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Tests for colour fastness of textiles — Sixth series

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FOREWORD

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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 105/VI (originally draft No. 2182) was drawn up by Technical Committee ISO/TC 38, *Textiles*.

It was approved in July 1971 by the Member Bodies of the following countries :

Australia	Hungary	Portugal
Brazil	India	Romania
Bulgaria	Ireland	South Africa, Rep. of
Canada	Israel	Spain
Czechoslovakia	Japan	Sweden
Denmark	Korea, Rep. of	Switzerland
Egypt, Arab Rep. of	Netherlands (Parts 1,3,4,5,6)	Thailand
Finland (Parts 3,4,5,6)	New Zealand	United Kingdom
France (Parts 1,3,4,5,6)	Norway	U.S.A.
Germany	Poland	U.S.S.R.

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium
Finland (Parts 1,2)
France (Part 2)
Netherlands (Part 2)

Tests for colour fastness of textiles — Sixth series

PART 1 COLOUR FASTNESS TO DRY CLEANING

1 SCOPE AND FIELD OF APPLICATION

This method is intended for assessing the resistance of the colour of textiles of all kinds and in all forms to dry cleaning.

This method is not suitable for the evaluation of the durability of textile finishes, nor is it intended for use in evaluating the resistance of colours to spot and stain removal procedures used by the drycleaner (see 7.1 and 7.2).

2 PRINCIPLE

A specimen of the textile in contact with cotton fabric and non-corrodible steel disks is agitated in perchloroethylene (see 7.2 and 7.3), then squeezed or centrifuged, and dried in hot air. The change of colour in the specimen is assessed with the standard grey scales.

3 APPARATUS AND REAGENTS

3.1 Appropriate mechanical apparatus for shaking the containers (see 7.4 and 7.5)

3.2 Glass or stainless-steel containers, of approximately 550 ml capacity, which can be closed using solvent-resistant gaskets.

3.3 Non-corrodible steel disks, 30 ± 2 mm $\times$ $3 \pm 0,5$ mm, smooth and free from rough edges, of mass 20 ± 2 g.

3.4 Undyed cotton "twill" cloth, of mass 270 ± 70 g/m², free from finishes and cut into samples 120 mm $\times$ 120 mm.

3.5 Perchloroethylene, which must be stored over anhydrous sodium carbonate to neutralize any hydrochloric acid formed.

3.6 Grey scale, for assessing change in colour¹⁾.

4 SPECIMEN

4.1 If the textile to be tested is fabric, use a specimen 100 mm $\times$ 40 mm.

4.2 If the textile to be tested is yarn, knit it into fabric and use a specimen 100 mm $\times$ 40 mm.

5 PROCEDURE

5.1 Prepare a bag with inside dimensions of 100 mm $\times$ 100 mm using the undyed cotton twill cloth (see 3.4) by sewing together two squares of this cloth around three sides. Place the specimen and 12 steel disks (see 3.3) inside the bag. Close the bag by any convenient means.

5.2 Place the bag containing the specimen and the steel disks in the container and add 200 ml of perchloroethylene at 30 ± 2 °C. Treat the specimen for 30 min at 30 ± 2 °C in the specified equipment (see 7.4).

5.3 Remove the bag from the container, withdraw the specimen, place it between absorbent paper or cloth and squeeze or centrifuge to remove surplus solvent. Dry the specimen freely suspended in hot air at a temperature of 60 ± 5 °C.

1) See ISO/R 105/I, Parts 1 and 2.

5.4 Assess the change in colour of the specimen with the standard grey scale.

6 REPORT

Report the numerical rating for the change in colour of the test specimen.

7 NOTES

7.1 This test covers colour fastness to dry cleaning only; commercial dry cleaning practice normally involves other operations such as water spotting, solvent spotting, steam pressing, etc., for which other standard test methods are available if the full "dry cleanability" of the textile is to be assessed.

