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Leather — Tests for colour fastness — General principles of testing

*Cuir — Essais de solidité des coloris — Principes généraux
s'appliquant aux essais*

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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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

IULTCS, originally formed in 1897, is a world-wide organization of professional leather societies to further the advancement of leather science and technology. IULTCS has three Commissions, which are responsible for establishing international methods for the sampling and testing of leather. ISO recognizes IULTCS as an international standardizing body for the preparation of test methods for leather.

This document was prepared by the Fastness Tests Commission of the International Union of Leather Technologists and Chemists Societies (IUF Commission, IULTCS), in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 289, *Leather*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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.

Leather — Tests for colour fastness — General principles of testing

1 Scope

This document specifies general principles on colour fastness evaluation tests for leather, as listed in [Annex A](#).

Procedures included in this document are common to most of the fastness test methods.

This document provides a common basis for testing and reporting colour fastness. The uses and limitations of the methods are pointed out, several terms are defined, an outline of the drafting of the methods is given and the contents of the clauses describing the methods are discussed.

Procedures common to a number of the methods are discussed briefly.

Colour fastness means the resistance of the colour to the different agents to which these materials can be exposed during manufacture and their subsequent use.

The change in colour of leather and staining of undyed adjacent fabrics or other materials are assessed as fastness ratings.

Other visible changes in the leather under test, for example surface appearance, change in gloss or shrinkage, are considered as separate properties and reported as such.

The leather fastness test methods can be used not only for assessing leather and related materials, such as coated leather and leather board, but also for the eventual assessment of the colour fastness of leather dyes. When such a method is so used, the dye is applied to a specified retanned leather or crust leather in defined depths of colour by stated procedures and the material is then tested in the usual way.

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

ISO 15115, *Leather — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15115 apply.

ISO and IEC maintain terminology 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 General principles

This method allows the evaluation of the eventual colour change and/or migration to which a leather or related material, such as coated leather or leather board specimen, may be exposed by means of chemicals, radiation, temperature, weathering and/or interaction with adjacent materials, expressed in relative fastness numbers.

5 Outline of form of the methods

The headings of the principal clauses of the individual test methods are as follows:

- “Introduction”;
- “Scope”;
- “Normative references”;
- “Terms and definitions”;
- “Principle”;
- “Apparatus”, “Reagents” or “Reference materials”;
- “Test specimen”;
- “Procedure”;
- “Test report”.

6 The “Scope” clause

This method is intended to be used for the evaluation of colour change and/or staining on leather and related materials, such as coated leather and leather board, and the eventual adjacent materials subject to colour migration and/or appearance alteration.

7 The “Normative references” clause

Under this heading is given a complete list of other documents which are indispensable for the application of the method.

8 The “Terms and definitions” clause

Under this heading are definitions of any terms that may not be clear and eventual limitations to the scope.

9 The “Principle” clause

Under this heading is given a concise statement of the principle of the method to enable the user to decide whether it is appropriate for the desired scope.

10 The “Apparatus”, “Reagents” or “Reference materials” clause(s)

10.1 General

Under these headings, either individually or combined, the equipment and supplies required for the test are described.

10.2 Test solutions

10.2.1 Test solutions shall be prepared using Grade 3 water that conforms to ISO 3696.

10.2.2 The concentrations of baths or solutions are given in millilitres per litre (ml/l) or grams per litre (g/l).

10.2.3 The qualities of chemicals to be used are given in each method.

10.2.4 For crystalline substances, the amount of water of crystallization is given and, for liquids, the relative density at 20 °C.

10.3 Adjacent materials

10.3.1 Adjacent materials are used for assessing staining under both static and dynamic test conditions. Adjacent materials may be specific fabrics, plastic materials, metals or leathers as specified in the single test methods. Adjacent materials are usually in a natural, uncoloured state. In the case of fabrics, they can be made of an undyed cloth of a single or several generic kinds of fibre. Adjacent plastics may be reference or industrial polymers.

10.3.2 Single-fibre adjacent fabrics, if not otherwise specified, should be of plain weave, with an average mass per unit area and free from chemically damaged fibres, residual finishing chemicals, dyes or fluorescent whitening agents.

