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Leather — Physical and mechanical tests — Determination of water vapour permeability

Cuir — Essais physiques et mécaniques — Détermination de la perméabilité à la vapeur d'eau

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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 Physical Tests Commission of the International Union of Leather Technologists and Chemists Societies (IUP 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).

This third edition cancels and replaces the second edition (ISO 14268:2012), which has been technically revised.

The main changes are as follows:

— Introduction added;

— new Clause 3, Terms and definitions, added;

— new Clause 8 added for the new Procedure B – Accelerated test method.

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

This document describes two methods (Procedure A and Procedure B) for water vapour permeability determination:

— The method in accordance with Procedure A is the standard test method for water vapour permeability determination and is used in any case of discrepancy or dispute.

— The method in accordance with Procedure B is equivalent to the method described in ISO 20344 and can be applied for an accelerated routine control in production processes and/or if requested by the client.

Leather — Physical and mechanical tests — Determination of water vapour permeability

1 Scope

This document describes a method for determining the water vapour permeability of leather and provides alternative methods of sample preparation and for the measurement procedure.

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 2418, *Leather — Chemical, physical and mechanical and fastness tests — Sampling location*

ISO 2419, *Leather — Physical and mechanical tests — Sample preparation and conditioning*

ISO 2589, *Leather — Physical and mechanical tests — Determination of thickness*

ISO 5402-1, *Leather — Determination of flex resistance — Part 1: Flexometer method*

3 Terms and definitions

No terms and definitions are listed in this document.

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 Principle

The test piece is clamped over the opening of a container which contains a solid desiccant and is placed in a strong current of air in a standard atmosphere. The air inside the container is constantly agitated by the desiccant, which is kept in motion by the rotation of the container. The container is weighed at the start and the end of the test and the mass of moisture which has been absorbed by the desiccant is determined from the difference.

5 Apparatus

The usual laboratory apparatus and, in particular, the following shall be used.

5.1 Containers, in the form of jars or bottles, with a neck of internal diameter 30 mm ± 3 mm fitted with a screw top with a circular opening whose diameter is equal to the internal diameter of the neck. Suitable containers typically have a height range of 70 mm to 90 mm.

5.2 Test machine, see Annex A for sources of a suitable apparatus, including the following:

5.2.1 Vertically mounted turntable, rotating at (75 ± 5) r/min, capable of holding containers (5.1) with their axis parallel to and (67 ± 2) mm from the axis of rotation of the turntable.

5.2.2 Fan, mounted in front of the mouths of the containers, consisting of three flat blades in planes that are inclined 120° to one another. The planes of the blades pass through the prolongation of the axis of the vertically mounted turntable (5.2.1). The blades are of approximate dimensions 90 mm × 75 mm and the 90 mm side nearest the mouths of the jars passes them at a distance of (10 ± 5) mm. The fan rotates at (1 400 ± 100) r/min with the direction of rotation being opposite to that of the vertically mounted turntable. The general arrangement of the turntable and fan are as shown in Figure 1.