7.2 The presence of absorbed water in either the fabric or dry cleaning solution, or the presence of a detergent and water in the dry cleaning solution, has not been found to be

a critical factor in assessing colour fastness. This test gives results which correlate satisfactorily with those obtained in commercial dry cleaning.

7.3 In recording fastness to dry cleaning, perchloroethylene must be used, but the results obtained with other solvents may be recorded in addition if this information is required.

7.4 A suitable mechanical device consists of a water bath containing a rotatable shaft which supports, radially, glass or stainless steel containers (75 ± 5 mm diameter X 125 ± 10 mm high) of approximately 550 ± 50 ml capacity, the bottom of the containers being 45 ± 10 mm from the centre of the shaft. The shaft container assembly is rotated at a speed of 40 ± 2 rev/min. The temperature of the water bath is thermostatically controlled to maintain the test solvent at 30 ± 2 °C.

7.5 Other mechanical devices may be used for the test provided the results are identical to those obtained with apparatus conforming to the description given in 7.4.

PART 2

COLOUR FASTNESS TO LIGHT : DAYLIGHT (L-TEST)¹⁾

1 SCOPE AND FIELD OF APPLICATION

This method is intended for assessing the resistance of the colour of textiles of all kinds and in all forms to the action of daylight on the basis of light fastness standards, or a mutually agreed-upon standard sample.

The method may be used for rating colour fastness of dyes by applying the dye to textiles by a specified procedure and at a specified depth of colour, and testing the dyed textiles.

If there is a possibility of the sample being photochromic, then the test for photochromism shall be applied.

NOTE — Since differences in outdoor fading may be caused by the influence of atmospheric contaminants, gas and ozone fading standards may be exposed simultaneously with the blue wool cloth light fastness standards.

2 PRINCIPLE

A specimen of the textile together with the standard, or standards, is exposed to daylight continuously, 24 h a day, under prescribed conditions including protection from rain. The fastness is assessed by comparing the fading of the textile with that of the standards.

3 STANDARDS AND EQUIPMENT

3.1 Standards

3.1.1 *Grey scale*, for assessing change in colour²⁾.

3.1.2 *Blue wool cloth light fastness standards* (see 7.1).

3.2 Equipment

3.2.1 *Exposure rack*

Facing due south in the Northern Hemisphere, due north in the Southern Hemisphere, and sloping at an angle from the horizontal approximately equal to the latitude of the place where the exposure is made, the rack shall be sited preferably in a non-residential, non-industrial area free from

dust and automobile exhaust fumes. The rack shall be placed so that shadows of surrounding objects will not fall on the exposed textiles and constructed so that the latter are firmly held. There shall be free circulation of air behind the mounted specimens and the rack shall be covered with window glass to protect the specimens from rain and other elements of the weather. The glass employed shall be a good grade of clear, flat, drawn sheet glass (see 7.2). It shall be cleaned at least once each day and replaced after one year of use.

The minimum permissible distance between the glass and the specimens is 76 mm. In order to minimize shadows from the sides of the cabinet due to the varying angle of the sun, the usable exposure area under the glass is limited to that of the glass cover reduced on each side by twice the distance from the glass cover to the specimen.

3.2.2 *Cardboard* (see 7.3).

3.2.3 *Instruments* suitable for determining maximum, minimum and average daily temperatures and humidities (see 7.4).

4 SPECIMEN

Use an area of textile measuring not less than 30 mm X 60 mm, with the exposed area not less than 30 mm X 30 mm adjacent to an unexposed area having the same dimensions. 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 PROCEDURE

5.1 For exposures employing standards

5.1.1 Mount a set of standards and the specimens to be tested on cardboard as shown in Figure 1 with an opaque cover (see 3.2.2) across one-half of each of the standards and specimens. Where a large number of specimens are to be exposed, they may be mounted in the same manner on as many additional cards as are necessary. As an aid in rating, each standard and specimen to be compared shall have the same area.

