International Standard

ISO 105-C12

Textiles — Tests for colour fastness —

Part C12: Colour fastness to industrial laundering

Textiles — Essais de solidité des coloris —

Partie C12: Solidité des coloris au lavage industriel

Second edition
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 1, *Tests for coloured textiles and colorants,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 105-C12:2004), which has been technically revised.

The main changes are as follows:

— ISO 105-F:1985 was withdrawn and the test conditions of industrial laundering are seldom used for the fabrics mainly made of delicate fibres (for example silk or wool), therefore ISO 105-C12:2004/Cor 1:2007 has not been suitable to be incorporated into this method;

— addition of ISO 3696 and replacement of ISO 105-A01:1994 with ISO 105-A01 in Clause 2;

— revision of clause title from “Reagents” to “Reagents and materials” in Clause 5 (Former Clause 4);

— addition of “Other suitable detergent can be used if agreed upon between interested parties.” in 5.1 (former 4.1);

— clarification that 30 % is mass fraction in 5.3 (former 4.3);

— addition of sodium percarbonate as an optional reagent in 5.6, 8.1.3, Table 1 and A.1 (former 4.6, 7.1.3, Table 1 and A.1);

— replacement of “see 8.2 of ISO 105-A01:1994” with “in accordance with ISO 3696” in 5.7 (former 4.7);

— movement of “Adjacent fabrics” and “Grey scales” to the clause “Reagent and materials”;

— addition of the statement “using either a multifibre adjacent fabric or two single-fibre adjacent fabrics as specified in ISO 105-A01.” in 5.8 (former 5.4);

— deletion of “Condition the sample for 24 h before assessing to allow for temporary colour change caused by heat.” in 6.6 (former 5.6);

— addition of “Balance, with a resolution of 0,01 g.” in Clause 6 (former Clause 5);

— addition of the dimension of the multifibre TV adjacent fabric as “80 mm × 100 mm” in 7.2 (former 6.2);

— revision of Figure 1;

— replacement of “mixer” with “mechanical stirrer” in 8.1 (former 7.1);

— replacement of “running tap water for 10 min” with “running tap water until being clean” and addition of a NOTE to check the cleanness degree of the rinsed test specimen in 8.2.2 (former 7.2.2);

— revision of the requirement for conditioning the test specimen in 8.2 (former 7.2);

— improvement of the contents in Test report;

— revision of Annex A from “informative” to “normative”;

— improvement of the Formula (A.1);

— updating of the Bibliography.

A list of all parts in the ISO 105 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The test method in this document is intended to reflect the effect of comprehensive laundering during industrial laundry procedures, as distinct from the domestic washing test methods as given in ISO 105-C06, ISO 105-C08 and ISO 105-C10. Four test conditions are described, one at (92 ± 2) °C intended for the evaluation of workwear and three, as given below, at (75 ± 2) °C, for the evaluation of bed and table linen and corporate wear:

— without the addition of peroxy bleach compounds;

— with the addition of hydrogen peroxide (for the bleaching of white workwear with coloured trimmings);

— with the addition of sodium perborate tetrahydrate (or sodium percarbonate) and tetra-acetylethylene diamine (TAED) (for the bleaching of white workwear with coloured trimmings).

NOTE The addition of TAED/perborate (or percarbonate) is a conveniently stable way of producing peracetic acid in situ.

This test method does not reflect the effect of optical brightening agents.

This method and the single cycle test methods described in ISO 105-C06 and ISO 105-C08 might not reproduce the effect of coloured fabrics treated with certain dye fixing agents and finishes after multiple (5 to 10) industrial washes.

Textiles — Tests for colour fastness —

Part C12:
Colour fastness to industrial laundering

1 Scope

This document specifies methods for determining the resistance of the colour of textiles of all kinds exposed to all forms of industrial laundering procedures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *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-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

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

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

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

A test specimen of the textiles in contact with specified adjacent fabrics is laundered, rinsed and dried. Test specimens are laundered under appropriate conditions of temperature, alkalinity, bleaching and mechanical

action such that the result is obtained in a conveniently short time. The mechanical action is accomplished by the use of an appropriate number of steel balls. The change in colour of the test specimens and the staining of the adjacent fabrics are assessed with reference to the original fabric, either using the grey scale or instrumentally.

One cycle approximates to the colour in change and cross staining resulting from chemical and/or mechanical action achieved after multiple (5 to 10) industrial launderings.

5 Reagents and materials

All chemicals shall be of at least general purpose laboratory grade.

