
**Rubber, vulcanized or
thermoplastic — Methods of test
for staining in contact with organic
material**

*Caoutchouc vulcanisé ou thermoplastique — Méthodes d'essai pour
déterminer le tachage lors du contact avec des matières organiques*

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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.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fifth edition cancels and replaces the fourth edition (ISO 3865:2005), which has been technically revised. The main changes to the previous edition are as follows:

- the list of normative references has been updated in [Clause 2](#).

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

When rubber is in contact with organic material, such as paints, varnishes, plastics or rubber, under conditions of heat, pressure and light, staining can occur on the surface in contact with the rubber, on the surface adjacent to the rubber or on the surface of the organic material which covers the rubber. In addition, in the presence of water, constituents of the rubber can be leached out, which can cause staining on surfaces with which the water subsequently comes into contact.

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Rubber, vulcanized or thermoplastic — Methods of test for staining in contact with organic material

WARNING 1 — Persons using this document shall be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of any other restrictions.

WARNING 2 — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This document specifies three methods for estimating the staining of organic finishes (subsequently referred to as “organic material”) by vulcanized or thermoplastic rubber, as defined in [Clause 3](#):

- method A: contact staining and migration staining;
- method B: extraction staining;
- method C: penetration staining;

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

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1382, *Rubber — Vocabulary*

ISO 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures*

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1382 and the following apply.

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 <http://www.electropedia.org/>

3.1 contact staining

stain which occurs on the surface of the organic material directly in contact with the rubber

3.2 migration staining

stain which occurs on the surface of the organic material surrounding the contact area

3.3 extraction staining

stain which occurs on the surface of the organic material as a result of contact with a liquid containing leached out constituents of the rubber

3.4 penetration staining

stain which occurs on the surface of a veneer layer of an organic material which is bonded to the rubber surface

4 Principle

4.1 Method A — Determination of contact straining and migration staining

The rubber to be tested is placed in direct contact with the specified organic material and then exposed to heat and/or artificial light.

4.2 Method B — Determination of extraction staining

The rubber to be tested is subjected to a test liquid which afterwards contacts the organic material. This may be followed by irradiation of the organic material.

4.3 Method C — Determination of penetration staining

A light-coloured veneer or lacquer of specified material is applied to the rubber to be tested and then exposed to heat followed by artificial light.

4.4 Assessment of staining

The stain is assessed qualitatively by visual inspection or quantitatively by comparison with a grey scale or by using a reflectance spectrometer.

5 Apparatus

Use the following apparatus for the methods indicated.

5.1 Ageing air oven, in accordance with ISO 188.

5.2 Artificial light source, consisting of a xenon-arc lamp, filtered to give a spectral distribution corresponding to that of sunlight, as specified in ISO 4892-2 and in [9.1](#) and [9.2](#).

5.3 Irradiation chamber, containing the lamp and the test piece racks, designed to meet the requirements in [9.3](#) and [9.4](#).

5.4 Thermocouple or black panel thermometer, as specified in ISO 4892-1 for measurement of surface temperature.

5.5 Suitable apparatus for measuring the light intensity over the range of wavelengths given in [9.1](#) (recommended, although not mandatory).

5.6 Blue dyed wool standards, as specified in ISO 105-B01.

5.7 Grey scale, as specified in ISO 105-A02.

5.8 Reflectance spectrometer, operating in the range 400 nm to 600 nm.

5.9 Beaker or dripping apparatus (in method B).

5.10 Dripping and drying frame, for finishing with lacquer (in method C).

6 Test pieces

6.1 Rubber test pieces

Rubber test pieces shall be rectangular in shape, of uniform thickness and preferably cut from sheet $2 \text{ mm} \pm 0,2 \text{ mm}$ thick. The minimum dimensions shall be:

- for method A: $12 \text{ mm} \times 25 \text{ mm}$;
- for method B.1: $25 \text{ mm} \times 150 \text{ mm}$;
- for method B.2: 3 pieces with a total mass of $5 \text{ g} \pm 0,2 \text{ g}$;
- for method C: $12 \text{ mm} \times 25 \text{ mm}$.

Test pieces for method C shall be cut from samples prepared in accordance with [6.3](#).

Test pieces may also be cut from finished products, in which case they may be cleaned of extraneous contamination before test with a 2 % non-alkaline soap solution.

6.2 Metal or plastics panels for methods A and B

The dimensions of metal or plastics panels shall meet the requirements specified in [8.1](#) or [8.2](#), but otherwise are not critical.

Panels shall be coated with a material to be agreed between purchaser and supplier. Unless otherwise specified, a white acrylic-based stoving enamel shall be used. This lacquer shall be dried in the oven ([5.1](#)) for 30 min at $125 \text{ }^\circ\text{C}$ and tests shall commence between 24 h and 48 h after drying. If other times are used, these shall be stated in the test report.

6.3 Test piece preparation for method C

6.3.1 General

A white or light-coloured non-discolouring rubber veneer, of a composition to be agreed between purchaser and supplier, shall be applied under pressure to a sheet of the test rubber. The veneer shall either be vulcanized with the test rubber or be applied as a paint on a previously prepared sheet of vulcanized or thermoplastic rubber.

As agreed between the interested parties, test pieces may be taken from finished products with light-coloured veneered or lacquered surfaces, such as white tyre sidewalls. The method of construction and the sample thickness shall be mentioned in the test report.