Dimension in millimetres

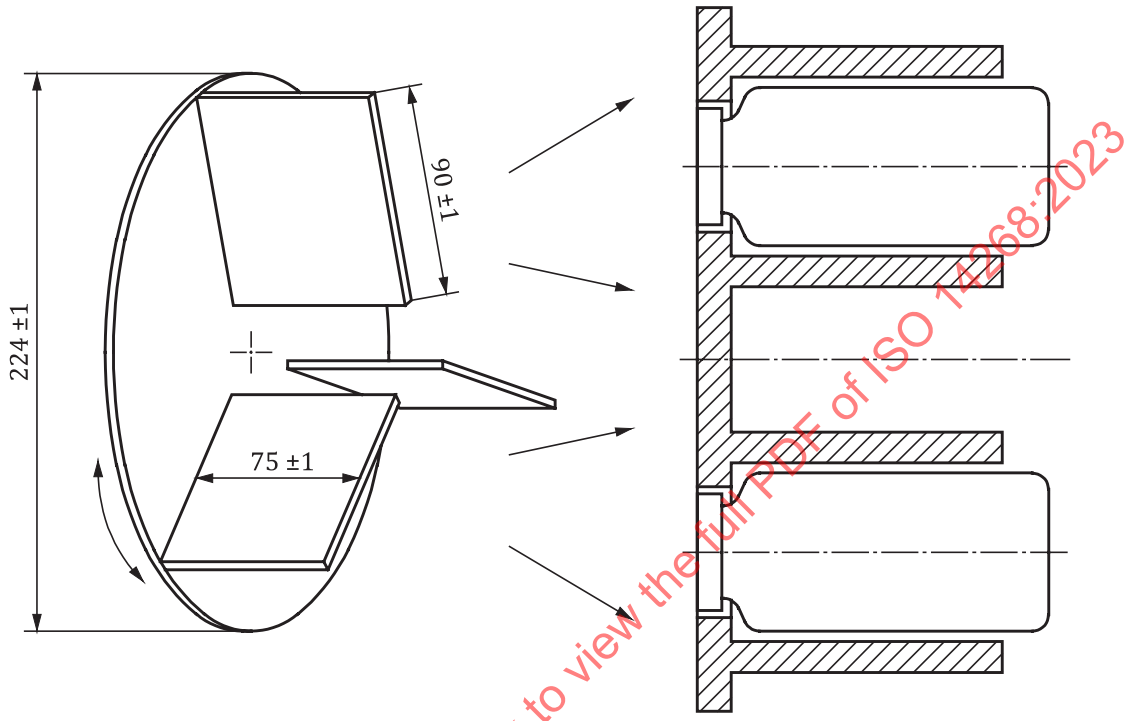

Figure 1 — General arrangement of test machine

5.3 Self-indicating silica gel desiccant, particle size 2 mm to 5 mm sieved to remove small particles and dust, and freshly regenerated by heating in a ventilated oven for at least 16 h at (125 ± 5) °C, then cooling to standard temperature in a hermetically sealed vessel. The granular size of the crystals shall be such that they shall not pass through a 2 mm sieve. The silica gel shall not be used if it is warmer than the test piece.

NOTE 1 Silica gel beads are preferred to granules as they generate less dust.

NOTE 2 Large volumes of silica gel will only cool slowly in a closed vessel. A long cooling time can be necessary to ensure that all the silica gel has cooled to standard temperature.

5.4 Balance, weighing to 0,001 g.

5.5 Stop clock, reading to 1 min.

5.6 Vernier callipers, reading to 0,1 mm and capable of measuring the internal diameter of the necks of the containers.

5.7 Press knife, as specified in ISO 2419, capable of cutting circular test pieces of a suitable size to allow a good seal at the open end of the container (5.1).

5.8 Beeswax or other suitable inert sealant.

5.9 **Abrasive paper**, grade P180.

5.10 **Flex machine**, as specified in ISO 5402-1, if test pieces are to be subjected to flexing prior to test.

6 Sampling and sample preparation

6.1 Sample in accordance with ISO 2418. Cut three test pieces by applying the press knife (5.7) to the grain surface.

If there is a requirement for more than two hides or skins to be tested in one batch, then only one sample need be taken from each hide or skin, provided that the overall total is not fewer than three test pieces.

If necessary, determine the thickness, as specified in ISO 2589, to ensure test pieces are below 3,0 mm thickness.

6.2 Prepare the three test pieces by one of the following methods; if no pre-treatment is specifically required by the client then procedure c) is the preferred method:

a) Cut a square piece of minimum size 50 mm. Place the piece grain-upwards on a flat surface, press a piece of P180 grade abrasive paper (5.9) against the leather and draw it across the leather 10 times in various directions under a load of about 2 N applied by hand pressure. Cut a circular test piece from the buffed area using the press knife specified in 5.7.

b) Flex a sample for 20 000 cycles using the method and apparatus specified in ISO 5402-1. Cut a circular test piece from the flexed area using the press knife specified in 5.7.

c) Cut a test piece using the press knife specified in 5.7.

Many leathers have on the grain a surface coat which reduces the water vapour permeability of the leather, but which has less effect after the coat has been flexed or exposed to slight abrasive action. The treatments specified in a) and b) are intended to simulate the abrasion which the leather would receive in wear. If no pre-treatment is required by the client, method c) may be used, and this option can be preferable for suede and unfinished leathers.

6.3 Condition the test specimens (6.2) in accordance with ISO 2419 and carry out the test using either Procedure A (Clause 7) or Procedure B (Clause 8) in the standard atmosphere.

7 Procedure A – Standard test method

7.1 Half fill a container with freshly regenerated silica gel.

7.2 Place a test piece centrally over the open container so that the surface which is exposed to the higher humidity when the final product is in use is uppermost.

7.3 Fit a screw top to the container and tighten so that the test piece is securely held around the edge and the container is sealed. If it is necessary to seal the junction between the test piece and the neck of the jar, warm the bottle and apply a thin layer of beeswax or other suitable inert sealant (5.8) to the flat surface of the neck. If the opening of the jar has been coated with beeswax, warm to (50 ± 5) °C before introducing the silica gel and fixing the test piece.

