BRITISH STANDARD

BS 1006:1990

Incorporating Amendments Nos 1, 2, 3, 4 and 5

Methods of test for

Colour fastness of textiles and leather

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Textiles and Clothing Standards Policy Committee (TCM/-) to Technical Committee TCM/24, upon which the following bodies were represented:

Association of Consulting Scientists
British Nonwovens Manufacturers' Association
British Polyolefin Textiles Association
British Textile Machinery Association
British Textile Technology Group
Confederation of British Wool Textiles Ltd.

The detailed preparation of this British Standard was carried out by the Society of Dyers and Colourists and the Society of Leather Technologists and Chemists.

Council of British Cotton Textiles (Cbct)
International Wool Secretariat
Man-Made Fibres Producers' Committee
Ministry of Defence
North East Lancashire Textile Manufacturers' Association
SATRA Footwear Technology Centre
Soap and Detergent Industry Association
Society of Dyers and Colourists
Textile Finishers' Association
Textile Institute

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Contents

Foreword

This British Standard has been prepared under the direction of the Textiles and Clothing Standards Policy Committee and is a revision of BS 1006:1978, which is withdrawn.

The principal changes introduced in this revision are as follows.

a) The following new methods are included:

A04, F07, F08, F09, F10 and G04.

The instrumental method for assessing degree of staining of adjacent fabrics (A04) is an alternative to the grey scale (A03) and may be used in all tests where technically feasible.

b) The following methods have been revised:

B01, C01, C02, C03, C04, C05, E01, E02, E04, E05, E06, E07, E09, E12, UK-TB, UK-TI and UK-TJ.

These methods introduce use of the multifibre adjacent fabric (F10).

c) The following methods have been deleted:

X03, UK-TC, UK-TD and UK-TF.

d) With the exception of the methods described in Groups UK-T and UK-L, the text of this British Standard is identical to ISO 105 "*Textiles — Tests for colour fastness*", published by the International Organization for Standardization (ISO). In due course it is expected that ISO 105 will be proposed for adoption as a European Standard and this change has therefore been made in preparation for this. For ease of production the ISO text has been used. The editorial style varies to a certain extent since the Parts of ISO 105 were published over a 12-year period. ISO 105: Parts G, N, P, S and Z are currently being revised and when published will be incorporated in this British Standard.

e) As a consequence of the above change, additional procedures for the following methods, which are applicable to leather, have been included in an introduction to UK-L:

B01, B02, D01, E07. Also in several methods additional information previously included in BS 1006 has been retained.

Amendment No. 1 introduced revised methods in the UK-L group.

f) Certain text or additional information has been retained as national appendices for E03, E07, C06 and X14.

Laboratories carrying out the tests described in this standard should comply with local and national regulations.

The majority of the methods in this standard are based directly on the work of the Society of Dyers and Colourists to whom we are indebted. The majority of the methods for leather have been developed by the Society of Leather Technologists and Chemists and have been adopted by the International Union of Leather Technologists and Chemists Societies (IULTCS).

Following a decision by CEN/TC 248 "Textiles and textile products" to propose all published Parts of ISO 105 for adoption as European Standards, several methods have been adopted as European Standards and published separately under the BS EN 20105 identifier. These methods are identical to the equivalent methods in this British Standard, which are therefore being retained for ease of use for the time being.

Readers should consult the BSI Catalogue for a complete list of all published Parts of BS EN 20105, since in future it is expected that new or revised methods, that are not in accordance with the methods in BS 1006, will be adopted as European Standards. At that time, any conflicting methods in this British Standard will be withdrawn by amendment.

Sources of supply

For details of sources of supply of the apparatus and reference materials apply to the BSI Information Centre, British Standards House, 389 Chiswick High Road, London W4 4AL.

Cross-reference

International standard	Corresponding British Standard
ISO 3072:1975	BS 3568:1988 Method for determination of solubility of wool in alkali (Technically equivalent)

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to xii, pages 1 to 104, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

A04. Method for the instrumental assessment of the degree of staining of adjacent fabrics

NOTE See foreword for information on applicability of this method.

1 Scope

This part of ISO 105 specifies an instrumental method for assessing the degree of staining of adjacent fabrics in any fastness test, as an alternative to the visual method.

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 agreements 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 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

ISO 105-J01:1989, *Textiles — Tests for colour fastness — Part J01: Measurement of colour and colour differences.*

3 Principle

The colour of an adjacent fabric which has been subjected to a fastness test in contact with the fabric under test and that of a specimen of the adjacent fabric which has been subjected to the fastness test in the absence of the fabric under test are measured. The colour difference between them is calculated in CIELAB units and converted to a staining-scale rating by means of a simple equation.

4 Apparatus

Spectrometer or *colorimeter*, capable of measuring the colour of a specimen of the size of one stripe in a multifibre adjacent fabric (see ISO 105-F10) and which irradiates the specimen with light resembling that of standard illuminant D_{65} or standard illuminant C.

5 Test specimen

Mount the adjacent fabric which has been subjected to a fastness test, together with a specimen of the adjacent fabric which has been subjected to the fastness test in the absence of the fabric under test, on non-optically-brightened white card stock.

6 Procedure

6.1 Measure the colour of the piece of adjacent fabric which has been subjected to the fastness test in the absence of the fabric under test.

6.2 Measure the colour of the adjacent fabric which has been subjected to the fastness test as part of a composite specimen. If the staining is uneven, several measurements shall be made and the arithmetic mean value employed in the calculations. If the instrument permits different viewing geometries to be used, the preferred method is to include the specular component.

6.3 Calculate the colour difference ΔE_{CIELAB} and the magnitude of the lightness difference ΔL_{CIELAB} between the adjacent fabrics, as described in **6.1** and **6.2**, to two places of decimals. Either of two CIE instrument geometries may be used:

a) sphere (d/0°), specular included;

b) 0°/45° or 45°/0°.

Calculations shall be performed using the CIE 10° observer and illuminant D_{65}, with the 2° observer and illuminant C being a permitted alternative.

6.4 Calculate, to two places of decimals, the grey-scale difference ΔE_{GS} equivalent to ΔE_{CIELAB} using the following equation:

$$\Delta E_{GS} = \Delta E_{CIELAB} - 0,4\sqrt{(\Delta E^{*2} - \Delta L^{*2})}$$

6.5 Calculate, to two places of decimals, the staining-scale rating (SSR) using one of the following equations:

Ratings 1 to 4 $\quad SSR = 6,1 - 1,45 \ln (\Delta E_{GS})$

If SSR is greater than 4, recalculate using the following equation:

Ratings 4 to 5 $\quad SSR = 5 - 0,23\ \Delta E_{GS}$

6.6 Determine from Table 1 the staining-scale rating to be reported.

Table 1 — Staining-scale rating

Calculated SSR	Reported SSR
5,00 to 4,75	5
4,74 to 4,25	4-5
4,24 to 3,75	4
3,74 to 3,25	3-4
3,24 to 2,75	3
2,74 to 2,25	2-3
2,24 to 1,75	2
1,74 to 1,25	1-2
< 1,25	1

7 Test report

Include the staining-scale rating (instrumental) from Table 1 and a reference to this part of ISO 105 in the test report of the colour fastness test concerned.

Group B. Colour fastness to light and weathering

B01. Colour fastness to light: Daylight

NOTE This method is applicable to leather. See introduction to UK-L.

1 Scope

1.1 This part of ISO 105 specifies a method intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of daylight.

1.2 If there is a possibility of the sample being photochromic, then the test for photochromism shall be applied additionally (see ISO 105-B05).

1.3 This method employs two sets of blue wool references. The results from the two sets of references may not be identical.

NOTE General information on colour fastness to light is given in Annex A.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-B05:1988, *Textiles — Tests for colour fastness — Part B05: Detection and assessment of photochromism.*

3 Principle

A specimen of the textile is exposed to daylight under prescribed conditions, including, protection from rain, along with eight dyed wool references. The colour fastness is assessed by comparing the change in colour of the specimen with that of the references.

4 Reference materials and apparatus

4.1 Reference materials

Two sets of blue wool references may be used. The two sets of references are not interchangeable. The correlation between the two sets of blue wool references, illustrated in Figure 1, shall not be used to convert ratings obtained from exposure based on one set of references to the other.

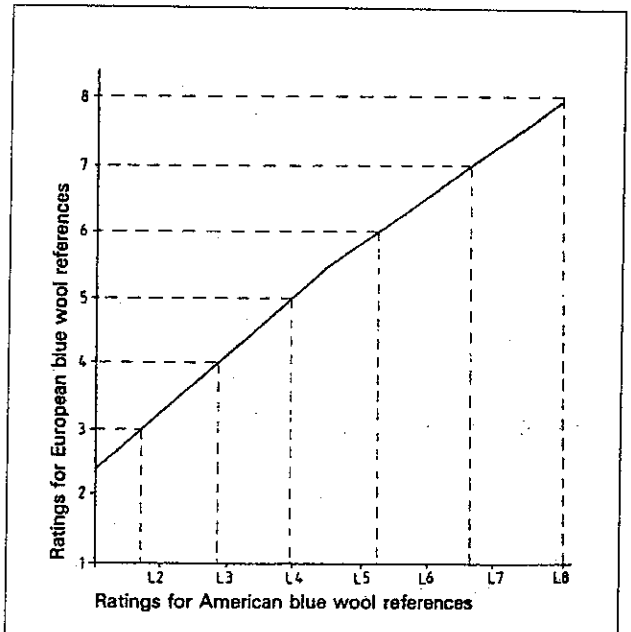


Figure 1 — Correlation of blue wool references for exposure to daylight

4.1.1 *References 1 to 8*

Blue wool references developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in Table 1. They range from 1 (very low colour fastness) to 8 (very high colour fastness) (see **9.1**).

Table 1 — Dyes for blue wool references 1 to 8

Reference	Dye — Colour index designation[a]
1	CI Acid Blue 104
2	CI Acid Blue 109
3	CI Acid Blue 83
4	CI Acid Blue 121
5	CI Acid Blue 47
6	CI Acid Blue 23
7	CI Solubilized Vat Blue 5
8	CI Solubilized Vat Blue 8

[a] The Colour Index (Third edition) is published by the Society of Dyers and Colourists, P.O. Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, West Yorks., United Kingdom, and by the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, North Carolina 27709, USA.

4.1.2 *References L2 to L9*

Blue wool references developed and produced in America are identified by the letter L followed by the numerical designation 2 to 9. These eight references are specially prepared by blending varying proportions of wool dyed with CI Mordant Blue 1 (Colour Index, Third edition, 43830) and wool dyed with CI Solubilized Vat Blue 8 (Colour Index, Third edition, 73801), so that each higher-numbered reference is approximately twice as fast as the preceding reference (see **9.2**).

Figure 2 and Figure 3 illustrate mounting of the blue wool references, but do not show any numerical or performance relationship between the two sets of references.

4.2 Apparatus

4.2.1 *Exposure rack*, facing south in the Northern hemisphere, 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, including any framing, will not fall on the exposed materials and constructed so that the latter are firmly held. There shall be adequate ventilation 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 transparency of the glass used shall be at least 90 % between 380 nm, and 750 nm, falling to 0 % between 310 nm and 320 nm.

The minimum permissible distance between the glass and the surface of the specimens is 5 cm. In order to minimize shadows 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.

4.2.2 *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.

4.2.3 *Grey scale for assessing change in colour*, in accordance with ISO 105-A02.

5 Test specimen

5.1 An area of the material not less than 1 cm × 6 cm is used for method 1 (see **6.1**) or 1 cm × 10 cm for method 2 (see **6.2**) so that each exposed portion is not less than 1 cm × 2 cm. 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 or specimens to be tested and the similar strips of the references may be mounted on a card in an arrangement as indicated in Figure 2 or Figure 3 (see **6.1** or **6.2**).

5.3 The specimens to be tested and the blue strips of the references shall be of equal size and shape in order to avoid errors in assessment due to over-rating the visual contrast between exposed and unexposed parts on a larger pattern as against narrower references.

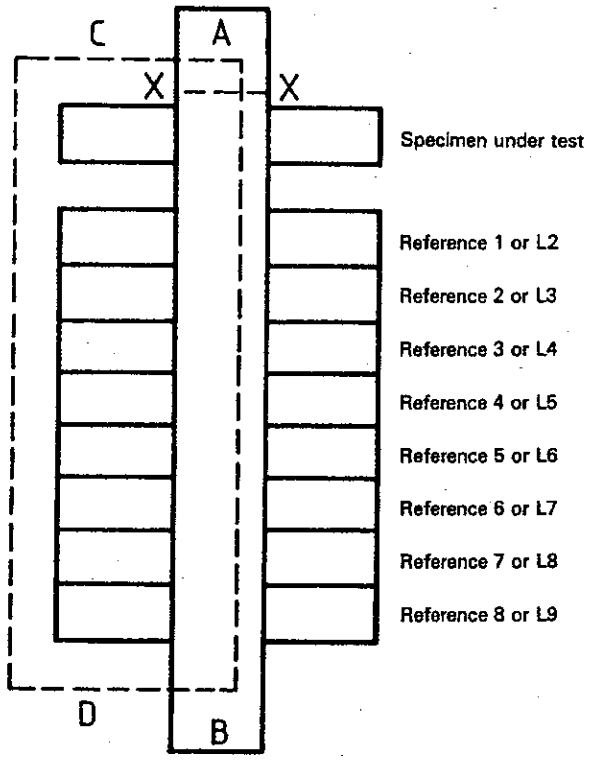
6 Procedure for mounting, exposure and preliminary assessment of colour fastness

Expose the specimen (or group of specimens) and the references simultaneously for 24 h per day under the conditions described in **4.2.1**, in such a manner and for such times as are necessary to evaluate fully the colour fastness of each specimen relative to that of the references, by successively covering the specimens and exposed references throughout the duration of the test. Four suggested methods follow.

6.1 Method 1

6.1.1 This method is considered the most satisfactory and shall be used in cases of dispute over the numerical rating. The basic feature is the control of the exposure periods by inspection of the *specimen* and, therefore, one set of references is required for each specimen under test.

6.1.2 Arrange the specimen to be tested and the references as shown in Figure 2 with an opaque cover AB across the middle one-third of the specimen and references. Expose to daylight under the conditions described in **4.2.1**. Follow the effect of light by removing the cover AB and inspecting the specimen frequently. When a change can be perceived equal to grey scale 4–5, note the number of the reference showing a similar change. (This is a preliminary assessment of colour fastness.) At this stage attention shall be given to the possibility of photochromism (see ISO 105-B05).



AB: Opaque cover.

May be hinged at X-X so that it can be lifted and returned to the same place over the specimen and references.

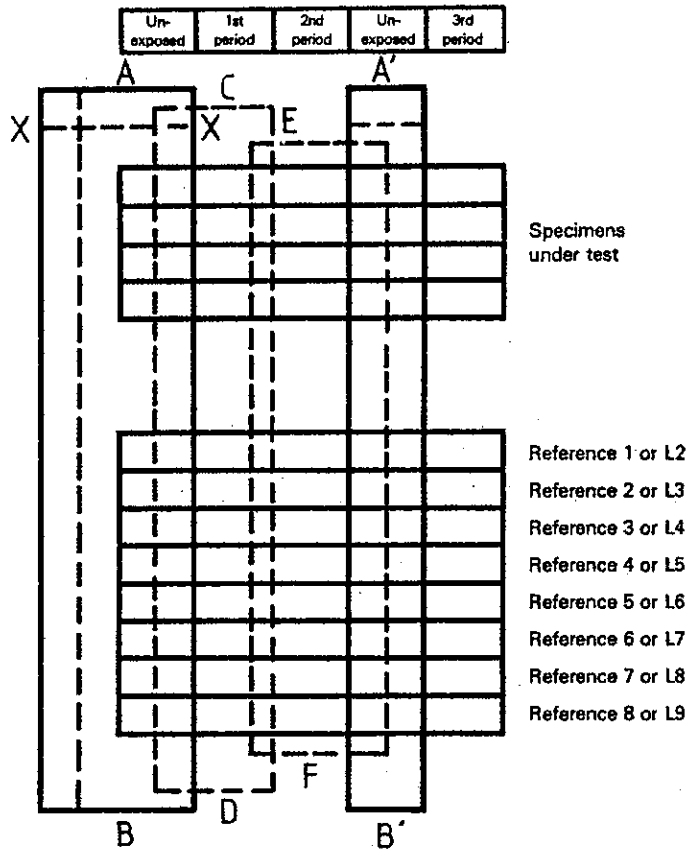
CD: Second cover.

Figure 2 — Mounting for method 1

6.1.3 Continue to expose until the contrast between the exposed and the unexposed portions of the specimen is equal to grey scale grade 4. Cover a second one-third of the specimen and references with an additional opaque cover (CD in Figure 2).

6.1.4 Continue to expose until the contrast between the fully exposed and unexposed portions is equal to grey scale grade 3.

6.1.5 If Reference 7 or L7 fades to a contrast equal to grey scale grade 4 before the specimen does, the exposure may be terminated at this stage. When a specimen has a colour fastness equal to or greater than 7 or L7, it would require unduly long exposure to produce a contrast equal to grey scale grade 3; moreover, this contrast would be impossible to obtain when the colour fastness is 8 or L9. Assessments in the region of 7 to 8 or L7 to L9 are made, therefore, when the contrast produced on Reference 7 or L7 is equal to grey scale grade 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.



AB and A′B′: Opaque covers.

AB may be hinged at X-X so that it can be lifted and returned to the same place over the specimens and references.

CD: Third cover.

EF: Fourth cover.

Figure 3 — Mounting for method 2

6.2 Method 2

6.2.1 This method is intended for use when a large number of specimens have to be tested simultaneously. The basic feature is the control of the exposure period by inspection of the *references*, which allows a number of specimens differing in colour fastness to be tested against a single set of references, thus conserving supplies.

6.2.2 Arrange the specimens to be tested and the references as shown in Figure 3, with covers A′B′ and AB each covering one-fifth of the total length of each specimen and reference. Expose to daylight under the conditions described in **4.2.1**. Follow the effect of light by lifting cover AB periodically and inspecting the references. When a change in Reference 3 or L2 can be perceived equal to grey scale grade 4–5, inspect the specimens and rate their colour fastness by comparing any change that has occurred with the changes that have occurred in References 1, 2 and 3 or L2. (This is a preliminary assessment of colour fastness.) At this stage attention shall be given to the possibility of photochromism (see ISO 105-B05).

6.2.3 Replace the lifted cover AB in exactly the same position and continue to expose until a change in Reference 4 or L3 can be perceived equal to grey scale grade 4–5; at this point fix an additional cover CD in the position shown in Figure 3, overlapping the cover AB.

6.2.4 Continue to expose until a change in colour in Reference 6 or L5 can be perceived, equal to grey scale grade 4–5; then fix the final cover EF in the position shown in Figure 3, the other three covers remaining in position.

6.2.5 Expose until either

a) a contrast is produced on Reference 7 or L7 equal to the contrast illustrated by grey scale grade 4; or

b) a contrast equal to grey scale grade 3 is produced on the most resistant specimen,

whichever occurs first.

6.3 Method 3

Where the test is to be used to check conformity with a performance specification, it is permissible to expose the specimens with two references only: that specified as minimum and the one below it. Continue exposure until grey scale grade 4 and grey scale grade 3 contrasts have been produced on separate areas of the minimum reference.

6.4 Method 4

Where the test is to be used to check conformity with an agreed reference sample, it is permissible to expose the specimens with the reference sample only. Continue exposure until grey scale grade 4 and/or grey scale grade 3 contrasts have been produced on the reference sample.

7 Assessment of fastness to light

7.1 The final assessment in numerical ratings is based on contrasts equal to grey scale grade 4 and/or grade 3 between exposed and unexposed portions of the specimen.

7.2 Remove all the covers, thus revealing on specimens and references two or three areas, depending on the method used, which have been exposed for different times, together with at least one area which has not been exposed to light. Compare, under suitable illumination (see ISO 105-A01:1989, clause **14**), the changes of the specimen with the relevant changes of the references. The colour fastness of the specimen is the number of the reference which shows similar changes in colour (visual contrast between exposed and unexposed parts of the specimen). If the specimen shows changes in colour which are nearer to the imaginary reference midway between any two consecutive references than they are to either of the two consecutive references, the intermediate rating, for example 3–4 or L2–L3, shall be given.

If different assessments are obtained at the different degrees of contrast, the colour fastness of the specimen is the arithmetic mean of these expressed to the nearest whole or half grade. When three areas are being rated, take the mean of the contrasts closest to grades 4 and 3. Assessments, however, shall be confined to whole or midway ratings only. When the arithmetic mean gives a quarter or three-quarter rating, the assessment is defined as the next higher half or whole grade.

In order to avoid a misrating of the colour fastness of the specimen due to photochromism, the specimens shall be allowed to condition in the dark at room temperature for 24 h before the colour fastness is assessed (see ISO 105-B05).

7.3 If the colour of the specimen is more fugitive than that of Reference 1 or L2, a rating of 1 or L2 is given.

7.4 Comparison of the changes in the specimen with changes in the references may be facilitated by surrounding the specimen with a mask of neutral grey colour approximately midway between the lighter chips in grades 1 and 2 (approximately Munsell N5) and surrounding the references in turn with a similar mask of equal aperture.

7.5 If the colour fastness is equal to or higher than 4 or L3, any preliminary assessment based on the contrast equal to grey scale 4–5 (see **6.1.2** and **6.2.2**) becomes significant; if this preliminary assessment is 3 or L2, it shall be included in the rating in brackets. For example, a rating of 6(3) indicates that the specimen changes very slightly in the test when Reference 3 just begins to fade, but that on continuing the exposure the resistance to light is equal to that of Reference 6.

7.6 If the specimen is photochromic, the colour fastness rating shall include a P bracketed with the rating obtained from the test for photochromism, for example 6(P3-4) (see ISO 105-B05).

7.7 The term "change in colour" includes changes in hue, depth, brightness, or any combination of these characteristics of colour (see ISO 105-A02:1987, sub-clause 2.6).

8 Test report

8.1 For method 1 or 2

Report the numerical rating for colour fastness to light. The fastness rating shall be expressed either

a) by the figure alone (when using the references designated 1 to 8); or

b) together with the prefix L (when using the references designated L2 to L9).

If the rating is equal to or higher than 4 or L3 and the preliminary assessment is equal to or lower than 3 or L2, report the latter figure in brackets. If the specimen is photochromic, the colour fastness shall be followed by a P bracketed together with the grey scale rating.

8.2 For method 3 or 4

Report the classification "satisfactory" or "unsatisfactory" together with the performance reference or the reference sample used.

8.3 For all methods

Report the method used and the exposure conditions.

9 Notes

9.1 The colour fastness references 1 to 8 are specially dyed to match a master set of references in colour and in fading behaviour. It has been found that, when repeated dyeings of the blue dyed references are made, the amount of dye required to match the previous lot is often different from that originally used. The dyeing strengths would, therefore, be misleading and they are intentionally omitted from the listing in Table 1.

9.2 In the colour fastness references L2 to L9, the two primaries are specially dyed and the blending proportions adjusted so that repeat productions of the references have the same fading characteristics. It has been found in repeat production of the references that the amount of each dye and the proportion of the fugitive and fast-dyed primaries needs to be adjusted to obtain the same fading behaviour in the various references. The dyeing strengths of the two primaries and the blending proportions are intentionally omitted.

Annex A (informative) General information on colour fastness to light

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 needs to 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 out-living 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.

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

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.

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.

Annex B (informative) Bibliography

B.1 References to publications relating to the spacing of references 1 to 8

[1] RICKETTS, R.H., *J. Soc. Dyers & Col.*, 1952, **68**, 200.

[2] RAWLAND, 0., *J. Soc. Dyers & Col.*, 1963, **79**, 697.

[3] JAECKEL, S.M., *et al, J. Soc. Dyers & Col.*, 1963, **79**, 702.

[4] MCLAREN, K., *J. Soc. Dyers & Col.*, 1964, **80**, 250.

B.2 Other International Standards dealing with the colour fastness of textile dyeings to light and weathering

[5] ISO 105-B02:1988, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test.*

[6] ISO 105-B02:1988, *Textiles — Tests for colour fastness — Part B03: Colour fastness to weathering: Outdoor exposure.*

[7] ISO 105-B04:1988, *Textiles — Tests for colour fastness — Part B04: Colour fastness to weathering: Xenon arc.*

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

NOTE This method is applicable to leather. See introduction to UK-L.

1 Scope and field of application

1.1 This part of ISO 105 specifies a method intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of an artificial light source representative of natural daylight (D_{65}). The method is also applicable to white (bleached or optically brightened) textiles.

1.2 If there is a possibility of the sample being photochromic, then the test for photochromism shall be applied additionally (see ISO 105-B05).

1.3 This method employs two sets of Blue Wool References. The results from the two sets of references may not be identical.

NOTE General information on colour fastness to light is given in Annex C.

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 B05: Detection and assessment of photochromism.*

CIE Publication No. 51, *Method for assessing the quality of daylight simulators for colorimetry.*

3 Principle

A specimen of the textile is exposed to artificial light under prescribed conditions, along with Blue Wool References. There are two different sets of Blue Wool References which are not interchangeable. The colour fastness is assessed by comparing the change in colour of the specimen with that of the references used.

For white (bleached or optically brightened) textiles the fastness is assessed by comparing the change of whiteness of the specimen with that of the references used.

4 Reference materials and apparatus

4.1 Reference materials

Two sets of Blue Wool References may be used. The two sets of references are not interchangeable.

4.1.1 *References 1 to 8*

Blue Wool References developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in the table. They range from 1 (very low light fastness) to 8 (very high light fastness) so that each higher numbered reference is approximately twice as fast as the preceding one.

Table — Dyes for Blue Wool References 1 to 8

Reference	Dye — Colour Index designation[a]
1	CI Acid Blue 104
2	CI Acid Blue 109
3	CI Acid Blue 83
4	CI Acid Blue 121
5	CI Acid Blue 47
6	CI Acid Blue 23
7	CI Solubilized Vat Blue 5
8	CI Solubilized Vat Blue 8

[a] *The Colour Index* (Third edition) is published by the Society of Dyers and Colourists, P.O. Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, West Yorks., United Kingdom, and by the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, North Carolina 27709, USA.

4.1.2 *References L2 to L9*

Blue Wool References developed and produced in America are identified by the letter L followed by the numerical designation 2 to 9. These eight references are specially prepared by blending varying proportions of wool dyed with CI Mordant Blue 1 (Colour Index, Third edition, 43830) and wool dyed with CI Solubilized Vat Blue 8 (Colour Index, Third edition, 73801), so that each higher numbered reference is approximately twice as fast as the preceding reference.

The relationship shown in Figure 1 and Figure 2 between the two sets of Blue Wool References is a numerical rather than a performance relationship.

4.1.3 *Humidity test control*

The humidity test control is a red azoic dyed cotton cloth (see **9.3**).

4.2 Apparatus

4.2.1 *Xenon arc lamp apparatus*, either air-cooled or water-cooled.

The specimens and the references are exposed in one of the two types of apparatus (see **4.2.1.1** and **4.2.1.2**). The variation of the light intensity over the area covered by the specimens and references shall not exceed ± 10 % of the mean.

The distance from the surface of the specimen and that of the references to the lamp shall be the same.

4.2.1.1 *Air-cooled xenon arc lamp apparatus* (see Annex A), consisting of the following elements:

a) *Light source*, in a well ventilated exposure chamber.

The light source is a xenon arc lamp of correlated colour temperature 5 500 to 6 500 K.

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

c) *Heat filter*. The spectrum of the xenon arc contains an appreciable amount of infra-red radiation which shall be minimized by heat filters (see **9.1**, **A.1.1** and **A.2.2**).

d) *Exposure conditions*. (The light fastness ratings mentioned below are obtained with the Blue Wool References 1 to 8 only):

1) Normal conditions (temperate zone): moderate effective humidity (see **9.3**); light fastness of the humidity test control: 5; maximum black panel temperature: 45 °C (see **9.2**).

2) Extreme conditions: For testing sensitivity of specimens to different humidity during irradiation, the following extreme conditions are useful:

— low effective humidity; light fastness of the humidity test control: 6 to 7; maximum black panel temperature: 60 °C (see **9.2**);

— high effective humidity; light fastness of the humidity test control: 3; maximum black panel temperature: 40 °C (see **9.2**).

4.2.1.2 *Water-cooled xenon arc lamp apparatus* (see Annex B), consisting of the following elements:

a) *Light source*, in a well ventilated exposure chamber.