10.3.3 Properties of the single-fibre adjacent fabrics are given under the different adjacent fabric specifications.

10.3.4 Multifibre adjacent fabrics are made of yarns of various generic kinds of fibre, each of which forms a strip of at least 1,5 cm width, providing even thickness of the fabric. It is intended that the staining properties of generic fibres used in single-fibre and multifibre adjacent fabrics are identical. The staining properties of these fabrics should be verified by the supplier. There are two standardized multifibre adjacent fabrics, whose contents differ:

- a) type DW (diacetate-wool): secondary acetate, bleached cotton, polyamide, polyester, acrylic, wool (see ISO 105-F10);
- b) type TV (triacetate-viscose): triacetate, bleached cotton, polyamide, polyester, acrylic, viscose (see ISO 105-F10).

10.3.5 Suitable plastic-adjacent materials, such as plasticized poly(vinyl chloride) (PVC), thermoplastic polyurethane (TPU) and ethylene vinyl-acetate (EVA), are defined in the specific standards. In the case of contact with non-standard polymeric materials, such as specific polymers, an accurate description shall be given in the test report.

10.3.6 Single metals or alloys, such as silver, copper and brass, can be used as adjacent materials in specific standards. Detailed information of the metal or alloy composition used shall be given in the test report if not already specified in the single standard.

10.3.7 Leather can be used as adjacent material for specific compatibility tests, such as linings or leather-on-leather applications. In this case, an accurate description of the contact material shall be given in the test report.

10.4 Coating substances

Polymeric coating, such as acrylics, polyurethanes and nitrocellulose, may be used in specific standards for assessing eventual migration or staining. In this case, the addition of a white pigment or a base coat is recommended to cover the colour of the leather specimen. Details of the coating composition applied shall be given in the test report.

10.5 Standard reference for fading

A standard reference for fading is a dyed fabric of appearance similar to the test control (see [11.1.4](#)) showing the colour to which the test control should fade during the test and shall be specified in each single standard.

10.6 Standard reference for rubbing and soiling

Dynamic fastness test materials, such as rubbing felts and fabrics and soiling fabrics, shall be specified in each single standard.

10.7 Selection and use of adjacent fabrics

10.7.1 General

Two alternative procedures for selection of adjacent fabrics are provided, and details of the type of adjacent fabrics used shall be given in the test report (see [Clause 16](#)), including dimensions, since there may be differences in test results when multifibre adjacent fabrics are used instead of single-fibre adjacent fabrics.

10.7.2 Types of adjacent fabric

Either of the following adjacent fabric types may be used:

- a) Single-fibre adjacent fabrics: each single fabric type shall be placed in contact with the test side of the specimen and tested separately.
- b) Multifibre adjacent fabric: the multifibre fabric shall be placed in contact with the test side of the specimen and tested separately.

Eventually tests may be done on both specimens' sides contemporarily.

10.7.3 Dimensions and use of adjacent fabrics

10.7.3.1 When single-fibre adjacent fabrics are used, these shall be of the same dimensions as the specimen under test (normally 40 mm × 100 mm). As a general principle, each surface of the specimen is completely covered by each of the adjacent fabrics. Special requirements are outlined in [11.3](#).

10.7.3.2 When a multifibre adjacent fabric is used, this shall be of the same dimensions as the specimen under test (normally 40 mm × 100 mm). As a general principle, it shall cover the face side only of the specimen. Special requirements are given in [11.3](#).

11 The “Test specimen” clause

11.1 General

11.1.1 Under this heading, in each method, are given the particular requirements for the specimen to be used in the test.

Definitions of the following terms are given in [11.1.2](#) to [11.1.4](#):

- “specimen”;
- “composite specimen”;
- “test-control specimen”.

General directions for their preparation are given in [11.1.2](#) to [11.1.4](#).

11.1.2 A specimen is a small piece of leather or related materials, such as coated leather or leather board, that is to be submitted to the test. It should be sampled following the recommendations of ISO 2418 and/or ISO 2588 when indicated.

11.1.3 A composite specimen is the specimen together with one or two selected adjacent materials used for assessing staining.

11.1.4 A test-control specimen is a specimen of known extent of colour change and/or staining during the test, used to ensure that the test is conducted correctly. Details of the preparation of the test-control specimens are given, as appropriate, in each individual test method. The test-control specimen is treated in parallel with the test specimen under the same conditions, as prescribed in the individual test method.

11.2 Preparation of specimens

Leather or related materials, such as coated leather or leather board, should be cut avoiding surface faults, folds, creases or bends as much as possible, following the dimensions and eventual conditioning defined in each single method.

