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**Rubber- or plastics-coated fabrics —  
Accelerated-ageing tests**

*Supports textiles revêtus de caoutchouc ou de plastique — Essais de  
vieillessement accéléré*

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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](http://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](http://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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products other than hoses*.

This third edition cancels and replaces the second edition (ISO 1419:1995), which has been technically revised.

The main changes compared to the previous edition are as follows:

- normative references have been added;
- in [Clause 4](#), additional apparatus for Method A has been added.

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](http://www.iso.org/members.html).

## Introduction

The ageing of coated fabrics consists in subjecting test pieces, with previously determined properties, to a controlled deteriorating influence for a known period. The selection of the most appropriate test method(s), ageing time and temperature will depend on the purpose of the test and the type of coated fabric. The properties used to measure the deterioration of coated fabrics may be strength properties, flexing, blocking or any other desired physical or chemical property. By selection of appropriate methods of test, the properties can be investigated.

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# Rubber- or plastics-coated fabrics — Accelerated-ageing tests

**WARNING** — Persons using this document should 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 ensure compliance with any national regulatory conditions.

## 1 Scope

This document describes four methods of assessing the resistance of coated fabrics to deterioration by accelerated ageing.

## 2 Normative references

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

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

ISO 2231, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing*

ISO 2286-1, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 1: Methods for determination of length, width and net mass*

ISO 2286-2, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 2: Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate*

## 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 <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Method A: Loss of volatiles on heating of plasticized-PVC-coated fabrics

### 4.1 General

As a result of natural ageing, PVC-coated fabrics may lose plasticizer by volatilization, and in time this will have an adverse effect on the performance of the coating. The extent to which a particular material will be so affected will depend on the formulation of the coating, so it is desirable to assess this property. The method described is designed to accelerate the loss of volatiles by exposing test pieces to an elevated temperature, followed by determination of the loss in mass of the coating. The procedure shall be in conformance with ISO 188.

## 4.2 Apparatus

### 4.2.1 Air Oven

It shall have slow circulation of air, providing not less than three and not more than ten air changes per hour. It shall have provisions for controlling and measuring the rate of airflow and for maintaining and measuring the desired temperature and relative humidity, if necessary.

There shall be provisions for suspending the test pieces vertically within the oven. During the ageing process, in order to prevent individual test pieces touching each other or the inner walls of the oven and being exposed to higher temperature, the test pieces shall not be within 10 mm of each other or within 50 mm of the inner surfaces of the oven. The incoming air shall be at the temperature specified before coming into contact with the test pieces. Any electric elements used for heating the incoming air shall be shielded to avoid direct radiation on to the test pieces. No copper or copper alloy shall be within the ageing chamber of the oven. The oven shall be of such a size that the total volume of the test pieces does not exceed 10 % of the free air space in the oven. Means shall be provided for suspending the test pieces vertically within the oven so that they are not within 10 mm of each other or within 50 mm of the inner surfaces of the oven.

The temperature of the oven shall be maintained at 100 °C with an accuracy of  $\pm 1$  °C.

**4.2.2 Thermometer**, or other temperature-indicating device, for monitoring the oven temperature with an accuracy of  $\pm 1$  °C.

**4.2.3 Balance**, capable of weighing to an accuracy of 1 mg.

**4.2.4 Ruler** or other length-measuring device, of accuracy  $\pm 0,5$  mm.

**4.2.5 Desiccator** for cooling the specimens after removal from the oven.

## 4.3 Preparation of test pieces

Cut out six test pieces, each measuring  $100 \text{ cm}^2 \pm 1 \text{ cm}^2$ , selected so that, as far as possible, they are evenly spaced across the Sample, but not within 50 mm of a selvedge.

## 4.4 Conditioning and determination of mass

Condition the test pieces in atmosphere A, B or C as defined in ISO 2231. Determine and record the mass  $m_1$  of each test piece to an accuracy of 1 mg in accordance with ISO 2286-1. Determine the mass per unit area  $Q_{AC}$  of the coating of three test pieces in accordance with ISO 2286-2.

## 4.5 Procedure

Select three of the conditioned test pieces, making a note of the conditioned mass of each. Pre-heat the oven to the test temperature of  $100 \text{ °C} \pm 1 \text{ °C}$ . Place the test pieces in the oven so that they are free from strain and exposed to the free passage of air on both sides. Remove the test pieces from the oven after 16 h and allow to cool.

Re-condition the test pieces in accordance with [4.4](#) and determine and record the mass  $m_2$  of each to an accuracy of 1 mg in accordance with ISO 2286-2.

**NOTE** If test pieces conditioned as specified in [4.4](#) after preparation approach equilibrium from the wet side of the hysteresis curve, this may result in an apparent inaccuracy due to the hysteresis loss caused by re-conditioning from the dry side of the hysteresis curve after ageing. This effect will be more marked with highly hygroscopic substrates, and in such cases it is advisable to pre-condition the test pieces in a dry atmosphere, i.e. one having a relative humidity less than 10 %, prior to conditioning as specified in [4.4](#).

#### 4.6 Expression of results

Calculate the loss in mass of each test piece, expressed as a percentage of the coating mass, using the formula

$$\frac{m_1 - m_2}{m_1} \times \frac{Q_{AT} \times 100}{Q_{AC}}$$

where

$m_1$  is the mass, in grams, of the test piece before ageing;

$m_2$  is the mass, in grams, of the test piece after ageing;

$Q_{AT}$  is the mass per unit area, in grams per square metre, of the material under test;

$Q_{AC}$  is the coating mass per unit area, in grams per square metre.