Light sources are long-life xenon arc lamps of various sizes depending on the size of the apparatus (see **B.1.1** and **B.2.1**).

b) *Light filter*. Inner and outer filter glass containing and directing the flow of cooling water. An inner filter of Pyrex (borosilicate) glass and an outer filter of clear (soda-lime) glass are used so that the irradiation at the specimen has a lower spectral cut-off at approximately that of window glass (see **B.1.2**).

c) *Heat filter*. Distilled or deionized water circulating through the lamp assembly between the inner and outer filter glass, cooled by passing through a heat-exchange unit (see **B.1.4**).

d) *Exposure conditions*. Black panel temperature 63 ± 1 °C (see **9.2**), controlled by continuous operation of the blower with thermostatic control of the temperature of a constant volume of air, whose relative humidity is increased by adding moisture to the air as it passes through the conditioning chamber by means of an electrically operated atomizer; the controls of the apparatus are adjusted so that the relative humidity of the air in the test chamber is (30 ± 5) %.

Effective humidity: low.

Light fastness of the humidity test control: 6-7.

4.2.2 *Opaque cardboard*, or other thin opaque material, for example thin sheet aluminium or cardboard covered with aluminium foil.

4.2.3 *Black panel thermometer* (see **9.2**).

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

4.2.5 *Colour matching lamp*, complying with CIE Publication No. 51, for assessment of the change in whiteness.

5 Test specimens

Depending on the number of specimens to be tested and on the shape and dimensions of the specimen holders supplied with the apparatus, the size of the specimen may vary.

5.1 In apparatus of the air-cooled type, usually an area of the textile not less than 4,5 cm × 1 cm is used when several periods of exposure are made side by side on the same specimen, which is the preferred practice. 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. Each exposed and unexposed area shall be not less than 10 mm × 8 mm.

5.2 To facilitate handling, the specimen or specimens to be tested and the similar strips of the references may be mounted on one or more cards as indicated in Figure 1 or Figure 2.

5.3 In apparatus of the water-cooled type, specimen holders are fitted to take specimens of approximately 7 cm × 12 cm. When desired, specimens of different sizes to fit alternative sizes of specimen holder may be used. The covers shall make close contact with the surface of the unexposed areas of the specimens and the references in order to give a sharp line of demarcation between exposed and unexposed areas but shall not compress the specimen unnecessarily. L references shall be exposed on a white cardboard backing. Specimens may also be mounted on white cardboard if desired.

5.4 The specimens to be tested and the Blue Wool References shall be of equal size and shape in order to avoid errors in an assessment due to overrating the visual contrast between exposed and unexposed parts on a larger pattern as against narrower references (see **7.4**).

5.5 When testing pile fabrics, the references shall be arranged in such a way that they are the same distance from the light source as the surface of the pile fabrics. This can be achieved for example by using pieces of cardboard as underlay. Note that covers for the unexposed portions shall avoid surface compression.

6 Procedure

6.1 Adjustment of the humidity conditions (see 4.2.1.1 and 4.2.1.2)

6.1.1 Check that the apparatus is in good running order and that it is equipped with a clean xenon burner tube. (Follow the manufacturer's directions and see **A.1.3**, **B.1.1**, **B.1.2**, **B.1.3** and **B.1.4**.)

6.1.2 Place a portion of the humidity test control of an area not less than 4,5 cm × 1 cm, together with the light fastness references, on to a card, if possible in the middle area of the sample holder (see **5.2**).

6.1.3 Place the filled specimen holders on the specimen rack of the apparatus with the holders supported both top and bottom, and in proper vertical alignment. Completely fill all remaining spaces in the specimen rack with holders containing white cardboard.

6.1.4 Operate the apparatus with the light on continuously until a test is completed unless the lamp requires cleaning, or the burner, outer filter or inner filter requires changing because they have reached the maximum number of hours of recommended usage.

6.1.5 Proceed to expose the partially covered strip of the humidity test control and the references simultaneously until a contrast between the exposed and unexposed portions equal to grade 4 on the grey scale is produced on the humidity test control.

6.1.6 Assess the light fastness of the humidity test control at this stage and, if necessary, adjust the controls on the apparatus to give the selected exposure conditions. Check daily and when necessary re-adjust the controls to maintain the specified black panel temperature and humidity [see **4.2.1.1** d) and **4.2.1.2** d)].

6.2 Exposure methods

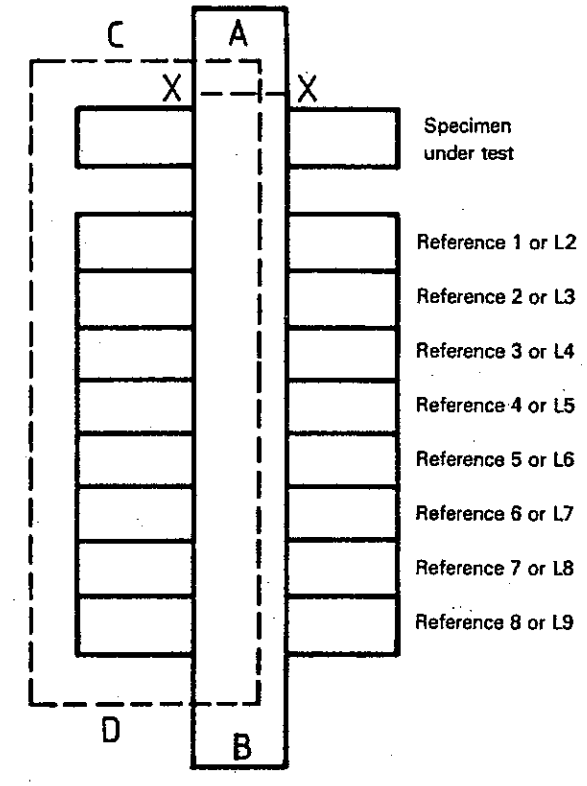
Expose the specimen (or group of specimens) and the references simultaneously, under the desired conditions, in such a manner and for such a time as is necessary to evaluate fully the light fastness of each specimen relative to that of the references, by progressively covering both the specimens and the exposed references during the test (either by method 1 or by method 2).

6.2.1 *Method 1*

6.2.1.1 This method is considered most exact and should be used in cases of dispute over the numerical rating. The basic feature is the control of the exposure period by inspection of the *specimen* and therefore only one set of references is required for each specimen under test.

6.2.1.2 Arrange the specimen to be tested and the references as shown in Figure . with an opaque cover AB across the middle one third of the specimen and references. Expose to the xenon arc light under the conditions enumerated in **4.2.1.1** or **4.2.1.2**. Follow the effect of light by removing the cover and inspecting the specimen frequently. When a change can be perceived equal to grey scale 4–5, note the number of the references showing a similar change. (This is preliminary assessment of light fastness.) At this stage attention should be given to the possibility of photochromism (see ISO 105-B05).

For all specimens except for white (bleached or optically brightened) specimens, continue the procedure as described in **6.2.1.3** to **6.2.1.5**. For optically brightened textiles, continue with the procedure as described in **6.2.1.6**.



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned to the same place over the specimen and references.

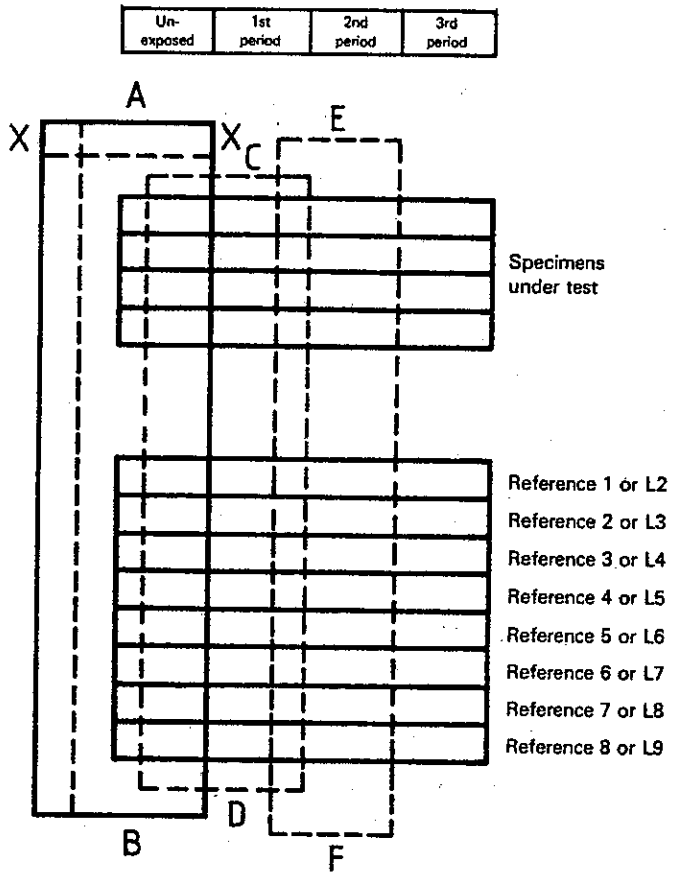
CD: Second cover.

Figure 1 — Mounting for method 1

6.2.1.3 Continue to expose until the contrast between the exposed and the unexposed portions of the specimen is equal to grey scale grade 4. Cover the left-hand one-third of the specimen and references with an additional opaque cover (CD in Figure 1).

6.2.1.4 Continue to expose until the contrast between the fully exposed and unexposed portions of the specimen is equal to grey scale grade 3.

6.2.1.5 If Reference 7 or L7 fades to a contrast equal to grey scale grade 4 before the specimen does, the exposure is terminated at this stage. When a specimen has a light fastness equal to or greater than 7 or L7, it would require unduly long exposure to produce a contrast equal to grey scale grade 3; moreover, this contrast would be impossible to obtain when the light fastness is 8 or L8. Assessments in the region of 7-8 or L7-L8 are made, therefore, when the contrast produced on Reference 7 or L7 is equal to grey scale 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned to the same place over the specimen and references.

CD: Second cover.

EF: Third cover.

Figure 2 — Mounting for method 2

6.2.1.6 For white (bleached or optically brightened) textiles, continue to expose until the contrast between the exposed and unexposed portions of the specimen is equal to grey scale grade 4. If Reference 7 or L7 fades to a contrast equal to grey scale grade 4 before the specimen does, the exposure is terminated at this stage. Assessments in the region of 7–8 or L7–L8 are made, therefore, when the contrast produced on Reference 7 or L7 is equal to grey scale grade 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.

6.2.2 *Method 2*

6.2.2.1 This method should be used when a large number of specimens have to be tested simultaneously. The basic feature is the control of the exposure periods by inspection of the *references*, which allows a number of specimens differing in light fastness to be tested against a single set of references, thus conserving supplies.

6.2.2.2 Arrange the specimens to be tested and the references as shown in Figure 2 with the cover AB covering one-quarter of the total length of each specimen and reference. Expose under the conditions enumerated in **4.2.1.1** or **4.2.1.2**. Follow the effect of light by lifting the cover AB periodically and inspecting the references. When a change in Reference 3 or L2 can be perceived equal to grey scale grade 4–5, inspect the specimens and rate their light fastness by comparing any change that has occurred with the changes that have occurred in References 1, 2 and 3 or L2. (This is a preliminary assessment of light fastness.) At this stage attention should be given to the possibility of photochromism (see ISO 105-B05).

6.2.2.3 Replace the cover AB in exactly the same position and continue to expose until a change in Reference 4 or L3 can be perceived equal to grey scale grade 4–5; at this point fix an additional cover, CD, in the position shown in Figure 2, overlapping the first cover, AB.

6.2.2.4 Continue to expose until a change in Reference 6 or L5 can be perceived equal to grey scale 4–5, then fix the final cover, EF, in the position shown in Figure 2, the other two covers remaining in position.

6.2.2.5 Expose until either

a) a contrast is produced on Reference 7 or L7 equal to the contrast illustrated by grey scale grade 4; or

b) a contrast equal to grey scale grade 3 has been produced on the most resistant specimen; or

c) for white (bleached or optically brightened) textiles, a contrast equal to grey scale grade 4 has been produced on the most resistant specimen;

NOTE This may occur before the fading defined in **6.2.2.3** or **6.2.2.4** has taken place.

whichever occurs first.

6.2.3 ***Method 3***

Where the test is to be used to check conformity with a performance specification, it is permissible to expose the specimens with two references only: that specified as minimum and the one below it. Continue exposure until grey scale grade 4 and grey scale grade 3 contrasts have been produced on separate areas of the minimum reference. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced between separate areas of the minimum reference.

6.2.4 ***Method 4***

Where the test is to be used to check conformity with an agreed upon reference sample, it is permissible to expose the specimens with the reference sample only. Continue exposure until grey scale grade 4 and/or grey scale grade 3 contrasts have been produced on the reference sample. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced on the reference sample.

7 Assessment of light fastness

7.1 The final assessment in numerical ratings is based on contrasts equal to grey scale grade 4 and/or grade 3 between exposed and unexposed portions of the specimen. For white (bleached or optically brightened) textiles, the final assessment in numerical ratings is based on a contrast equal to grey scale grade 4 between exposed and unexposed portions of the specimen.

7.2 Remove all the covers, thus revealing on specimens and references two or three areas, depending on the method used, which have been exposed for different times, together with at least one area which has not been exposed to light. Compare the changes of the specimen with the relevant changes of the references under suitable illumination (see ISO 105-A01, clause **13**). For white (bleached or optically brightened) textiles, the use of artificial daylight produced by a colour matching lamp (**4.2.5**) is recommended and is necessary in cases of dispute, unless otherwise agreed. The light fastness of the specimen is the number of the reference which shows similar changes in colour (visual contrast between exposed and unexposed parts of the specimen). If the specimen shows changes in colour which are nearer to the imaginary reference midway between any two consecutive references the intermediate rating, for example 3–4 or L2–L3, shall be given.

If different assessments are obtained at the different degrees of contrast, the light fastness of the specimen is the arithmetic mean of these expressed to the nearest half or whole grade. When three areas are being rated, take the mean of the contrasts closest to grey scale grades 4 and 3. Assessments, however, shall be confined to whole or midway ratings only. When the arithmetic mean gives a quarter or three-quarter rating, the assessment is defined as the next higher half or whole grade.

However, to avoid a misrating of the light fastness of the specimen due to its photochromism, the specimen should be allowed to condition in the dark at room temperature for 24 h before assessing the light fastness (see ISO 105-B05).

7.3 If the colour of the specimen is more fugitive than that of Reference 1 or L2, a rating of 1 or L2 is given.

7.4 Comparison of the changes in the specimen with changes in the references may be facilitated by surrounding the specimen with a mask of neutral grey colour approximately midway between the lighter chips in grades 1 and 2 (approximately Munsell N5) and surrounding the references in turn with a similar mask of equal aperture.

7.5 If the light fastness is equal to or higher than 4 or L3, preliminary assessment based on the contrast equal to grey scale grade 4–5 (see **6.2.1.2** and **6.2.2.2**) becomes significant; if this preliminary assessment is 3 or lower or L2, it shall be included in the rating in brackets. For example, a rating of 6(3) or L5(L2) indicates that the specimen changes very slightly in the test when Reference 3 or L2 just begins to fade, but that on continuing the exposure the resistance to light is equal to that of Reference 6 or L5.

7.6 If the specimen is photochromic, the light fastness rating shall include a P bracketed with the rating obtained from the test for photochromism, for example 6(P3-4) (see ISO 105-B05).

7.7 The term "change in colour" includes change in hue, depth, brightness, or any combination of these characteristics of colour (see ISO 105-A02, sub-clause **2.6**).

7.8 Exposures based on a performance reference (see **6.2.3**) or together with an agreed upon reference sample (see **6.2.4**) shall be assessed by comparison of the colour changes of the specimen and the references. If the specimen shows no greater change in colour than the performance reference or the reference sample, the light fastness shall be classified "satisfactory"; if the specimen shows a greater change in colour than the performance reference or the reference sample, the light fastness shall be classified "unsatisfactory".

8 Test report

8.1 For method 1 or 2

Report the numerical rating for the light fastness. The light fastness rating shall be expressed either

a) by the figure alone (when using the references designated 1 to 8); or

b) together with the prefix L (when using the references designated L2 to L9).

If this rating is equal to or higher than 4 or L3 and the preliminary assessment is equal to or lower than 3 or L2, report the latter figure in brackets. If the specimen is photochromic, the light fastness shall be followed by a P bracketed together with the grey scale rating.

8.2 For method 3 or 4

Report the classification "satisfactory" or "unsatisfactory" together with the performance reference or the reference sample used.

8.3 Report the apparatus used, the method and the exposure conditions.

9 Notes

9.1 If a glass or water filter is used to eliminate excess infrared radiation so as to meet the temperature conditions specified in **4.2**, frequent cleaning shall be carried out to avoid unwanted filtering caused by dirt (see **B.1.4**).

9.2 The black panel thermometer shall consist of a metal panel at least 4,5 cm × 10 cm whose temperature is measured with a thermometer or a thermocouple with its sensitive portion located in the centre of and in good contact with the panel. The side of the panel facing the light source shall be black with a reflectance of less than 5 % throughout the spectrum reaching the specimen; the side of the panel not facing the light source shall be thermally isolated (see also **B.1.5**).

9.3 Effective humidity descriptions:

9.3.1 ***Qualitative***

The combination of air and surface temperatures and air relative humidity which governs the moisture content of the surface of the specimen during exposure.

9.3.2 ***Quantitative***

The effective humidity can be measured only by determining the light fastness of a specific humidity test control such as that described in **4.1.3**. This control has been calibrated by exposing it facing south in several West European locations at different times of the year, the exposures being made together with the references in sealed vessels containing air maintained at constant humidities between 0 and 100 %; the results did not vary greatly and the mean values are shown in Figure 3.

When this control was exposed under the conditions specified in ISO 105-B01 in temperate zones, its light fastness was found to be, on average, 5.

9.4 Pile fabrics, such as carpets, which have fibres that may shift position, or texture which may make evaluation of small areas difficult, shall be tested with an exposed area not less than 5 cm × 4 cm and preferably larger (see **5.4**).

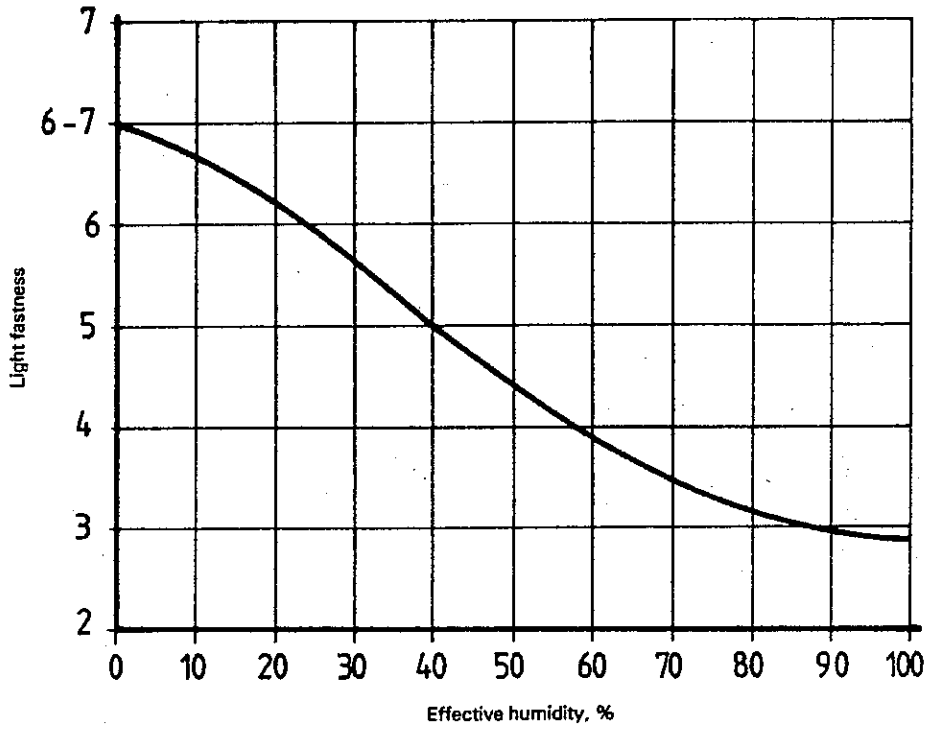


Figure 3 — Mean values obtained from exposures described in 9.3.2

Annex A Apparatus for determining light fastness with air-cooled xenon arc lamps

(This annex forms an integral part of the standard.)

A.1 Description and conditions of use

A.1.1 The test apparatus (see also clause **A.2**) is equipped with an air-cooled xenon arc lamp as the source of radiation. There are two different models of the apparatus using xenon arc lamps with a wattage of 1 500 W or 4 500 W. The xenon arc lamp is surrounded by a filter system consisting of a quartz inner cylinder, an additional lamp-chimney of seven heat filters and an outer cylinder of ultra-violet special glass. With this filtering device the requirements given in **4.2.1** are satisfied.

A.1.2 The space between the xenon arc lamp and the filtering device is cooled by a current of air. This cooling air should be discharged into the open.

A.1.3 The decrease in intensity of air-cooled xenon arc lamps due to ageing is small. After 1 500 h of use, the radiation flux has dropped to approximately 90 % and replacement of the lamps is recommended.

The change in the transmission properties of the heat filter due to ageing can be eliminated almost entirely by replacing the oldest filter in rotation after 500 h.

A.1.4 Slot-in specimen holders are mounted on a revolving rack and at a given distance in circular fashion around the vertical lamp unit. The rack rotates at 5 min^{-1}. After each revolution of the rack, the sample holders are turned 180° about their longitudinal axis.

The surface area of specimen radiated at any one time is 450 cm^2 in the case of the test apparatus with a 1 500 W xenon arc lamp and 1 800 cm^2 with a 4 500 W xenon arc lamp.

A.1.5 An air current generated with a blower is directed through the test chamber and over the surface of the sample. In the case of the apparatus with a 1 500 W xenon arc lamp, the test chamber is air conditioned by adding moisture to the air via spray jets or by means of an ultrasonic humidification device, whilst, in the case of the apparatus with a 4 500 W xenon arc lamp, water is atomized very finely via an aerosol device and added to the air current. Measurement and control of the relative humidity in the test chamber is carried out either by a contact hygrometer or by electronic means.

A.1.6 The exposure conditions, relative to effective humidity, laid down in the present specifications are achieved in the test apparatus by regulating the relative humidity of the air within certain values, which are given in the instructions for using the apparatus.

The test chamber temperature and black panel temperature can be influenced by appropriately throttling the air supply. In the case of the apparatus with a 4 500 W xenon arc lamp, it is possible, by connecting to a heating and/or cooling device, to control the test chamber temperature over a wide range.

A.2 Description and conditions of use of an alternative system

A.2.1 Except for the changes given in **A.2.2** and **A.2.3**, the description and conditions of use of this apparatus are similar to those given in clause **A.1**.

A.2.2 There are three different models of the apparatus, with a wattage of 1 500 W, 2 500 W or 4 500 W. The xenon arc lamp is surrounded by a filter system consisting of an outer cylinder of ultra-violet special glass and a lamp-chimney of six heat filters.

A.2.3 After each revolution of the rack, the sample holders are either turned 180° about their longitudinal axis or always face the xenon arc lamp for the 1 500 W type. The sample holders always face the xenon arc lamp for the 2 500 W and 4 500 W types.

Annex B Apparatus for determining light fastness with water-cooled xenon arc lamps

(This annex forms an integral part of the standard.)

B.1 Description and conditions of use

B.1.1 The test apparatus (see also clause **B.2**) employed utilizes a long-arc water-cooled xenon arc lamp as the source of radiation. While all of the xenon arc lamps employed are of the same general type, different size lamps operated in different wattage ranges are employed in several sizes and types of apparatus. In each of the various models of exposure apparatus, the diameter of the specimen rack and the size and wattage of the lamp are chosen so that when the specimens are exposed in holders the irradiance at the face of the specimen is at the appropriate level.

B.1.2 The xenon arc lamp used consists of a xenon burner tube, an inner filter glass, an outer filter glass and the necessary hardware. For colour fastness tests, a borosilicate (Corning 7740) inner and soda-lime (Kimble R6) outer filter glass are used so that the irradiation at the specimen has a lower spectral cut-off at approximately that of window-glass. Other filter glasses are available with different spectral cut-offs but these should not be used for light fastness tests. Because of transmission changes (solarization), outer filter glasses should be discarded after 2 000 h of use and inner filter glasses discarded after 400 h of use. Xenon burners, because of a drop off of intensity with continued use, should be discarded when they no longer will produce adequate fading in 25 h of exposure.

B.1.3 All xenon arc exposure apparatus is equipped with suitable starters, reactance transformers and indicating and control equipment for either manually or automatically controlling the wattage of the lamp. In manually controlled units, the wattage of the lamp may require periodic adjustment to maintain adequate fading in 20 ± 5 h of operation.

B.1.4 To prevent contamination and minimize the formation of deposits on the burner tube and filter glasses, distilled or deionized water is circulated through the lamp assembly at an approximate minimum flow rate of 380 l/h, and is polished by the use of a mixed bed deionizer just ahead of the lamp. The recirculated lamp water is cooled without contaminating it by the use of a heat-exchange unit employing either tap water or refrigerant as the heat-transfer medium.

B.1.5 Accurate, close control of testing temperature, because of the sensitivity to temperature of some fabrics, is extremely important in tests made by this procedure. The temperature is measured and controlled on the basis of a black panel thermometer, which is mounted on the revolving specimen rack so that its face is in the same relative position and subjected to the same influences as the test specimens. The black panel thermometer consists of a 20-gauge stainless steel panel 7 cm × 14,9 cm to which is mechanically fastened either a stainless steel bimetallic dial-type thermometer or a stainless steel resistance thermometer element. The sensitive portion in each case is centred on the panel both from top to bottom and from side to side. The face of the panel is finished with a black enamel having high absorption of light.

B.1.6 The exposure apparatus is enclosed in an insulated cabinet to minimize the effects of variation in room temperature. A ventilating system provides a constant volume of air through the test chamber and over the test specimens. The temperature of the air is automatically controlled by circulating warm air from the test chamber mixed with cooler room air. Moisture in the amount required to maintain the specified relative humidity of the exit air from the test chamber as measured by wet and dry bulb temperatures may be added to the air stream as it passes through the air conditioning chamber in the base of the instrument.

B.1.7 A cylindrical vertical or inclined frame or rack supporting the specimen holders is rotated at 1 min^{-1} around the lamp, which is located centrally with respect to the specimen rack so that the effective arc is centred both horizontally and vertically relative to the exposure area of the sample holders.

B.1.8 Apparatus for use in this method is equipped with a timer unit for controlling the length of exposure. Some apparatus is also equipped with control equipment for turning the arc lamp on and off to produce predetermined periods of light and darkness each at a controlled temperature and relative humidity.

B.2 Description and conditions of use of an alternative system

B.2.1 Except for the changes given in **B.2.2** and **B.2.3**, the description and conditions of use of this apparatus are similar to those given in clause **B.1**.

B.2.2 There are two different models of the apparatus, with a wattage of 2 500 W or 6 000 W.

B.2.3 After each revolution of the rack, the sample holders are turned 180° about their longitudinal axis.

Annex C 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 [2)], 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.

[2)] 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.

Group C. Colour fastness to washing and laundering

Part C01. Colour fastness to washing: Test 1

1 Scope

This part of ISO 105 specifies Test No. 1 of a series of five washing tests that have been established to investigate the fastness to washing of coloured textiles and which between them cover the range of washing procedures from mild to severe.

NOTE 1 This method is designed to determine the effect of washing only on the colour fastness of the textile. It is not intended to reflect the result of the comprehensive laundering procedure.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

A specimen of the textile in contact with one or two specified adjacent fabrics is mechanically agitated under specified conditions of time and temperature in a soap solution, then rinsed and dried. The change in colour of the specimen and the staining of the adjacent fabric(s) are assessed with the grey scales.

4 Apparatus and reagents

4.1 *Suitable mechanical device* (see clause 8), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers 75 mm ± 5 mm in diameter × 125 mm ± 10 mm high of 550 ml ± 50 ml capacity, the bottom of the containers being 45 mm ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 min^{-1} ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature of 40 °C ± 2 °C.

4.2 *Soap*, containing not more than 5 % moisture and complying with the following requirements based upon dry mass:

— free alkali, calculated as Na_2CO_3: 0,3 % maximum;

— free alkali, calculated as NaOH: 0,1 % maximum;

— total fatty matter: 850 g/kg minimum;

— titre of mixed fatty acids prepared from soap: 30 °C maximum;

— iodine value: 50 maximum.

The soap shall be free from fluorescent brightening agents.