11.3 Preparation of composite specimens

11.3.1 General

With static tests there is no need to fix the composite specimens. Depending on the standard applied, leather should be placed with the test side centred on the adjacent material, applying a gentle pressure to it to ensure a natural extension without folds. An appropriate weight as specified in each standard will ensure that the composite will not move during the duration of the test. In the case of dynamic tests, such as washing fastness, composite samples shall be stapled together.

11.3.2 Staples

Staples shall be, if possible, resistant to the solutions applied. In general, the test procedures are of short duration in aqueous solutions so that possible rusting of metal staples is not significant.

11.3.3 Composite specimens using two single-fibre adjacent fabrics

11.3.3.1 If the leather or related material specimen shall be placed between two adjacent fabrics, those should be of the same composition. In this case, the composite shall be stapled along all four sides.

11.3.3.2 If the specimen is a printed or plotted leather, the composite specimen should be arranged in such a manner that the face is in contact with half of each of the two adjacent fabrics; depending on the design of the print, the adjacent fabric should be in contact with the single plotted colours. In this case, more than one composite specimen may be required.

11.3.4 Composite specimens using one multifibre adjacent fabric

11.3.4.1 The leather or related material specimen is placed with its face in contact with the multifibre fabric and stapled along one short side.

11.3.4.2 When testing unions in which one material predominates on one side and another material on the other side, tests shall be carried out by making a single composite specimen, so each side is in contact with the multifibre adjacent fabric.

11.3.4.3 In the case of multicoloured, printed or plotted leathers or related materials, each of the different colours shall be tested in contact with all six components of the multifibre adjacent fabric strip. In this case it may be necessary to carry out more than one test.

12 Conditioning

12.1 Special conditioning of leather and related material specimens and of adjacent fabrics used with them is not usually necessary, but they shall be neither moist nor very dry.

12.2 For most tests of leather and related material specimens in contact with adjacent polymeric, metallic or leathers, conditioning may be required. If conditioning is required, please refer to ISO 2419, unless otherwise specified.

13 The “Procedure” clause

13.1 Under this heading, in each fastness test method a description of a series of operations through which the specimen is taken, including the assessment of colour change and staining of adjacent materials, should be found. The use of test-control specimens is specified in some of the methods to ensure that the tests have been conducted correctly.

13.2 Tolerances are given for numerical values of dimensions, temperatures, humidity, radiation, time and any other critical parameter. If no tolerance is given, the precision of the measurements need be only that to be expected when using common instruments and reasonable care. The precision is further indicated by the number of significant figures in the values given.

13.3 Liquor ratio means the ratio of the volume of the liquor used in the treatment, expressed in millilitres (ml), to the mass of the specimen or the composite specimen (specimen plus adjacent materials), expressed in grams (g).

13.4 Wetting out: when wetting specimens, special care shall be taken to ensure that they are uniformly saturated. Eventual vacuum application to improve wetting out shall be specified in the standard.

13.5 Spotting: for tests in which the material is spotted with water, chemicals or a specific reagent and there is a need to rub the surface with a glass rod to ensure penetration, care shall be taken not to raise the surface of the material, otherwise there will be a change in the reflection of light and hence in appearance.

13.6 Wetting to 100 % increase in mass: when the material is to be wetted to contain its own mass of liquor, it may be saturated with the liquor and then drawn between two rubber rollers or squeezed by means of a rubber roller on a glass plate, or centrifuged. Wringing by hand does not give uniform wetting.

13.7 Temperatures are given in degrees Celsius (°C), usually with a tolerance of ± 2 °C. For reliable results, continuous temperature control is essential.

14 Assessment of colour fastness

14.1 General conditions

Colour fastness is assessed separately with respect to change in colour of the specimen in the test and with staining of adjacent materials. Specimens and adjacent materials shall have been cooled after drying and shall have regained their normal moisture content before the assessment, except when otherwise specified.

Any loose fibres from the specimen adhering to the adjacent fabrics shall be removed before assessment of staining.

14.2 Colour fastness with respect to change in colour

The change which occurs in a test may be a change in lightness, chroma or hue, or any combination of these.

Regardless of the character of the change, the assessment is based upon the magnitude of the visual contrast between the specimen after the test and a specimen of the original material. This contrast is compared visually with the contrast represented by nine pairs of grey chips, ranging from a rating of 5, which illustrates no contrast, to a rating of 1, which illustrates a large contrast, as carried out according to ISO 105-A02. The fastness rating of the specimen is that number of the grey scale which corresponds to the contrast between the original and the treated specimens. Visual assessments to less than one half-step are not permitted. A rating of 5 is given only when there is no difference between the tested specimen and the original material.

