



# Leather — Physical and mechanical tests — Determination of surface coating thickness

*Cuir — Essais physiques et mécaniques — Détermination de l'épaisseur du revêtement de surface*

[Revision of first edition (ISO 17186:2002)]

ICS 59.140.30

## ISO/CEN PARALLEL PROCESSING

This draft has been developed within the European Committee for Standardization (CEN), and processed under the **CEN-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

**This draft International Standard is submitted to all ISO member bodies for voting, as a standard prepared by an international standardizing body in accordance with Council Resolution 42/1999. The proposer, *Physical Test Commission of the International Union of Leather Technologists and Chemists Societies (Commission IUP, IULTCS)*, has been recognized by the ISO Council as an international standardizing body for the purpose of Council Resolution 42/1999.**

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17186/IUP 41 was prepared by the Physical Test 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*, the secretariat of which is held by UNI, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (EN ISO 17186:2002) which has been technically revised.

# Leather — Physical and mechanical tests — Determination of surface coating thickness

## 1 Scope

This International Standard specifies a method for determining the thickness of the surface coating applied to leather when measured under zero compression. It is applicable to all types of leather.

## 2 Normative references

The following referenced documents are indispensable for the application 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*

## 3 Principle

A section of leather is taken perpendicular to the coated surface. The thickness of the surface coating is measured using a microscope and expressed both as a thickness and as a percentage to the total thickness.

## 4 Apparatus

**4.1 Light microscope or scanning electron microscope**, which can be operated with an object field size of 1 mm x 1 mm or lower and is fitted with:

- a camera image unit connected to a computer (resolution of at least 500 x 500 pixel) or
- a photographic unit or
- equipped with an eyepiece with a graduated scale (at least 100 scale marks). Note, 100 scale marks correspond to a scaling of 10 µm in the object field dimension for object field size of 1mm x 1mm.

For measurement of coating thicknesses of less than 50 µm an object field size of 0,4 mm x 0,4 mm or lower has to be used. For measurement of values of less than 15 µm a scanning electron microscope with a suitable object field dimension should be used.

**4.2 Razor blade**

**4.3 Grid** or similar calibration device reading to at least 10 µm and suitable for use in the light microscope or scanning electron microscope.

**4.4 Coating unit**, sputter or evaporation including suitable element or alloy (e. g. gold) for coating, if scanning electron microscope is used.

4.5 **Specimen stubs**, suitable for scanning electron microscope.

## 5 Sampling and sample preparation

5.1 Sample in accordance with ISO 2418. Condition in accordance with ISO 2419.

5.2 Cut three test pieces approximately 10 mm x 10 mm. Section each of the three test pieces as described in 5.3 .

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

5.3 Place the cutting edge of the razor blade (4.2) on the flash side with the blade perpendicular to the leather surface and press the blade through the whole thickness of the leather ensuring that the blade remains vertical.

NOTE It is recommended that a new razor blade is used for each section.

In case of using a scanning electron microscope stick a section prepared (5.3) to a specimen stub (4.5) with the cut surface uppermost. Coat the stub and section in the coating unit (4.4) so that a sufficient image quality can be obtained.

## 6 Procedure

### 6.1 General descriptions

#### 6.1.1 Principles of measurement

This standard describes two basic principles to measure the surface coating thickness.

**Method A** is based on a measurement of many single values on equidistant positions (see figure 1). It allows to determine a standard deviation as well as a confidence interval.

**Method B** is based on a measurement using parallel lines (see figure 2). A statistical evaluation of the results is not possible due to the fact that the operator has to position the graduation of the grid between peaks and troughs manually. This process already includes an averaging.

Method A should be preferred.

Method A and B can be used for light microscopes as well as for scanning electron microscopes.

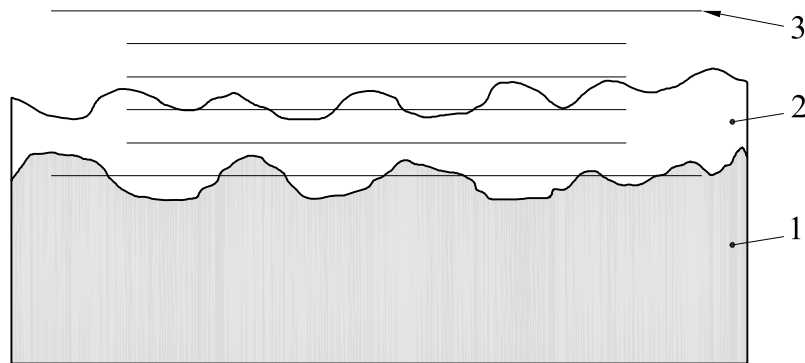
NOTE The working distance and the acceleration voltage of the scanning electron microscope shall be the same for calibration and measurement of the sample.