#### 4.7 Test report

The test report shall include the following information:

- a) a reference to this document including its year of publication, and to the method used (method A);
- b) all details necessary for the identification of the coated fabric tested;
- c) the conditioning atmosphere used;
- d) the loss in mass of each test piece, expressed as a percentage of the coating mass, and the mean value;
- e) details of any deviation from the test procedure specified.

### 5 Method B: General method

#### 5.1 General

This ageing test consists of subjecting test pieces to air at an elevated temperature and atmospheric pressure, after which the condition of the coated fabric is assessed. In this test, the oxygen concentration is comparatively low and, if oxidation is rapid, oxygen may not diffuse into the coating quickly enough to maintain uniform oxidation. The test is therefore liable to give misleading results with poor-ageing coatings unless the coatings are very thin.

If desired, selected samples may be aged for periods considerably in excess of those specified, in order to ensure that decomposition will occur; such samples are then used to illustrate the effects of ageing.

The procedure shall be in conformance with ISO 188.

#### 5.2 Apparatus

**5.2.1 Air oven**, as described in [4.2.1](#), except that it be maintained at a temperature of  $70 \text{ }^\circ\text{C} \pm 1 \text{ }^\circ\text{C}$  unless otherwise specified.

**5.2.2 Thermometer**, or other temperature-indicating device, for monitoring the oven temperature.

#### 5.3 Test pieces

The number of test pieces, and their dimensions, shall be as required by the particular post-exposure physical test(s) selected. The test pieces shall not be selected from within 50 mm of a selvedge.

It is recommended that in any event the number of test pieces chosen for post-ageing comparisons should be not less than five.

### 5.4 Procedure

Pre-heat the oven to the operating temperature and place the test pieces in the oven so that they are free from strain, exposed to the free passage of air on both sides and not exposed to light. Ensure that the pressure inside the oven does not exceed atmospheric pressure. Simultaneous ageing of different types of compound shall be avoided in order to ensure that migration of sulfur or antioxidant does not occur.

After 168 h (7 days) or 336 h (14 days), or multiples thereof, remove the test pieces from the oven and condition in atmosphere A, B or C as defined in ISO 2231.

### 5.5 Assessment

Compare the properties of the aged material with those of the unaged material using appropriate methods of test.

### 5.6 Test report

The test report shall include the following information:

- a) reference to this document including its year of publication, and to the method used (method B);
- b) all details necessary for the identification of the coated fabric tested;
- c) the conditioning atmosphere used;
- d) the results of the assessment conducted in accordance with [5.5](#);
- e) the period and conditions of exposure in the air oven;
- f) details of any deviation from the test procedure specified.

## 6 Method C: Tropical test

### 6.1 General

Some polymeric materials are markedly affected by moisture as well as by elevated temperatures, and in certain applications very high humidities are experienced in combination with relatively high temperatures. When such service conditions are probable, it is preferable, because of the interaction of effects, to test by exposing the material to both conditions simultaneously. In the ageing test given here, test pieces of coated fabric are exposed for a given period to an atmosphere of air having a relative humidity of not less than 95 % and a temperature of 70 °C. For particular applications, it may be appropriate to use alternative relative humidities, temperatures and exposure times. It should be noted that this test is not intended for use in cases where the material will be continuously immersed in water during use.

### 6.2 Apparatus

**6.2.1 Air oven**, as described in [4.2.1](#), except that it shall be maintained at a temperature of 70 °C ± 1 °C and a relative humidity of at least 95 %.

The injection of live steam at a temperature above 71 °C as a means of achieving the requisite relative humidity shall not be used.

**6.2.2 Thermometer**, or other temperature-indicating device, for monitoring the oven temperature.

**6.2.3 Humidity-measuring instrument**, for monitoring the actual relative humidity.

### 6.3 Test pieces

The number of test pieces, and their dimensions, shall be as required by the particular post exposure physical test(s) selected. The test pieces shall not be selected from within 50 mm of a selvedge.

It is recommended that in any event the number of test pieces chosen for post-ageing comparisons should be at least five.

### 6.4 Procedure

Pre-heat the oven to  $70\text{ °C} \pm 1\text{ °C}$  and at less than 95 % relative humidity. Place the test pieces in the oven so that they are free from strain, exposed to the free passage of air on both sides and not exposed to light. Ensure that the pressure inside the oven does not exceed atmospheric pressure. Simultaneous ageing of different types of compound shall be avoided in order to ensure that migration of sulfur or antioxidant does not occur.

After 168 h (7 days) or 336 h (14 days), or multiples thereof, remove the test pieces from the oven and condition in atmosphere A, B or C as defined in ISO 2231.

### 6.5 Assessment

Compare the properties of the aged material with that of the unaged material using appropriate methods of test.

### 6.6 Test report

The test report shall include the following information:

- a) a reference to this document including its year of publication, and to the method used (method C);
- b) all details necessary for the identification of the coated fabric tested;
- c) the conditioning atmosphere used;
- d) the results of the assessment conducted in accordance with [6.5](#);
- e) the period and conditions of exposure in the air oven;
- f) details of any deviation from the test procedure specified.

## 7 Method D: Ageing test for nitrocellulose-type coatings

### 7.1 General

In a similar way to PVC-coated fabrics, nitrocellulose coated fabrics may lose plasticizer by volatilization, and in time this will have an adverse effect on the flexibility of the coating. This is particularly relevant in bookbinding, which is the main end-use for this type of product, where long-term flexibility at the hinge is required. This test attempts to simulate and accelerate this situation, and hence the end-point is based on visual inspection rather than mass loss.

### 7.2 Apparatus

**7.2.1 Three test-tubes**, measuring 150 mm × Ø25 mm.

**7.2.2 Three clean corks**, to fit the tubes.