1) This test is mostly used in the countries of North America. It differs from the test in ISO/R 105/1, Part 11 — *Colour fastness to light : Daylight*, in several respects but especially in the standard Blue Scale (L2 — L9). The light fastness ratings of the two tests are not directly comparable.

2) See ISO/R 105/1, Parts 1 and 2.

5.1.2 Expose the specimens and standards simultaneously to daylight under the conditions described above. The specimens and standards remain in the cabinet 24 h per day and are removed only for inspection.

5.1.3 Follow the effect of daylight by frequently removing the cover and inspecting the standards. Continue the exposure until the change in colour (see 7.5) of the exposed and covered portions of the standard L2 equals the contrast between the two grey colour chips illustrating Grade 4 on the grey scale. When this occurs, uncover all specimens and remove from the exposure cabinet Standard L2 and those specimens which have a difference in colour between the exposed and covered portions equal to or greater than Grade 4 of the grey scale.

5.1.4 Re-cover the remaining standards and test specimens and continue the exposure until the change in colour of the exposed and covered portions of the next higher numbered standard equals Grade 4 on the grey scale. Uncover all specimens and remove the standard and those specimens which at that time show a difference in colour between the exposed and covered portions equal to or greater than Grade 4 on the grey scale.

5.1.5 Continue the exposure, removing successively higher numbered standards and specimens which show equal or greater colour change whenever the standard shows a difference in colour of Grade 4 on the grey scale until all standards and/or specimens exhibit a difference in colour between the exposed and unexposed portions equal to Grade 4 on the grey scale.

5.2 For exposures employing a standard sample

5.2.1 Mount the standard sample and one or more test specimens on cardboard as shown in Figure 2 with an opaque cover across one-half of each of the standard and test specimens. Where a large number of specimens are to be exposed they may be mounted in the same manner on as many additional cards as are necessary.

5.2.2 Follow the effect of daylight by frequently removing the cover and inspecting the standard. Continue the exposure until the standard sample is equal to the contrast between the two grey colour chips illustrating Grade 4 on the grey scale. Remove both the standard and the specimens.

5.3 Additional recommended practices applicable to all of the above procedures

5.3.1 Alternatively, when desired, a second set of standards and specimens may be exposed until a grey scale Grade 3 colour change is obtained between the covered portion and the exposed area.

5.3.2 Compare the covered portion of each exposed standard and specimen with a corresponding piece which has not been in the exposure cabinet. A difference in colour between original material and the covered portion of the exposed specimen indicates that the textile has been affected by some agent other than light, such as heat or a reactive gas in the atmosphere. Note this fact in the report of the test.

5.3.3 In many cases, high humidity in combination with atmospheric contaminants have been found to produce colour changes as great as those produced by light. It is therefore recommended that a duplicate set of test specimens and standards mounted on cardboard, but not masked, be exposed simultaneously in another cabinet of the same type as used in the daylight exposures but with the glass covered with an opaque material so that the light is excluded. Since there is a combined effect of light, temperature, humidity and atmospheric contaminants, it cannot be assumed that a comparison between specimens exposed in the covered cabinet, and in the uncovered cabinet under glass, will permit separating the effects produced by light only. However, a comparison of the two sets of specimens with a piece of the original textile which has not been in an exposure cabinet will indicate whether a material is sensitive to moisture and atmospheric contaminants and may help to explain why differences occur in the relationship between the specimens and the standards in daylight exposures made at different times and at different locations.

5.4 Classification based on light fastness standards

5.4.1 Classify the colour fastness to light of a dyestuff by classifying the fastness of dyeings made from it and indicate the kind of fibre to which it was applied, the method of application, strength of dyeing, and nature of finishing treatments, if any.

5.4.2 Where different classifications are obtained at the grey scale Grades 4 and 3 levels of colour change, report the average of these as the light fastness classification.