4.3 *Soap solution*, containing 5 g of soap (**4.2**) per litre of water (**4.6**).

4.4 *Adjacent fabrics* (see ISO 105-A01:1989, sub-clause 8.3).

Either:

4.4.1 A multifibre adjacent fabric complying with ISO 105-F10.

Or:

4.4.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F01 to F08 of ISO 105-F:1985.

One of the adjacent fabrics shall be made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece made of the fibre as indicated in Table 1 or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	wool
wool	cotton
silk	cotton
linen	cotton
viscose	wool
acetate	viscose
polyamide	wool or viscose
polyester	wool or cotton
acrylic	wool or cotton

4.4.3 If required, a non-dyeable fabric (for example, polypropylene).

4.5 *Grey scale for assessing change in colour*, complying with ISO 105-A02, and *grey scale for assessing staining*, complying with ISO 105-A03.

4.6 *Grade 3 water* (see ISO 105-A01:1989, subclause **8.2**).

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen; or

b) attach a specimen measuring 40 mm × 100 mm between the two single-fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarn or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics (see below), and either

a) place it between a 40 mm × 100 mm piece of the multifibre adjacent fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, subclause **9.6**); or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Place the composite specimen in the container and add the necessary amount of soap solution (**4.3**), previously heated to 40 °C ± 2 °C, to give a liquor ratio of 50 : 1.

6.2 Treat the composite specimen at 40 °C ± 2 °C for 30 min.

6.3 Remove the composite specimen, rinse it twice in cold grade 3 water (**4.6**) and then in cold, running tap water for 10 min, and squeeze it. Open out the composite specimen (by breaking the stitching except on one of the shorter sides, if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabric(s) with the grey scales (**4.5**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-C01:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

C02. Colour fastness to washing: Test 2

1 Scope

This part of ISO 105 specifies Test No. 2 of a series of five washing tests that have been established to investigate the fastness to washing of coloured textiles and which between them cover the range of washing procedures from mild to severe.

NOTE 1 This method is designed to determine the effect of washing only on the colour fastness of the textile. It is not intended to reflect the result of the comprehensive laundering procedure.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

A specimen of the textile in contact with one or two specified adjacent fabrics is mechanically agitated under specified conditions of time and temperature in a soap solution, then rinsed and dried. The change in colour of the specimen and the staining of the adjacent fabric(s) are assessed with the grey scales.

4 Apparatus and reagents

4.1 *Suitable mechanical device* (see clause 8), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers 75 mm ± 5 mm in diameter × 125 mm ± 10 mm high of 550 ml ± 50 ml capacity, the bottom of the containers being 45 mm ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 min^{-1} ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature of 50 °C ± 2 °C.

4.2 *Soap*, containing not more than 5 % moisture and complying with the following requirements based upon dry mass:

— free alkali, calculated as Na_2CO_3: 0,3 % maximum;

— free alkali, calculated as NaOH: 0,1 % maximum;

— total fatty matter: 850 g/kg minimum;

— titre of mixed fatty acids prepared from soap: 30 °C maximum;

— iodine value: 50 maximum.

The soap shall be free from fluorescent brightening agents.

4.3 *Soap solution*, containing 5 g of soap (**4.2**) per litre of water (**4.6**).

4.4 *Adjacent fabrics* (see ISO 105-A01-1989, sub-clause 8.3).

Either:

4.4.1 A multifibre adjacent fabric complying with ISO 105-F10.

Or;

4.4.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F01 to F08 of ISO 105-F:1985.

One of the adjacent fabrics shall be made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece made of the fibre as indicated in Table 1 or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	wool
wool	cotton
silk	cotton
linen	cotton
viscose	wool
acetate	viscose
polyamide	wool or viscose
polyester	wool or cotton
acrylic	wool or cotton

4.4.3 If required, a non-dyeable fabric (for example, polypropylene).

4.5 *Grey scale for assessing change in colour*, complying with ISO 105-A02, and *grey scale for assessing staining*, complying with ISO 105-A03.

4.6 *Grade 3 water* (see ISO 105-A01:1989, sub-clause **8.2**).

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen; or

b) attach a specimen measuring 40 mm × 100 mm between the two single-fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarn or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics (see below), and either

a) place if between a 40 mm × 100 mm piece of the multifibre adjacent fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, subclause **9.6**) or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Place the composite specimen in the container and add the necessary amount of soap solution (**4.3**), previously heated to 50 °C ± 2 °C, to give a liquor ratio of 50 : 1.

6.2 Treat the composite specimen at 50 °C ± 2 °C for 45 min.

6.3 Remove the composite specimen, rinse it twice in cold grade 3 water (**4.6**) and then in cold, running tap water for 10 min, and squeeze it. Open out the composite specimen (by breaking the stitching except on one of the shorter sides, if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabric(s) with the grey scales (**4.5**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-C02:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

Part C03. Colour fastness to washing: Test 3

1 Scope

This part of ISO 105 specifies Test No. 3 of a series of five washing tests that have been established to investigate the fastness to washing of coloured textiles and which between them cover the range of washing procedures from mild to severe.

NOTE 1 This method is designed to determine the effect of washing only on the colour fastness of the textile. It is not intended to reflect the result of the comprehensive laundering procedure.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03-1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

A specimen of the textile in contact with one or two specified adjacent fabrics is mechanically agitated under specified conditions of time and temperature in a soap solution, then rinsed and dried. The change in colour of the specimen and the staining of the adjacent fabric(s) are assessed with the grey scales.

4 Apparatus and reagents

4.1 *Suitable mechanical device* (see clause 8), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers 75 mm ± 5 mm in diameter × 125 mm ± 10 mm high of 550 ml ± 50 ml capacity, the bottom of the containers being 45 mm ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 min^{-1} ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature of 60 °C ± 2 °C.

4.2 *Soap*, containing not more than 5 % moisture and complying with the following requirements based upon dry mass:

— free alkali, calculated as Na_2CO_3: 0,3 % maximum;

— free alkali, calculated as NaOH: 0,1 % maximum;

— total fatty matter: 850 g/kg minimum;

— titre of mixed fatty acids prepared from soap: 30 °C maximum;

— iodine value: 50 maximum.

The soap shall be free from fluorescent brightening agents.

4.3 *Soap solution*, containing 5 g of soap (4.2) and 2 g of anhydrous sodium carbonate per litre of water (4.6).

4.4 *Adjacent fabrics* (see ISO 105-A01:1989, sub-clause 8.3).

Either:

4.4.1 A multifibre adjacent fabric (TV) not containing wool or acetate, complying with ISO 105-F10, or, where specified, a multifibre adjacent fabric (DW) containing wool and acetate, also complying with ISO 105-F10. If multifibre adjacent fabric (DW) is used, this shall be indicated in the test report.

Or:

4.4.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F01 to F08 of ISO 105-F:1985.

One of the adjacent fabrics shall be made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece made of the fibre as indicated in Table 1 or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	wool
wool	cotton
silk	cotton
linen	cotton
viscose	wool
acetate	viscose
polyamide	wool or viscose
polyester	wool or cotton
acrylic	wool or cotton

4.4.3 If required, a non-dyeable fabric (for example, polypropylene).

4.5 *Grey scale for assessing change in colour*, complying with ISO 105-A02, and *grey scale for assessing staining*, complying with ISO 105-A03.

4.6 *Grade 3 water* (see ISO 105-A01:1989, subclause **8.2**).

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen; or

b) attach a specimen measuring 40 mm × 100 mm between the two single-fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarn or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics (see below), and either

a) place it between a 40 mm × 100 mm piece of the multifibre adjacent fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, sub-clause **9.6**); or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Place the composite specimen in the container and add the necessary amount of soap solution (**4.3**), previously heated to 60 °C ± 2 °C, to give a liquor ratio of 50 : 1.

6.2 Treat the composite specimen at 60 °C ± 2 °C for 30 min.

6.3 Remove the composite specimen, rinse it twice in cold grade 3 water (**4.6**) and then in cold, running tap water for 10 min, and squeeze it. Open out the composite specimen (by breaking the stitching except on one of the shorter sides, if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabric(s) with the grey scales (**4.5**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-C03:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

C04. Colour fastness to washing: Test 4

1 Scope

This part of ISO 105 specifies Test No. 4 of a series of five washing tests that have been established to investigate the fastness to washing of coloured textiles and which between them cover the range of washing procedures from mild to severe.

NOTE 1 This method is designed to determine the effect of washing only on the colour fastness of the textile. It is not intended to reflect the result of the comprehensive laundering procedure.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

A specimen of the textile in contact with one or two specified adjacent fabrics is mechanically agitated under specified conditions or time and temperature in a soap solution, then rinsed and dried. The change in colour of the specimen and the staining of the adjacent fabric(s) are assessed with the grey scales.

4 Apparatus and reagents

4.1 *Suitable mechanical device* (see clause 8), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers 75 mm ± 5 mm in diameter × 125 mm ± 10 mm high of 550 ml ± 50 ml capacity, the bottom of the containers being 45 mm ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 min^{-1} ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature of 95 °C ± 2 °C.

4.2 *Non-corrodible (stainless) steel balls*, approximately 6 mm in diameter.

4.3 *Soap*, containing not more than 5 % moisture and complying with the following requirements based upon dry mass:

— free alkali, calculated as Na_2CO_3: 0,3 % maximum;

— free alkali, calculated as NaOH: 0,1 % maximum;

— total fatty matter: 850 g/kg minimum;

— titre of mixed fatty acids prepared from soap: 30 °C maximum;

— iodine value: 50 maximum.

The soap shall be free from fluorescent brightening agents.

4.4 *Soap solution*, containing 5 g of soap (**4.3**) and 2 g of anhydrous sodium carbonate per litre of water (**4.7**).

4.5 *Adjacent fabrics* (see ISO 105-A01:1989, subclause **8.3**).

Either:

4.5.1 A multifibre adjacent fabric (TV) not containing wool or acetate, complying with ISO 105-F10.

Or:

4.5.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F01 to F08 of ISO 105-F:1985.

One of the adjacent fabrics shall be made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece made of the fibre as indicated in Table 1 or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	viscose
silk	cotton
linen	cotton or viscose
viscose	cotton
triacetate	viscose
polyamide	cotton or viscose
polyester	cotton or viscose
acrylic	cotton or viscose

4.5.3 If required, a non-dyeable fabric (for example, polypropylene).

4.6 *Grey scale for assessing change in colour*, complying with ISO 105-A02, and *grey scale for assessing staining*, complying with ISO 105-A03.

4.7 *Grade 3 water* (see ISO 105-A01:1989, sub-clause **8.2**).

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen; or

b) attach a specimen measuring 40 mm × 100 mm between the two single-fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarn or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics (see below), and either

a) place it between a 40 mm × 100 mm piece of the multifibre adjacent fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, sub-clause **9.6**); or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Place the composite specimen in the container together with 10 non-corrodible (stainless) steel balls (**4.2**) and add the necessary amount of soap solution (**4.4**), previously heated to 95 °C ± 2 °C, to give a liquor ratio of 50 : 1.

6.2 Treat the composite specimen at 95 °C ± 2 °C for 30 min.

6.3 Remove the composite specimen, rinse it twice in cold grade 3 water (**4.7**) and then in cold, running tap water for 10 min, and squeeze it. Open out the composite specimen (by breaking the stitching except on one of the shorter sides, if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabric(s) with the grey scales (**4.6**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-C04:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

C05. Colour fastness to washing: Test 5

1 Scope

This part of ISO 105 specifies Test No. 5 of a series of five washing tests that have been established to investigate the fastness to washing of coloured textiles and which between them cover the range of washing procedures from mild to severe.

NOTE 1 This method is designed to determine the effect of washing only on the colour fastness of the textile. It is not intended to reflect the result of the comprehensive laundering procedure.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

A specimen of the textile in contact with one or two specified adjacent fabrics is mechanically agitated under specified conditions of time and temperature in a soap solution, then rinsed and dried. The change in colour of the specimen and the staining of the adjacent fabric(s) are assessed with the grey scales.

4 Apparatus and reagents

4.1 *Suitable mechanical device* (see clause 8), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless-steel containers 75 mm ± 5 mm in diameter × 125 mm ± 10 mm high of 550 ml ± 50 ml capacity, the bottom of the containers being 45 mm ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 min^{-1} ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature of 95 °C ± 2 °C.

4.2 *Non-corrodible (stainless) steel balls*, approximately 6 mm in diameter.

4.3 *Soap*, containing not more than 5 % moisture and complying with the following requirements based upon dry mass:

— free alkali, calculated as Na_2CO_3: 0,3 % maximum;

— free alkali, calculated as NaOH: 0,1 % maximum;

— total fatty matter: 850 g/kg minimum;

— titre of mixed fatty acids prepared from soap: 30 °C maximum;

— iodine value: 50 maximum.

The soap shall be free from fluorescent brightening agents.

4.4 *Soap solution*, containing 5 g of soap (**4.3**) and 2 g of anhydrous sodium carbonate per litre of water (**4.7**).

4.5 *Adjacent fabrics* (see ISO 105-A01:1989, subclause **8.3**).

Either:

4.5.1 A multifibre adjacent fabric (TV) not containing wool or acetate, complying with ISO 105-F10.

Or:

4.5.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F02 to F05 of ISO 105-F:1985.

One of the adjacent fabrics shall be made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece made of the fibre as indicated in Table 1 or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	viscose
linen	cotton or viscose
viscose	cotton
polyamide	cotton or viscose
polyester	cotton or viscose
acrylic	cotton or viscose

4.5.3 If required, a non-dyeable fabric (for example, polypropylene).

4.6 *Grey scale for assessing change in colour*, complying with ISO 105-A02, and *grey scale for assessing staining*, complying with ISO 105-A03.

4.7 *Grade 3 water* (see ISO 105-A01:1989, subclause **8.2**).

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen; or

b) attach a specimen measuring 40 mm × 100 mm between the two single-fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarn or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics (see below), and either

a) place it between a 40 mm × 100 mm piece of the multifibre adjacent fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, subclause **9.6**); or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Place the composite specimen in the container together with 10 non-corrodible (stainless) steel balls (**4.2**) and add the necessary amount of soap solution (**4.4**), previously heated to 95 °C ± 2 °C, to give a liquor ratio of 50 : 1.

6.2 Treat the composite specimen at 95 °C ± 2 °C for 4 h.

6.3 Remove the composite specimen, rinse it twice in cold grade 3 water (**4.7**) and then in cold, running tap water for 10 min, and squeeze it. Open out the composite specimen (by breaking the stitching except on one of the shorter sides, if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabric(s) with the grey scales (**4.6**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-C05:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

Group F. Adjacent fabrics

F01. Specification for standard adjacent fabric: Wool

1 Scope and field of application

This specification is intended to establish an undyed pure wool adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard wool adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, two water fastness tests and also a wash test carried out at 50 °C are conducted on two composite specimens made from a dyed master fabric and a cotton adjacent fabric with

a) the wool fabric under test, and

b) a sample of the master standard wool adjacent fabric.

Staining is then assessed using the grey scale for assessing staining.

3 References

ISO 105: section A01, *General principles of testing* — section A03, *Grey scale for assessing staining* — section C02, *Colour fastness to washing: Test 2* — section E01, *Colour fastness to water.*

ISO 3072, *Wool — Determination of solubility in alkali.*

4 Apparatus and reagents

4.1 *Apparatus and reagent,* as specified in section E01.

4.2 *Apparatus and reagents,* as specified in section C02.

4.3 *Grey scale for assessing staining* (see clause 3).

4.4 For first dyed master fabric — *1,5 % CI Direct Red 16* (Colour Index, 3rd Edition).

For second dyed master fabric — *3 % CI Acid Red 42* (Colour Index, 3rd Edition).

For third dyed master fabric — *2 % CI Acid Red 42* (Colour Index, 3rd Edition).

4.5 *Samples of master standard wool adjacent fabric* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard wool adjacent fabric is a wool cloth of mass per unit area $125\ ^{+5}_{0}$ g/m^2. It consists of a plain weave cloth with an even and smooth surface made of pure wool fibres. After wetting and tensionless drying, a sample shall remain flat. It shall be free from finishes, residual chemicals, and chemically damaged fibres.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the wool adjacent fabrics shall conform to those of the dyed master fabric.

5.2.1 ***Dyed master fabrics to be subjected to the colour fastness tests***

a) First dyed master fabric: 1,5 % CI Direct Red 16 (Colour Index, 3rd Edition) dyed on a specified cotton adjacent fabric (see **6.2.1**). This dyeing is intended for the water fastness test method [see **5.2.2** a)].

b) Second dyed master fabric: 3 % CI Acid Red 42 (Colour Index, 3rd Edition) dyed on a specified wool adjacent fabric (see **6.2.2**). This dyeing is intended for the water fastness test method [see **5.2.2** a)].

c) Third dyed master fabric: 2 % CI Acid Red 42 (Colour Index, 3rd Edition) dyed on a specified wool adjacent fabric (see **6.2.3**). This dyeing is intended for the washing test 2 (50 °C) [see **5.2.2** b)].

5.2.2 ***Colour fastness test methods employed for assessing the staining properties***

The staining properties of the standard wool adjacent fabric are determined by the following test methods:

a) water fastness test according to section E01;

b) washing test 2 (50 °C) according to section C02.

5.2.3 ***Test specimens***

In order to test the wool fabric, which is prepared as described in **6.1** and which is intended to be used as a specified wool adjacent fabric, a dyed master fabric (see **5.2.1**) is placed between the wool fabric to be tested and a cotton adjacent fabric. For comparison, another composite specimen is made by using a sample of the master wool adjacent fabric. Both composite specimens are tested according to **5.2.2**.

5.2.4 ***Results of the staining during the tests***

The staining of the wool adjacent fabrics shall yield the following assessment, measured by the grey scale for assessing staining (see **6.3**):

a) water fastness test with the first dyed master fabric: 3;

b) water fastness test with the second dyed master fabric: 2–3;

c) washing test 2 (50 °C) with the third dyed master fabric: 3–4.

Test assessment of the staining shall not differ by more than half a step from those specified.

The change of colour of the dyed master fabric and the staining of the cotton adjacent fabric are neglected.

6 Notes

6.1 Production of the standard wool adjacent fabric

6.1.1 ***Raw material for warp and weft***

Australian Merino wool — Mean fibre diameter in the range 18,5 to 19,7 µm = 74 s British fineness washed in weak alkali.

Staple length 50 to 70 mm.

6.1.2 ***Yarn, warp and weft identical***

15,6 tex × 2 worsted.

Spin twist: 620 t/m.

Yarn twist: 600 t/m.

Fat content of the yarn: 0,6 ± 0,2 % (emulsified groundnut oiling agent).

Steam treatments of single yarn and after twisting: mild and uniform in respect of the charge and the duration of steam treatment and conditions for the whole batch.

Production samples of the yarn shall be tested to determine compliance with the following requirements:

pH value of the aqueous extract at 20 °C: 9,5 ± 0,2;

fat content: 0,6 ± 0,2 %.

Staining in the water fastness test according to **5.2.2** a) should be 3 or 3–4, i.e. similar or somewhat less than master standard adjacent fabric.

Alkali solubility shall not exceed 18 % (determined by the method in ISO 3072).

6.1.3 ***Grey goods***

Weave 1/1 plain.

Number of threads

warp 210 ± 5 per 10 cm

weft 180 ± 5 per 10 cm

weaving without sizing.

Staining after washing according to **6.1.4** in water fastness test [see **5.2.2** a)] should be 3–4.

Fat content: 0,5 ± 0,2 %.

6.1.4 ***Finishing***

No singeing.

Continuous washing, for example with the Vibrotex (Kuesters, Krefeld) using non-ionic detergent, pH 8,5 to 8, temperature 45 °C, time in the washing liquor about 2 min.

Continuous rinsing until pH 6,5 to 7,5 is reached.

Continuous hot water fixation, for example with the "Conticrab" machine (Monforts, Moenchengladbach), the goods being passed through a hot water tank at 80 °C and then passed over a heated drum at 90 °C below a rubber cloth. Time on the heated drum about 100 s; pH of the water at 80 °C, 6,5 to 7,5.

Mild drying, with 6 % over feed at 80 °C, for example with a Famatex jet dryer, speed 20 m/min.

Shearing on both sides, for example with a hollow bed shearing machine (Ateliers Raxhon, Belgium).

Stain removal with perchloroethylene.

Straightening on a stenter frame with gentle steaming.

Degree of whiteness according to Stephanson:

$$W = 2B - A = 2R_z - R_x$$

Standard source D_{65}. CIE 1931 standard observer. White Standard: absolute White. Thickness of material: ≥. The value should be 43 ± 1.

For visual assessment the specimen should be compared with the master standard.

The pH value of the aqueous extract should be 8,0 ± 0,5. The residual fat content: 0,4 ± 0,1 % (determined by IWTO-method 10–62 edition 1966).

The alkali solubility shall not exceed 18 % (determined by the method in ISO 3072).

6.2 Production of the dyed master samples (see 5.2.1)

6.2.1 *1,5 % CI Direct Red 16 (Colour Index, 3rd Edition) dyed on a specified cotton adjacent fabric* [see 5.2.1 a)]

A wetted-out pattern of the cotton fabric is entered at 30 °C into a dye-bath containing 1,5 % CI Direct Red 16 (Colour Index, 3rd Edition) and 20 % sodium sulfate decahydrate ($Na_2SO_4.10H_2O$), all percentages being calculated on the mass of the cotton fabric, at a liquor ratio of 20 : 1.

Within 20 min the dye-bath is raised to 60 °C and the fabric is dyed for 60 min at this temperature. The dye-bath is discharged and the dyeing rinsed with cold running tap-water until the water is completely colourless. The dyed fabric is then dried.

6.2.2 *3 % CI Acid Red 42 (Colour Index, 3rd Edition) dyed on a specified wool adjacent fabric* [see 5.2.1 b)]

A wetted-out pattern of the wool fabric is entered at 40 °C into a dye-bath containing 3 % CI Acid Red 42 (Colour Index, 3rd Edition), 10 % sodium sulfate decahydrate ($Na_2SO_4.10H_2O$), and 4 % sulfuric acid (96 %), all percentages being calculated on the mass of the wool pattern at a liquor ratio of 40 : 1.

The dye-bath is raised to the boil within 30 min, and boiled for a further 60 min. The dye-bath is then cooled down by addition of cold water. The pattern is removed, rinsed in cold running tap-water and dried.

6.2.3 *2 % CI Acid Red 42 (Colour Index, 3rd Edition) dyed on a specified wool adjacent fabric* [see 5.2.1 c)]

This master sample is dyed in the same manner as given in 6.2.2 but using 2 % Acid Red 42 (Colour Index, 3rd Edition) instead of 3 %.

6.3 Master standard and dyed master standard

Samples of the master standard wool adjacent fabric and the dyed master standards are available from

Beuth-Vertrieb GmbH
Burggrafenstrasse 4–7
D-1000 Berlin 30
Germany.

The master standard wool adjacent fabric may also be obtained from

Society of Dyers and Colourists
P.O. Box 244, Perkin House
82 Gratton Road
Bradford BD1 2JB
West Yorks
United Kingdom.

blank

F02. Specification for standard adjacent fabric: Cotton and viscose

1 Scope and field of application

This specification is intended to establish undyed cotton and viscose adjacent fabrics which may be used for the assessment of staining in colour fastness test procedures. The standard cotton and viscose adjacent fabrics exhibit standardized staining properties.

2 Principle

For testing the standardized staining properties, a wash fastness test carried out at 40 °C is conducted on a composite specimen made from a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. Upon completion of the test the staining of the two adjacent fabrics is evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section C01, *Colour fastness to washing: Test 1.*

4 Apparatus and reagents

4.1 *Apparatus and reagents*, as specified in section C01.

4.2 *Reference dye*: CI Direct Blue 1, applied to standard cotton adjacent fabric (see **6.2**).

4.3 *Grey scale for assessing change in colour* (see clause **3**).

4.4 *Samples of master standard cotton and viscose adjacent fabrics* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard cotton adjacent fabric is a cotton cloth of mass per unit area 115 ± 5 g/m^2 and the standard viscose adjacent fabric is a viscose cloth of mass 140 ± 5 g/m^2. They consist of plain weave cloths with even and smooth surfaces made of pure cotton or viscose fibres. After wetting and tensionless drying, samples shall remain flat. They shall be free from finishes, residual chemicals, and chemically damaged fibres.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the cotton and viscose adjacent fabrics shall conform to those of the dyed master fabrics.

5.2.1 *Dyed master fabrics to be subjected to the colour fastness test*

Dyed master fabric: CI Direct Blue 1 (Colour Index, 3rd Edition) dyed on a specified cotton adjacent fabric (see **6.2**).

5.2.2 *Colour fastness test method employed for assessing the staining properties*

The staining properties of the standard cotton and viscose adjacent fabrics are determined by washing test 1 (40 °C) according to section C01.

5.2.3 *Test specimens*

In order to test the cotton and viscose fabrics, which are prepared as described in **6.1** and which are intended to be used as specified cotton and viscose adjacent fabrics, a dyed master fabric (see **5.2.1**) is placed between the cotton or viscose fabric to be tested and a cotton adjacent fabric. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen.

5.2.4 *Results of the staining during the tests*

The colour difference between the stain of the standard adjacent fabric and that on the fabric under test is evaluated using the grey scale for assessing change in colour. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard cotton and viscose adjacent fabrics

6.1.1 *Yarn*

a) Cotton

warp: 16,5 tex 820
weft: 14 tex 900

b) Viscose

warp: 20 tex 740
weft: 33 tex 700

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.2 *Loomstate fabric*

a) Cotton

Plain weave 1/1

Number of threads

warp 35 per cm
weft 31 per cm

b) Viscose

Plain weave 1/1

Number of threads

warp 28 per cm
weft 22 per cm

6.1.3 *Finished fabric*

Degree of whiteness: 70 ± 5, measured on a reflectometer (whiteness formula: $L + 3A - 3B$)

Other cotton and viscose fabrics having the same staining characteristics may be used.

Standard source D_{65}

CIE 1931 standard observer

White Standard: absolute White

6.2 Production of the dyed master fabric

The fabric is desized, scoured and bleached in such a manner as to obtain the characteristics given in **6.1**. It shall have a wetting time of less than 3 s and a pH of 7,0 ± 0,5.

6.3 Standard cotton and viscose adjacent fabrics and dyed master fabric

These are available from

Centre de Recherches Textiles de Mulhouse
185, rue de l'Illberg
F-68093 Mulhouse Cedex
France

and

Association pour la détermination de la solidité des teintures
12, rue d'Anjou
F-75008 Paris
France.

F03. Specification for standard adjacent fabric: Polyamide

1 Scope and field of application

This specification is intended to establish an undyed polyamide adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard polyamide adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a wash fastness test carried out at 50 °C is conducted with a composite specimen made from a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. Upon completion of the test the colour difference between the two adjacent fabrics is evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section C02, *Colour fastness to washing: Test 2.*

4 Apparatus and reagents

4.1 *Apparatus and reagents,* as specified in section C02.

4.2 *Grey scale for assessing change in colour* (see clause **3**).

4.3 *Reference dye,* CI Acid Red 151, applied to standard adjacent fabric (see **6.2**).

4.4 *Samples of master standard polyamide adjacent fabric* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard polyamide adjacent fabric is a polyamide cloth of mass per unit area 130 ± 5 g/m^2. It consists of a plain weave cloth with an even and smooth surface made of 100 % polyamide fibres. After wetting and tensionless drying, a sample shall remain flat. It shall be free from finishes, residual chemicals, and chemically damaged fibres.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the polyamide adjacent fabric shall conform to those of the dyed master fabric.

5.2.1 *Dyed master fabric to be subjected to the colour fastness test*

Dyed master fabric: CI Acid Red 151 (Colour Index, 3rd Edition) dyed on a specified polyamide adjacent fabric (See **6.2**).

5.2.2 *Colour fastness test method employed for assessing the staining properties*

The staining properties of the standard polyamide adjacent fabric are determined by washing test 2 (50 °C) according to section C02.

5.2.3 *Test specimens*

In order to test the polyamide fabric, which is prepared as described in **6.1** and which is intended to be used as a specified polyamide adjacent fabric, a dyed master fabric (see **5.2.1**) is placed between the polyamide fabric to be tested and a standard adjacent fabric. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen.

5.2.4 *Results of the staining during the tests*

The colour difference between the stain on the standard adjacent fabric and that on the fabric under test is evaluated with the grey scale for assessing change in colour. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard polyamide adjacent fabric

6.1.1 *Raw material for warp and weft*

Staple fibre (nylon 6.6)

a) 0,333 tex per filament;

b) 38 mm length;

c) semi-dull lustre, round cross-section;

d) acid and disperse dyeable, normal tenacity.