If a sealant other than beeswax is used care should be taken to ensure that it does not affect the material or results.

7.4 Place the container on the turntable (5.2.1) and start the test machine.

NOTE It can be necessary to use additional containers made up as in 7.1 to 7.3 to ensure that the turntable is balanced.

7.5 Using vernier callipers (5.6), measure the internal diameter of the neck of a second container (to the nearest 0,1 mm) in two mutually perpendicular directions and calculate the mean diameter.

7.6 After (20 ± 4) h, remove the first container from the test machine then, as rapidly as possible, half fill the second container with freshly regenerated silica gel. Remove the test piece and screw top from the first container, place them on the second container (keeping the same side facing outwards) and weigh the second container with the silica gel and test piece. Record the mass (m_0).

7.7 If the test piece is approximately 3 mm in thickness, is heavily embossed or is expected to have a vapour permeability below 5 mg/(cm^2.h), the end surface of the neck of the second container, taken in 7.5, should be dipped in melted beeswax. Afterwards, half fill the second container with freshly regenerated silica gel. Remove the test piece and screw top from the first container, place them on the second container (keeping the same side facing outwards) and weigh the second container with the silica gel and test piece. Record the mass (m_0).

7.8 Replace the container on the vertical turntable and start the test machine and stop clock.

7.9 After (11,5 ± 4,5) h, stop the test machine and note the time.

7.10 Remove the container and reweigh it. Record the mass (m_1).

8 Procedure B – Accelerated test method

8.1 If the accelerated test method for water vapour permeability is agreed between the contracting entities, the procedure is carried out as described in 8.2 to 8.6. If Procedure B is used it shall be noted in the test report.

8.2 Using vernier callipers (5.6), measure the internal diameter of the neck of a container (to the nearest 0,1 mm) in two mutually perpendicular directions and calculate the mean diameter.

8.3 Carry out the steps described in 7.1 to 7.4.

8.4 After it has run for (60 ± 5) min, stop the machine and weigh the container. Record the mass (m_0).

8.5 Replace the container in the apparatus and switch on the machine, noting the time.

8.6 After an additional (450 ± 30) min stop the machine and reweigh the container, noting once again the time. Record the mass (m_1).

9 Expression of results

Calculate the water vapour permeability, P_{wv}, in milligrams per square centimetre hour, using Formula (1).

$$P_{wv} = \frac{7\ 639\Delta m}{d^2 t} \quad (1)$$

where

Δm is the increase in mass of the container ($m_1 - m_0$), in milligrams;

d is the mean diameter of the neck of the container, in millimetres;

t is the time between the first and second weighings, in minutes.

NOTE The constant 7 639 arises from the conversion of the diameter (measured in millimetres) to a radius in centimetres, the time (measured in minutes) to hours and the constant π, as follows:

$$7\ 639 = \frac{(20)^2 \times 60}{\pi}$$

If, in addition, the water vapour number is required, it can be calculated according to Annex B.

10 Test report

The test report shall contain at least the following information:

a) a reference to this document, i.e. ISO 14268:2023;

b) the mean water vapour permeability, $\bar{P}_{wv}$, in milligrams per square centimetre hour, expressed to one decimal place;

c) the preparation given to the test piece in 6.2;

d) the standard atmosphere used for conditioning and testing, as given in ISO 2419;

e) any deviations from the method specified in this document;

f) full details for identification of the sample and any deviation from ISO 2418 with respect to sampling;

g) a reference if Procedure B is applied;

h) the date of the test.

Annex A
(informative)

Sources of apparatus

Examples of suitable products available commercially are given in this annex. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

The recommended apparatus is the Nice-Mitton permeability apparatus manufactured, for example, by:

— SATRA Technology Centre, Wyndham Way, Telford Way, Kettering, Northants, NN16 8SD, United Kingdom, www.satra.co.uk;

— Giuliani Tecnologie srl, via Centrallo, 62/18, I-10156 Torino, Italy, www.giuliani.it;

— EMI Groupe Prodys Equipment, 9 chemin des Pres, Zirst 4403, F-38944 Meylan, France, www.emi-developpement.com;

— Muver - Francisco Muñoz Irles, Avda Hispanoamerica 42, E-03610 Petrer (Alicante), Spain, www.muver.com;

— PFI, Test and Research Institute, Marie-Curie-Straße 19, D-66953 Pirmasens, Germany, www.pfi-germany.de.