5.1 Detergent, as specified in Annex A. Other suitable detergent can be used if agreed upon between interested parties.

5.2 Acetic acid solution, containing 0,2 g/l of acetic acid, if required for souring treatment.

5.3 Hydrogen peroxide solution, with a mass fraction of 30 %.

5.4 Sodium hydroxide (NaOH) pellets.

5.5 Tetra-acetylethylenediamine (TAED).

5.6 Sodium perborate tetrahydrate or sodium percarbonate. Preference should be given to the use of sodium percarbonate.

NOTE As bleaching agent, sodium perborate tetrahydrate and sodium percarbonate are chemically equivalent.

WARNING — Sodium perborate is known to be hazardous and appropriate measures shall be taken.

5.7 Distilled water, grade 3 water in accordance with ISO 3696.

5.8 Adjacent fabrics, using either a multifibre adjacent fabric or two single-fibre adjacent fabrics as specified in ISO 105-A01.

a) A multifibre adjacent fabric conforming with type (TV) of ISO 105-F10.

b) Two single-fibre adjacent fabrics, one cotton and one polyester, in accordance with ISO 105-F02 and ISO 105-F04, or as otherwise specified between interested parties.

5.9 Grey scales, for assessing change in colour in accordance with ISO 105-A02, or instrumentally ISO 105-A05, and for assessing staining in accordance with ISO 105-A03, or instrumentally ISO 105-A04.

5.10 Non-dyeable fabric, if required, for example polypropylene or to mechanically stabilize a knitwear test specimen.

6 Apparatus

6.1 Suitable mechanical device, consisting of a water bath containing a rotatable shaft which supports, radially, stainless steel containers with an inner diameter of (75 ± 5) mm and a height of (125 ± 10) mm**,** of 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.

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

6.2 Mechanical stirrer, (1 100 ± 100) min^{-1} or equivalent, to ensure dispersion and prevent settling.

6.3 Non-corrodible (stainless) steel balls, approximately 6,0 mm in diameter.

6.4 Flat-iron, with a mass of 2 500 g ± 100 g and capable of giving the temperature indicated in 8.2.5, if a pressing treatment is required.

6.5 Balance, with a resolution of 0,01 g.

7 Test specimens

7.1 Fabric test specimen

Cut two fabric test specimens, each measuring 80 mm × 160 mm, one test specimen with the long dimension parallel to the warp (woven fabric) or the wale (knitted fabric) direction, and the other one parallel to the weft (woven fabric) or courses (knitted fabric) direction. Weigh the two test specimens with the mass rounded off to two decimal places (in grams). Fold each test specimen across the narrow dimension in the centre of the test specimen with fabric face on the outside (see Figure 1). Using dimensionally stable thread, sew along the two sides to form a bag. Place 25 stainless steel balls (6.3) inside each bag and seal by sewing to form a combined test specimen.

7.2 Adjacent fabrics

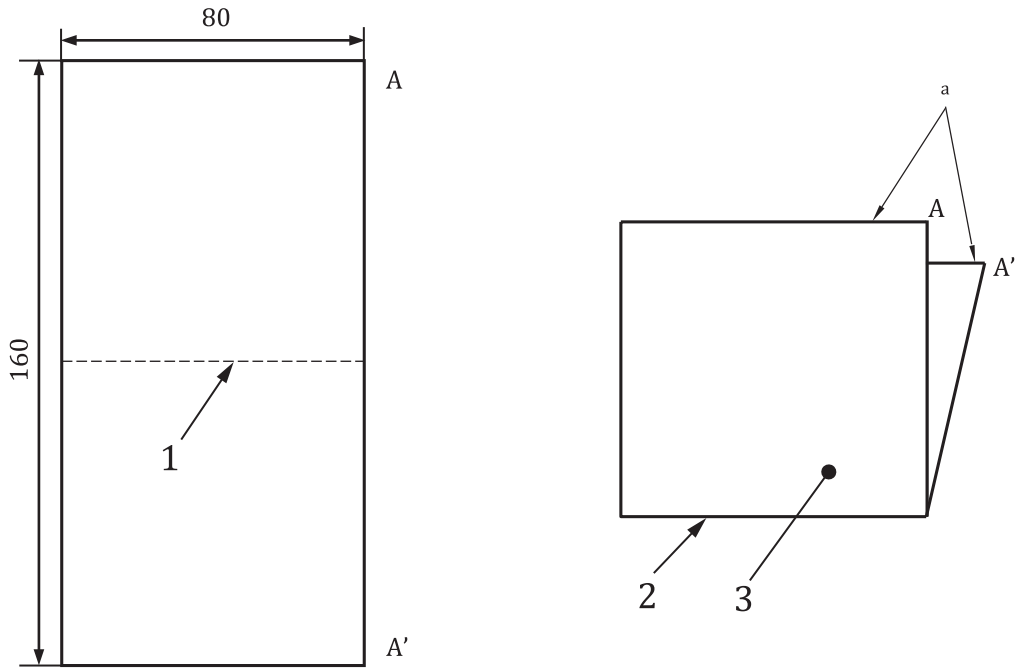
Either:

