INTERNATIONAL STANDARD

ISO 105-B04

Fourth edition
1994-11-15

Textiles — Tests for colour fastness —

Part B04:
Colour fastness to artificial weathering: Xenon arc fading lamp test

Textiles — Essais de solidité des teintures —

Partie B04: Solidité des teintures aux intempéries artificielles: Lampe à arc au xénon

Reference number
ISO 105-B04:1994(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

International Standard ISO 105-B04 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 1, *Tests for coloured textiles and colorants*.

This fourth edition cancels and replaces the third edition (ISO 105-B04:1988), of which it constitutes a technical revision.

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

Annexes A and B of this part of ISO 105 are for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

Textiles — Tests for colour fastness —

Part B04:
Colour fastness to artificial weathering: Xenon arc fading lamp test

1 Scope

This part of ISO 105 specifies a method intended for determining the resistance of the colour of textiles of all kinds, except loose fibres, to the action of weather as determined by exposure to simulated weathering conditions in a cabinet equipped with a xenon arc lamp.

This method can be used to determine if a textile is wet light-sensitive.

NOTE 1 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-A01:1994, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-B01:1994, *Textiles — Tests for colour fastness — Part B01: Colour fastness to light: Daylight.*

ISO 105-B02:1994, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test.*

3 Principle

Specimens of the textile are exposed under specified conditions to light from a xenon arc lamp and to water spray. At the same time, eight dyed blue wool references are exposed to light but are protected from water spray by a sheet of window-glass. The fastness is assessed by comparing the change in colour of the specimen with that of the references.

If the method is used to determine if a textile is wet light-sensitive (see 4.3.1), the simultaneous exposure of references is unnecessary. In this case the assessment is performed by comparison with the grey scale in accordance with ISO 105-A02.

4 Reference materials and apparatus

4.1 Blue wool references

The reference materials used in this test are those blue wool references specified in ISO 105-A01 and ISO 105-A02, and subclause 4.1.1 of ISO B01:1994.

4.2 Apparatus

4.2.1 Xenon arc lamp apparatus.

4.2.1.1 Light source, in a well-ventilated exposure chamber. The light source is a xenon arc lamp of correlated colour temperature 5 500 K to 6 500 K.

4.2.1.2 Light filter, placed between the light source and the specimens and references so that the ultraviolet spectrum is steadily reduced. The glass used shall have a transmission of 0 % between 290 nm and 300 nm, rising to at least 90 % between 380 nm and 750 nm.

4.2.1.3 Heat filters, placed between the light source and the specimens and references so that the amount of infrared radiation is steadily reduced.

The spectrum of the xenon arc contains an appreciable amount of infrared radiation which should be minimized by the heat filters to satisfy the temperature conditions. The filters shall be cleaned regularly to avoid undesirable reduction in light intensity by dirt.

4.2.2 Radiometer (when available/specified), for measuring irradiance and radiant exposure.

Since irradiance at the test specimen face can vary as a function of lamp intensity and lamp-to-specimen distance, a monitoring radiometer may be used to control uniformity of exposure. The radiometer permits exposure to an established level of irradiation (radiant energy flux per unit area) at a point in the plane of the specimen rack (see annex B).

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

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

4.3 Exposure conditions

The test specimens and the blue wool references are exposed simultaneously in the apparatus (4.2.1), the specimens to both light and water spray, and the references to light only. The air temperature in the chamber shall be measured with a thermometer whose sensitive portion is shielded from the direct radiation of the arc.

The temperature in the test chamber shall not exceed 40 °C during the drying period.

The temperature of the black panel, which is measured in the centre and under the same illumination as the specimens, shall not exceed that of the test chamber by more than 20 °C at the maximum drying period (black panel temperature, see ISO 105-B02: 1994, subclause 4.2.3).

The variation in light intensity over the area covered by specimens and references shall not exceed ±10 % of the mean.

4.3.1 Exposure of test specimens

The specimens shall be subjected to the following accurately adjusted, reproducible weathering cycle:

— duration of spraying: 1 min;

— duration of drying: 29 min.

For spraying the specimens, only completely ion-free water shall be used. It should be especially noted that this water shall not contain any metal salts. Tubing, tanks and spray jets shall be of corrosion-resistant material.

If the method is used to determine if a textile is wet light-sensitive, the weathering cycle shall be repeated for a total of 16 h testing.

The specimens shall be mounted on a suitable holder. The specimens shall completely enclose the holder and the side to be assessed shall not be in contact with metal plates, other specimens, or backing fabric.

NOTE 2 The holders described in *Textil-Rundschau*, **18** (1963) 2, 76, photo 2, left, may be used. The manufacturer of these holders also supplies a case to protect the references.

4.3.2 Exposure of colour fastness references

The blue wool references (4.1) shall be protected from the water spray by a shield of glass whilst being exposed to light from the same xenon arc lamp as the specimens. The transmission of the glass shall be 0 % between 310 nm and 320 nm, rising to at least 90 % between 380 nm and 750 nm. The glass case shall be well ventilated, i.e. there shall be an opening at the top and another at the bottom to allow good circulation of air.

5 Test specimens

5.1 If the textile to be tested is fabric, prepare two specimens, each of a suitable size, mounted on holders or other equipment which will fit the weathering test equipment.

5.2 If the textile to be tested is yarn, knit or weave it into fabric and treat it as described in 5.1.

Loose fibres are not suitable for weathering tests.

5.3 Mount strips of blue wool references on cardboard, (4.2.3), cover one-third of each as described in ISO 105-B02:1994, 7.2.1.2 and fix the mounted references under glass according to 4.3.2.