In assessing the results of tests for colour fastness to light, the exposed specimens are compared with the scale of eight dyed blue wool reference fabrics, which have been exposed simultaneously. In addition, the grey scale for assessing change in colour is used as a means of defining the extent to which fading shall be carried out in the test (see ISO 105-B01, ISO 105-B02 and ISO 105-B06).

In addition to the change in colour in some tests, the surface appearance of the specimen (e.g. fibre arrangement and direction, structure, lustre) may change. In such cases, the surface of the specimen shall be restored, if possible, to its original condition by gentle combing or brushing. If this restoration is not possible, then the fact that the resultant rating gives not only the change in colour but also the overall change in appearance shall be noted in the test report (see [Clause 16](#)).

A simple wetting of leather specimens and eventual adjacent materials can create a difference in colour and appearance compared with the same dry materials. This effect cannot be considered a real change in colour. It is recommended that the samples are allowed to dry naturally and then conditioned according to ISO 2419, as a first choice, or the reference wetted for a quick evaluation, in which case details of wetting procedures shall be included in the test report (see [Clause 16](#)).

It is recommended that instrumental assessment is carried out according to ISO 105-A05 after visual rating evaluation.

For a more accurate definition of the change in colour, specimens and samples can be measured and compared spectrophotometrically according to ISO 22700.

Changes in the reflective properties of the coloured leather can be measured instrumentally according to ISO 17502.

Any other evaluation procedure not specified in this document shall be noted in the test report (see [Clause 16](#)).

14.3 Colour fastness with respect to staining

The degree of staining of the adjacent material is assessed by visual inspection of the side of the adjacent material which was in contact with the specimen. The colour of the bath is ignored, unless otherwise specified (e.g. in the colour fastness to solvents test).

For assessing staining, the nine-step scale in accordance with ISO 105-A03 is used in a manner similar to that described for assessing change in colour in [14.2](#). Staining is assessed for each type of adjacent material in the test. Staining at the eventual stapling points should be ignored. If the adjacent material undergoes any visual change when subjected to a test in the absence of a specimen, a sample of the adjacent material which has been treated in this manner shall be used as the reference sample for the assessment of staining.

It is recommended that instrumental assessment is carried out according to ISO 105-A04 after visual rating evaluation.

15 Conditions of viewing and illumination in assessing colour fastness

In assessing colour fastness, a piece of the original material and one of the tested specimens, or a piece of the undyed adjacent fabric and one of the stained fabrics, are arranged side by side in the same plane and oriented in the same direction.

The appropriate grey scale is placed nearby in the same plane. For optimum precision, the areas of contrast to be compared shall be approximately of the same size and shape. This can be achieved by the use of a mask of neutral grey colour approximately midway between that illustrating grade 1 and that illustrating grade 2 of the grey scale for assessing change in colour (i.e. approximately Munsell N5) and of a size equal to that of the grey scale steps. The surrounding field should be uniform neutral grey, between Munsell N5 and Munsell N7, with a $DE\ 2\ 000 < 1,5$ tolerance (see ISO 22700).

As large a surface as possible shall be used for the assessment and the openings in the mask shall cover the area that will be assessed. In order to obtain reliable test results, the samples shall be masked with a material that is identical in colour to the sleeve that is used to mask the test strip being used, normally supplied with the grey scales sets. (See ISO 105-A02 and ISO 105-A03.)

The surfaces to be compared are illuminated by a source that conforms with the CIE standard illuminant D65 (see CIE Publication 51) and the light source definitions included in ISO 22700. Suggested luminous intensity should be within $1\ 500\ lx \pm 600\ lx$ and a colour fidelity index (R_f) > 90 (see CIE Publication 224). The light should be incident upon the surfaces at an angle of approximately 45° and the direction of viewing approximately along the perpendicular to the plane of the surfaces, to avoid eventual specular reflexion directed to the observer's sight. It is advisable to turn the samples alternately in 90° steps to avoid the eventual appearance difference caused by the direction of the follicles. In the case of suede articles it is advisable to gently comb the fibres of the specimen and of the reference in the same direction.

16 Test report

Under this heading in each fastness method is indicated the information to be supplied in the corresponding test report. In addition to fastness ratings, where applicable, information shall be given on at least the following aspects of the test:

- a) a reference to this document, i.e. ISO 7906:2022;
- b) when applicable, the type of adjacent material used;