INTERNATIONAL STANDARD

ISO 105-B05

Third edition
1988-05-01

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

Textiles — Tests for colour fastness —

Part B05:
Detection and assessment of photochromism

Textiles — Essais de solidité des teintures —

Partie B05: Détection et évaluation de la phototropie

Reference number
ISO 105-B05 : 1988 (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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 105-B05 was prepared by Technical Committee ISO/TC 38, *Textiles*.

This third edition cancels and replaces the second edition (included in ISO 105-B : 1984), of which it constitutes a minor revision.

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.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Textiles — Tests for colour fastness —

Part B05:
Detection and assessment of photochromism

1 Scope and field of application

This part of ISO 105 specifies a method intended for detecting and assessing change in colour, after brief exposure to light, of coloured textiles which change in colour on exposure to light but which virtually return to their original shade when stored in the dark.

NOTE — General information on colour fasteness to light is given in the annex.

2 References

ISO 105, *Textiles — Tests for colour fastness* —

Part A01: General principles of testing.

Part A02: Grey scale for assessing change in colour.

Part B01: Colour fastness to light: Daylight.

Part B02: Colour fastness to artificial light: Xenon arc fading lamp test.

3 Principle

A specimen of the textile is exposed to light of high intensity for a time much shorter than that necessary to cause a permanent change. The change in colour of the specimen is assessed immediately after exposure, using the grey scale. The specimen is then stored in the dark and assessed again.

4 Reference materials and apparatus

4.1 Reference materials

The references used for this test are References 1 and L2 as specified in sub-clauses 4.1.1 and 4.1.2 of ISO 105-B01.

4.2 Apparatus

4.2.1 Light source: a xenon arc lamp of correlated colour temperature 5 500 to 6 500 K.

4.2.2 Filter.

A filter is placed between the light source and the specimens and references so that the ultra-violet spectrum is steadily reduced. The transmission of the glass shall be at least 90 % between 380 and 750 nm, falling to 0 % between 310 and 320 nm.

The equipment described in ISO 105-B02 is considered most satisfactory.

4.2.3 Opaque cardboard, or other thin opaque material, for example thin sheet aluminium, or cardboard covered with aluminium foil, or, in the case of pile fabrics, a cover that avoids surface compression.

4.2.4 Grey scale for assessing change in colour (see clause 2).

5 Test specimen

5.1 An area of the textile not less than 1 cm × 4,5 cm is required. The specimen may be a strip of cloth, yarns wound close together on a card or laid parallel and fastened on a card, or a mat of fibres combed and compressed to give a uniform surface and fastened on a card.

5.2 To facilitate handling, the specimen and a similar strip of the reference may be mounted on cards.

6 Procedure

6.1 Cover approximately one-half of the strip of Reference 1 or Reference L2 (see 4.1) with opaque cardboard (4.2.3).

6.2 Expose the partially covered Reference 1 or Reference L2 continuously to the xenon arc fading lamp at moderate effective humidity (see ISO 105-B02) until the contrast between the unexposed and the exposed portions of the reference is equal to grey scale grade 4. Determine the time necessary to produce this change. It will only be necessary to repeat this operation if exposure conditions change significantly.

6.3 Cover approximately one-half of the specimen (see 5.1) with opaque cardboard (4.2.3).

6.4 Expose the specimen in the same position and under the same conditions as in 6.2 for one-quarter of the time necessary to produce a grey scale grade 4 fade on Reference 1 or one-twenty-fifth of the time necessary to produce a grey scale grade 4 fade on Reference L2 (see 6.2).

6.5 Remove the specimen from the source of light. Immediately remove the cover from the specimen and assess the contrast between the unexposed and the exposed portions with the grey scale.

6.6 If the contrast is not greater than grey scale grade 4, the specimen is not photochromic and further examination is not necessary.

6.7 If the contrast between the original and the exposed portion of the specimen is greater than grey scale grade 4, leave the specimen in the dark for 1 h at 20 ± 2 °C and a relative humidity of (65 ± 2)%. If, after this period, the contrast between the unexposed and exposed portions of the specimen can still be perceived, expose the specimen to steam at atmospheric pressure to accelerate further colour restoration.

Carry out the steaming by placing the specimen on a mesh of non-corrodible material which is attached to the mouth of a 1 litre flask containing 500 ml of gently boiling water. Mount the specimen with the unexposed side facing the mesh. Steam for a period of 60 s.

6.8 Inspect the specimen to determine if the contrast between the unexposed and the exposed portions is still visible, and, if so, re-assess the contrast between the unexposed and exposed portions of the specimen against the grey scale.

7 Test report

7.1 If the specimen shows a contrast not greater than grey scale grade 4 between the exposed and unexposed portions immediately after exposure (see 6.6), the specimen is not photochromic; report the light fastness of the specimen in the normal manner described in ISO 105-B01 or ISO 105-B02.

7.2 If the specimen immediately after exposure shows a contrast between the unexposed and the exposed portions of the specimen which is greater than grey scale grade 4 but which after conditioning according to 6.7 shows a difference not greater than grey scale grade 4-5, it is photochromic.

The light fastness rating of the specimen (as determined by ISO 105-B01 or ISO 105-B02) shall be followed by the letter P and the grey scale rating, in brackets, for example 6(P3-4), 6-7(P2-3).