6.1.2 *Yarn for warp and weft*

Warp: 10 tex Z 700 × 2 S 600; R 20 tex

Weft: 20 tex Z 700

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 ***Loomstate fabric***

Width in the loom at the reed: 127 cm

Weave 1/1 plain

Number of threads

warp: 17,5 per cm

weft: 20 per cm

6.1.4 ***Finishing***

6.1.4.1 *Jig scour*

a) Set bath at 60 °C.

b) Use a non-ionic detergent (ethylene oxide condensate) and tetrasodium pyrophosphate.

c) Run one end at 60 °C.

d) Raise to 95 °C, run one end, drop bath.

e) Rinse twice, one end each at 95 °C.

f) Rinse, cold running water, three ends.

6.1.4.2 *Neutralization*

a) Set bath at 60 °C.

b) Use a buffer solution containing, per litre, 0,5 g monosodium phosphate and 1,5 g disodium phosphate.

c) Run for 30 min at 60 °C.

Dry at 95 °C in gas-fired tenter frame. Frame to 110 to 112 cm.

6.1.5 ***Requirements of finished fabric***

pH of finished fabric: $7 \pm 0,5$

Residual oil content: less than 1,0 %

Degree of whiteness: 70 ± 5, measured on a reflectometer (whiteness formula: $L + 3A - 3B$)

Standard source D_{65}

CIE 1931 standard observer

White Standard: absolute White

Any other polyamide fabric having the same staining properties may be used.

6.2 Production of the dyed master fabric

The dyed master fabric is produced with CI Acid Red 151 applied to standard adjacent fabric (see **6.1**) with 4 % ammonium sulfate and a levelling agent, such as 0,75 % sodium salt of dodecyl diphenyl ether disulfonate at a liquor ratio of approximately 30 : 1 for 1 h near the boil.

6.3 Standard polyamide adjacent fabric and dyed master polyamide fabric

These are available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F04. Specification for standard adjacent fabric: Polyester

1 Scope and field of application

This specification is intended to establish an undyed polyester adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard polyester adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a fastness to dry heat test carried out at 170 °C [3] is conducted with a composite specimen made from a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. Upon completion of the test the colour difference between the two adjacent fabrics is evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section P01, *Colour fastness to dry heat (excluding pressing).*

4 Apparatus and reagent

4.1 *Apparatus,* as specified in section P01.

4.2 *Grey scale for assessing change in colour* (see clause **3**).

4.3 *Reference dye,* CI Disperse Red 4, applied to standard adjacent fabric (see **6.2**).

4.4 *Samples of master standard polyester adjacent fabric* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard polyester adjacent fabric is a polyester cloth of mass per unit area 130 ± 5 g/m^2. It consists of a plain weave cloth with an even and smooth surface made of 100 % polyester fibres. After wetting and tensionless drying, a sample shall remain flat. It shall be free from finishes, residual chemicals, and chemically damaged fibres.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the polyester adjacent fabric shall conform to those of the dyed master fabric.

5.2.1 *Dyed master fabric to be subjected to the colour fastness test*

Dyed master fabric: CI Disperse Red 4 (Colour Index, 3rd Edition) dyed on a specified polyester adjacent fabric (see **6.2**).

5.2.2 *Colour fastness test method employed for assessing the staining properties*

The staining properties of the standard polyester adjacent fabric are determined by the method for fastness to dry heat in section P01.

5.2.3 *Test specimens*

In order to test the polyester fabric, which is prepared as described in **6.1** and which is intended to be used as a specified polyester adjacent fabric, a dyed master fabric (see **5.2.1**) is placed between the polyamide fabric to be tested and a standard adjacent fabric. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen.

5.2.4 *Results of the staining during the tests*

The colour difference between the stain on the standard adjacent fabric and that on the fabric under test is evaluated with the grey scale for assessing change in colour. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard polyester adjacent fabric

6.1.1 *Raw material for warp and weft*

Staple fibre

a) 0,17 tex per filament;

b) 38 mm length;

c) semi-dull lustre, round cross-section;

d) disperse dyeable.

[3] The temperature of 170 °C has been chosen to give the desired depth of stain, although it differs from the temperature specified in section P01.

6.1.2 *Yarn for warp and weft*

Warp: 7,5 tax Z 1 000 × 2 S 800; R 15 tex

Weft: 20 tex S 800

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 *Loomstate fabric*

Width in the loom at the reed: 127 cm

Weave 1/1 plain

Number of threads

warp: 23,5 per cm

weft: 20,5 per cm

6.1.4 *Finishing*

6.1.4.1 *Jig scour*

a) Set bath at 60 °C.

b) Use a non-ionic detergent (ethylene oxide condensate) and tetrasodium pyrophosphate.

c) Run one end at 60 °C.

d) Raise to 95 °C, run one end, drop bath.

e) Rinse twice, one end each at 95 °C.

f) Rinse, cold running water, three ends.

6.1.4.2 *Neutralization*

a) Set bath at 60 °C.

b) Use a buffer solution containing, per litre, 0,5 g monosodium phosphate and 1,5 g disodium phosphate.

c) Run for 30 min at 60 °C.

Dry at 95 °C in gas-fired tenter frame. Frame to 110 to 112 cm.

6.1.5 *Requirements of finished fabric*

pH of finished fabric: 7 ± 0,5

Residual oil content: less than 0,5 %

Degree of whiteness: 75 ± 5, measured on a reflectometer (whiteness formula: $L + 3A - 3B$)

Standard source D_{65}

CIE 1931 standard observer

White Standard: absolute White

Any other polyester fabric having the same staining properties may be used.

6.2 Production of the dyed master fabric

The dyed master fabric is produced with CI Disperse Red 4, applied to standard adjacent fabric (see **6.1**). The dye is applied at a liquor ratio of 20 : 1 with an appropriate amount of a suitable carrier, e.g. 6 % methyl biphenyl emulsion, 0,5 % sodium salt of EDTA, 2 g ammonium sulfate per litre of liquor and formic acid to attain a pH of 5,5 and held at the boil for 60 min.

The dyeing process is followed by a reductive scour with 1 g sodium carbonate per litre and 1 g sodium hydrosulfite per litre at 60 °C for 20 min, and by subsequent rinsing.

6.3 Standard polyester adjacent fabric and dyed master polyester fabric

These are available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F05. Specification for standard adjacent fabric: Acrylic

1 Scope and field of application

This specification is intended to establish an undyed acrylic adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard acrylic adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a fastness to steam pleating test carried out at 115 °C (intermediate temperature specified in section P02) is conducted with a composite specimen made from a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. Upon completion of the test the colour difference between the two adjacent fabrics is evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section P02, *Colour fastness to pleating: Steam pleating.*

4 Apparatus and reagent

4.1 *Apparatus*, as specified in section P02.

4.2 *Grey scale for assessing change in colour* (see clause **3**).

4.3 *Reference dye*, CI Basic Green 4, applied to standard adjacent fabric (see **6.2**).

4.4 *Samples of master standard acrylic adjacent fabric* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard acrylic adjacent fabric is an acrylic cloth of mass per unit area 135 ± 5 g/m^2. It consists of a plain weave cloth with an even and smooth surface made of 100 % acrylic fibres. After wetting and tensionless drying, a sample shall remain flat. It shall be free from finishes, residual chemicals, and chemically damaged fibres.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the acrylic adjacent fabric shall conform to those of the dyed master fabric.

5.2.1 *Dyed master fabric to be subjected to the colour fastness test*

Dyed master fabric: CI Basic Green 4 (Colour Index, 3rd Edition) dyed on a specified acrylic adjacent fabric (see **6.2**).

5.2.2 *Colour fastness test method employed for assessing the staining properties*

The staining properties of the standard acrylic adjacent fabric are determined by the method for fastness to steam pleating in section P02.

5.2.3 *Test specimens*

In order to test the acrylic fabric, which is prepared as described in **6.1** and which is intended to be used as a specified acrylic adjacent fabric, a dyed master fabric (see **5.2.1**) is placed between the acrylic fabric to be tested and a standard adjacent fabric. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen.

5.2.4 *Results of the staining during the tests*

The colour difference between the stain on the standard adjacent fabric and that on the fabric under test is evaluated with the grey scale for assessing change in colour. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4.

6 Notes

6.1 Production of the standard acrylic adjacent fabric

6.1.1 *Raw material for warp and weft*

Staple fibre

a) 0,278 tex per filament;

b) 38 mm length;

c) semi-dull lustre, dogbone cross-section;

d) basic dyeable.

6.1.2 *Yarn for warp and weft*

Warp and weft: 10 tex Z 790 × 2 S 470; R 20 tex

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 ***Loomstate fabric***

Width in the loom at the reed: 127 cm

Weave 1/1 plain

Number of threads

warp: 17,5 per cm

weft: 16 per cm

6.1.4 ***Finishing***

6.1.4.1 *Jig scour*

a) Set bath at 60 °C.

b) Use a non-ionic detergent (ethylene oxide condensate) and tetrasodium pyrophosphate.

c) Run one end at 60 °C.

d) Raise to 95 °C, run one end, drop bath.

e) Rinse twice, one end each at 95 °C.

f) Rinse, cold running water, three ends.

6.1.4.2 *Neutralization*

a) Set bath at 60 °C.

b) Use a buffer solution containing, per litre, 0,5 g monosodium phosphate and 1,5 g disodium phosphate.

c) Run for 30 min at 60 °C.

Dry at 95 °C in gas-fired tenter frame. Frame to 110 to 112 cm.

6.1.5 ***Requirements of finished fabric***

pH of finished fabric: 7 ± 0,5

Residual oil content: less than 1,0 %

Degree of whiteness: 70 ± 5, measured on a reflectometer (whiteness formula: $L + 3A - 3B$)

Standard source D_{65}

CIE 1931 standard observer

White Standard: absolute White

Any other acrylic fabric having the same staining properties may be used.

6.2 Production of the dyed master fabric

The dyed master fabric is produced with CI Basic Green 4 applied to standard adjacent fabric (see **6.1**) with the 2,0 % acetic acid 56 % (pH 4 to 5) and 10 % anhydrous sodium sulfate at a liquor ratio of approximately 30 : 1 for 1 h at the boil.

6.3 Standard acrylic adjacent fabric and dyed master acrylic fabric

These are available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F06. Specification for standard adjacent fabric: Silk

1 Scope and field of application

This specification is intended to establish an undyed silk adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard silk adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, two water fastness tests carried out at 37 °C are conducted with composite specimens made from a standard silk adjacent fabric, an adjacent fabric under test and either

a) a dyed master silk fabric, or

b) a dyed master cotton fabric.

Upon completion of the test the staining of each silk adjacent fabric in each test is evaluated using the grey scale for assessing staining.

3 References

ISO 105: section A01, *General principles of testing* — section A03, *Grey scale for assessing staining* —section E01, *Colour fastness to water* — section F02, *Specification for standard adjacent fabric: Cotton and viscose.*

ISO 3072, *Wool — Determination of solubility in alkali.*

4 Apparatus and reagents

4.1 *Apparatus and reagent*, as specified in section E01.

4.2 *Grey scale for assessing staining* (see clause **3**).

4.3 *Reference dye:*

a) for silk dyed master fabric — CI Acid Blue 59;

b) for cotton dyed master fabric — CI Direct Red 79.

4.4 *Samples of master standard silk adjacent fabric* (see **6.3**).

5 Characteristics of the fabric

Choose a fabric having technical characteristics as similar as possible to those of the master standard adjacent fabric.

5.1 Composition and construction

The standard silk adjacent fabric is a silk cloth of mass per unit area 60 ± 3 g/m^2 [4]. It consists of a plain weave cloth with a uniformly smooth surface which has been desized, degummed, dried and calendered. It shall be free from finishes and residual chemicals.

5.2 Staining properties

As adjacent fabrics shall yield exact and reproducible assessments, their most important property is standardized staining characteristics during colour fastness tests. Dyed master fabrics are set up, whose staining properties in specified fastness tests are defined. Staining characteristics of the silk adjacent fabric shall conform to those of the dyed master fabric.

5.2.1 *Dyed master fabrics to be subjected to the colour fastness test*

a) Silk dyed master fabric: CI Acid Blue 59 (Colour Index, 3rd Edition) dyed on a specified silk adjacent fabric (see **6.2**).

b) Cotton dyed master fabric: CI Direct Red 79 (Colour Index, 3rd Edition) dyed on a specific cotton adjacent fabric (see section F02).

5.2.2 *Colour fastness test method employed for assessing the staining properties*

The staining properties of the standard silk adjacent fabric are determined by the method for fastness to water in section E01.

5.2.3 *Test specimens*

In order to test the silk fabric, which is prepared as described in **6.1** and which is intended to be used as a specified silk adjacent fabric, a dyed master fabric (see **5.2.1**) is placed between the silk fabric to be tested and a standard adjacent fabric. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen.

5.2.4 *Results of the staining during the tests*

The staining of the silk adjacent fabrics shall yield the following assessment, measured by the grey scale for assessing staining:

a) water fastness test with the silk dyed master fabric: 3;

b) water fastness test with the cotton dyed master fabric: 3.

The assessment of the staining shall not differ by more than half a step from those specified.

[4] The mass per unit area of the silk adjacent fabric is considerably less than that agreed in principle for such standard fabrics. This is allowed because silk is normally used in this lighter mass per unit area because of its properties.

6 Notes

6.1 Production of the standard silk adjacent fabric

6.1.1 *Raw material for the warp and weft*

Warp: Japanese raw silk 2,3 tex × 3

Weft: Japanese raw silk 2,3 tex × 4

6.1.2 *Loomstate fabric*

Number of threads

warp: 50 per cm

weft: 37 per cm

6.1.3 *Boiling-off and finishing* (inspecting, stain removal and preparing)

6.1.3.1 *Desizing*

Set bath at 70 to 80 °C with boiling-off liquor and treat the material at this temperature overnight.

6.1.3.2 *First scouring*

Treat the desized fabric in loop form in the box for 4 h at 98 to 100 °C in a liquor containing (on mass of fibre)

— soap	10 %
— sodium silicate	5 %
— sodium carbonate, anhydrous	0,5 %
— sodium hydrosulfite	1,2 %

The liquor ratio is 30 : 1.

Rinse once in water at 35 to 45 °C.

6.1.3.3 *Second scouring*

Treat the scoured materials in loop form in the box for 1 h at 98 to 100 °C in a liquor containing (on mass of fibre)

— non-ionic detergent (ethylene oxide condensate)	6 %
— sodium silicate	2 %
— sodium hydrosulfite	1,2 %

The liquor ratio is 30 : 1.

Rinse three ends in warm water at 35 °C. Hydro-extract and dry the material.

6.1.3.4 Finally, calender the material as follows:

— first calendering: two ends by light two-bowl calender;

— second calendering: one end by felt calender.

NOTE Degumming will result in a loss in mass of approximately 27 %.

6.1.4 *Requirements of finished fabric*

pH of aqueous extract: 7,8 ± 0,5

Residual fat content (extract with diethyl ether): 0,5 % max.

Alkali solubility: 19 % maximum (by ISO 3072, but treated with 16 g/l sodium hydroxide solution instead of 0,1 N sodium hydroxide solution)

Degree of whiteness: 70 ± 5, measured on a reflectometer (whiteness formula: $L + 3A - 3B$)

Standard source D_{65}

CIE 1931 standard observer

White Standard: absolute White

Any other silk fabric having the same staining properties may be used.

6.2 Production of the dyed master fabric

6.2.1 *Silk dyed master fabric*

A wetted-out pattern of the silk fabric is entered at 40 °C into a dye-bath containing CI Acid Blue 59, and 0,25 % sodium sulfate (anhydrous), the percentage being calculated on the mass of silk fabric, at a liquor to fabric ratio of 50 : 1. Within 15 min the dye-bath is raised to 90 °C and the fabric is dyed for 30 min at this temperature.

The dye-bath is discharged and the dyeing rinsed with cold water until the water is completely colourless. The dyed fabric is then dried.

6.3.2 *Cotton dyed master fabric*

A wetted-out pattern of the cotton fabric is entered at 40 °C into a dye-bath containing CI Direct Red 79, 20 % sodium sulfate (anhydrous), the percentage being calculated on the mass of cotton fabric, at a liquor to fabric ratio of 50 : 1. Within 20 min the dye-bath is raised to 90 °C and the fabric is dyed for 60 min at this temperature.

The dye-bath is discharged and the dyeing rinsed with cold water until the water is completely colourless. The dyed fabric is then dried.

6.3 Standard silk adjacent fabric and the two dyed master fabrics

These are availalble from

Japanese Standards Association
1-24 Akasaka 4 Chome
Minato-ku
Tokyo, 107
Japan.

F07. Specification for standard adjacent fabric: Secondary acetate

1 Scope and field of application

This specification is intended to establish an undyed secondary acetate adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard secondary acetate adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a wash test is conducted with a composite specimen of a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. The colour difference between the two adjacent fabrics shall be not greater than 4–5 when evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section C02, *Colour fastness to washing: Test 2.*

4 Apparatus and reagents

4.1 *Apparatus and reagents*, as specified in section C02.

4.2 *Standard secondary acetate adjacent fabric* (see **6.3**).

4.3 *Reference dye*: CI Disperse Red 1, applied to standard adjacent fabric (see **6.2**).

The reference dye was selected to give a dyed master standard which, when tested according to section C02 with two master standard adjacent fabrics, gives a staining in the range of 2–3 and 3–4.

5 Characteristics of the fabric

5.1 Choice of fabric

Select a fabric having technical characteristics approaching those of the standard secondary acetate adjacent fabric (see **6.1**).

5.2 Requirements of finished fabric

pH of finished fabric: $7 \pm 0,5$

Finished mass per unit area: 160 ± 5 g/m^2

Residual oil content: less than 1,0 %

Whiteness (defined by trichromatic co-ordinates, D_{65}, 10° observer):

$x = 0,321\,0 \pm 0,003\,0$

$y = 0,338\,0 \pm 0,003\,0$

$Y = 87,5 \pm 2,0$

Any other fabrics having the same staining properties may be used.

5.3 Staining properties

Conduct a test according to section C02 with the dyed master fabric (see **6.2**) placed between the standard adjacent fabric and the adjacent fabric under test. The colour difference between the stain on the standard adjacent fabric and that on the fabric under test is evaluated with the grey scale for assessing change in colour. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard secondary acetate adjacent fabric

6.1.1 *Material for warp and weft*

Staple fibre

a) 0,333 tex per filament

b) 50,8 mm length

c) bright lustre

6.1.2 *Yarn for warp and weft*

15 tex Z 630 × 2 S 400; R 30 tex

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 *Loomstate fabric*

Width in the loom at the reed: 127 cm

Weave 1/1 plain

Number of threads

warp: 14,4 per cm

weft: 12,8 per cm

6.1.4 *Finishing*

6.1.4.1 *Jig scour*

a) Set bath at 60 °C.

b) Use a non-ionic detergent (ethylene oxide condensate) and tetrasodium pyrophosphate.

c) Run one end at 60 °C.

d) Raise to 95 °C, run one end, drop bath.

e) Rinse twice, one end each at 95 °C.

f) Rinse cold running water, three ends.

6.1.4.2 *Neutralization*

a) Set bath at 60 °C.

b) Use a buffer solution containing, per litre, 0,5 g monosodium phosphate and 1,5 g disodium phosphate.

c) Run for 30 min at 60 °C.

6.1.4.3 *Drying*

Dry at 95 °C in a tenter frame. Frame to 110 to 112 cm.

6.2 Preparation of dyed master fabric

The dyed master fabric is produced with CI Disperse Red 1 applied to standard adjacent fabric (see **6.1**) with 0,5 % anionic dispersing agent and monosodium phosphate to a pH of 6 to 7 at a liquor ratio of 30 : 1. Raise temperature at 2 °C/min to 85 °C. Run for 1 h at 85 °C.

6.3 Standard secondary acetate adjacent fabric and dyed master secondary acetate fabric

These are available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F08. Specification for standard adjacent fabric: Triacetate

1 Scope and field of application

This specification is intended to establish an undyed triacetate adjacent fabric which may be used for the assessment of staining in colour fastness test procedures. The standard triacetate adjacent fabric exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a wash test is conducted with a composite specimen of a dyed master fabric, a standard adjacent fabric and an adjacent fabric under test. The colour difference between the two adjacent fabrics shall be not greater than 4–5 when evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section C02, *Colour fastness to washing: Test 2.*

4 Apparatus and reagents

4.1 *Apparatus and reagents*, as specified in section C02.

4.2 *Standard triacetate adjacent fabric* (see **6.3**).

4.3 *Reference dye*: CI Disperse Red 1, applied to standard adjacent fabric (see **6.2**).

The reference dye was selected to give a dyed master standard which, when tested according to section C02 with two master standard adjacent fabrics, gives a staining in the range of 2–3 and 3–4.

5 Characteristics of the fabric

5.1 Choice of fabric

Select a fabric having technical characteristics approaching those of the standard triacetate adjacent fabric (see **6.1**).

5.2 Requirements of finished fabric

pH of finished fabric: $7 \pm 0{,}5$

Finished mass per unit area: 190 ± 5 g/m^2

Residual oil content: less than 1,0 %

Whiteness (defined by trichromatic co-ordinates, D_{65}, 10° observer):

$x = 0{,}322\,0 \pm 0{,}003\,0$

$y = 0{,}339\,0 \pm 0{,}003\,0$

$Y = 84{,}0 \pm 2{,}0$

Any other fabric having the same staining properties may be used.

5.3 Staining properties

Conduct a test according to section C02 with the dyed master fabric (see **6.2**) placed between the standard adjacent fabric and the adjacent fabric under test. The colour difference between the stain on the standard adjacent fabric and that on the fabric under test is evaluated with the grey scale for assessing change in colour. To eliminate possible differences in test conditions, both the standard adjacent fabric and the adjacent fabric under test are used in the same composite specimen. The fabric under test is acceptable for its staining properties when the colour difference between the staining of the standard and that of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard triacetate adjacent fabric

6.1.1 *Material for warp and weft*

Staple fibre

a) 0,278 tex per filament

b) 33 mm length

c) bright lustre

6.1.2 *Yarn for warp and weft*

16,5 tex Z 640 × 2 S 400; R 33 tex

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 *Loomstate fabric*

Width in the loom at the reed: 127 cm

Weave 1/1 plain

Number of threads

warp: 14,4 per cm

weft: 12,8 per cm

6.1.4 *Finishing*

6.1.4.1 *Jig scour*

a) Set bath at 60 °C.

b) Use a non-ionic detergent (ethylene oxide condensate) and tetrasodium pyrophosphate.

c) Run one end at 60 °C.

d) Raise to 95 °C, run one end, drop bath.

e) Rinse twice, one end each at 95 °C.

f) Rinse cold running water, three ends.

6.1.4.2 *Neutralization*

a) Set bath at 60 °C.

b) Use a buffer solution containing, per litre, 0,5 g monosodium phosphate and 1,5 g disodium phosphate.

c) Run for 30 min at 60 °C.

6.1.4.3 *Drying*

Dry at 95 °C in a tenter frame. Frame to 110 to 112 cm.

6.2 Preparation of dyed master fabric

The dyed master fabric is produced with CI Disperse Red 1 applied to standard adjacent fabric (see **6.1**) with 0,5 % anionic dispersing agent and 5,0 % butyl benzoate carrier and acetic acid to a pH 5,5 to 6,5 at a liquor ratio of 30 : 1. Raise temperature at 1 °C/min to 95 °C. Run for 1 h at 95 °C.

6.3 Standard triacetate adjacent fabric and dyed master triacetate fabric

These are available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F09. Specification for standard rubbing cloth: Cotton

1 Scope and field of application

This specification is intended to establish an undyed cotton cloth which may be used for the assessment of staining in colour fastness to rubbing test procedures. The standard cotton rubbing cloth exhibits standardized staining properties.

2 Principle

For testing the standardized staining properties, a rubbing test is conducted with a specimen of a dyed master fabric, a standard rubbing cloth and a rubbing cloth under test. The colour difference between the two rubbing cloths shall be not greater than 4–5 when evaluated using the grey scale for assessing change in colour.

3 References

ISO 105: section A01, *General principles of testing* — section A03, *Grey scale for assessing staining* — section F02, *Specification for standard adjacent fabric: Cotton and viscose* — section X12, *Colour fastness to rubbing.*

4 Apparatus and reagents

4.1 *Apparatus and reagents*, as specified in section X12.

4.2 *Standard cotton rubbing cloth* (see **6.3**).

4.3 *Reference dye*: CI Direct Blue 1, applied to standard adjacent fabric: Cotton (see **6.2**).

5 Characteristics of the fabric

5.1 Choice of fabric

Select a fabric having technical characteristics approaching those of the standard cotton rubbing cloth (see **6.1**).

5.2 Requirements of finished fabric

pH of finished fabric: $7 \pm 0,5$

Finished mass per unit area: 110 ± 5 g/m^2

Residual oil content: less than 1,0 %

Whiteness (defined by trichromatic co-ordinates, D_{65}, 10° observer):

$x = 0,317\,0 \pm 0,003\,0$

$y = 0,333\,0 \pm 0,003\,0$

$Y = 90,5 \pm 2,0$

Any other fabric having the same properties may be used.

5.3 Staining properties

Conduct tests under standard conditions (see clause **9** of section A01), according to section X12 with the dyed master fabric (see **6.2**) using both ten pieces of standard rubbing cloth and ten pieces of the rubbing cloth under test. The colour difference between the mean obtained for the ten pieces of standard rubbing cloth and the mean obtained for the ten pieces of the fabric under test is evaluated with the grey scale for assessing staining. The fabric under test is acceptable for its staining properties when the colour difference between the mean of the staining of the ten pieces of the standard rubbing cloth and the mean of the staining of the ten pieces of the adjacent fabric under test is not greater than 4–5.

6 Notes

6.1 Production of the standard cotton rubbing cloth

6.1.1 *Material for warp and weft*

Fibre

a) 100 % combed cotton staple.

b) 10,3 to 26,8 mm length

c) strict low middling grade

6.1.2 *Yarn for warp and weft*

15 tex Z 590

The yarn shall not contain fluorescent brighteners. No warp sizing material shall be present.

6.1.3 *Loomstate fabric*

Width in the loom at the reed: 119 cm

Weave 1/1 plain

Number of threads

warp: 32 per cm

weft: 33 per cm

6.1.4 *Finishing*

6.1.4.1 *Enzyme saturation*

a) Singe both sides of the fabric, gas fired, open width.

b) Preliminary treatment — hold in solution at 70 to 82 °C for a minimum of 2 h.

c) Kier boil — under pressure, 107 to 110 °C, in rope form for 12 h in a weak alkali solution.

6.1.4.2 *In a J-Box series continuous operation*

a) Detergent scour at 95 °C.

b) Rinse clear water at 50 °C.

c) Hydrogen peroxide bleach.

d) Acetic acid sour.

e) Rinse clear water at 95 °C.

6.1.4.3 *Drying*

Dry at 150 °C in a tenter frame. Frame to 110 cm.

6.2 Preparation of dyed master fabric

The dyed master fabric is that used in section F02, dyed with CI Direct Blue 1.

6.3 Standard cotton rubbing cloth

Available from

AATCC
P.O. Box 12215
Research Triangle Park
North Carolina, 27709
USA.

F10. Specification for adjacent fabric: Multifibre

1 Scope

This part of ISO 105 establishes general requirements for undyed multifibre adjacent fabrics which may be used for the assessment of staining in colour fastness test procedures. The multifibre adjacent fabrics exhibit standardized staining properties.

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 agreements 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 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-C02:1989, *Textiles — Tests for colour fastness — Part C02: Colour fastness to washing: Test 2.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-J02:1987, *Textiles — Tests for colour fastness — Part J02: Method for the instrumental assessment of whiteness.*

3 General requirements

3.1 Each component of the multifibre adjacent fabric shall be made from fibres having staining characteristics similar to those used in the corresponding single-fibre adjacent fabrics specified in ISO 105-F:1985, sections F01 to F05, F07 and F08. The staining characteristics of multifibre adjacent fabrics shall be determined using the method in Annex A.

3.2 There are two types of multifibre adjacent fabric as described in Table 1.

Table 1 — Multifibre adjacent fabrics

Multifibre DW	Multifibre TV
Secondary acetate	Triacetate
Bleached cotton	Bleached cotton
Polyamide	Polyamide
Polyester	Polyester
Acrylic	Acrylic
Wool	Viscose

Some colour fastness test procedures cannot be performed in the presence of wool and/or secondary acetate. In this case, type TV multifibre adjacent fabric shall be used in place of type DW.