**Key**

1 leather

2 coating

3 equidistant single measurement

**Figure 1 — Principle of method A****Key**

1 leather

2 coating

3 graduated scale or parallel lines

**Figure 2 — Principle of method B****6.1.2 Magnification and calibration**

Due to the differences of typical thickness of surface coating (e.g. 10 – 200  $\mu\text{m}$ ) and total thickness of leather (e. g. 800 – 3000  $\mu\text{m}$ ) it is usually necessary to use different magnifications of the microscope.

Select for each case a suitable magnification, which allow a reliable thickness measurement.

Calibrate the measurement system following the detailed instructions in 6.2 and 6.3. for each used magnification.

**6.2 Method A – based on a measurement of single values on equidistant positions**

**6.2.1 Measurement using measuring marks of a suitable computer programme as analysis unit of the microscope**

**6.2.1.1** Calibrate the measuring system of the microscope (4.1) using the grid (4.3). Follow the instructions of the manual of the used system.

**6.2.1.2** Place one section prepared in 5.3 under the microscope. Start the measurement at a random point of the cross-section and adjust this point in the middle of the field of vision. According to the software of your measuring system set the starting point of the measurement in the coating/leather boundary.

**6.2.1.3** Then set the measuring point to the surface of the leather whereas the adjustment has to be executed perpendicular to the run of the coating boundary (see Figure 1). Note the indicated distance.

**6.2.1.4** Move the sample parallel to the surface by moving the microscope table on a defined distance on one field of vision or a fix offset (i.e. 50 to 500 µm) so that a new measuring point is located in the middle of the field of vision. The distance between two measurements shall be larger than coating thickness. Measure the coating thickness at this point as described in 6.2.1.3.

**6.2.1.5** Continue the measurement in the manner described in 6.2.1.2 - 6.2.1.4 , until at least 6 measurements have been carried out.

**6.2.1.6** Convert all readings obtained to micrometres using the calibration described in 6.2.1.1.

**6.2.1.7** Measure the total thickness analogically to the procedure as described in 6.2.1.2 to 6.2.1.6. aligning the measurement point to the flesh side of the leather.

**6.2.1.8** Repeat 6.2.1.2 to 6.2.1.7 for the two remaining sections.

**6.2.1.9** Calculate the arithmetic mean of all single values of thickness and total thickness. Express the coating thickness to the nearest 5 µm for coating thickness of 50 µm or higher and to the nearest 2 µm for coating thickness less than 50 µm. Express the total thickness to the nearest 10 µm.

If required calculate the standard deviation as follows:

$$s = \sqrt{\frac{\sum (t_i - t)^2}{n - 1}}$$

Where:

s is the standard deviation

t<sub>i</sub> is the single values of coating thickness

t is the mean of coating thickness

n is the number of single measurements

**6.2.2 Measurement using a light microscope fitted with graduated scale**

**6.2.2.1** Calibrate the microscope with the graduated scale (4.1) using the grid (4.3).

**6.2.2.2** Place one section prepared in 5.3 under the microscope. Start the measurement at a random point of the cross-section and adjust this point in the middle of the field of vision. Position the section such that the

crosswire or one of the major graduations is aligned with the coating/leather boundary exactly at this point of cross-section.

Take the reading of the scale graduation corresponding to the outer surface of the coating at the measuring point.

**6.2.2.3** Move the sample parallel to the surface by moving the microscope table on a defined distance on one field of vision or a fix offset (i.e. 50 to 500  $\mu\text{m}$ ) so that a new measuring point is located in the middle of the field of vision. The distance between two measurements shall be larger than coating thickness. Measure the coating thickness at this point as described in 6.2.2.2.

**6.2.2.4** Continue the measurement in the manner described in 6.2.2.2 - 6.2.2.3 , until at least 6 measurements have been carried out.

**6.2.2.5** Convert all readings obtained to micrometres using the calibration described in 6.2.2.1.

**6.2.2.6** Measure the total thickness analogically to the procedure as described in 6.2.2.2 to 6.2.2.5. aligning the graduated scale to the flesh side of the leather

**6.2.2.7** Repeat 6.2.2.2 to 6.2.2.6 for the two remaining sections.

**6.2.2.8** Calculate the arithmetic mean of all single values of thickness and total thickness. Express the coating thickness to the nearest 5  $\mu\text{m}$  for coating thickness of 50  $\mu\text{m}$  or higher and to the nearest 2  $\mu\text{m}$  for coating thickness less than 50  $\mu\text{m}$ . Express the total thickness to the nearest 10  $\mu\text{m}$ .

If required calculate the standard deviation as described in 6.2.1.9

### **6.3 Method B – Based on a measurement using parallel lines**

#### **6.3.1 Measurement using measuring lines of a suitable computer programme as analysis unit of the microscope**

**6.3.1.1** Calibrate the measuring system of the microscope (4.1) using the grid (4.3). Follow the instructions of the manual of the used system.