5.4.3 Classify the colour fastness to light according to the following :

Less colour change than standard	Equal but no greater change in colour than standard	More colour change than standard	The light fastness is class
—	—	L2	1
—	L2	L3	2
L2	—	L3	2-3
—	L3	L4	3
L3	—	L4	3-4
—	L4	L5	4
L4	—	L5	4-5
—	L5	L6	5
L5	—	L6	5-6
—	L6	L7	6
L6	—	L7	6-7
—	L7	L8	7
L7	—	L8	7-8
—	L8	L9	8
L8	—	L9	8-9
—	L9	—	9

5.5 Classification based upon a standard sample

When the agreed-upon standard sample and the specimen have been exposed together until the standard has a change in colour equal to Grade 4 on the grey scale, the fastness is classified "satisfactory" if the specimen shows no greater change in colour than the standard; "unsatisfactory" if the specimen has a greater change in colour than the standard.

6.2.3 The amount of colour change in terms of the grey scale produced by simultaneous exposure in a covered cabinet when compared with the original sample which has not been placed in the cabinet.

6.2.4 Any variation from the specified conditions.

6 REPORT

6.1 Report the numerical ratings for the change in colour for the test specimen, the method employed and the date and location of the exposure.

6.2 When available, include in the report the following :

6.2.1 Daily air temperatures and relative humidities.

6.2.2 Any differences observed between covered portions of the test specimen and the original sample which has not been placed in the cabinet.

7 NOTES

7.1 The eight Light Fastness Standards¹⁾ are specially prepared by blending varying proportions of wool dyed with C.I. Mordant Blue 1 (C.I. 43830), and wool dyed with C.I. Solubilized Vat Blue 8 (C.I. 73801), so that each higher numbered standard is approximately twice as fast as the preceding standard. The two primaries are specially dyed and the blending proportions adjusted so that repeat productions of the standards have the same fading characteristics. It has been found in repeat production of the standards that the amount of each dye and the proportion of the fugitive and fast dyed primaries must be adjusted to obtain the same fading behaviour in the various standards. The dyeing strengths of the two primaries and the blending proportions are intentionally omitted.

1) Available from American Association of Textile Chemists and Colorists P.O. Box 12215, Research Triangle Park, North Carolina 27709, U.S.A.

7.2 The glass shall be 2,0 to 2,5 mm thick, free from bubbles or other imperfections, with a lower cut-off at approximately 310 nm with an increase in transmission to approximately 90 % at 370 to 380 nm. This glass is described in the manufacturers' catalogues as transmitting a minimum of 77 % ultraviolet, 90 % Illuminant C (average daylight) at 85 % total radiation. Transmittance curves of two panels secured from dealer stock showed no transmittance below 310 nm, close to a straight-line rise to 90 % at 370 to 380 nm and 90 % transmittance in the visible region to 700 nm.

7.3 Cardboard, 41 kg*) White Index Bristol, 160 g/m²**) obtainable from stationery stores and dealers in artists' supplies. The cover must make tight contact with the specimens, and when removed temporarily, must be replaced in exactly the same position as before.

7.4 For use in measuring temperature and relative humidity of the air in the vicinity of test cabinets, any suitable indicating or recording instruments may be used. Continuous recording of temperature and relative humidity is preferable.

7.5 The term *change in colour* includes not only true "fading" i.e. destruction of dyes, but also changes in hue, depth, brightness, or any combination of these characteristics of colour. If the difference in colour is a change of hue or brightness, this can be indicated by adding abbreviations, as follows, to the numerical colour fastness rating :

Bl. = Bluer	G = Greener	R = Redder
Y = Yellower	Br. = Brighter	D = Duller

If the change in hue is accompanied by a change in depth, this can also be indicated by the abbreviations :

W = Weaker	Str. = Stronger
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* U.S.A. designation of the mass of the board.

** Designation of the grammage in accordance with ISO/R 536, *Determination of paper substance*.