NOTE 1 For sources of supply, reference should be made to national standards institutions.

3.3 Fabrics of other constructions, but having the same width of strip and exhibiting the same staining characteristics as the multifibre fabric described in this part of ISO 105, may also be used, but such use shall be noted in the test report.

3.4 Since there may be differences in test results when multifibre adjacent fabrics are used instead of single-fibre adjacent fabrics, the type of adjacent fabric used shall be indicated in the test report.

4 Characteristics of the fabrics

4.1 Material for the warp yarn

Fibre: bright filament polyester (not containing optical brightener)

Yarn: 15,5 tex/27 filament/R02
400 turns/m Z twist

4.2 Material for the weft yarn

See Table 2.

Table 2 — Material for the weft yarn

Properties	Secondary acetate	Bleached cotton	Polyamide	Polyester	Acrylic	Wool	Triacetate	Viscose
Staple fibre								
Lustre or grade	bright	"strict low middling" to "bright"	semi-dull	semi-dull	semi-dull	Australian 64's quality	bright	dull
Tex per filament	0,333	—[a]	0,333	0,17	0,28	—[b]	0,333	0,17
Length, mm	50,8	27 to 25,7	38,0	38,0	38,0	82,5 ± 27	50,8	40,0
Yarn								
Linear density	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply	30 tex × 2 ply
Spin twist, turns/m	640 Z	570 Z	670 Z	640 Z	640 Z	450 Z	640 Z	510 Z
Doubling twist, turns/m	400 S	590 S	400 S	400 S	480 S	130 S	400 S	400 S
Whiteness[c]								
x	0,320 ± 0,003	0,318 ± 0,003	0,320 ± 0,003	0,318 ± 0,003	0,318 ± 0,003	0,338 ± 0,003	0,320 ± 0,003	0,328 ± 0,003
y	0,338 ± 0,003	0,335 ± 0,003	0,335 ± 0,003	0,336 ± 0,003	0,335 ± 0,003	0,335 ± 0,003	0,338 ± 0,003	0,345 ± 0,003
Y	80,0 ± 2,0	86,0 ± 2,0	83,0 ± 2,0	80,0 ± 2,0	82,0 ± 2,0	65,0 ± 2,0	80,0 ± 2,0	82,0 ± 2,0
W_{10}	63 ± 5	76 ± 5	71 ± 5	68 ± 5	72 ± 5	—[d]	63 ± 5	47 ± 5

[a] Micronaire: 4,4 average.

[b] Diameter: 22,22 µm.

[c] D_{65}, 10° observer, calculations in accordance with ISO 105-J02.

[d] The whiteness value for this fibre will be included in a subsequent edition of this part of ISO 105.

4.3 Fabric construction

Width in the loom at the reed: 127 cm

Weave: 6/6 in the filling stripes
1/1 in the cutting stripes

Number of threads: warp 35,4 per centimetre
weft 29,5 per centimetre (average)

Each weft stripe measured in the warp direction shall be 1,5 cm in width. The cutting stripe shall be 0,5 cm of the spun polyester.

Weaving pattern:

Type DW	Type TV
62 threads spun secondary acetate	62 threads spun triacetate
48 threads bleached cotton	48 threads bleached cotton
56 threads spun polyamide	56 threads spun polyamide
48 threads spun polyester	48 threads spun polyester
44 threads spun acrylic	44 threads spun acrylic
60 threads worsted wool	60 threads spun viscose
16 threads spun polyester — cutting stripe —	16 threads spun polyester

4.4 Preparation

It is recommended that the woven fabric be washed in a jig as follows:

Set bath at 70 °C with a non-ionic detergent (ethylene oxide condensate) and sodium tetraphosphate.

Run two ends. Drop bath.

Rinse two ends at 50 °C.

Rinse two ends in cold running water.

Dry at 93 °C.

Frame to 114 cm to 116 cm.

Annex A (normative) Method for establishing the consistency in staining between different production batches of adjacent fabric

A.1 Scope

This annex specifies a method of quality control for establishing the consistency in staining between different production batches of adjacent fabric.

A.2 Principle

Comparative staining tests are conducted on a sample of a reference batch and a sample of the new batch of the fabric. The staining of each of the adjacent fabrics is then compared with the grey scale for assessing change in colour.

A.3 Apparatus and reagents

A.3.1 *Apparatus and reagents*, as specified in ISO 105-C02.

A.3.2 *Samples of undyed reference adjacent fabric and adjacent fabric under test*, each measuring 40 mm × 100 mm.

A.3.3 For staining polyamide, wool and silk: *Irgalan Orange RL-KWL* 250 % (CI Acid Orange 86). For staining cotton and viscose: *Solophenyl Blue GL* 230 % (CI Direct Blue 71). For staining diacetate, triacetate, polyamide and polyester: *Terasil Yellow 2GW* 200 % (CI Disperse Yellow 54). For staining polyester, diacetate, triacetate and polyamide: *Terasil Navy Blue BGLN* (CI Disperse Blue 130).

A.4 Procedure

A.4.1 Place the sample of undyed reference fabric and the sample of undyed adjacent fabric under test (**A.3.2**) in separate containers and add to each the necessary amount of soap solution (see **A.3.1**) and appropriate dye solution (see clause **A.7**).

A.4.2 Treat each fabric at 50 °C ± 2 °C for 45 min.

A.4.3 Remove each fabric, rinse twice in cold grade 3 water (see **A.3.1**) and then in cold, running tap-water for 10 min, then squeeze. Open out each fabric and dry by hanging in air at a temperature not exceeding 60 °C.

A.4.4 Assess the staining of the reference adjacent fabric using the grey scale for assessing staining (see **A.3.1**) to ensure that the degree of staining is 3–4.

A.4.5 Compare the staining of the reference adjacent fabric with that of the adjacent fabric under test using the grey scale for assessing change in colour (see **A.3.1**).

A.5 Assessment of results

The adjacent fabric under test is acceptable for its staining properties when the colour difference between the staining of the reference and that of the fabric under test is not greater than 4–5 as measured by the grey scale for assessing change in colour.

A.6 Test report

Report the staining of the adjacent fabric under test (see clause **A.5**).

A.7 Notes

The amount of dye used shall give a staining on the reference adjacent fabric of 3–4 whilst ensuring that there is dye left in the test liquor at the end of the test. The following concentrations of dye are given as a guide:

Irgalan Orange RL-KLW (250 %): 0,025 g/l
Solophenyl Blue GL (230 %): 0,001 5 g/l
Terasil Yellow 2GW (200 %): 0,002 g/l
Terasil Navy Blue BGLN (100 %): 0,100 g/l

The test shall be carried out separately with each dye.

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G04. Colour fastness to oxides of nitrogen in the atmosphere at high humidities

1 Scope

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles to the action of oxides of nitrogen in the atmosphere at elevated temperatures and high relative humidities.

For testing at lower humidities, see ISO 105-G:1978, section G01.

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 agreements 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 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-C01:1989, *Textiles — Tests for colour fastness — Part C01: Colour fastness to washing: Test 1.*

ISO 105-C02:1989, *Textiles — Tests for colour fastness — Part C02: Colour fastness to washing: Test 2.*

ISO 105-C03-1989, *Textiles — Tests for colour fastness — Part C03: Colour fastness to washing: Test 3.*

ISO 105-C04:1989, *Textiles — Tests for colour fastness — Part C04: Colour fastness to washing: Test 4.*

ISO 105-C05:1989, *Textiles — Tests for colour fastness — Part C05: Colour fastness to washing: Test 5.*

ISO 105-D01:1987, *Textiles — Tests for colour fastness — Part D01: Colour fastness to dry cleaning.*

ISO 105-G:1978, *Textiles — Tests for colour fastness — Part G: Colour fastness to atmospheric contaminants.*

ISO 105-J01:1989, *Textiles — Tests for colour fastness — Part J01: Measurement of colour and colour differences.*

3 Principle

A test specimen and a piece of control fabric are simultaneously exposed to oxides of nitrogen in an atmosphere which is maintained at 87,5 % ± 2,5 % relative humidity and a temperature of 40 °C ± 1 °C until the control fabric shows a colour change corresponding to that of a reference of fading. The exposure/measurement cycle is repeated until the specimen shows a definite colour change or for a prescribed number of cycles.

4 Apparatus and reagents

4.1 *Exposure chamber*, made of stainless steel which is coated on the inside with a resistant coating, capable of maintaining an atmosphere having a relative humidity of 87,5 % ± 2,5 % relative humidity at a temperature 40 °C ± 1 °C and containing nitrogen dioxide at a concentration by volume of 5 ppm ± 1 ppm.

4.2 *Control fabric* (see **8.2**).

4.3 *Reference of fading (fabric)* (see **8.2**).

4.4 *Grey scale for assessing change of colour*, complying with ISO 105-A02.

4.5 *Supply of oxides of nitrogen* (see **8.3**).

WARNING — Oxides of nitrogen in high concentrations are injurious to health and should be exhausted to the atmosphere or trapped in water and neutralized with a 10 % (*m/m*) solution of sodium hydroxide or sodium hydrogen carbonate. The maximum concentration in a work area should not exceed 5 ppm (*V/V*).

5 Test specimens

5.1 Cut out test specimens measuring at least 60 mm × 60 mm. For subsequent colour comparison, the unexposed sample shall be kept in an air-tight container away from light to avoid further colour changes.

5.2 If the test involves the effect of oxides of nitrogen on laundered or dry-cleaned material, use laundered or dry-cleaned material for both the control and test exposure. For the preparation of specimens for testing after laundering or dry cleaning, follow the procedures described in parts C01 to C05 and/or part D01 of ISO 105.

6 Procedure

6.1 Suspend the test specimens and piece of control fabric (**4.2**) in the exposure chamber (**4.1**) which should produce a cycle of fade within 5 h to 15 h of exposure.

6.2 Examine the control fabric periodically until its colour corresponds to that of the reference of fading. This constitutes one cycle.

An alternative method of determining one cycle of fade is to terminate the exposure cycle when the control fabric exhibits a colour change of (16,5 ± 1,5) CIELAB units (see ISO 105-J01).

6.3 Remove those specimens which exhibit a noticeable colour change at the end of one cycle. One cycle will generally produce a measurable colour change in samples which are sensitive to oxides of nitrogen.

6.4 Suspend a fresh piece of control fabric (**4.2**) for each additional cycle of fade until the required number of cycles has been completed.

Specimens exposed to oxides of nitrogen may continue to change colour after removal from the test chamber. The colour may be stabilized by plunging them into a buffered urea solution (see **8.4**) for 5 min, squeezing them out, thoroughly rinsing them in clean water and drying them in air at a temperature not above 60 °C. Do not treat with the urea solution any specimen that is to be returned to the test chamber for additional exposure.

6.5 At the end of each cycle, immediately assess the change in colour of the specimen using the grey scale for assessing change in colour (**4.4**).

6.6 Classify the effect on colour of test specimens after the specified number of cycles, using the grey scale for assessing change in colour (**4.4**).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-G04:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen, the number of cycles and the temperature and relative humidity at which the test was performed.

8 Notes

8.1 Humidity for testing

The fading of dyes by oxides of nitrogen on some fibres such as polyamide and acetate is altered greatly by relatively small variations in relative humidity at high humidities. Therefore, to achieve reproducibility and good interlaboratory correlation in test results, close control of temperature and relative humidity is required.

8.2 Test control and standard of fading

The test-control fabric is a dyeing of 0,4 % CI Disperse Blue 3 on secondary cellulose acetate satin. Use Celliton Blue FFRN since its fading characteristics are well known and other CI Disperse Blue 3 dyes tend to exhibit different fading characteristics and may differ in tinctorial strength.

The reference of fading for the control fabric is dyed on cellulose (viscose) satin with approximately the following formula: 0,300 % CI Direct Blue 80 and 0,015 % CI Direct Violet 47 based on the mass of the fabric.

Both the control fabric and the reference of fading shall be kept in a suitable container or enclosure to protect them from possible exposure to oxides of nitrogen and other contaminants which might be present in the atmosphere during transportation and storage and which could cause a colour change.

The control fabric is sensitive to other atmospheric contaminants such as ozone. Its fading rate will vary considerably at different humidities and temperatures and its use in natural or end-use testing as a measure of exposure to oxides of nitrogen is not recommended. The colour change produced on the control will reflect the combined effects of the atmospheric contaminants present and the effect of temperature/humidity variations, not just the effects of exposure to oxides of nitrogen.

8.3 Oxides of nitrogen

Use bottled gas which contains approximately 1 % nitrogen dioxide in nitrogen, in cylinders equipped with the proper reducing valves. For safety, chain the cylinders to a wall so that they cannot fall or be knocked down.

8.4 Urea after treatment

The use of this treatment is optional.

Experience has shown that colour change after removal of specimens from the exposure chamber is negligible. The urea treatment itself will often cause a colour change in specimens. Therefore, if this procedure is used, it is essential that both the exposed and unexposed control specimens be treated in an identical manner.

Use urea solution containing 10 g of urea per litre of water, buffered to pH 7 by addition of 0,4 g of sodium dihydrogen orthophosphate, 2,5 g of disodium orthophosphate and 0,1 g or less of a rapid-wetting surface-active agent (for example, sodium dioctyl sulfosuccinate).

Group J. Measurement of colour and colour differences

J01. Measurement of colour and colour differences

1 Scope

This part of ISO 105 specifies a method for measuring the colour difference between two specimens of textile in any form. The existence of a master reference is necessary when the test is carried out by comparing the master reference with the test specimen. The method is applicable to coloured specimens.

2 Normative reference

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

CIE Publication No. 15.2:1986, *Colorimetry* (Second edition)[5].

3 Principle

This part of ISO 105 selects from the several options published by the International Commission on illumination (CIE) those best suited to the needs of the textile industry whenever the difference in colour between two specimens has to be quantified.

4 Methods of test

4.1 Determination of basic colorimetric data

4.1.1 Whenever it is desirable to minimize the variations in reflectance values obtained from different spectrometers, the specular component shall be included.

4.1.2 The reflectance values shall be converted into X, Y, Z tristimulus values using the colour matching functions (spectral tristimulus values) in the CIE 1964 supplementary standard colorimetric system (10° observer data) for illuminant D_{65}.

4.1.3 Whenever a master reference is established, the tristimulus values shall be converted into the x, y chromaticity co-ordinates and recorded together with the Y tristimulus value.

4.2 Calculation of colour differences

4.2.1 The X, Y, Z, tristimulus values of a specimen representating the reference and of a specimen representing a sample shall be determined using either a spectrometer or a tristimulus colorimeter.

4.2.2 These values shall then be converted into L^*, a^*, b^* values using the equations given in CIE Publication **15.2**. If any one of the ratios X/X_n, Y/Y_n or Z/Z_n is equal to or less than 0,008 856, the equations given in note 1 of sub-clause **4.2.3** of CIE Publication 15.2:1986 shall be used.

4.2.3 The L^*, a^*, b^* values of the reference and the sample shall then be used to calculate the colour difference in CIELAB units using the equation given in CIE Publication **15.2.**

4.2.4 Any colour difference may be partitioned into three components:

— a lightness component,

— a chroma component and

— a hue component,

using the differences in CIE 1976 psychometric lightness (ΔL^*), in CIE 1976 a, b chroma and in CIE 1976 a, b hue using the equations in CIE Publication **15.2.**

4.2.5 Whenever the colorimetric data x, y, Y of a master reference are established, the tolerances for working references shall be given in CIELAB units.

[5] Available from the Central Bureau of the CIE, P.O. Box 169, A-1033 Vienna, Austria.

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J02. Method for the instrumental assessment of whiteness

1 Scope and field of application

This part of ISO 105 specifies a method intended for quantifying the whiteness of textiles, including fluorescent materials.

2 References

ISO 105-J01, *Textiles — Tests for colour fastness — Part J01: Method for the measurement of colour and colour differences.*

CIE Publication No. 15.2:1986, *Colorimetry* (second edition)[6].

3 Principle

The chromaticity co-ordinates x_{10}, y_{10} and the Y_{10} tristimulus values are calculated from the spectral radiance factors of the specimen and converted into a whiteness value. If these cannot be calculated, the x, y, Y values may be used instead. The redness/greenness tint factor may also be determined.

4 Apparatus

Spectrophotometer, that irradiates the specimen with light resembling standard illuminant D_{65}.

5 Test specimen

The specimen shall consist of a number of layers sufficient to ensure that the addition of another layer does not alter the spectral radiance factors.

6 Procedure

6.1 Measure the spectral radiance factors of the test specimen with a spectrophotometer (clause 4).

6.2 Calculate the x_{10}, y_{10} and Y_{10} values under illuminant D_{65} using the colour matching functions defining the CIE 1964 supplementary standard colorimetric observer. If this is not possible, the x, y, Y values obtained from the colour matching functions defining the CIE 1931 colorimetric observer may be used.

6.3 Calculate the whiteness value W_{10} from the equation

$$W_{10} = Y_{10} + 800\,(0{,}313\,8 - x_{10}) + 1\,700\,(0{,}331\,0 - y_{10})$$

If required, calculate the tint factor $T_{W,10}$ from the equation

$$T_{W,10} = 900\,(0{,}313\,8 - x_{10}) - 650\,(0{,}331\,0 - y_{10})$$

If x, y, Y values have been obtained, the corresponding equations are :

$$W = Y + 800\,(0{,}312\,7 - x) + 1\,700\,(0{,}329\,0 - y)$$

$$T_W = 1\,000\,(0{,}312\,7 - x) + 650\,(0{,}329\,0 - y)$$

7 Test report

Report details of the sample tested, the whiteness value W_{10} and, if required, the tint factor $T_{W,10}$.

8 Notes

8.1 The perfect diffuser has whiteness values, W_{10} and W, of 100,00. The higher the whiteness value, the greater the indicated whiteness.

8.2 The tint formulae are based on the empirical result that lines of equal tint run approximately parallel to lines of dominant wavelength 466 nm in the x_{10}, y_{10} and xy chromaticity diagrams. The perfect diffuser has tint factors, $T_{W,10}$ or T_W, of zero. This corresponds to a dominant wavelength in the blue region of the spectrum at 466 nm. Positive values of $T_{W,10}$ or T_W indicate greenness; negative values, redness.

8.3 The test method provides relative, but not absolute, evaluations of whiteness and is restricted to specimens which are measured on the same instrument or on instruments known to give values which are acceptably close. The application of the formulae is restricted to samples whose values of W_{10} or W and $T_{W,10}$ or T_W, lie within the following limits:

W_{10} or W greater than 40 and less than $5Y_{10} - 280$ or $5Y - 280$;

$T_{W,10}$ or T_W greater than -3 and less than $+3$.

[6] This publication is available from the
Central Bureau of the CIE
P.O. Box 169
A-1033 Vienna
Austria.

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Group UK-L. Colour fastness of leather

Introduction

The UK-L series includes methods that are specific to leather. The following sections of BS 1006 are applicable to leather.

A01 General principles of testing

A02 Grey scale for assessing change in colour

A03 Grey scale for assessing staining

B01 Colour fastness to light: Daylight

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

D01 Colour fastness to dry cleaning

E01 Colour fastness to water

In general, in these methods leather is tested as for textile fabric and consequently the procedures in A01 and the grey scales are used. However, additional procedures are given in a National appendix to method E07.

In this revision, the methods in UK-LH and UK-LI have been deleted since they are covered by the revised UK-LB.

UK-LJ has also been deleted. The principal changes introduced are as follows.

a) *UK-LA*. The revision of this method takes account of changes to the equipment available to carry out the test.

b) *UK-LB*. This method has been revised to refine the procedure and introduce into the main text the use of materials other than filter paper. (This usage was previously only given in a note.)

c) *UK-LC*. This method has been revised to update the testing procedure and introduce more flexibility e.g. in terms of numbers of rubs that are to be applied. The equipment is described by its essential features and not by a diagram.

d) *UK-LD*. This method has been replaced by the current IULTCS method.

e) *UK-LF*. This method has been replaced by the current IULTCS method.

f) *UK-LG*. This method has been revised to update the testing procedure, which is now similar to that of UK-LC in terms of its flexibility.

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UK-LA. Colour stability to heat

1 Scope

This method is intended for determining the stability of the colour of sheet materials to heating, such as may occur during processing, for example when leathers are used in the production of shoes and subjected to hot blasting and ironing. The purpose of the test is primarily to ascertain if changes of colour occur, but other changes in appearance are noted. The test is applicable to all sheet materials used in the production of footwear.

2 Principle

A test specimen is placed in contact with the flat face of a heated metal member for a period of 5 s, with a contact pressure of 0.02 MPa. When cool, the resultant change of colour is assessed, using the grey scale, and other changes in appearance are noted.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour.*

4 Apparatus and materials

4.1 *Device*, incorporating the features specified in **4.1.1** to **4.1.6**.

4.1.1 *Copper member* (referred to as the bit), of mass 200 g ± 20 g, with a polished chromium plated face of area 645 mm^2 ± 50 mm^2 and with its outer surfaces lagged with heat insulating material.

4.1.2 *Means* for heating the bit progressively up to a maximum temperature of 270 °C (e.g. by an electrical resistance heating element) and for switching the heat source on and off or for otherwise controlling the temperature.

4.1.3 *Means* for raising and lowering the bit and for bringing its face into contact with the test specimen in a horizontal plane, with a uniformly distributed pressure of 20.7 kPa ± 2.1 kPa.

4.1.4 *Support*, with an insulated face, on which the face of the bit can be rested during heating and which can be moved aside to enable the bit to be lowered onto the test specimen.

4.1.5 *Platform*, of area not less than that of the polished face of the bit, to receive the test specimen.

NOTE The equipment is designed so as to ensure that the platform lies in the same plane as the face of the bit irrespective of the thickness of the test sample.

4.1.6 *Thermometer*, to cover the range 50 °C to 250 °C, for measuring the temperature of the bit.

4.2 *Stopwatch*, that can be read to 0.2 s.

4.3 *Grey scale*, for assessing change in colour (see clause **3**).

5 Test specimen

A strip of material, 40 mm wide and at least 120 mm long, is suitable for the majority of tests.

NOTE A longer strip (or additional strips) may be required if additional or duplicate test temperatures are used.

6 Procedure

6.1 Turn on the means of heating (**4.1.2**), with the bit (**4.1.1**) resting on its support (**4.1.4**), and place the test specimen on the platform (**4.1.5**) beneath the face of the bit, with the side to be tested uppermost.

6.2 When the temperature has reached 20 °C above the temperature at which the test is to be carried out, turn off the heat and, when the temperature has fallen to the test temperature (i.e. initially 150 °C ± 3 °C), move the support aside and lower the face of the bit onto the test specimen. Start the stopwatch at the instant of contact.

6.3 After 5 s ± 0.2 s, raise the bit clear of the test specimen.

6.4 Repeat the test successively at temperatures of 200 °C ± 4 °C and 250 °C ± 5 °C, each test being carried out on a fresh area of the test specimen.

6.5 Allow the test specimen to cool to room temperature.

6.6 Assess, using the grey scale (**4.3**), the change in colour between the tested areas and the untreated specimen.

6.7 If required, assess the reparability of the damage to the test specimen by applying a colourless wax polish to restore gloss or by brushing the nap of suede leathers using a stiff brush. Reassess in accordance with **6.6**.

7 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LA:1992;

b) which surface of the specimen was tested;

c) for each temperature of test:

1) the numerical rating for the degree of colour change shown by the test;

2) the nature of the colour change, if any [e.g. darkened, scorched (yellowing)], loss of gloss;

3) any other change in appearance;

4) if required, the effect of the repair treatments given in **6.7**;

d) any deviations from the test procedure.

8 Notes

8.1 For information on the availability of suitable apparatus write to Customer Services, Information Services Group, BSI, Linford Wood, Milton Keynes MK14 6LE.

8.2 To prevent sticking, apply a thin coat of anti-stick release agent to the face of the bit as and when necessary. Precautions should be taken to ensure that this anti-stick agent does not affect the colour of the test sample.

8.3 If appropriate, other temperatures of test and contact times may be used.

UK-LB. Colour fastness to marking-off of coloured leathers

1 Scope

This method is intended for determining the resistance of the colour of leather to marking-off onto other materials with which it is in contact, particularly during storage.

2 Principle

A specimen of leather is stored under heat and pressure in contact with a material of interest. The staining of the contact material through movement of colour from the leather is assessed using the grey scale.

3 References

BS 1006: section A01, *General principles of testing* — section A03, *Grey scale for assessing staining*.

4 Apparatus and materials

4.1 *Smooth glass plate*, of at least 50 mm × 50 mm and of mass 50 g ± 5 g.

4.2 *Support plate*, of at least 50 mm × 50 mm, with a flat surface.

4.3 *Weight*, of mass 1 000 g ± 10 g.

4.4 *Contact material*, 60 mm × 50 mm, being filter paper or other material of interest, e.g. coated fabric.

4.5 *Grey scale*, for assessing staining (see clause **3**).

4.6 *Oven*, maintained at a temperature of 60 °C ± 2 °C.

5 Test specimen

A piece of leather, 50 mm ± 2 mm × 40 mm ± 2 mm, is suitable for the test.

6 Procedure

6.1 Place the contact material (**4.4**) symmetrically on the support plate (**4.2**) and place the test specimen, surface of interest downwards, symmetrically on top of the contact material (see **8.1**). Cover with the glass plate (**4.1**) and place the weight (**4.3**) symmetrically on the glass plate.

6.2 Place the assembly (**6.1**) in the oven (**4.6**) for 4 h ± 5 min.

6.3 Remove from the oven and separate the contact material and the test specimen.

6.4 Assess, using the grey scale (**4.5**), the degree of staining of the contact material.

7 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LB:1992;

b) which surface of the specimen was tested;

c) sufficient details of the contact material used to allow precise identification for the purposes of repeat testing;

d) the numerical rating for the staining of the contact material;

e) the colour of staining (if any);

f) any deviations from the test procedure.

8 Notes

8.1 This procedure ensures that the entire area of the leather test specimen is in contact with the contact material. In addition it provides an area of contact material which remains practically unstained and this considerably facilitates the assessment of marking-off where this has occurred.

8.2 The development of this test has been described by Kirkpatrick C.F., *Journal of the Society of Leather Trades Chemists*, 1961, **45**.

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UK-LC. Colour fastness to rubbing

1 Scope

This method is intended for determining the fastness of materials to wet and dry circular rubbing and for measuring the transfer of colour to the material with which it is rubbed. The method is applicable to all coloured sheet materials used in the production of footwear.

2 Principle

A specimen of material under test is rubbed with a revolving felt pad and the loss of colour from the surface and/or the colour transfer to the rubbing pad are assessed after a particular number of revolutions.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining.*

BS 3144, *Methods of sampling and physical testing of leather.*

BS 4060, *Specification for pressed wool felts.*

4 Apparatus and materials

4.1 *Machine*, suitable for carrying out the various tests of fastness to rubbing, incorporating the following features.

a) *Horizontal platform*, on which the test specimen is clamped, preferably of metal to act as a heat sink with thin test specimens.

b) *Means* of holding a 25 mm diameter circular felt pad (see **4.2**) against the test specimen under fixed forces of 7.1 N ± 0.2 N and 24.5 N ± 0.5 N and of rotating the pad at 150 r/min ± 5 r/min.

c) *Method of counting* the number of revolutions of the pad.

4.2 *Felt pads*, complying with the following requirements.

Material	: Scoured pure wool felt
Outside diameter	: 25 mm ± 1 mm
Bore	: 3 mm ± 0.5 mm
Thickness	: 5 mm ± 0.5 mm (measured in accordance with clause **3** of BS 3144:1968), and 6.5 mm ± 0.5 mm (measured in accordance with **E.1** of BS 4060:1989)
Density	: 0.19 g/cm^3 ± 0.02 g/cm^3

NOTE The reason for using two different thicknesses is that a felt producer will measure sheet material in accordance with BS 4060. It is not practical to apply BS 4060 measurements to the felt pads themselves due to the very tight downward pressure tolerance.

4.3 *Grey scales*, for assessing change in colour and staining (see clause **3**).

4.4 *Distilled or demineralized water.*

5 Test specimen

Prepare test specimens of sufficient size to allow them to be fixed firmly to the test platform.