a) cut the multifibre TV adjacent fabric (5.8a) of 80 mm × 100 mm and weigh the mass rounded off to two decimal places (in grams); or

b) cut two single-fibre adjacent fabrics (5.8b) of 80 mm × 100 mm and weigh the mass rounded off to two decimal places (in grams).

NOTE The two-fabric test specimen and adjacent staining fabrics are not sewn to each other. This allows fabric abrasion to occur.

Dimension in millimetres



Key

1 fold line
2 folded edge
3 folded test specimen
AA' a long side
[a] Sew along the open sides.

Figure 1 — Preparation of test specimen

8 Test procedures

8.1 Preparation of wash liquor

8.1.1 Tests without the addition of hydrogen peroxide

Using the mechanical stirrer (6.2), disperse 5 g/l of the industrial reference detergent (5.1) base powder (without optical brightener) in grade 3 water (5.7) at ambient temperature for (10 ± 1) min. Add 1 g of sodium hydroxide (5.4) per litre of solution. Using acetic acid solution (5.2), adjust the pH to be within the range 12,0 to 12,5 and use immediately. Proceed as in 8.2.

8.1.2 Tests with the addition of hydrogen peroxide

Using the mechanical stirrer (6.2), disperse 5 g/l of the industrial reference detergent (5.1) base powder (without optical brightener) in grade 3 water (5.7) at ambient temperature for (10 ± 1) min. Add 1 g of sodium hydroxide (5.4) per litre of solution. Using acetic acid solution (5.2), adjust the pH to be within the range 11,0 to 11,5. Add 2 ml of 30 % hydrogen peroxide (5.3) per litre of solution and use immediately. Proceed as in 8.2.

8.1.3 Tests with the addition of sodium perborate (or sodium percarbonate) and tetra acetylethylenediamine (peracetic acid)

Using the mechanical stirrer (6.2), disperse 5 g/l of the industrial reference detergent (5.1) base powder (without optical brightener), 2 g/l of sodium perborate tetrahydrate (or equivalent amount of sodium

percarbonate) (5.6) and 0,3 g/l TAED (5.5) (100 % activity) in grade 3 water (5.7) at ambient temperature for (10 ± 1) min. Using sodium hydroxide (5.4), adjust the pH to be within the range 10,0 to 10,5 and use immediately. Proceed as in 8.2.

8.2 Testing the test specimens

8.2.1 Prepare two containers separately used for two test specimens. Add wash liquor (8.1) to each container (6.1) at a liquor ratio of 15:1 [i.e., 15 ml of solution for each gram of the total mass of a combined test specimen (7.1) and adjacent fabric(s)]. Place both the combined test specimen and the separate adjacent fabric(s) in each container. Close the containers, place them in the machine (6.1), commence rotation and raise the temperature at a rate of (1,5 ± 0,5) °C/min to the temperature specified in Table 1. Continue to run the test for a further 60 min at this temperature.

During the test, pressure can develop within the container. Containers should always be cooled and the pressure released before opening.

Table 1 — Test conditions

Test number	Temperature	pH	Additions of bleaching agents
1 S	(92 ± 2) °C	12,0 to 12,5	—
2 S	(75 ± 2) °C	12,0 to 12,5	—
1 P	(75 ± 2) °C	11,0 to11,5	2 ml/l of 30 % hydrogen peroxide
2 P	(75 ± 2) °C	10,0 to 10,5	2 g/l sodium perborate tetrahydrate (or equivalent amount of sodium percarbonate) 0,3 g/l TAED

8.2.2 Remove the fabric test specimens and the adjacent fabric(s) at the end of the wash and rinse twice in two separate 100 ml portions of grade 3 water (5.7), each time for 1 min, and then in cold, running tap water until being clean.

NOTE The degree of cleanness can be checked if the water where the test specimen is rinsed appears clear.