**6.3.1.2** Place one section prepared in 5.3 under the microscope. Position the section such that the measuring line of the computer programme is aligned with the coating/leather boundary. If the coating/leather boundary undulates position the measuring line of the computer programme midway between the peaks and troughs as shown in Figure 2. Following the function of the computer based programme realign the measuring line in the same way to the outer surface of the coating and note the indicated distance.

**6.3.1.3** Measure the total thickness at the same point by positioning the section such that the measuring line of the computer programme is aligned with the flesh side of the leather. Than align the measuring line to the outer surface of the coating and note the indicated distance.

**6.3.1.4** Convert the readings obtained in accordance with 6.3.1.2 to micrometres using the calibration described in 6.3.1.1.

**6.3.1.5** Repeat 6.3.1.2 to 6.3.1.4 for the two remaining sections.

**6.3.1.6** Calculate the arithmetic mean of the three coating thicknesses and the three total thicknesses. Express the coating thickness to the nearest 5  $\mu\text{m}$  for coating thickness of 50  $\mu\text{m}$  or higher and to the nearest 2  $\mu\text{m}$  for coating thickness less than 50  $\mu\text{m}$ . Express the total thickness to the nearest 10  $\mu\text{m}$ .

#### **6.3.2 Measurement using light microscope fitted with graduated scale**

**6.3.2.1** Calibrate the microscope with the graduated scale (4.1) using the grid (4.3).

**6.3.2.2** Place one section prepared in 5.3 under the microscope. Position the section such that the crosswire or one of the major graduations is aligned with the coating/leather boundary. If the coating/leather boundary undulates position the crosswire or major graduation midway between the peaks and troughs as shown in Figure 2.

Take the reading of the scale graduation corresponding to the outer surface of the coating.

**6.3.2.3** Measure the total thickness at the same point by positioning the section such that the crosswire or one of the major graduations is aligned with the flesh side of the leather. Take the reading of the scale graduation corresponding to the outer surface of the coating

**6.3.2.4** Convert the readings obtained in accordance with 6.3.2.2 and 6.3.2.3 to micrometres using the calibration described in 6.3.2.1.

**6.3.2.5** Repeat 6.3.2.2 to 6.3.2.4 for the two remaining sections.

**6.3.2.6** Calculate the arithmetic mean of the three coating thicknesses and the three total thicknesses. Express the coating thickness to the nearest 5 µm for coating thickness of 50 µm or higher and to the nearest 2 µm for coating thickness less than 50 µm. Express the total thickness to the nearest 10 µm.

### **6.3.3 Measurement using a microscope fitted with a means of obtaining photographs**

**6.3.3.1** Place the grid (4.3) under the microscope, photograph and obtain a print.

**6.3.3.2** Place one section prepared in 5.3 under the microscope, photograph at the same magnification as used in 6.3.3.1 and obtain a print.

**6.3.3.3** Providing that the leather section and the grid were both photographed at the same magnification (6.3.3.1 and 6.3.3.2), the print of the grid can be used as the direct means of measuring both the coating and total leather thickness.

NOTE It is necessary to print the grid to a transparent foil.

**6.3.3.4** Position one of the major graduations of the print of the grid on the coating/leather boundary on the print obtained in 6.3.3.2. If the coating/leather boundary undulates position the major graduation midway between the peaks and troughs as shown in Figure 2. Take the reading of the scale graduation corresponding to the outer surface of the coating.

**6.3.3.5** Measure the total thickness at the same point on the print by aligning a major scale graduation on the print of the grid with the flesh side of the leather and taking the scale reading corresponding to the outer surface of the coating.

**6.3.3.6** Convert the readings obtained in accordance with 6.3.3.4 and 6.3.3.5 to micrometres using the calibration described in 6.3.3.3.

**6.3.3.7** Repeat 6.3.3.2 to 6.3.3.6 for the two remaining sections.

**6.3.3.8** Calculate the arithmetic mean of the three coating thicknesses and three total thicknesses. Express the coating thickness to the nearest 5 µm for coating thickness of 50 µm or higher and to the nearest 2 µm for coating thickness less than 50 µm. Express the total thickness to the nearest 10 µm.

## **7 Expression of results**

The percentage of the coating in % shall be calculated using the expression:

$$\frac{t}{T} \times 100$$

where

$t$  is the mean coating thickness in micrometres

$T$  is the mean leather thickness in micrometres

## 8 Test report

The test report shall include the following:

- a) reference to this International Standard, i.e. ISO 17186;
- b) method used (A or B);
- c) the mean thickness of the coating;
- d) the mean thickness of the leather;
- e) the percentage of the coating;
- f) the standard atmosphere used for conditioning as given in ISO 2419;
- g) any deviation from the method specified in this International Standard;
- h) full details for identification of the sample and any deviation from ISO 2418 with respect to sampling.