6 Procedure

6.1 Wet rubbing test

6.1.1 Immerse the felt pads (**4.2**) in boiling distilled or demineralized water (**4.4**) and continue to boil for 60 s. Cool to room temperature, a process which may be facilitated by decanting the water and replacing with cool fresh water several times. Adjust the mass of each pad by squeezing out water or adding cold water until it lies between 2.9 g and 3.2 g immediately before use. Pads shall not be kept in water for more than 24 h.

6.1.2 Clamp the test specimen onto the horizontal platform [**4.1** a)] and configure the machine (**4.1**) to operate with a fixed force of 7.1 N. Secure a wet felt pad onto the rubbing spindle. Proceed either as in **6.1.3** a) or as in **6.1.3** b).

6.1.3 Use one of the methods as follows.

a) *Method A.* Lower the felt pad onto the surface of the test specimen and immediately start the machine. After eight revolutions have been completed, stop the machine and immediately raise the felt pad clear of the surface of the test specimen.

Using the same procedure and a fresh pad for each test, subject separate areas of the test specimen (or separate test specimens) to the following numbers of revolutions: 16, 32, 64, 128, 256, 512 and 1024.

b) *Method B.* Lower the felt pad onto the surface of the test specimen and immediately start the machine. After the required number of revolutions have been completed, stop the machine and immediately raise the felt pad clear of the surface of the test specimen.

NOTE This method applies to tests carried out to an agreed specification, when only the required number of revolutions need be carried out. In such cases, tests should be conducted in duplicate by subjecting two separate areas of the test specimen, or two test specimens, to the specified number of revolutions.

6.1.4 Dry the test specimen(s) and felt pads at a temperature not exceeding 60 °C.

6.2 Dry rubbing test

6.2.1 Clamp the test specimen onto the horizontal platform [4.1 a)] and configure the machine (**4.1**) to operate with a fixed force of 24.5 N. Secure a dry felt pad onto the rubbing spindle. Proceed either as in **6.2.2** a) or as in **6.2.2** b).

6.2.2 Use one of the methods as follows.

a) *Method A.* Lower the felt pad onto the surface of the test specimen and start the machine. After eight revolutions have been completed, stop the machine and raise the felt pad clear of the surface of the test specimen.

Using the same procedure and a fresh pad for each test, subject separate areas of the test specimen (or separate test specimens) to the following numbers of revolutions: 16, 32, 64, 128, 256, 512 and 1024.

b) *Method B.* Lower the felt pad onto the surface of the test specimen and start the machine. After the required number of revolutions have been completed, stop the machine and raise the felt pad clear of the surface of the test specimen.

NOTE This method applies to tests carried out to an agreed specification, when only the required number of revolutions need be carried out. In such cases, tests should be conducted in duplicate by subjecting two separate areas of the test specimen, or two test specimens, to the specified number of revolutions.

6.3 Modified form of test for finishes that smear on rubbing

Under the conditions of test given in **6.2.2** a), some finishes soften due to the frictional heating at higher numbers of revolutions. The finishes then smear and pick up small fibres of felt. If this occurs, the fact shall be recorded and the test procedure shall be modified to reduce heat build up. This is facilitated by interrupting the test at certain intervals and cooling the test specimen, using either a flow of cool air or a polished metal block (heat sink). The interval shall cover as small a number of revolutions as practical to prevent heat build up and shall be established by trial and error.

6.4 Assessment

6.4.1 Assess the tested areas of the test specimen(s), using the grey scale for assessing change in colour (**4.3**).

6.4.2 Where colour transfer is of interest, assess the staining of the felt pads using the grey scale for assessing staining (**4.3**).

7 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LC:1992;

b) which surface of the specimen was tested;

c) for each number of revolutions carried out:

1) test condition, dry or wet;

2) the numerical rating for the degree of colour change shown by the test specimen;

3) the numerical rating for the staining of the felt pad (if required);

d) any deviations from the test procedure.

8 Notes

8.1 For information on the availability of suitable apparatus write to Customer Services, Information Services Group, BSI, Linford Wood, Milton Keynes MK14 6LE.

8.2 The development of this test has been described by Grimwade, D. and Wolstenhome, S., *Journal of the Society of Leather Trades Chemists,* 1961, **45**.

8.3 If appropriate, other numbers of revolutions may be carried out, together with other specialist modifications such as pads wetted with solvent, shoe polish, artificial perspiration, etc. However, any deviation of this type should be recorded in the test report.

UK-LD. Colour fastness to water of leather

1 Scope

This method is intended for determining the resistance of the colour of leather to the prolonged action of water.

2 Principle

A wetted piece of specified undyed textile is placed on the surface of the specimen to be tested. The composite specimen is then left under pressure for a specified time in an appropriate apparatus. The specimen and textile are dried. The change in colour of the specimen and the staining of the textile are assessed using the grey scale.

3 References

BS 1006: section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining* — section F10, *Specification for adjacent fabric: Multifibre.*

4 Apparatus and reagents

4.1 *Apparatus* (see **7.1**) in which the composite specimen can be subjected to a uniform pressure of 0.0123 MPa (loaded with 125 g/cm^2).

4.2 *Oven*, maintained at 37 °C ± 20 °C.

4.3 *Multifibre fabric* (see clause **3**), as accompanying textile (see **7.2**), measuring 100 mm × 36 mm.

4.4 *Demineralized water*, pH 5 to pH 7.

4.5 *Fine-grained abrasive paper* (grade 180).

4.6 *Grey scales*, for assessing change of colour and staining (see clause **3**).

4.7 *Vacuum desiccator*, or other glass container suitable for evacuation.

4.8 *Vacuum pump*, capable of evacuating the container to 5 kPa within 4 min.

5 Procedure

5.1 Cut out a specimen of leather 100 mm × 36 mm and one or two pieces of accompanying textile, also 100 mm × 36 mm. If the grain is to be tested with the finish broken, the breaking of the finish is to be carried out using abrasive paper (see **4.5** and **7.3**). Immerse the specimen and textile in separate vessels in demineralized water (**4.4**), using bent glass rods or a similar device to keep them immersed. One vessel may be used for all pieces of textile, while each piece of leather specimen shall be immersed in a separate vessel. Place the vessels in the vacuum desiccator (**4.7** produce a vacuum of 5 kPa and hold it for 2 min. Restore normal pressure. Repeat this procedure twice more.

Place one piece of accompanying textile on a glass plate and cover it with the specimen, with the side to be tested down. If both sides are to be tested, cover the specimen with a second piece of textile. Cover the resulting composite specimen with a second glass plate.

5.2 Preheat the load of 4.5 kg (see **4.1**) to 37 °C ± 2 °C for at least 1 h. Place the composite specimen between the two glass plates in the apparatus and subject it to the load of 4.5 kg. In order to allow excess of water to run off, incline the apparatus at 30° ± 5° towards the horizontal on each side for a few seconds. When several composite specimens are being tested simultaneously, take care to ensure that each is placed centrally between two plates in such a way that pressure is exerted evenly on it. Leave the charged apparatus in the oven at 37 °C ± 2 °C for 3 h ± 5 min.

5.3 At the end of the test, take off the load, remove the composite specimen from the apparatus, stitch it together in one corner and dry it at 20 °C ± 2 °C and (65 ± 2) % r.h. so that each specimen and its accompanying textile are freely suspended.

5.4 Assess the staining of each kind of fibre of the accompanying textile and also assess the change in colour of the specimen, using the appropriate grey scale (**4.6**).

6 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LD:1992;

b) a description of the type of leather used;

c) the side of the leather tested;

d) if the finish was broken, a note to this effect;

e) the numerical ratings for staining of the accompanying textile, giving a separate rating for each type of fibre;

f) the numerical rating for change in colour of the test specimen;

g) any deviations from the test procedure.

7 Notes

7.1 The recommended apparatus consists of a stainless steel frame, of 4.5 kg in mass and 115 mm × 60 mm in cross-section, into which a piston fits precisely, and plates of an inert material, e.g. glass of the same area and about 1.5 mm thick. Any other apparatus may be used, provided it gives the same results.

7.2 As accompanying textile, the multifibre fabric type DW is normally used. It is intended to conform to ISO 105-F10:1989.

7.3 For breaking the finish, a specimen of leather, of about 120 mm × 50 mm, is loaded uniformly with 1.0 kg, on an area of the back measuring 100 mm × 36 mm, and the side bearing the finish is moved 100 mm to and fro 10 times, over a fine-grained abrasive paper (**4.5**). The roughened area of the specimen is then cut to 100 mm × 36 mm. With some practice, the finish can also be broken by hand with the same effect, using the same abrasive paper. The roughened area should be brushed out thoroughly.

UK-LE. Colour fastness to washing of leather

1 Scope and field of application

1.1 This method is intended for determining the resistance of the colour of leather to washing under domestic conditions. In washing leather, not only do many changes in colour in the leather occur but also coloured substances may bleed from it and may stain adjacent materials.

1.2 This method is applicable to leathers of all kinds that are normally exposed to use in mild domestic laundering in an aqueous medium.

2 Principle

Specimens of leather in contact with specified undyed textiles of wool and of cotton are agitated in a neutral solution of a synthetic detergent, rinsed, and dried. The change in colour of the specimens and the staining of the textiles are assessed with the grey scales.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining*.

4 Apparatus and materials

4.1 *Suitable mechanical device* (see **8.1**), consisting of a water bath containing a rotatable shaft that supports, radially, glass or stainless steel containers (75 ± 5 mm diameter × 125 ± 10 mm high) of approximately 550 ± 50 ml capacity, the bottom of the containers being 45 ± 10 mm high from the centre of the shaft. The shaft/container assembly is rotated at a speed of 40 ± 2 r/min. The temperature of the water bath is thermostatically controlled to maintain the test solution at the specified temperature of 40 ± 2 °C.

4.2 *Dodecyl sodium sulphate* (see **8.2**).

4.3 *Undyed cloths of cotton and of wool*, 3 cm × 5 cm, of plain weave and having a mass per unit area of about 250 g/m^2 (see **8.3**).

4.4 *Grey scales*, for assessing change in colour and staining (see clause **3**).

5 Test specimen

5.1 Two specimens of leather, each measuring 3 cm × 5 cm, are required.

5.2 Place one specimen between two pieces of cotton, the other between two pieces of wool, and sew together each set around its four sides to form two composite specimens.

6 Procedure

6.1 Prepare the wash liquor by dissolving 5 g dodecyl sodium sulphate in about 200 ml hot, distilled water and dilute to 1 l.

6.2 Place each composite specimen in the container and add the necessary amount of detergent solution (see **6.1**), previously heated to 40 ± 2 °C, so as to give a liquor ratio of 50 : 1.

Treat the composite specimen at 40 ± 2 °C for 30 min.

The milling action on the composite specimen may be increased by the addition of glass balls or by appropriate attachment to the stopper of the drum. The use of such devices shall be reported (see **7.3**).

6.3 Remove the composite specimen, rinse it twice in cold distilled water and then in cold running tap-water for 10 min and squeeze it. Open out the composite specimen by breaking the stitching on all but one of the shorter sides and dry it by hanging it in air at a temperature not exceeding 60 °C, with the three parts in contact only at the remaining line of stitching.

6.4 When dry, and after treatment in accordance with a) and b), assess the change in colour of the leather and the staining of the accompanying textile with the grey scales (see clause **3**).

a) *Soft leathers*. The surface of soft leathers, such as gloving, may be more or less marked by the texture of the accompanying textile. Manipulate such leather lightly to soften, after drying but before assessment.

b) *Suede leathers*. After drying, but before assessment, brush suede leathers in the direction of the nap with a brush that has bristles with a length of trim of about 3.5 cm.

7 Test report

7.1 State the type of leather tested.

7.2 Specify which surface of the specimen was tested.

7.3 Record any deviation from the procedure, such as the use of glass balls (see **6.2**) or the use of alternative apparatus (see **8.1**).

7.4 For every composite specimen, state the nature of the accompanying textile and report the numerical ratings for the change in colour of the leather and for the staining of the accompanying textile.

8 Notes

8.1 Suitable testing devices are as follows.

a) Glass drums of dimensions 18 cm diameter and 8 cm tall, with the opening fitted with a rubber stopper as designed by Dr Wacker for dyeing. Additional means of rotating the drum at 40 ± 2 r/min and for maintaining the specified temperature will be required.

b) Wash Wheel sponsored by the Society of Dyers and Colourists.

c) Launderometer as described in the *Technical Manual of the American Association of Textile Chemists and Colorists* (AATCC), test method 61.

d) Linitest as described in *Melliand Textilberichte,* 1968, **49**, 6, pp 709–711.

Other devices may be used provided that the results are identical with those obtained using the apparatus described in **4.1**.

8.2 The dodecyl sodium sulphate should be of a purity corresponding to B.P. or U.S.P.

8.3 If required, the test may also be carried out with cloths made of other fibres, e.g. silk, linen, viscose, acetate, nylon or polyester. The method is not valid for accompanying materials that are impervious to water or that let water pass only with difficulty. With such materials the changes in colour of the leather may be greater or smaller than when the wash liquor has ready access.

UK-LF. Colour fastness to perspiration of leather

1 Scope

This test is intended for determining the resistance of leather to the action of an artificial perspiration solution which simulates the action of human perspiration.

Since there are great individual variations in perspiration, it is not possible to design a method with universal validity but the alkaline artificial perspiration specified in this test gives results corresponding to natural perspiration in most cases.

This method is valid for leather of all kinds at all stages of processing, but it applies particularly to gloving, clothing, and lining leathers as well as to upper leather for unlined shoes.

2 Principle

A piece of specified undyed textile, wetted with artificial perspiration, is placed on the side of the specimen to be tested. The specimen is also wetted with artificial perspiration. The composite specimen is then left under pressure for a specified time in an appropriate apparatus. The specimen and the textile are dried. The change in colour of the specimen and the staining of the textile are assessed with the grey scales. Leathers bearing finish may be tested intact or with the finish broken; in the latter case, this is stated in the report.

3 References

BS 1006: section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining* — section F10, *Specification for adjacent fabric: Multifibre.*

4 Apparatus and reagents

4.1 *Apparatus* (see **7.2**), in which the composite specimen can be subjected to a uniform pressure of 0.0123 MPa (loaded with 125 g/cm^2).

4.2 *Oven*, maintained at 37 °C ± 2 °C.

4.3 *Multifibre fabric* (see clause **3**), as accompanying textile (see **7.3**), measuring 100 mm × 36 mm.

4.4 *Artificial perspiration solution*, containing the following quantities per litre:

5.0 g sodium chloride
5.0 g tris (hydroxymethyl) aminomethane ($NH_2C(CH_2OH)_3$)
0.5 g urea
0.5 g nitrilotriacetic acid ($N(CH_2COOH)_3$)

and adjusted to pH 8.0 ± 0.1 with hydrochloric acid (cHCl = 0.1 mol/l) [see **7.1** b)].

4.5 *Fine-grained abrasive paper* (grade 180).

4.6 *Grey scales*, for assessing change in colour and for assessing staining (see clause **3**).

4.7 *Vacuum desiccator*, or other glass container suitable for evacuation.

4.8 *Vacuum pump*, capable of evacuating the container to 5 kPa within 4 min.

5 Procedure

5.1 Cut out a specimen of leather 100 mm × 36 mm and one or two pieces of accompanying textile, also 100 × 36 mm. If the grain is to be tested with the finish broken, the breaking of the finish is to be carried out using abrasive paper (see **4.5** and **7.4**). Immerse the specimen and textile in separate vessels in the artificial perspiration solution (**4.4**) using bent glass rods or a similar device to keep them immersed. One vessel may be used for all pieces of textile, while each piece of leather specimen shall be immersed in a separate vessel. Place the vessels in the vacuum desiccator (**4.7**), produce a vacuum of 5 kPa and hold it for 2 min. Restore normal pressure. Repeat this procedure twice more.

Place one piece of accompanying textile on a glass plate and cover it with the specimen with the side to be tested down. If both sides are to be tested, cover the specimen with a second piece of textile. Cover the resulting composite specimen with a second glass plate.

5.2 Preheat the load of 4.5 kg (see **4.1**) to 37 °C ± 2 °C for at least 1 h. Place the composite specimen between the two glass plates in the apparatus and subject it to the load of 4.5 kg. In order to allow excess of perspiration solution to run off, incline the apparatus at 30° ± 5° towards the horizontal on each side for a few seconds. When several composite specimens are being tested simultaneously, take care to ensure that each is placed centrally between two plates in such a way that pressure is exerted evenly on it. Leave the charged apparatus in the oven at 37 °C ± 2 °C for 3 h.

5.3 At the end of the test, take off the load, remove the composite specimen from the apparatus, stitch it together in one corner, and dry at 20 °C ± 2 °C and (65 ± 2) % r.h. so that each specimen and its accompanying textile are freely suspended.

5.4 Assess the staining of each kind of fibre of the accompanying textile and also assess the change in colour of the specimen, using the appropriate grey scale (**4.6**).

6 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LF:1992;

b) a description of the type of leather used;

c) the side of the leather tested;

d) if the finish was broken, a note to this effect;

e) the numerical ratings for staining of the accompanying textile, giving a separate rating for each type of fibre;

f) the numerical rating for change in colour of the test specimen;

g) any deviations from the test procedure.

7 Notes

7.1 The following information is relevant to the artificial perspiration solution.

a) *pH.* In general, human perspiration is weakly acid when freshly produced. Micro-organisms then cause it to change, the pH usually becoming weakly alkaline (pH 7.5 to pH 8.5). Alkaline perspiration has a considerably greater effect on the colour of leather than has acid perspiration. Since the more demanding fastness test gives the limiting result, use of an acid perspiration liquor is omitted.

b) *Preparation of artificial alkaline perspiration solution.* To prepare 1 l solution, dissolve the weighed-out components in about 900 ml demineralized water in a 2 l beaker, having a 1 000 ml mark. Allow hydrochloric acid (c HCl = 2 mol/l) solution to drop in, whilst stirring, until an electrometric pH of 8.0 ± 0.1 is reached. Make up to 1 000 ml. Check pH periodically and discard solution if not within pH 8.0 ± 0.1. If colonies of microbes become visible, discard solution also.

7.2 The recommended apparatus consists of a stainless steel frame of 4.5 kg in mass and 115 m × 60 mm in cross-section, into which a piston fits precisely, and plates of an inert material, e.g. glass of the same area and about 1.5 mm thick. Any other apparatus may be used, provided it gives the same results.

7.3 As accompanying textile the multifibre fabric, type DW is normally used. It is intended to conform to ISO 105-F10:1989.

7.4 For breaking the finish, a specimen of leather, of about 120 mm × 50 mm, is loaded uniformly with 1.0 kg, on an area of the back measuring 100 mm × 36 mm, and the side bearing the finish is moved 100 mm to and fro, 10 times, over a fine-grained abrasive paper (**4.5**). The roughened area of the specimen is then cut to 100 mm × 36 mm. With some practice, the finish can also be broken by hand with the same effect, using the same abrasive paper. The roughened area should be brushed out thoroughly.

UK-LG. Colour fastness to to-and-fro rubbing

1 Scope

This method is intended for determining the fastness of materials to wet and dry to-and-fro rubbing and for measuring the transfer of colour to the material with which it is rubbed. The method is applicable to all coloured sheet materials used in production of footwear.

2 Principle

A specimen of material under test is rubbed with a felt pad and the loss of colour from the surface and/or the colour transfer to the rubbing pad are assessed after a particular number of rubs.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining.*

BS 3144, *Methods of sampling and physical testing of leather.*

4 Apparatus and materials

4.1 *Machine*, suitable for carrying out the various tests of fastness to rubbing, incorporating the following features.

a) *Carriage* with the following:

1) a horizontal completely planar metal platform;

2) a holder for securing the test specimen;

3) a device allowing the test specimen to be extended linearly (at least 10 %) in the direction of rubbing.

b) *Removable finger*, having a mass of 500 g ± 5 g, with the following:

1) a base of dimension 15 mm ± 1 mm ± 15 mm ± 1 mm;

2) a device for attaching pieces of wool felt (see **4.2**) to the base;

3) an additional load of 500 g ± 5 g;

4) a means of guiding the finger when fully loaded (total mass 1 kg) flat onto the specimen.

c) *Means* for driving the carriage to and fro with the following:

1) a distance of travel of 35 mm ± 1 mm;

2) a frequency of 40 ± 2 to-and-fro motions per min.

NOTE The following items are convenient, but not essential to the apparatus:

i) means to move the finger at right angles to the direction of rubbing, so that two or three tracks may be used for rubbing on one piece of leather;

ii) means to secure the test finger in a raised position;

iii) a motor as a means for driving the carriage to and fro;

iv) means for preselecting a given number of to-and-fro motions.

4.2 *Felt pads*, complying with the following requirements.

Material	: Scoured pure wool felt
Dimensions	: 15 mm ± 0.5 mm × 15 mm ± 0.5 mm
pH	: min. 6, max. 7 (i.e. 5 g felt is shaken with 100 ml of water (**4.3**) for 2 h in a polyethylene bottle)
Mass per unit area	: 1 750 g/m^2 ± 87.5 g/m^2
Thickness	: 5.5 mm ± 0.5 mm (measured in accordance with clause **3** of BS 3144:1968)
Mean water uptake	: 1.0 ml ± 0.1 ml (see **8.1**)

4.3 *Grey scales*, for assessing change in colour and staining (see clause **3**).

4.4 *Demineralized or distilled water.*

5 Test specimen

Prepare a rectangular test specimen of sufficient size to be clamped onto the carriage of the machine.

6 Procedure

6.1 Setting up of machine

Attach the additional weight of 500 g to the finger.

6.2 Wet rub fastness

6.2.1 Immerse the felt pads (**4.2**) in water (**4.3**) and heat to boiling. Continue boiling gently until all pieces of felt sink. Cool to room temperature, a process which may be facilitated by decanting the water and replacing with cool water several times. Adjust the water uptake of each pad by squeezing or adding cold water until the mean water uptake is 1.0 ml ± 0.1 ml. Pads shall not be allowed to soak in water for more than 24 h.

6.2.2 Clamp the test specimen onto the carriage [**4.1** a)] and extend until taut. This will prevent the test piece rucking up during the rubbing test. The test specimen shall be so positioned as to ensure that the rubbing track created by the finger is more than 5 mm from the edge of the specimen.

6.2.3 Attach a wet piece of felt to the finger and proceed either as in **6.2.4** a) or as in **6.2.4** b).

6.2.4 Use one of the methods as follows.

a) *Method A.* Lower the felt pad onto the surface of the test specimen and immediately start the machine. After 10 to-and-fro motions have been completed, stop the machine and immediately raise the felt pad clear of the surface of the test specimen.

Using the same procedure and a fresh pad for each test, subject separate areas of the test specimen (or separate test specimens) to the following number of to-and-fro motions: 50 and 150. Each rubbing track shall be at a distance of at least 10 mm from the adjacent track.

b) *Method B.* Lower the felt pad onto the surface of the test specimen and immediately start the machine. After the required number of to-and-fro motions have been completed, stop the machine and immediately raise the felt pad clear of the surface of the test specimen.

NOTE This method applies to tests carried out to an agreed specification, when only the required number of to-and-fro motions need be carried out. In such cases, tests should be conducted in duplicate by subjecting two separate areas of the test specimen, or two test specimens, to the specified number of to-and-fro motions.

6.2.5 Dry the test specimen (s) and felt pads at a temperature not exceeding 60 °C.

6.3 Dry rubbing test

6.3.1 Clamp the test specimen onto the carriage [**4.1** a)] and extend until taut. This will prevent the test piece rucking up during the rubbing test. The test specimen shall be so positioned as to ensure that the rubbing track created by the finger is more than 5 mm from the edge of the specimen.

6.3.2 Attach a dry piece of felt to the finger and proceed as in **6.3.3** a) or **6.3.3** b).

6.3.3 Use one of the methods as follows.

a) *Method A.* Lower the felt pad onto the surface of the test specimen and start the machine. After 10 to-and-fro motions have been completed, stop the machine and raise the felt pad clear of the surface of the test specimen.

Using the same procedure and a fresh pad, subject separate areas of the test specimen (or separate test specimens) to 50 to-and-fro motions.

b) *Method B.* Lower the felt pad onto the surface of the test specimen and start the machine. After the required number of to-and-fro motions have been completed, stop the machine and raise the felt pad clear of the surface of the test specimen.

NOTE This method applies to tests carried out to an agreed specification, when only the required number of to-and-fro motions need be carried out. In such cases, tests should be conducted in duplicate by subjecting two separate areas of the test specimen, or two test specimens, to the specified number of to-and-fro motions.

6.4 Assessment

6.4.1 Assess the tested areas of the test specimen(s), using the grey scale for assessing change in colour (**4.3**).

6.4.2 Where colour transfer is of interest, assess the staining of the felt pads using the grey scale for assessing staining (**4.3**).

7 Test report

The test report shall include the following particulars:

a) the number, method and date of this British Standard, i.e. BS 1006:UK-LG:1992;

b) which surface of the specimen was tested;

c) for each number of to-and-fro motions carried out:

1) test condition, dry or wet;

2) the numerical rating for the degree of colour change shown by the test specimen;

3) the numerical rating for the staining of the felt pad (if required);

d) any deviations from the above procedure.

8 Notes

8.1 To achieve a controlled water uptake, weigh 10 dry felt pads and subsequently place them in water. Wet completely as described in **6.2.1**. Remove the felt pads from the water and place them on a glass plate, out of contact with each other. Lay another glass plate on top of them and load this with 4.5 kg. Incline the whole assembly at 10° to the horizontal for 60 s to each of its four sides to allow water to drain off. Reweigh the 10 felt pads. The water uptake should be 10 ml ± 1.0 ml.

8.2 If appropriate, other numbers of to-and-fro motions may be carried out, together with other specialist modifications such as pads wetted with solvent, shoe polish, artificial perspiration, etc. or the test specimen wetted before the test. However, any deviation of this type should be recorded in the test report.

Group UK-T. Colour fastness tests for textiles (not yet adopted internationally)

UK-TB. Colour fastness to shampooing of textile floor coverings

1 Scope

This method is intended for determining the resistance of textile floor coverings, yarns, loose fibres and tufts extracted from textile floor coverings to the action of a reference shampoo solution.

2 Principle

A specimen of the textile floor covering, yarn, loose fibre or tufts, in contact with specified adjacent fabrics, is immersed under pressure in a solution of shampoo buffered to pH 7.5 ± 0.2. The specimen and adjacent fabric are dried separately. The change in colour of the specimen and the staining of the adjacent fabrics are assessed using the grey scales.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining.*

4 Apparatus and reagents

4.1 *Testing device,* consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and base of 60 mm × 115 mm is closely fitted so that a pressure of 12.5 kPa can be applied on test specimens measuring 40 mm × 100 mm, placed between glass or acrylic resin plates. If the weight-piece is removed during the test, the testing device shall be so constructed that the pressure of 12.5 kPa remains unchanged.

4.2 *Flat-bottomed dish,* approximately 150 mm × 150 mm × 50 mm.

4.3 *Smooth glass or clear acrylic resin plates,* approximately 115 mm × 60 mm × 3 mm thick.

4.4 *Weight-piece,* of mass 5 kg.

4.5 *pH meter,* complying with BS 3145.

4.6 *Oven,* maintained at 37 ± 2 °C.

4.7 *Shampoo solution,* prepared by dissolving 1 g dodecyl sodium sulphate and 0.2 g lauric monoisopropanolamide in 500 ml of grade 3 water complying with BS 3978. Heat, if necessary, to ensure dissolution of the surfactant. Cool to a temperature of about 30 °C. Prepare buffer solution by adding 14 ml of citric acid, $c(C_6H_8O_7) = 0.5$ mol/l to 372 ml of *di*sodium hydrogen phosphate solution, $c\ (Na_2\ HPO_4) = 0.5$ mol/l. Add the buffer solution to the surfactant solution and make up to 1 l. Check that the pH is 7.5 ± 0.2.

4.8 ***Adjacent fabrics***

4.8.1 When the specimen to be tested is in the form of a textile floor covering, two adjacent fabrics each measuring 50 mm × 40 mm are required, one piece being made of the same fibre as that in the specimen or that predominating in the case of blends and the second piece being made of the fibre as indicated in Table 1. If the staining of further fibres is of interest, two or more specimens shall be tested separately.

4.8.2 When the specimen is in the form of yarn or loose fibre, two adjacent fabrics each measuring 100 mm × 40 mm are required, one piece being made of the same fibre as that in the specimen or that predominating in the case of blends and the second piece being made of the fibre as indicated in Table 1. If the staining of further fibres is of interest, two or more specimens shall be tested separately.