8.2.3 Where the practice is to sour at the end of the washing operation, the following optional operation may be conducted and shall be recorded in the test report.

Treat the fabric test specimens in a 100 ml portion of acetic acid solution (5.2) for 1 min at 30 °C then rinse each composite test specimen in a 100 ml portion of grade 3 water (5.7) for 1 min.

8.2.4 Extract excess water from the fabric test specimen by squeezing.

8.2.5 Open out the test specimens for measurement, by cutting along the seams. Dry the test specimens and adjacent fabric(s) by hanging in air at a temperature not exceeding 60 °C.

If required, press dry each test specimen by pressing with a flat iron (6.4) at a temperature appropriate to the fabric under test, but in no case at a temperature above 150 °C.

8.2.6 For the air dry, condition the test specimens for at least 4 h at the standard atmosphere for testing in accordance with ISO 139 before assessing.

For the pressing dry, condition the test specimens for 24 h at the standard atmosphere for testing in accordance with ISO 139 before assessing to allow for temporary colour change caused by heat.

8.2.7 Assess against the unwashed fabric, the change in colour of the test specimen and the staining of the adjacent fabric, using the grey scale (5.9) or instrumentally.

Any change in colour at the fold line shall be visually assessed and commented on.

8.2.8 If agreed upon between parties, further wash cycles may be carried out on the same specimens in order to simulate a greater number of industrial washes.

9 Test report

The test report shall include at least the following information:

a) a reference to this document, i.e., ISO 105-C12:2024;

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

c) the test number used;

d) whether the treatment in acetic acid solution described in 8.2.3 was conducted;

e) whether the fabric test specimens were air dried or dried by pressing as described in 8.2.5 and if the latter, the temperature of the pressing treatment;

f) the number of wash, rinse and drying cycles carried out (see 8.2.8);

g) whether any bleaching agent is added;

h) the numerical grey scale ratings and/or instrumental assessment for the change in colour of the test specimen and for the staining of the adjacent fabric(s) used;

i) any deviation from the procedure specified;

j) any unusual features observed;

k) the date of the test.

Annex A
(normative)

Nominal percentage composition of detergent

A.1 Industrial reference detergent (without optical brightener)

The detergent base is composed of the following:

linear sodium alkylbenzenesulfonate (mean length of alkane chain C_{12})	0,425 %
nonionic surfactant: ($C_{13\text{-}15}$, 7EO or $C_{12\text{-}14}$, 7EO)	6,0 %
sodium citrate dihydrate	5,0 %
HEDP – Na Salt (hydroxyethanediphosphonic acid)	1,0 %
anhydrous metasilicate	42,3 %
polymer (polymaleic acid)	2,0 %
foam inhibitor (phosphoric acid ester)	3,0 %
sodium carbonate	39,5 %
moisture to 100 %	0,475 %

Values in % are based on 100 % raw material (pure).

Hydrogen peroxide, sodium perborate tetrahydrate (30 %) (or equivalent amount of sodium percarbonate) and tetra-acetylethylenediamine (TAED) are included as separate additions.

The detergent base is available from Ecolab, Germany[1)].

A.2 TAED

The activity of the supplied TAED will be specified and is likely to be less than 100 %. The required amount of TAED per litre of wash liquor is calculated as Formula (A.1):

$$w = \frac{0{,}3 \times 100}{A} \qquad \text{(A.1)}$$

where

w is the required amount of TAED per litre of wash liquor, in g;

A is the activity of the supplied TAED, %.

Due to the variability which can result from the manufacturing procedure of the detergent or from its ageing, the use is recommended, for comparative measurements, of a reference detergent supplied by one definite manufacturer from a definite production batch and of recent supply. It is recommended to keep the

1) Reisholzer Werfstrass 38-42, Düsseldorf D-40589 and at Canthalstrasse 7,Hanau D-63450. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the company named. Equivalent products can be used if they can be shown to lead to the same results.

detergent and any bleaching agent separate. It is also recommended to keep small quantities and to use it within a limited time. The reference detergent shall be stored in closed containers in a cool and dry place.

Bibliography

[1] ISO 105-C06, *Textiles — Tests for colour fastness — Part C06: Colour fastness to domestic and commercial laundering*

[2] ISO 105-C08, *Textiles — Tests for colour fastness — Part C08: Colour fastness to domestic and commercial laundering using a non-phosphate reference detergent incorporating a low-temperature bleach activator*

[3] ISO 105-C10, *Textiles — Tests for colour fastness — Part C10: Colour fastness to washing with soap or soap and soda*

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