5.4 Unexposed samples of original fabric identical to those being tested are required as references for comparison with the specimens during weathering.

6 Procedure

6.1 Procedure common to methods 1, 2 and 3

6.1.1 Place the specimens mounted on the holders (see 4.3.1) in the apparatus and expose them continuously to weathering following method 1, 2 or 3 (see 6.2 to 6.4).

6.1.2 At the same time, expose the mounted and partially covered blue wool references (see 4.1 and 5.3) to light in the glass case of the same apparatus (see 4.3.2).

6.1.3 Only one side of the test specimen shall be exposed to weathering and light.

6.1.4 Whilst the specimens are drying, the air in the test chamber shall not be moistened.

NOTE 3 The actual conditions of the weathering test depend on the kind of test apparatus used.

6.1.5 Contrary to stipulations for the outdoor exposure test, the speciments shall not be washed after the weathering test.

6.2 Method 1

6.2.1 This method is considered most satisfactory and is mandatory 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 blue wool references is required for each specimen under test. It is therefore impracticable when large numbers of specimens have to be tested concurrently; in such cases, method 2 (see 6.3) shall be used.

6.2.2 Expose the specimens and the blue wool references under the conditions described in 6.1 until the contrast between the exposed specimens and a portion of the original fabric (5.4) is equal to grey scale grade 3. Remove one of the specimens and cover a second one-third of the references with an additional opaque cover.

6.2.3 Continue the exposure until the contrast between the remaining specimen and a portion of the unexposed original fabric is equal to grey scale grade 2. If blue wool reference 7 fades to a contrast equal to grey scale grade 4 before the contrast between the specimen and the portion of the original fabric is equal to grey scale grade 2, the exposure may be concluded at this stage and the remaining specimen and the reference removed.

6.2.4 Prepare both specimens, and a portion of the original fabric for assessment (see 6.4 and 6.5).

6.2.5 If textiles are to be examined for wet light-sensitivity, a 16 h testing period shall be used prior to assessment.

6.2.6 Assess the colour fastness to weathering in accordance with the method given in 7.1 to 7.3.

6.3 Method 2

6.3.1 This method should be used when the number of specimens to be tested simultaneously is so large that method 1 is impracticable. The basic feature of this method is the control of the exposure period by inspection of the blue wool *references*, which allows a number of specimens differing in weathering fastness to be tested against only one set of references, thus conserving supplies of the latter.

6.3.2 Expose the specimens and the blue wool references under the conditions described in 6.1 until the contrast between the exposed and unexposed portions of reference 6 is equal to grey scale grade 4. At this stage, remove one specimen from each pair and cover a second one-third of the blue wool references with an additional opaque cover.

6.3.3 Continue the exposure until the contrast between the fully exposed and unexposed portions of reference 7 is equal to grey scale grade 4. Remove the remaining specimens and the references.

6.3.4 Prepare the exposed specimens and a portion of the original fabric (5.4) from each specimen for assessment (see 6.5 and 6.6).

6.3.5 Assess the colour fastness to weathering of each specimen in accordance with the method given in 7.1 to 7.3.

6.4 Method 3

Where the test is to be used to check conformity of colour fastness to exposure to agreed-upon radiant energy levels, it is permissible to expose the specimens alone or with references. The specimens should undergo weathering for the time required for exposure to the specified level of radiant energy, then removed together with the blue wool references and evaluated in accordance with clause 7.

6.5 Drying

Before mounting the tested specimens for assessment, dry them in air at a temperature not exceeding 60 °C.

6.6 Mounting for assessment

Trim and mount the tested specimens so that they measure at least 15 mm × 30 mm, one on each side of a portion of the original fabric (5.4) which has been trimmed to the same size and shape as the specimens. The specimen exposed for the shorter length of time shall be mounted on the left.

7 Assessment of colour fastness to weathering

7.1 Assess the magnitude of the contrast between the specimen exposed for the *shorter* time and the original fabric in terms of the contrasts produced on the blue wool references exposed for the same period: the assessment is the number of the blue wool reference showing the contrast closest to that of the specimen. If the specimen shows changes in colour approximately half-way between two blue wool references, an appropriate half-rating, for example 5-6, shall be given.

7.2 Assess the magnitude of the contrast between the specimen exposed for the *longer* time and the original fabric in terms of the contrasts produced in the blue wool references exposed for the same period: the assessment is the number of the blue wool reference showing the contrast closest to that of the specimen. If the specimen shows changes in colour approximately half-way between two blue wool references, an appropriate half-rating, for example 3-4, shall be given.

7.3 If specimens larger than the blue wool references are exposed, a mask of a neutral grey colour approximately midway between that illustrating grade 1 and that illustrating grade 2 of the grey scale for assessing change in colour (approximately Munsell N5) shall be used in the assessment, the mask covering the surplus area of the specimens and leaving open an area equal to that of the blue wool references for comparative evaluation.

7.4 To determine if the test specimen is wet light-sensitive, after 16 h weathering assess the magnitude of the contrast between the exposed specimen and the original fabric by comparison with the grey scale. If a colour change greater than 4-5 on the grey scale was obtained, the textile is judged to be wet light-sensitive; if a colour change of 4-5 or 5 on the grey scale was obtained, the textile is judged non-wet light-sensitive.

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

Bl = bluer
Y = yellower
G = greener
R = redder
D = duller
Br = brighter

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

W = weaker
Str = stronger

8 Test report

The test report shall include the following information:

a) the number and year of publication of this part of ISO 105, i.e. ISO 105-B04:1994;

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

c) for methods 1 and 2, the numerical rating for colour fastness to weathering: xenon lamp. If the two assessments (see 7.1 and 7.2) are different, report only the lower;