4.8.3 When the specimen is in the form of tufts extracted from a textile floor covering, two adjacent fabrics each measuring 50 mm × 40 mm are required, one piece being made of cotton, to act solely as a support for the tufts, and the second piece being made of the same fibre as that in the specimen or that predominating in the case of blends, or any other fibre. If the staining of two or more fibres is of interest, two or more specimens shall be tested separately.

Table 1 — Adjacent fabrics

If first piece is:	Second piece to be:
Cotton	Wool
Wool	Cotton
Silk	Cotton
Linen	Cotton
Viscose	Wool
Acetate	Viscose
Polyamide	Wool or viscose
Polyester	Wool or cotton
Acrylic	Wool or cotton

4.9 *Grey scales,* for assessing change in colour and staining (see clause 3).

5 Test specimen

5.1 If a textile floor covering is to be tested, cut a specimen 100 mm × 40 mm from which any integral foam underlay has been removed, and cover the use-surface with two pieces of adjacent fabric 50 mm × 40 mm (see **4.8.1**) to form a composite specimen.

5.2 If yarn is to be tested, sew a uniform layer of parallel 100 mm lengths of mass 0.4 g to one edge of one of the pieces of adjacent fabric measuring 100 mm × 40 mm (see **4.8.2**). Cover with the other piece measuring 100 mm × 40 mm and sew along the same edge to form a composite specimen.

5.3 If loose fibre is to be tested, comb and compress 0.4 g of the loose fibre into a uniform layer 100 mm × 40 mm. Place this between the two pieces of adjacent fabrics each measuring 100 mm × 40 mm (see **4.8.2**) and sew along two opposite sides to form a composite specimen.

5.4 If tufts extracted from textile floor coverings are to be tested, sew a number of identical tufts of mass approximately 0.2 g onto a piece of undyed cotton measuring 50 mm × 40 mm. Cover with a piece of adjacent fabric measuring 50 mm × 40 mm (see **4.8.3**) and sew along one side to form a composite specimen.

6 Procedure

6.1 Place the composite specimen in the flat-bottomed dish (**4.2**) and pour sufficient shampoo solution (**4.7**) at a temperature of 37 °C over the composite specimen to give a liquor to goods ratio of at least 10 : 1 ensuring thorough wetting of the specimen. Cover with a smooth glass or clear acrylic resin plate (**4.3**), press with the fingers to remove air bubbles and place the weight-piece (**4.4**) on top of the glass plate. A composite specimen of tufts should be placed in the dish with the cotton on the underside. Allow to stand for 15 min at 37 ± 2 °C. Remove the weight-piece and pour off the shampoo solution.

6.2 Proceed in either of the following ways.

a) If using the testing device (**4.1**), place the composite specimen between two glass or clear acrylic resin plates (**4.3**) under a pressure of 12.5 kPa. Place the apparatus containing the specimen in the oven (**4.6**) for 1.5 h at 37 ± 2 °C.

b) Replace the weight-piece and allow it to stand for a further 1.5 h at 37 ± 2 °C.

6.3 Separate the specimen from the adjacent fabrics, hydroextract to remove surplus liquor and dry them apart in air at a temperature not exceeding 60 °C.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabrics with the grey scale (see clause **3**). When tufts are being tested, the staining of the cotton support shall not be assessed.

NOTE Before assessing the test specimen for change in colour, it is recommended that the angle and direction of the pile be restored so that they resemble those of the control piece as closely as possible.

7 Test report

Report the numerical ratings for the change in colour of the test specimen and for the staining of each kind of adjacent fabric used.

8 Notes

Other devices may be used provided that the same results are obtained as with the apparatus described in **4.1**.

UK-TE. Sensitivity to peroxy compounds

1 Scope and field of application

This method is intended for determining the sensitivity of coloured textiles to peroxy compounds, a common ingredient of commercial washing products.

2 Principle

A specimen of the textile is treated in a solution of sodium perborate. It is then dried and the change in colour of the specimen is assessed with the grey scale.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour.*

4 Apparatus and reagents

4.1 *Sodium perborate solution,* containing 0.4 g/l of available oxygen (see **8.1**).

4.2 *Beaker or container,* for specimen and sodium perborate solution.

4.3 *Grey scale,* for assessing change in colour (see clause **3**).

5 Test specimen

5.1 If the textile to be tested is fabric, use a specimen 10 cm × 4 cm.

5.2 If the textile to be tested is yarn, knit it into fabric and use a specimen 10 cm × 4 cm.

5.3 If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet 10 cm × 4 cm and sew it on to a piece of undyed bleached cotton fabric to support the fibres.

6 Procedure

6.1 Place the specimen in the container and add the necessary amount of sodium perborate solution (**4.1**) previously heated to a temperature of 60 ± 2 °C to give a liquor ratio of 50 : 1.

6.2 Treat the specimen at a temperature of 60 ± 2 °C for 15 min.

6.3 Rinse the specimen twice in cold distilled water and then in cold running tap-water for 10 min, and squeeze it.

6.4 Dry in air at a temperature not exceeding 60 °C.

6.5 Assess the change in colour of the specimen with the grey scale.

7 Test report

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

8 Notes

8.1 A solution containing 0.4 g of available oxygen per litre may be obtained as follows.

Dissolve 2 g of sodium perborate in water and dilute to 100 ml at room temperature. To 20 ml of this solution add 100 ml of 10 % (*m/V*) sulphuric acid. Titrate with potassium permanganate solution, $c\ (KMnO_4) = 0.2$ mol/l, until a faint pink colour is obtained which remains for 30 s. The amount of this sodium perborate (in g) which has to be dissolved and diluted to 1 l at room temperature to give a solution containing 0.4 g of available oxygen is given by the following equation:

$$\frac{100}{\text{ml of potassium permanganate solution } c(KMnO_4) = 0.2 \text{ mol/l required}}$$

The solution shall be freshly prepared for each batch of tests.

8.2 It is emphasized that this test is not a fastness test in the accepted sense of the term; it merely serves to identify which coloured textiles may behave differently when washed with commercial washing products than when washed with soap with or without sodium carbonate so that additional tests with commercial washing powders under the widely varying conditions of domestic use may be carried out where advisable.

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UK-TG. Colour fastness to perspiration: plate method

1 Scope and field of application

This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of human perspiration.

2 Principle

Specimens of the textile in contact with adjacent fabrics are treated in two different solutions containing histidine, placed in a flat-bottomed dish, covered with the solution and then covered with a smooth glass plate.

The specimens and the adjacent fabrics are dried separately. The change in colour of each specimen and the staining of the adjcaent fabrics are assessed with the grey scales.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining.*

4 Apparatus and reagents

4.1 *Flat-bottomed dish,* of dimensions approximately 10 cm × 15 cm;

4.2 *Smooth glass or clear acrylic resin plates,* measuring approximately 11.5 cm × 6 cm × 0.3 cm thick and having a mass of approximately 80 g.

4.3 *Oven,* maintained at 37 ± 2 °C.

4.4 *Alkaline solution,* freshly prepared, containing the following:

L-histidine monohydrochloride monohydrate, $c(C_6H_9O_2N_3.\ HCl.H_2O) = 0.5$ g/l

sodium chloride, $c(NaCl) = 5$ g/l

*di*sodium hydrogen orthophosphate, $c(Na_2\ HPO_4.2H_2O) = 2.5$ g/l

The solution is brought to pH 8 with sodium hydroxide solution, $c(NaOH) = 0.1$ mol/l.

4.5 *Acid solution,* freshly prepared, containing the following:

L-histidine monohydrochloride monohydrate, $c(C_6H_9O_2N_3HCl.H_2O) = 0.5$ g/l

sodium chloride, $c(NaCl) = 5$ g/l

sodium dihydrogen orthophosphate, $c(NaH_2PO_4.2H_2O) = 2.2$ g/l

The solution is brought to pH 5.5 with sodium hydroxide solution, $c(NaOH) = 0.1$ mol/l.

4.6 *Two adjacent fabrics,* each measuring 10 cm × 4 cm, one piece being made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, and the second piece being made of the fibre indicated in Table 1, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

Table 1 — Adjacent fabrics

If first piece is:	Second piece to be:
Cotton	Wool
Wool	Cotton
Silk	Cotton
Linen	Wool
Viscose	Wool
Acetate	Viscose
Polyamide	Wool or viscose
Polyester	Wool or cotton
Acrylic	Wool or cotton

4.7 *Grey scales,* for assessing change in colour and staining (see clause **3**).

5 Test specimen

5.1 If the textile to be tested is fabric, place a specimen 10 cm × 4 cm between the two adjacent fabrics (**4.6**) and sew along one of the shorter sides to form a composite specimen. Two such composite specimens are required.

5.2 If the textile to be tested is yarn, knit it into fabric and treat it as in **5.1** or form a layer of parallel lengths of it between the two adjacent fabrics (**4.6**), the amount of yarn taken being approximately equal to half the combined mass of the adjacent fabrics. Sew along two opposite sides to hold the yarn in place and to form a composite specimen. Two such composite specimens are required.

5.3 If the textile to be tested is loose fibre, comb and compress an amount approximately equal to half the combined mass of the adjacent fabrics (**4.6**) into a sheet 10 cm × 4 cm. Place the sheet between the two adjacent fabrics and sew along all four sides to hold the fibres in place and to form a composite specimen. Two such composite specimens are required.

6 Procedure

6.1 Thoroughly wet one composite specimen in the solution at pH 8.0 (see **4.4**) at a liquor ratio of 20 : 1, and allow it to remain in the solution for 30 min at room temperature. Lay out the composite specimen smooth in the flat-bottomed dish (**4.1**) and cover with the solution. Place a glass or clear acrylic resin plate (**4.2**) on the composite specimen, and press evenly and lightly with the fingers to remove air bubbles. Allow to stand for 15 min at room temperature. Treat the other composite specimen in the same way but with the solution at pH 5.5 (see **4.5**).

6.2 Pour off the solution without removing the glass plate. Allow the composite specimen to remain under the plate for 4 h at a temperature of 37 ± 2 °C.

6.3 Open out the composite specimen by breaking the stitching on all but one of the shorter sides and dry it by hanging it in air at a temperature not exceeding 60 °C with the three parts in contact only at the remaining line of stitching.

6.4 Assess the change in colour of each specimen and the staining of the adjacent fabrics with the grey scales.

7 Test report

For each of the solutions specified in **4.4** and **4.5** report the numerical rating for the change in colour of the test specimen and for the staining of each kind of adjacent fabric used in the test.

8 Notes

In many cases of cellulosic fibres dyed with direct dyes containing copper or after-treated with copper salts, the prescribed tests and natural perspiration bring about a removal of copper from the dyeings. This may cause a material alteration in fastness to light and washing, and it is therefore recommended that this possibility should be taken into consideration.

UK-TI. Colour fastness to salt of textile floor coverings

1 Scope

This method is intended for determining the resistance of the colour of textile floor coverings, yarns, loose fibres and tufts extracted from textile floor coverings to the effect of inorganic salts such as those present in sea water, salt from roads and fertilizers.

2 Principle

A specimen of the textile floor covering, yarn, loose fibre or tufts is immersed under pressure in a salt solution. The specimen is then dried in air at room temperature. The change in colour of the specimen is assessed with the grey scale.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour.*

BS 3978, *Specification for water for laboratory use.*

4 Apparatus and reagents

4.1 *Testing device,* consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and base of 60 mm × 115 mm is closely fitted, so that a pressure of 12.5 kPa can be applied on test specimens measuring 40 mm × 100 mm placed between glass or acrylic resin plates. If the weight-piece is removed during the test, the testing device shall be so constructed that the pressure of 12.5 kPa remains unchanged (see clause 8).

4.2 *Flat bottomed dish,* approximately 150 mm × 150 mm × 50 mm deep.

4.3 *Smooth glass or clear acrylic resin plates,* approximately 115 mm × 60 mm × 3 mm thick.

4.4 *Weight-piece,* of mass 5 kg.

4.5 *Oven,* capable of being maintained at 37 ± 2 °C.

4.6 *Salt solution,* containing 30 g of sodium chloride and 0.1 g of sodium dioctylsulphosuccinate per litre.

4.7 *Grey scale,* for assessing change in colour (see clause 3)

5 Test specimen

5.1 If a textile floor covering is to be tested, cut a specimen 100 mm × 40 mm from which any integral foam underlay has been removed.

5.2 If yarn is to be tested, sew a uniform layer of parallel 100 mm lengths, of mass 0.4 g, to a piece of undyed cotton fabric 100 mm × 40 mm.

5.3 If loose fibre is to be tested, comb and compress 0.4 g of the loose fibre into a uniform layer 100 mm × 40 mm.

5.4 If tufts extracted from textile floor coverings are to be tested, sew a number of identical tufts of mass approximately 0.2 g on to a piece of undyed cotton measuring 50 mm × 40 mm.

6 Procedure

6.1 Place the specimen in the flat-bottomed dish (**4.2**) and pour over the specimen sufficient salt solution (**4.6**) at a temperature of 37° C to give a liquor to goods ratio of at least 10 : 1, ensuring thorough wetting of the specimen. Cover with a glass or clear acrylic resin plate (**4.3**), press with the fingers to remove air bubbles and place the weight-piece (**4.4**) on top of the glass plate in the dish with the cotton on the underside. Allow to stand for 15 min at 37 ± 2 °C in the oven (**4.5**). Remove the weight-piece and pour off the salt solution.

6.2 Proceed in either of the following ways.

a) If using the testing device (**4.1**), place the specimen between two glass plates (**4.3**) under a pressure of 12.5 kPa. Place the apparatus containing the specimen in the oven for 1.5 h at 37 ± 2 °C.

b) Replace the weight-piece and allow it to stand for a further 1.5 h at 37 ± 2 °C.

6.3 Remove the specimen, hydroextract to remove surplus liquor, and dry in air at a temperature not exceeding 60 °C. When dry, brush off any salt that may have been deposited on the specimen.

6.4 Assess the change in colour of the specimen with the grey scale (see clause 3).

NOTE Before assessing the test specimen for change in colour, it is recommended that the angle and direction of the pile be restored so that they resemble those of the control piece as closely as possible.

7 Test report

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

8 Notes

Other devices may be used provided that the same results are obtained as with the apparatus described in **4.1**.

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UK-TJ. Colour fastness to water of textile floor coverings

1 Scope

This method is intended for determining the resistance of the colour of textile floor coverings, yarns, loose fibres and tufts extracted from textile floor coverings to water.

2 Principle

A specimen of the textile floor covering, yarn, loose fibre or tufts, in contact with specified adjacent fabrics, is immersed under pressure in a buffered solution at pH 7.5. The specimen and adjacent fabrics are dried separately. The changes in colour of the specimen and the staining of the adjacent fabrics are assessed with the grey scales.

3 References

BS 1006: section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section A03, *Grey scale for assessing staining.*

BS 3145, *Specification for laboratory pH meters.*

BS 3978, *Specification for water for laboratory use.*

4 Apparatus and reagents

4.1 *Testing device*, consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and base of 60 mm × 115 mm is closely fitted, so that a pressure of 12.5 kPa can be applied on test specimens measuring 40 mm × 100 mm placed between glass or acrylic resin plates. If the weight-piece is removed during the test, the testing device shall be so constructed that the pressure of 12.5 kPa remains unchanged (see clause **8**).

4.2 *Flat-bottomed dish*, approximately 150 mm × 150 mm × 50 mm.

4.3 *Smooth glass or clear acrylic resin plates*, approximately 115 mm × 60 mm × 3 mm.

4.4 *Weight-piece*, of mass 5 kg.

4.5 *pH meter*, complying with BS 3145.

4.6 *Oven*, capable of being maintained at 37 ± 2 °C.

4.7 *Buffered solution*, containing 14 ml of citric acid, $c(C_6H_8O_7) = 0.5$ mol/l added to 372 ml of *di*sodium hydrogen orthophosphate solution, $c\ (Na_2\ HPO_4) = 0.5$ mol/l, made up to 1 l using grade 3 water complying with BS 3978. Check that the pH is 7.5 ± 0.2.

4.8 *Adjacent fabrics*

4.8.1 When the specimen to be tested is in the form of a textile floor covering, two adjacent fabrics each measuring 50 mm × 40 mm are needed, one piece being made of the same fibre as that in the specimen or that predominating in the case of blends and the second piece being made of the fibre as indicated in Table 1.

If the staining of further fibres is of interest, two or more specimens shall be tested separately.

4.8.2 When the specimen is in the form of yarn or loose fibre, two adjacent fabrics each measuring 100 mm × 40 mm are needed, one piece being made of the same fibre as that in the specimen or that predominating in the case of blends and the second piece being made of the fibre as indicated in Table 1. If the staining of further fibres is of interest, two or more specimens shall be tested separately.

4.8.3 When the specimen is in the form of tufts extracted from a textile floor covering, two adjacent fabrics each measuring 50 mm × 40 mm are needed, one piece being made of cotton, to act solely as a support for the tufts, and the second piece being made of the same fibre as that in the specimen or that predominating in the case of blends, or the fibre as indicated in Table 1. If the staining of further fibres is of interest, two or more specimens shall be tested separately.

4.9 *Grey scales*, for assessing change in colour and staining (see clause **3**).

Table 1 — Adjacent fabrics

If first piece is:	Second piece to be:
Cotton	Wool
Wool	Cotton
Silk	Cotton
Linen	Cotton
Viscose	Wool
Acetate	Viscose
Polyamide	Wool or viscose
Polyester	Wool or cotton
Acrylic	Wool or cotton

5 Test specimen

5.1 If a textile floor covering is to be tested, cut a specimen 100 mm × 40 mm from which any integral foam underlay has been removed, and cover the use-surface with the two pieces of adjacent fabric 50 mm × 40 mm (see **4.8.1**) to form a composite specimen.

5.2 If yarn is to be tested, sew a uniform layer of parallel 100 mm lengths, of mass 0.4 g, to one edge of one of the pieces of adjacent fabric measuring 100 mm × 40 mm and sew along the same edge to form a composite specimen.

5.3 If loose fibre is to be tested, comb and compress 0.4 g of loose fibre into a uniform layer 100 mm × 40 mm. Place this between the two pieces of adjacent fabric each measuring 100 mm × 40 mm (see **4.8.2**) and sew along two opposite sides to form a composite specimen.

5.4 If tufts extracted from textile floor coverings are to be tested, sew a number of identical tufts of mass approximately 0.2 g on to a piece of undyed cotton measuring 50 mm × 40 mm. Cover with a piece of adjacent fabric measuring 50 mm × 40 mm (see **4.8.3**) and sew along one side to form a composite specimen.

6 Procedure

6.1 Place the composite specimen in the flat-bottomed dish (**4.2**) and pour over the composite specimen sufficient buffered solution (**4.7**) at a temperature of 37 °C to give a liquor to goods ratio of at least 10 : 1, ensuring thorough wetting of the specimen. Cover with the glass or clear acrylic resin plate (**4.3**), press with the fingers to remove air bubbles and place the weight-piece (**4.4**) on top of the glass plate. A composite specimen of tufts shall be placed in the dish with the cotton on the underside. Allow to stand for 15 min at 37 ± 2 °C. Remove the weight-piece and pour off the buffered solution.

6.2 Proceed in either of the following ways.

a) If using the testing device (**4.1**), place the composite specimen between two glass or clear acrylic resin plates (**4.3**) under a pressure of 12.5 kPa. Place the apparatus containing the composite specimen in the oven for 1.5 h at 37 ± 2 °C.

b) Replace the weight-piece and allow it to stand for a further 1.5 h at 37 ± 2 °C.

6.3 Separate the specimen from the adjacent fabrics, hydroextract to remove surplus liquor and dry them apart in air at a temperature not exceeding 60 °C.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabrics with the grey scales (see clause **3**). When tufts are being tested, the staining of the cotton support shall not be assessed.

NOTE Before assessing the test specimen for change in colour, it is recommended that the angle and direction of the pile be restored so that they resemble those of the control specimen as closely as possible.

7 Test report

Report the numerical ratings for the change in colour of the test specimen and for the staining of each kind of adjacent fabric used.

8 Notes

Other devices may be used provided that the same results are obtained as with the apparatus described in **4.1**.

UK-TN. Colour fastness to artificial light: mercury vapour fading lamp test

1 Scope

This section of BS 1006 specifies a method for determining the resistance of the colour of textiles of all kinds, and in all forms, and leather to the action of artificial light produced by a mercury vapour lamp. The method is also applicable to white (bleached or optically brightened) textiles.

This method is intended as a quality control test. In cases of dispute the interested parties should agree which type of apparatus should be used. If agreement cannot be reached, the apparatus specified in BS EN 20105-B02:1993 should be used.

2 Normative references

This section of BS 1006 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed below. For dated references, only the edition cited applies, any subsequent amendments to or revisions of the cited publication apply to this section of BS 1006 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

BS 1006, *Methods for the determination of the colour fastness of textiles and leather* — section A01, *General principles of testing* — section A02, *Grey scale for assessing change in colour* — section B01, *Colour fastness to light: Daylight* — B05, *Detection and assessment of photochromism.*

BS 3677:1989, *Specification for high-pressure mercury vapour lamps.*

BS EN 20105-B02:1993, *Textiles — Tests for colour fastness Colour fastness to artificial light (xenon arc fading lamp test).*

CIE Publication No. 51, *Method for assessing the quality of daylight simulators for colorimetry.*

3 Principle

A specimen of the textile is exposed to artificial light under specified conditions, along with blue wool references. The colour fastness is assessed by comparing the change in colour of the specimen with that of the references used.

For white (bleached or optically brightened) textiles the fastness is assessed by comparing the change in whiteness of the specimen with that of the reference used.

4 Reference materials and apparatus

4.1 Reference materials

4.1.1 *References 1 to 8*

Blue wool references developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in Table 1. They range from 1 (very low light fastness) to 8 (very high light fastness) so that each higher numbered reference is approximately twice as fast as the preceding one.

Table 1 — Dyes for blue wool references 1 to 8

Reference	Colour index designation[a]
1	C.I. acid blue 104
2	C.I. acid blue 109
3	C.I. acid blue 83
4	C.I. acid blue 121
5	C.I. acid blue 47
6	C.I. acid blue 23
7	C.I. solubilized vat blue 5
8	C.I. solubilized vat blue 8

[a] The Colour Index (Third Edition) is published by the Society of Dyers and Colourists, PO Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, West Yorkshire.

4.1.2 *Humidity test control*

The humidity test control is a read azoic dyed cotton cloth (see **9.1**).

4.2 Apparatus

4.2.1 *Mercury vapour lamp apparatus*, in which the specimens and the references shall be exposed in a ventilated chamber, at the centre of which is mounted a suitable light source (see **4.2.2**), the axis of its arc being mounted vertically. The variation of the light intensity over the area covered by the specimens and references shall not exceed ± 10 % of the mean. The distance from the surface of the specimens and that of the references to the lamp shall be the same. The apparatus shall include the components in **4.2.2** to **4.2.4** and shall achieve the exposure conditions given in **4.2.5**.

4.2.2 *Light source*, being a 400 W MB/U, high pressure mercury vapour lamp, conforming to BS 3677:1989, in which the arc tube itself shall be enclosed in an outer glass cylindrical envelope, having an outside diameter of approximately 51 mm. The MB/U light source shall have a correlated colour temperature of 5 970 K.

NOTE Alternative light sources (see Annex A) may sometimes be used or requested; if used, this fact is stated in the test report (see clause 8).

4.2.3 *Exposure cells*, which shall comprise a series of rectangular water-cooled cells for arranging the specimens and the references mounted facing the lamp in such a manner that the centre of the specimen exposure mask of each cell shall be in the same horizontal plane as the centre of the light source.

The coolant shall be recycled, thus minimizing the services required and avoiding an unduly limited choice of locations. The front surface of the exposure cell, facing the centre of the arc, shall be made from 2 mm float glass. A polytetrafluoroethylene or polyethylene pot in the base of the cell shall allow the effective humidity of the exposure conditions to be closely controlled by the introduction of the required humidity control fluid. The liquid in the pot shall also be cooled.

4.2.4 *Specimen masks*, that hold the mounted specimens in an assembly of plates with a front masking plate, e.g. of aluminium. Spring devices shall ensure that the back of the mounting plates is in contact with the water-cooled block to obtain efficient heat exchange.

NOTE Various designs of masking plate are available to allow for the exposure variations described in **6.2**.

4.2.5 *Exposure conditions*, being:

a) Normal conditions: effective humidity 45 %, light fastness of humidity test control: 5; operating temperature 10 °C approximately above ambient.

b) Extreme conditions: for testing sensitivity of specimens to different humidities during exposure, the humidity control fluids listed in Table 2 shall be used. The light fastness of the humidity test control varies accordingly. Other conditions shall remain unchanged.

4.2.6 *Grey scale*, for assessing change in colour conforming to section A02 of BS 1006.

4.2.7 *Colour matching lamp*, conforming to CIE Publication No. 51, for assessment of colour change.

5 Test specimens

Depending on the number of specimens to be tested and on the shape and dimensions of the specimen holders supplied with the apparatus, the size of the specimen may vary.

Usually an area of the textile not less than 10 mm × 45 mm is used when several periods of exposure are made side by side on the same specimen, which is the preferred practice. The specimen may be a strip of fabric, 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. Each exposed and unexposed area shall be not less than 8 mm × 10 mm.

Table 2 — Humidity control fluids

Effective humidity required (%)	Humidity controller
0	Solid phosphorous pentoxide
10	Saturated aqueous solution of zinc chloride (245 g/100 ml)
20	Saturated aqueous solution of potassium acetate
45	Saturated aqueous solution of potassium carbonate (105 g/100 ml)
65	Saturated aqueous solution of sodium nitrate
90	Saturated aqueous solution of barium chloride (31 g/100 ml)
100	Deionized water

To facilitate handling, the specimen or specimens to be tested and the similar strips of the references may be mounted on one or more cards as indicated in Figure 1 or Figure 2.

The specimens to be tested and the blue wool references shall be of equal size and shape in order to avoid errors in an assessment due to overrating the visual contrast between exposed and unexposed parts on a larger pattern as against narrower references (see **7.3**).

When testing pile fabrics, arrange the references in such a way that they are the same distance from the light source as the surface of the pile fabrics. This can be achieved for example by using pieces of cardboard as underlay.

NOTE 1 Covers for the unexposed portions should avoid surface compression.

Test pile fabrics, such as carpets, which have fibres that may shift position, or texture which may make evaluation of small areas difficult, with an exposed area not less than 40 mm × 50 mm and preferably larger.

NOTE 2 Special exposure cells of increased thickness are available for pile fabrics.

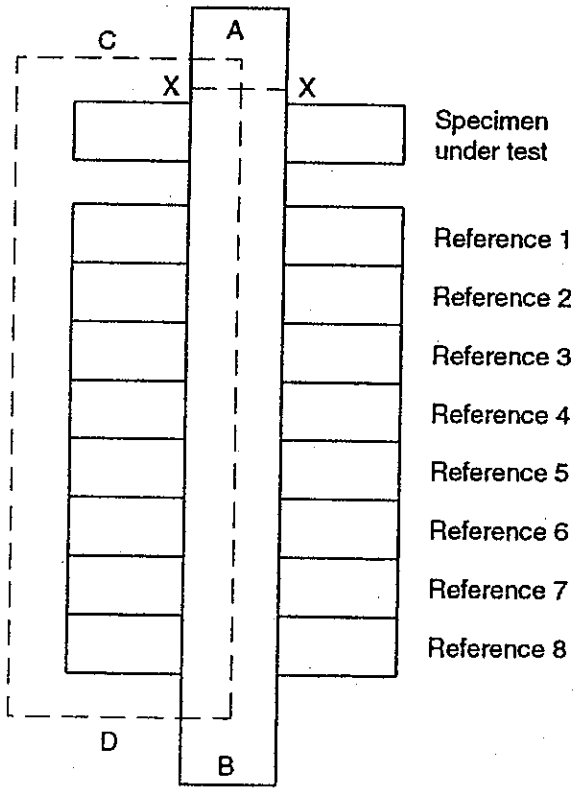
6 Procedure

6.1 Adjustment of the humidity conditions

6.1.1 Check that the apparatus is in good running order and that it is equipped with a clean mercury vapour lamp (see **4.2.1**).