7.3 If the contrast between the unexposed and the exposed portions of the specimen after conditioning is greater than grey scale grade 4-5, the sample is not photochromic, but is of low initial light fastness. Assess the light fastness and give the rating for the first perceptible change in brackets.

8 Notes

8.1 This phenomenon used to be termed "phototropism" but the latter is much more widely used in biological science where its meaning is entirely different. As the derivation of "phototropism" is in accord with its biological meaning, the term "photochromism" is preferable for reversible colour changes induced by light.

8.2 Temporary changes in colour which may be due to lower moisture content and/or higher temperature and whose existence can be ascertained by a hot pressing test shall not be reported as photochromic.

Annex

General information on colour fastness to light

(This annex does not form an integral part of the standard.)

When in use, textiles are usually exposed to light. Light tends to destroy colouring matters and the result is the well known defect of "fading", whereby coloured materials change colour — usually becoming paler and duller. Dyes used in the textile industry vary enormously in their resistance to light and it is obvious that there must be some method of measuring their fastness. The substrate also influences the light fastness of a dye.

This International Standard cannot satisfy completely all the interested parties (who range from dye manufacturers and the textile industry to wholesale and retail traders and the general public) without becoming technically involved and possibly difficult to understand by many who have a direct interest in its application.

The following non-technical description of the test has been prepared for the benefit of those who find the detailed technicalities of the standard difficult to understand. The method is to expose the pattern being tested and to expose also, at the same time and under the same conditions, a series of light fastness references which are pieces of wool cloth dyed with blue dyes of different degrees of fastness. When the pattern has faded sufficiently, it is compared with the references and if it has behaved, for instance, like Reference 4 [1], then its light fastness is said to be 4.

The light fastness references should cover a wide range since some patterns fade noticeably after exposure for 2 or 3 h to bright summer sunshine, although others may withstand several years' exposure without change, the dyes in fact outliving the material to which they have been applied. Eight references have been chosen, Reference 1 being the most fugitive and Reference 8 the most resistant. If it takes a certain length of time for Reference 4 to fade under certain conditions, then the same amount of fading will occur on Reference 3 in approximately half that time, or on Reference 5 in approximately twice that time, provided that the conditions are the same.

It is necessary to ensure that different people testing the same material will fade it to the same extent before assessment against the simultaneously faded reference. The ultimate users of dyed material differ widely in what they consider to be "faded articles" and therefore patterns under test are faded to two different degrees which adequately cover most opinions and make assessment more reliable. These required degrees of fading are defined by reference to a collection of reference contrasts (grey scale 5 equals no contrast, grey scale 1 equals large contrast). Thus the use of the grey scale enables fading to be taken to defined extents, and the blue wool cloths enable the light fastness to be rated.

This general principle of assessing on the basis of moderate and severe fading is complicated, however, by the fact that some patterns on exposure undergo a slight change very rapidly indeed but do not change further for a long time. These slight changes are such that under normal conditions of use they would seldom be observed, but in certain cases they become important, as the following example shows.

> Some curtain material is exposed so as to produce a moderate degree of fading and it is found that Reference 7 has faded to the same extent; the general light fastness of the fabric is therefore 7. A retailer has a length of this fabric in his window and on it is a cardboard ticket indicating the price. After a few days the ticket is removed and careful examination reveals the place where it has been resting because the surrounding cloth has changed shade slightly on exposure to light.

The important factor about this slight change is that it can only be detected when there is a sharp boundary between the exposed and unexposed areas and these conditions rarely occur during normal use. The magnitude of this slight change would be given as an additional assessment in brackets. Thus a rating for a test could be 7(2), indicating a slight initial change equivalent to the first perceptible fade of Reference 2, but otherwise a high light fastness of 7.

A further unusual colour change is also catered for, namely photochromism. This effect is shown when a dye changes colour rapidly on exposure to strong light but on removal to a dark place the original colour returns more or less completely. The extent of photochromism is determined by the special test described in this part of ISO 105 and is shown in the rating by a number following the letter P within brackets; for example 6(P2) means a photochromic effect equal to a grey scale 2 contrast but permanent fading equal to that of Reference 6.

1) The designations of the light fastness references referred to here are those of the European set (see ISO 105-B01, sub-clause 4.1.1). The principles explained are equally valid for the American set (see ISO 105-B01, sub-clause 4.1.2).

Finally, there are many patterns which change hue on prolonged exposure to light; for example, a yellow may become brown, or a purple may become blue. In the past there have been many arguments as to whether such patterns could be said to have faded or not. The technique used in parts B01 to B05 of ISO 105 is unambiguous on this point; it is visual contrast on exposure which is being measured, whether it be loss of colour or change in hue; in the latter case, however, the kind of change is included in the assessments. For example, consider two green patterns which, on exposure, change in appearance at the same rate as Reference 5; one becomes paler and finally white, while the other becomes first a greenish blue and finally a pure blue. The former would be rated "5" and the latter "5 bluer". In this instance also, the technique used in parts B01 to B05 of ISO 105 tries to present as complete a picture of the behaviour of a pattern on exposure as is possible without becoming excessively complicated.