INTERNATIONAL STANDARD

ISO 105-E04

Sixth edition
2013-03-15

Textiles — Tests for colour fastness —

Part E04: Colour fastness to perspiration

Textiles — Essais de solidité des coloris —

Partie E04: Solidité des coloris à la sueur

Reference number
ISO 105-E04:2013(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 105-E04 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 1, *Tests for coloured textiles and colorants*.

This sixth edition cancels and replaces the fifth edition (ISO 105-E04:2008), of which it constitutes a minor revision.

ISO 105 consists of many parts designated by a part letter and a two-digit serial number (e.g. A01), under the general title *Textiles — Tests for colour fastness*. A complete list of these parts is given in ISO 105-A01.

Textiles — Tests for colour fastness —

Part E04:
Colour fastness to perspiration

1 Scope

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

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 105-A01:2010, *Textiles — Tests for colour fastness — Part A01: General principles of testing*

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

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

ISO 105-A04, *Textiles — Tests for colour fastness — Part A04: Method for the instrumental assessment of the degree of staining of adjacent fabrics*

ISO 105-A05, *Textiles — Tests for colour fastness — Part A05: Instrumental assessment of change in colour for determination of grey scale rating*

ISO 105-F01, *Textiles — Tests for colour fastness — Part F01: Specification for wool adjacent fabric*

ISO 105-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

ISO 105-F03, *Textiles — Tests for colour fastness — Part F03: Specification for polyamide adjacent fabric*

ISO 105-F04, *Textiles — Tests for colour fastness — Part F04: Specification for polyester adjacent fabric*

ISO 105-F05, *Textiles — Tests for colour fastness — Part F05: Specification for acrylic adjacent fabric*

ISO 105-F06, *Textiles — Tests for colour fastness — Part F06: Specification for silk adjacent fabric*

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

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Principle

Specimens of the textile in contact with adjacent fabrics are treated in two different solutions containing histidine, drained and placed between two plates under a specified pressure in a test device. The specimens and the adjacent fabrics are dried separately. The change in colour of each specimen and the staining of the adjacent fabrics are assessed by comparison with the grey scales or instrumentally.

4 Apparatus and materials

4.1 Test devices, each consisting of a frame of stainless steel into which a weight-piece of mass approximately 5 kg and base 60 mm × 115 mm is closely fitted, so that a pressure of (12,5 ± 0,9) kPa can be applied on test specimens measuring (40 ± 2) mm × (100 ± 2) mm, placed between glass or acrylic-resin plates measuring approximately 60 mm × 115 mm × 1,5 mm. The test device shall be constructed so that, if the weight-piece is removed during the test, the pressure remains unchanged.

If the dimensions of the composite specimen differ from the size of (40 ± 2) mm × (100 ± 2) mm, the weight-piece used shall be such that a nominal pressure of (12,5 ± 0,9) kPa is applied to the specimen.

Other devices may be used provided that equivalent results are obtained.

4.2 Oven, maintained at (37 ± 2) °C.

4.3 Alkaline solution, freshly prepared, using grade 3 water complying with ISO 3696, containing, per litre:

— 0,5 g of L-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$);

— 5 g of sodium chloride (NaCl);

and either

— 5 g of disodium hydrogen orthophosphate dodecahydrate ($Na_2HPO_4 \cdot 12H_2O$)

or

— 2,5 g of disodium hydrogen orthophosphate dihydrate ($Na_2HPO_4 \cdot 2H_2O$).

The solution is brought to pH 8 (±0,2) with 0,1 mol/l sodium hydroxide solution.

4.4 Acid solution, freshly prepared, using grade 3 water complying with ISO 3696, containing, per litre:

— 0,5 g of L-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$);

— 5 g of sodium chloride (NaCl);

— 2,2 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4 \cdot 2H_2O$).

The solution is brought to pH 5,5 (±0,2) with 0,1 mol/l sodium hydroxide solution.

4.5 Adjacent fabrics (see ISO 105-A01).

Either:

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

or:

4.5.2 Two single-fibre adjacent fabrics, complying with the relevant document selected from ISO 105-F01 to F06.

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, the second piece being made of the fibre indicated in Table 1 or, in the case of blends, of the kind of fibre that is second in order of predominance, or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

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

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.