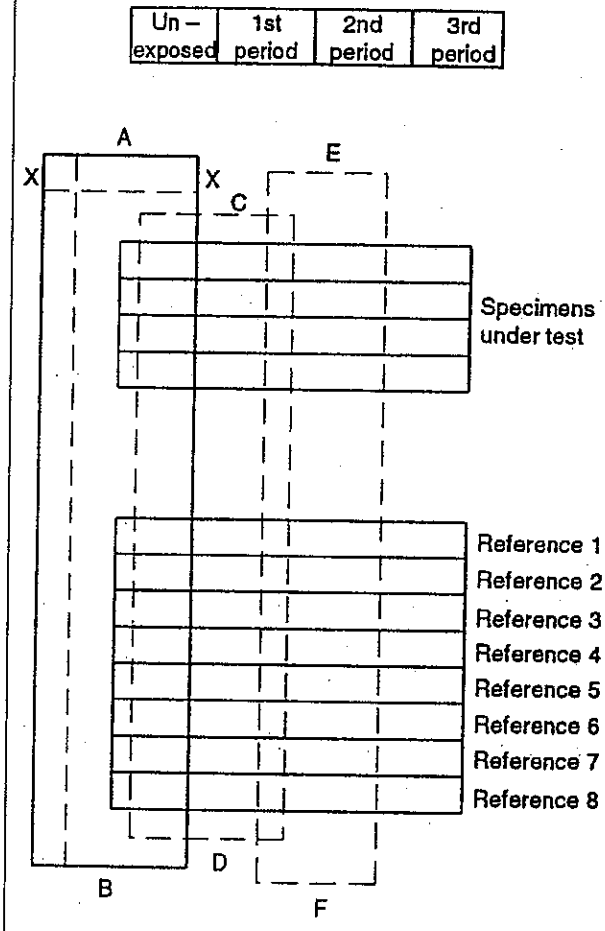
NOTE See the manufacturer's directions and Annex A.

Introduce into the polytetrafluoroethylene pot of the exposure cell (**4.2.3**) the humidity controller as described in Table 2 to give the required effective humidity conditions. Where appropriate place solid material in the bottom of the exposure cell and add the required solvent by means of an extended syringe.



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned to the same place over the specimens and references.
CD: Second cover.

Figure 1 — Mounting for method 1



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned to the same place over the specimens and references.
CD: Second cover.
EF: Third cover.

Figure 2 — Mounting for method 2

6.1.2 Expose a specimen, measuring 10 mm × 45 mm, of the humidity test control together with the light fastness references during the running of the apparatus.

6.1.3 Assess the light fastness of the humidity test control against the references and determine the effective humidity (see Figure 3).

6.2 Exposure methods

6.2.1 *General*

Expose the specimen (or group of specimens) and the references simultaneously, under the desired conditions, in such a manner and for such a time as is necessary to evaluate fully the light fastness of each specimen relative to that of the references, by progressively covering both the specimens and the exposed references during the test (methods 1 to 4).

6.2.2 *Method 1*

NOTE This method is considered most exact and should be used in cases of dispute over the numerical rating. The basic feature is the control of the exposure period by inspection of the specimen and therefore only one set of references is required for each specimen under test.

6.2.2.1 Arrange the specimen to be tested and the references as shown in Figure 1 with an opaque cover AB across the middle one-third of the specimen and references. Expose to the mercury vapour light under the conditions described in **4.2**. Follow the effect of light by removing the cover and inspecting the specimen frequently. When a change can be perceived equal to grey scale grade 4–5, note the number of the reference showing a similar change. (This is a preliminary assessment of light fastness.)

NOTE At this stage attention should be given to the possibility of photochromism (see section B05 of BS 1006).

For all specimens except for white (bleached or optically brightened) specimens, continue the procedure as described in **6.2.2.2** to **6.2.2.4**. For optically brightened textiles, continue with the procedure as described in **6.2.2.5**.

6.2.2.2 Continue to expose until the contrast between the exposed and the unexposed portions of the specimen is equal to grey scale grade 4. Cover the left hand one-third of the specimen and references with an additional opaque cover (CD in Figure 1).

6.2.2.3 Continue to expose until the contrast between the fully exposed and unexposed portions of the specimen is equal to grey scale grade 3.

6.2.2.4 If reference 7 fades to a contrast equal to grey scale grade 4 before the specimen does, terminate the exposure at this stage and report the light fastness as greater than 7.

NOTE When a specimen has a light fastness equal to or greater than 7, it would require unduly long exposure to produce a contrast equal to grey scale grade 3; moreover, this contrast would be impossible to obtain when the light fastness is 8. Assessments in the region of 7–8 are made, therefore, when the contrast produced on reference 7 is equal to grey scale grade 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.

6.2.2.5 For white (bleached or optically brightened) textiles, continue to expose until the contrast between the exposed and unexposed portions of the specimen is equal to grey scale grade 4. If reference 7 fades to a contrast equal to grey scale grade 4 before the specimen does, terminate the exposure at this stage.

NOTE Assessments in the region of 7–8 are made, therefore, when the contrast produced on reference 7 is equal to grey scale grade 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.

6.2.3 *Method 2*

NOTE This method should be used when a large number of specimens have to be tested simultaneously. The basic feature is the control of the exposure periods by inspection of the references, which allows a number of specimens differing in light fastness to be tested against a single set of references, thus conserving supplies.

6.2.3.1 Arrange the specimens to be tested and the references as shown in Figure 2 with the cover AB covering one-quarter of the total length of each specimen and reference. Expose under the conditions described in **4.2**. Follow the effect of light by lifting the cover AB periodically and inspecting the references. When a change in reference 3 can be perceived equal to grey scale grade 4–5, inspect the specimens and rate their light fastness by comparing any change that has occured with the changes that have occurred in references 1, 2 and 3. (This is a preliminary assessment of light fastness.)

NOTE At this stage attention should be given to the possibility of photochromism (see section B05 of BS 1006).

6.2.3.2 Replace the cover AB in exactly the same position and continue to expose until a change in reference 4 can be perceived equal to grey scale grade 4–5; at this point fix an additional cover, CD, in the position shown in Figure 2, overlapping the first cover, AB.

6.2.3.3 Continue to expose until a change in reference 6 can be perceived equal to grey scale grade 4–5, then fix the final cover, EF, in the position shown in Figure 2, the other two covers remaining in position.

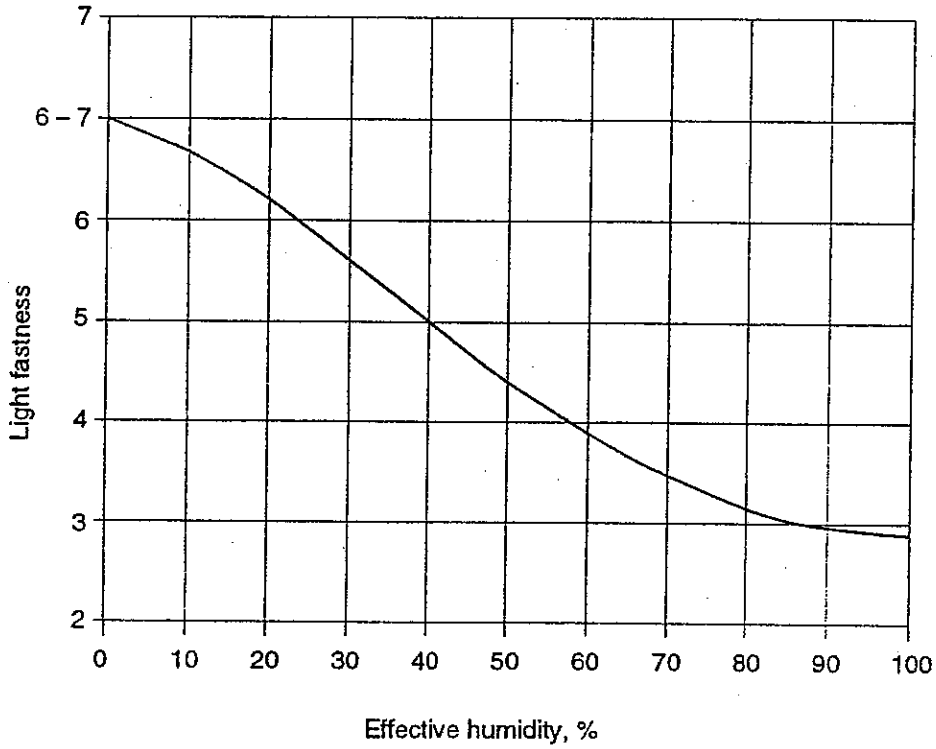


Figure 3 — Mean values obtained from exposures described in 9.1.2

6.2.3.4 Expose until:

a) either a contrast is produced on reference 7 equal to the contrast illustrated by grey scale grade 4; or

b) a contrast equal to grey scale grade 3 has been produced on the most resistant specimen;

c) for white (bleached or optically brightened) textiles, a contrast equal to grey scale grade 4 has been produced on the most resistant specimen.

NOTE This may occur before the fading defined in **6.2.3.2** or **6.2.3.3** has taken place) whichever occurs first.

6.2.4 *Method 3*

NOTE Where the test is to be used to check conformity with a performance specification, it is permissible to expose the specimens with two references only: that specified as minimum and the one below it.

Continue exposure until grey scale grade 4 and grey scale grade 3 contrasts have been produced on separate areas of the minimum reference. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced between separate areas of the minimum reference.

6.2.5 *Method 4*

NOTE Where the test is to be used to check conformity with an agreed reference sample, it is permissible to expose the specimens with the reference sample only.

Continue exposure until grey scale grade 4 and/or grey scale grade 3 contrasts have been produced on the reference sample. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced on the reference sample.

7 Assessment of light fastness

NOTE The final assessment in numerical ratings is based on contrasts equal to grey scale grade 4 and/or grade 3 between exposed and unexposed portions of the specimen. For white (bleached or optically brightened) textiles, the final assessment in numerical ratings is based on a contrast equal to grey scale grade 4 between exposed and unexposed portions of the specimen.

7.1 Remove all the covers, thus revealing on specimens and references two or three areas, depending on the method used, which have been exposed for different times, together with at least one area which has not been exposed to light. Compare the changes of the specimen with the relevant changes of the references under suitable illumination (see clause **13** of section A01 of BS 1006). For white (bleached or optically brightened) textiles, use artificial daylight produced by a colour matching lamp (**4.2.7**). The light fastness of the specimen is the number of the reference which shows similar changes in colour (visual contrast between exposed and unexposed parts of the specimen). If the specimen shows changes in colour which are nearer to the imaginary reference midway between any two consecutive references give the intermediate rating, for example 3–4.

If different assessments are obtained at the different degrees of contrast, the light fastness of the specimen is the arithmetic mean of these expressed to the nearest half or whole grade. When three areas are being rated, take the mean of the contrasts closest to grey scale grades 4 and 3. Confine assessments, however, to whole or midway ratings only. When the arithmetic mean gives a quarter or three-quarter rating, the assessment is defined as the next higher half or whole grade.

If photochromism is suspected, rate the specimen immediately on removal, and then leave in the dark in an atmosphere as specified in **10.2** of section A01 of BS 1006.

7.2 If the colour of the specimen is more fugitive than that of reference 1, assign a rating of 1.

NOTE Comparison of the changes in the specimen with changes in the references may be facilitated by surrounding the specimen with a mask of neutral grey colour approximately midway between the lighter chips in grades 1 and 2 (approximately Munsell N5) and surrounding the references in turn with a similar mask of equal aperture.

7.3 If the light fastness is equal to or higher than 4, preliminary assessment based on the contrast equal to grey scale grade 4–5 (see **6.2.2.1** and **6.2.3.1**) becomes significant; if this preliminary assessment is 3 or lower, it shall be included in the rating in brackets. For example, a rating of 6(3) indicates that the specimen changes very slightly in the test when reference 3 just begins to fade, but that on continuing the exposure the resistance to light is equal to that of reference 6.

7.4 If the specimen is photochromic, the light fastness rating shall include a P bracketed with the rating obtained from the test for photochromism, for example 6 (P 3–4) (see section B05 of BS 1006).

7.5 The term "change in colour" includes change in hue, depth, brightness, or any combination of these characteristics of colour (see **2.6** of section A02 of BS 1006).

7.6 Assess exposures based on a performance reference (see **6.2.3**) or together with an agreed reference sample (see **6.2.4**) by comparison of the colour changes of the specimen and the references. If the specimen shows no greater change in colour than the performance reference or the reference sample, assign the light fastness as "satisfactory"; if the specimen shows a greater change in colour than the performance reference or the reference sample, assign the light fastness as "unsatisfactory".

8 Test report

The test report shall include the following particulars:

a) a reference to the method, i.e. BS 1006-UK-TN:1994;

b) details of the sample tested;

c) for methods 1 or 2, the numerical rating for the light fastness. Express the light fastness rating by the figure alone when using the references designated 1 to 8;

If this rating is equal to or higher than 4 and the preliminary assessment is equal to or lower than 3, report the latter figure in brackets. If the specimen is photochromic, the light fastness shall be followed by a P bracketed together with the grey scale rating.

d) for methods 3 or 4, the classification "satisfactory" or "unsatisfactory" together with the performance reference or the reference sample used;

e) the apparatus used, the method and the exposure conditions;

f) whether an alternative light source has been used (see note to **4.2.2**).

9 Notes

9.1 Effective humidity descriptions

9.1.1 *Qualitative*

This is the combination of air and surface temperatures and air relative humidity which governs the moisture content of the surface of the specimen during exposure.

9.1.2 *Quantitative*

The effective humidity can be measured only by determining the light fastness of a specific humidity test control such as that described in **4.1.2**. This control has been calibrated by exposing it facing south in several west European locations at different times of the year and the exposures being made together with the references in sealed vessels containing air maintained at constant humidities between 0 % and 100 %. The results did not vary greatly and the mean values are shown in Figure 3.

When this control was exposed under the conditions specified in section B01 of BS 1006 in temperate zones, its light fastness was found to be, on average, 5.

Annex A (informative) Description and conditions of use of apparatus

Althought the equipment is usually operated with a 400 W MB/U light source, alternative sources can be employed, including the following:

1 000 W MBF/U;

500 W ML;

400 W MBF/U.

The lamp should be mounted with its axis vertical. The specimens to be exposed inside the exposure cells should face the arc tube so that they are no more than 55 mm above or below the centre of the arc, at a preferred horizontal separation of 200 mm from the axis of the lamp.

To limit the external services required by the equipment to electricity alone, a recirculatory heat exchange system can be used based on extracting the heat from the cooling water by means of an air-cooled exchanger.

A close frame is available when ultra rapid fading results are required on intrinsically high fastness materials.

A time clock is an integral part of the equipment.

UK-TO. Colour fastness to domestic laundering: oxidative bleach response

0 Introduction

The test method in this section of BS 1006 is intended to reflect the effect of multicycle laundering using an activated bleach detergent by domestic procedures. The washes are carried out in a similar manner as the BS EN ISO 105-C06 tests using an oxygen bleach containing reference detergent at 60 °C.

A paper describing the development of this method has been published in Journal of the Society of Dyers and Colourists, Volume **112**, No. 10 October 1996, pages 287 to 292.

1 Scope

This section of BS 1006 specifies a method for determining the consumer relevant shade change of textiles of all kinds and in all forms to domestic laundering procedures in which bleach activators (oxygen bleaching systems) are used.

The colour fastness of dye oxidation resulting from oxygen bleaching in this test approximates with the shade change behaviour observed by multiple domestic launderings.

This method is inapplicable for the assessment of the dye staining of adjacent fabrics, where the method described in BS EN ISO 105-C06 is used.

This method does not reflect the contribution to shade change of optical brighteners which are present in some commercial washing products.

2 Normative references

This section of BS 1006 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed below. For dated references, only the edition cited applies, any subsequent to or revisions of the cited reference apply to this section of BS 1006 only when incorporated in the reference by amendment or revision. For undated references, the latest edition or the cited reference applies, together with any amendments.

BS 1006, *Methods of test for colour fastness of textiles and leather* — section J01, *Measurement of colour and colour differences.*

BS EN ISO 105, *Textiles — Tests for colour fastness* — part A01:1996, *General principles of testing* — part A02:1995, *Grey scale for assessing change in colour* — part C06:1997, *Colour fastness to domestic and commercial laundering.*

3 Principle

A specimen of the textile is laundered, rinsed and dried. Specimens are laundered under appropriate conditions of temperature, alkalinity and bleach concentration such that a fading result which correlates with a multicycle machine washing is obtained in a conveniently short time. The change of colour of the specimen is assessed either with grey scales or instrumentally with reference to the original.

4 Apparatus and reagents

4.1 *Suitable mechanical laundering device,* consisting of water bath containing a rotatable shaft which supports, radially, stainless containers (75 ± 5) mm × (125 ± 10) mm of high capacity (550 ± 50) ml, the bottom of the containers being (45 ± 10) mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of (40 ± 2) min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature ± 2 °C.

NOTE Other mechanical devices maybe used for this test, provided that the results are identical with those obtained by the apparatus described in **4.1**.

4.2 *ECE reference detergent* in three parts as specified in Annex A

a) Base detergent;

b) Sodium perborate tetrahydrate ($NaBO_3\ 4H_2O$);

c) TAED (tetraacetylethylenediamine).

NOTE For details of sources of supply apply to Information Centre, BSI Standards, 389 Chiswick High Road, London W4 4AL.

4.3 *Grade 3 water* conforming to **8.1** of BS EN ISO 105-A01:1996.

4.4 *Grey scales* for assessing change of colour conforming to BS EN ISO 105-A02 or a spectrophotometer for assessing change of colour conforming to section J01 of BS 1006.

4.5 *Balance,* accurate to ± 0.01 g.

4.6 *Mechanical stirrer,* to ensure thorough dispersion and to prevent settling.

NOTE For details of a suitable stirrer apply to Information Centre, BSI Standards, 389 Chiswick High Road, London W4 4AL.

4.7 *Filter papers.*

5 Test specimen

5.1 If the textile to be tested is fabric, cut a 50 mm × 100 mm piece.

5.2 Yarn may be knitted into fabric of dimensions 50 mm × 100 mm, and tested in this form.

5.3 Determine the mass (in g) of the specimen using the balance (**4.5**), to aid accurate liquor ratio volumes.

6 Procedure

6.1 Prepare the wash liquor by dispersing 10 g of the base detergent powder [**4.2** a)] plus 1.8 g TAED at 100 % activity [**4.2** c)] and 12 g sodium perborate [**4.2** b)] per litre of water (see **4.3**).

NOTE A minimum of 1 l detergent solution (**6.1**) should be prepared and this should be freshly made for each laundering run.

6.2 Disperse vigorously the base detergent powder, TAED and the sodium perborate in the amounts specified in **6.1** using the mixer (**4.6**) in water (**4.3**) at (20 ± 2) °C and stir for (10 ± 1) min.

6.3 Place the specimen in one of the containers of the laundering device (**4.1**), add to the container the appropriate volume of wash liquor to provide a liquor: specimen ratio of 100 : 1. Check that the solution is at the initial temperature of (20 ± 2) °C. Close the container, place in the laundering device (**4.1**) and commence rotation.

6.4 Raise the temperature in (22 ± 2) min to the required temperature of (60 ± 2) °C and continue to run the test for a further (30 ± 1) min at this temperature.

6.5 Remove the specimen at the end of the wash and place in a 4 l beaker half filled with water (**4.3**). Gently agitate and rinse for 1 min and then place the beaker under a cold running tap for 10 min.

6.6 Squeeze the test specimen by hand to remove the excess water.

6.7 Dry the test specimen by pressing flat between filter papers to remove excess water. Then hang it in air at a temperature not exceeding 60 °C.

6.8 Assess the change in colour of the specimen either using the grey scales (**4.4**) or instrumentally using BS EN ISO 105-C06, with reference to the original fabric.

7 Test report

The test report shall include the following information:

a) reference to this section of BS 1006;

b) details of the sample tested;

c) the numerical rating for the change of colour of the specimen including the method of assessment.

Annex A (normative)
Reference detergent

The reference detergent is supplied in three separate parts as follows and has the composition given in Table A.1:

a) Base detergent powder;

b) Sodium perborate tetrahydrate;

c) Bleach activator tetraacetylethylenediamine (TAED).

Table A.1 — ECE Non phosphate reference detergent without optical brightner

	%
a) Base detergent	
Linear sodium alkyl benzene sulfonate (mean length of alkane chain $C_{11\cdot5}$)	9.7
Ethoxylated fatty alcohol C_{12-18}(7EO)	5.2
Sodium soap, chain length C_{12-18}: 65 % C_{20-22}: 65 %	3.6
Foam inhibitor concentrate, 8 % silicon on inorganic carrier	6.5
Sodium aluminimum silicate zeolite 4A	32.5
Sodium carbonate	11.8
Sodium salt of a copolymer from acrylic and maleic acid	5.2
Sodium silicate (SiO_2 : Na_2O = 3.3 : 1)	3.4
Carboxymethylcellulose (CMC)	1.3
Diethylene triamine penta (methylene phosphonic acid)	0.8
Sodium sulfate	7.8
Water	12.2
b) Sodium perborate tetrahydrate	As seperate addition
c) Tetraacetylethylenediamine (TAED) (100 % active)	As seperate addition

blank

UK-TP. Specification for pigment printed light fastness references

1 Scope

This section of BS 1006 specifies the materials used in, and the manufacture of, pigment printed blue lightfastness references. The pigment blue references are used in the determination of colour fastness to light.

NOTE 1 General information on colour fastness to light is given in Annex A.

NOTE 2 These references are known as "pigment blue references" in all subsequent text.

2 Normative references

This section of BS 1006 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed below. For dated references, only the edition cited applies, any subsequent amendments or revisions of the cited publication apply to this section of BS 1006 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

BS 1006, *Methods of test for colour fastness of textiles and leather* — section B02, *Colour fastness to artificial light: Xenon arc fading lamp test.*

BS 3432:1980, *Method for determination of grammage of paper and board.*

3 Materials

3.1 Pigments

The pigments used in the manufacture of the pigment blue references shall be as specified in Table 1.

Table 1 — Pigments used in the pigment printed lightfastness references

Pigment — Colour index designation[a]
Pigment white 6
Pigment blue 56
Pigment blue 60

[a] The Colour index is published by the Society of Dyers and Colourists, P.O.Box 244, Perkin House, 82 Grattan Road, Bradford, West Yorkshire, BD1 2JB, UK, and by the American Association of Textile Chemists and Colorists, P.O.Box 12215, Research Triangle Park, NC 27709, USA.

3.2 Composite varnish

The composite varnish shall have the following components:

a) complex mixed alkyd;

b) simple linseed/tung oil/rosin modified phenolic resin;

c) powdered polyethylene wax;

d) drier (10 % cobalt);

e) drier (24 % zirconium).

3.3 Protective coating

A protective coating of overprint acrylic varnish shall be applied.

3.4 Substrate

The substrate shall be a high quality bleached board coated on both sides with polyethylene. The grammage shall be 290 gm^{-2} with a tolerance of ± 5 % when determined in accordance with BS 3432. The whiteness shall be $L = 92$ to 98, $a = -2.0$ to $+1.0$, $b = +2.0$ to $+4.0$ when determined by CIELAB. No optical brightening agent shall be used in the manufacture of the board.

4 Apparatus

4.1 *Apparatus for preparation of lithographic inks*

4.1.1 *Balance*, capable of weighing accurately to at least 0.01 g.

4.1.2 *Mixer*. A low speed, high torque mixer is required to obtain a suitable smooth paste.

4.1.3 *Triple roll mill.*

4.2 *Apparatus for printing*

4.2.1 *Offset lithopress machine.*

4.2.2 *Conventional anodized aluminium positive plates.*

4.2.3 *Racking system*, in which the printed sheets can be individually stored.

NOTE The inks used in this process are slow drying and therefore the printed sheets should be kept separate for a minimum of 15 h to prevent contact damage.

4.2.4 *Guillotine*, for trimming sheets of pigment blue references to desired size.

5 Procedure

5.1 Selection of components

Take pigments (**3.1**) and varnish (**3.2**) as indicated in Table 2 and determine the proportions for pigment blue reference 4 by experiment and comparison with blue wool reference 4 (see BS 1006-B01). Take pigments (**3.1**) and varnish (**3.2**) as indicated in Table 2 and of such proportions that each pigment blue reference contains one or a combination of the materials indicated such that each successive reference is twice as fast as its predecessor. For example 5 is twice as fast as 4 and 4 is twice as fast as 3 when measured in accordance with BS 1006-B02.

Table 2 — Components required for preparation of individual pigment blue references

Pigment blue reference	1	2	3	4	5	6	7	8	9	10
Pigment white 6	*	*	*	*	*	*	*	*		
Pigment blue 56	*	*	*	*	*	*	*	*		
Pigment blue 60				*	*	*	*	*		
Varnish	*	*	*	*	*	*	*	*	*	*

5.2 Preparation of lithographic inks

Weigh the varnish into the low speed, high torque mixer and switch on. Add the weighed amounts of pigment to the varnish in the mixer while stirring is in progress. Continue stirring for 15 min or until a smooth paste has been obtained.

Pass the paste through the roll mill several times.

Add "let down" varnish and waxes to the mill base in a low speed, high torque mixer.

Pass the resultant paste through the triple roll mill.

Add the driers to the let down ink using the low speed, high torque mixer.

5.3 Printing

NOTE 1 The ink used in this process is viscous. Stirring of the ink in the duct is necessary to prevent it laying back from the rollers.

Place the vessel containing the ink in boiling water so that, after a few minutes warming in this manner, the viscosity is reduced sufficiently for the ink flow from its container into the press ink duct. Running the press under the following conditions:

Font solution.....None
Blanket.....Sovereign compressible (or equivalent)
Ink duct.....Stirring
Ink deposit.....Maximum

Feed the sheets of polyethylene coated board into the printing press and the ink coverage set to 210 mm × 297 mm.

NOTE 2 It is suggested that the polyethylene board size be 420 mm × 297 mm and the ink coverage set to 210 mm × 297 mm.

5.4 Coating

A suitable coating to protect the pigment from damage during handling.

5.5 Drying

Layout the printed sheets of board on a racking system to dry for at least 15 h before handling and storage.

NOTE The ink formulation is very slow drying.

5.6 Guillotining

Cut the completely dry sheets of pigment printed blue board to the desired size.

6 Performance

Discard the first and last sheets of each print run of an individual reference.

Examine each sheet of pigment blue reference visually for flaws in the printing process. If the printed sheet is not visually uniform discard it.

Determine the lightfastness according to section B02 of BS 1006. The value obtained shall be within the range + 0.5 to – 0.5 grey scale units when compared to the relevant master standard.

NOTE For information on sources of supply of master standards apply to Information Centre, BSI Standards, 389 Chiswick High Road, London W4 4AL.

For the first, multiple of 100, and the last sheets determine the colour difference (CMC 2 : 1, maximum ΔE 0.5 either side of the mean). Make the measurements at five points on each printed sheet, upper left, upper right, centre, lower left, lower right.

7 Labelling

The reverse side of each accepted sheet of pigment blue reference shall be printed several times with the following information:

a) The name and address of the manufacturer;

b) The batch number to allow the manufacturer to relate back to date of manufacture and performance data.

Annex A (informative)
Additional information

General information on colour fastness to light is given in Annex C of section B02 of BS 1006.

The following recommendations are given for storage of pigment blue references prior to use.

a) Stocks held by the manufacturer or main agents should be packed individually in light proof bags and stored in a cool, dark, dry environment.

b) At the time of sale to individual laboratories the package should be stamped with the date of sale and a recommended use by date which should be three years from the date of sale.

c) Each package should be labelled with recommendations for storage.

The pigment blue references may be used in the following methods in place of the blue wool references. However, if used this fact should be stated in the test report by using the prefix BS pp.

BS 1006	*Methods of test for colour fastness of textiles and leather*
Section B01:	*Colour fastness to light: Daylight*
Section B02:	*Colour fastness to artificial light: Xenon arc fading lamp test*
BS EN ISO 105	*Textiles — Tests for colour fastness*
Part B03:	*Colour fastness to weathering: outdoor exposure*
Part B04:	*Colour fastness to artificial weathering: Xenon arc fading lamp test*
Part B05:	*Detection and assessment of photochromism*

Alphabetical list of agencies

Publications referred to

See foreword.

BS 1051, *Glossary of terms relating to the conditioning, testing and mass determination of textiles.*

BS 3144, *Methods of sampling and physical testing of leather.*

BS 3145, *Specification for laboratory pH meters.*

BS 3978, *Specification for water for laboratory use.*

BS 4923, *Schedule of domestic washing and drying procedures for textile testing.*

BS 5497, *Precision of test methods.*

BS 5497-1, *Guide for the determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*

CIE Publication No 15.2:1986, *Colorimetry (second edition)*[7)].

CIE Publication 51, *Method for assessing the quality of daylight simulators for colorimetry*[7)].

[7)] Available from The Library, Jules Thorne Lighting Laboratories, Lincoln Road, Enfield, Middlesex EN1 1SB.

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