Tests for coloured textiles and colorants*.

This fourth edition cancels and replaces the third edition (ISO 105-J01:1989), which has been technically revised.

ISO 105 was previously published in thirteen “parts”, each designated by a letter (e.g. “Part A”), with publication dates between 1978 and 1985. Each part contained a series of “sections”, each designated by the respective part letter and by a two-digit serial number (e.g. “Section A01”). These sections are now being republished as separate documents, themselves designated “parts” but retaining their earlier alphanumeric designations. A complete list of these parts is given in ISO 105-A01.

Annex A forms an integral part of this part of ISO 105. Annex B is for information only.

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Textiles — Tests for colour fastness —

Part J01:
General principles for measurement of surface colour

1 Scope

This part of ISO 105 is designed as a reference document to support the proper measurement of the colour of specimens by instrumental means as required in many parts of ISO 105. The document describes general concepts and problems associated with reflectance colour measurement.

Annex A specifies techniques and specimen handling procedures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 105. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this part of ISO 105 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

CIE Publication No. 15.2, *Colorimetry*, 2nd ed. (1986)[1)].

3 Definitions

For the purposes of this part of ISO 105, the following definitions apply.

3.1 colour measurement: A numerical representation of the colour of a specimen obtained by use of a colour measuring instrument; a single measurement may represent an average of multiple readings of a specimen.

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1) Available from the International Commission on Illumination Central Bureau, Kegelgasse 27, A-1030 Vienna, Austria.

3.2 colour measuring instrument: Any device (such as a colorimeter or spectrophotometer) used to measure the relative amount of radiation reflected from a specimen in the visible region of the spectrum (comprising the wavelengths from 360 nm to 780 nm, and including as a minimum the region from 400 nm to 700 nm).

3.3 geometry (of a colour measuring instrument)**:** One of the following illumination/viewing conditions.

d/0	0/d	0/45	45/0

which describes the angle or manner in which a colour measuring instrument

1) illuminates the specimen:

d	0	0	45

2) views the resulting reflected light:

0(0°-10°)	d	45	0

d = diffuse; 0 = normal (0° to 10°); 45 (45° ± 2°) = tolerable range of the angle between the direction of illumination or viewing and the normal to the specimen.

NOTE — Instruments of different geometries may produce different colorimetric results on most textile materials.

3.4 area-of-view [optical aperture] (of a colour measuring instrument)**:** The dimensions (size and shape) of the surface area that a colour measuring instrument is capable of covering in a single colour measurement.

3.5 fluorescence: A phenomenon in which radiant flux of certain wavelengths is absorbed and re-emitted at other, usually longer, wavelengths.

3.6 reflectance: The ratio of the reflected radiant or luminous flux (light) to the incident flux in the given conditions.

3.7 reflectance factor: The ratio of the flux reflected from the specimen to the flux reflected from the perfect reflecting diffuser under the same geometric and spectral conditions of measurement.

3.8 specular reflection: The reflection without diffusion, in accordance with the laws of optical reflection, as in a mirror.

3.9 standardization (of colour measuring instrument)**:** The act of measuring one or more calibrated materials with a colour measuring instrument for the purpose of calculating a set of correction factors to be applied to subsequent measurements.

NOTE — Calibration is typically performed by an instrument manufacturer to ensure that the instrument meets the criteria as established by national standardizing laboratories.

3.10 verification standard: In colour measurement, any stable material which is used for the purpose of confirming (or verifying) the validity of an instrument standardization. Colour measurements, which are made immediately following a standardization, are compared to original measurements of the standard to detect improper standardization.

4 Principle

Materials of an opaque or nearly opaque nature (but not translucent) are measured by reflectance methods in order to obtain a numerical representation of the colour of the specimen.

NOTES

1 Proper equipment set-up, standardization of the colour measuring instrument and proper presentation of the test specimens to the instrument are required to achieve consistent, reliable and meaningful reflectance measurement results.

2 In general, instrumental colour measurement procedures are dictated by the type of specimen to be measured and the instrument with which it will be measured. Many types of colour measuring instrumentation are available, differing in such features as area-of-view, illumination method, and geometry. The user is cautioned that conflicting results may be obtained on comparisons of data acquired on instruments of different designs.

5 Apparatus

5.1 Reflectance colour measuring instrument, for illuminating a specimen and measuring the amount of light which is reflected from the surface of the specimen. Illumination is usually polychromatic (white light); however monochromatic mode is acceptable for nonfluorescent specimens. Reflectance colour measuring instruments may be broadly divided into two groups:

a) Spectrophotometers (typically diffuse/0, using polychromatic illumination) separate and measure the spectrum of light reflected from the specimen relative to a reference white at regular intervals (wavelength intervals of 5 nm, 10 nm and 20 nm are most common). These data may be used to calculate the desired tristimulus values (X,Y,Z) for any given illuminant and observer. Some spectrophotometers (typically 0/diffuse) illuminate the sample with monochromatic light and measure the amount of light reflected from the surface as the sample is illuminated at regular wavelength intervals.

b) Colorimeters measure the tristimulus values (X,Y,Z) directly through broadband filters which are designed to produce colorimetric values for one illuminant and observer (typically C/2). Measurement of reflectance factors at specific wavelengths is not possible with a colorimeter.

Within these two categories, the instruments are further defined by their geometry as defined in 3.3.

Diffuse/0 (sphere) instruments illuminate the specimen indirectly when the specimen is placed against a port opening into a diffusely illuminated sphere and view the specimen at an angle between 0° and 10° from the perpendicular. This arrangement is designed to capture all light reflected from the specimen. Some sphere instruments with a viewing angle greater than 0° include a specular port which permits the inclusion or exclusion of the specular reflectance.

0/diffuse (sphere) instruments are similar, but the path of illumination and viewing are reversed. This method illuminates the sample at an angle between 0° and 10° and measures the amount of light reflected from the surface into the sphere.

Instruments with 45/0 (or 0/45) geometry illuminate the specimen at the first angle and view the specimen at the second. These two geometries can be either circumferential (viewing or illuminating at 45 to the specimen in a complete circle) or directional. For most textile samples, either 45/0 or 0/45 yield equivalent results.

5.2 White calibrated standard, with which to standardize the instrument. The colorimetric values for this calibration standard are stored in the instrument or the software and require only that a specific standard be used to standardize the instrument. The correct white standard is usually identified with a serial number.

5.3 Black standard, required for some instruments. It may be of zero reflectance (a light trap) or it may be calibrated, in which case the comments in 5.2 apply.

6 Procedure

6.1 General

a) Collect and prepare specimen, noting any special sampling and/or conditioning procedures that may be required as described in 6.3 (see also annex A).

b) Standardize instrument according to 6.2. Maintain a record of the procedure and the results of any verification standards measured.

c) Present specimen to colour measuring instrument following any special techniques required for the type of material being measured per section 6.4 (see also annex A).

d) Measure the colour of the specimen, obtaining the appropriate spectral reflectance factors (or tristimulus values if a colorimeter is used).

e) Calculate colorimetric values, if required, as described in clause 7.

6.2 Standardization

Proper standardization of any colour measuring instrument is necessary in order to achieve more precise and accurate results. While different types of instruments require varying methods of standardization, there are common principles which shall be observed.