4.7 Grey scale for assessing staining, complying with ISO 105-A03.

4.8 Spectrophotometer or colorimeter for assessing change in colour and staining, complying with ISO 105-A04 and ISO 105-A05.

4.9 A set of 11 glass or acrylic resin plates.

4.10 Flat-bottomed dish made of inert materials.

5 Test specimen

5.1 If the textile to be tested is fabric, either

a) attach a specimen measuring (40 ± 2) mm × (100 ± 2) mm to a piece of the multifibre adjacent fabric (4.5.1), also measuring (40 ± 2) mm × (100 ± 2) 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 ± 2) mm × (100 ± 2) mm between the two single-fibre adjacent fabrics (4.5.2), also measuring (40 ± 2) mm × (100 ± 2) 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, and either

a) place it between a (40 ± 2) mm × (100 ± 2) mm piece of the multifibre fabric (4.5.1) and a (40 ± 2) mm × (100 ± 2) mm piece of the non-dyeable fabric (4.5.3) and sew them along all four sides (see ISO 105-A01:2010, Subclause 10.3, “Preparation of composite specimens”); or

b) place it between a (40 ± 2) mm × (100 ± 2) mm piece of each of the two specified single-fibre fabrics (4.5.2) and sew along all four sides.

6 Procedure

6.1 Lay out the composite specimen smoothly in a flat-bottomed dish and cover with alkaline solution (4.3). Thoroughly wet the composite specimen in this solution at pH 8 (±0,2) at an approximate liquor ratio of 50:1, and allow it to remain in the solution at room temperature for 30 min. Press and move it

from time to time to ensure good and uniform penetration of the liquor. Pour off the solution and wipe the excess liquor off the specimen between two glass rods.

Place the composite specimen between two glass or acrylic-resin plates (see 4.9), under a nominal pressure of (12,5 ± 0,9) kPa, and place in a test device (4.1) which has been preheated to the test temperature.

By the same procedure, wet a composite specimen in the acid solution at pH to 5,5 (±0,2) (4.4) and then test it in a separate pre-heated test device.

NOTE Up to 10 test specimens, each separated from the next by one plate, can be tested in one test device simultaneously. If less than 10 specimens are prepared, all 11 plates must still be used to maintain the correct nominal pressure.

6.2 Place the test device containing the composite specimen in the oven (4.2) for 4 h at (37 ± 2) °C, positioning it so that the test specimens are in either the horizontal position (Figure 1) or the vertical position (Figure 2) depending on the type of device available.

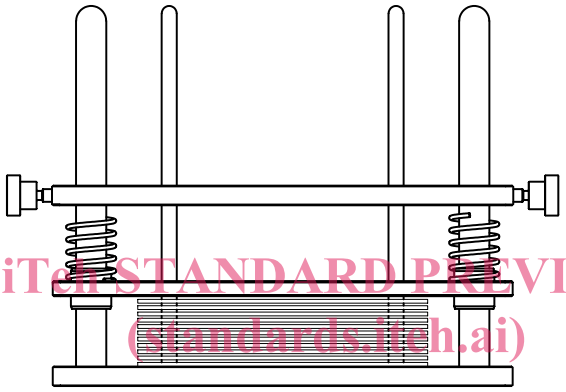

Figure 1

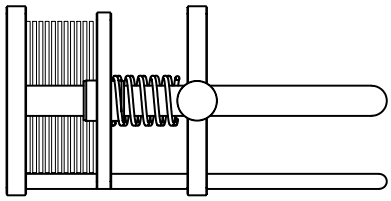

Figure 2

6.3 Open out each 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 each specimen and the staining of the adjacent fabric(s) by comparison with the grey scales (4.6 and 4.7) or instrumentally (see ISO 105-A04 and ISO 105-A05).

In many cases of cellulosic fibres dyed with direct dyes containing copper, or after treatment with copper salts, the prescribed tests and natural perspiration bring about a removal of copper from the dyeings. This may cause a significant alteration in colour fastness to light, perspiration or washing, and it is therefore recommended that this possibility be taken into consideration.

7 Test report

The test report shall include the following information:

a) a reference to this part of ISO 105 (ISO 105-E04:2013);

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

c) the numerical grey scale ratings for change in colour of the specimen in each solution;

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

e) if a multifibre adjacent fabric was used, the numerical grey scale rating and/or instrumental assessment for staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

f) the option used.