INTERNATIONAL STANDARD

ISO 19076

IULTCS IUP 58

Second edition
2023-01

Leather — Measurement of leather surface — Electronic techniques

Cuir — Mesurage de la surface du cuir — Techniques électroniques

Reference numbers
ISO 19076:2023(E)
IULTCS/IUP 58:2023(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword iv
Introduction v
1 Scope 1
2 Normative references 1
3 Terms and definitions 1
4 Principle 2
5 Apparatus and materials 2
5.1 Measuring machines 2
5.1.1 General 2
5.1.2 Measuring machine types with linear sensor array (types A, B and C) 2
5.1.3 Type A roller measuring machine 3
5.1.4 Roller measuring machine with transport roller (type A1) 3
5.1.5 Roller measuring machine with transport conveyor (type A2) 3
5.1.6 Conveyor measuring machine (type B) 4
5.1.7 Standard conveyor measuring machine (type B1) 4
5.1.8 Vacuum tape conveyor measuring machine (type B2) 4
5.1.9 Flatbed scanning machines (type C) 4
5.1.10 Camera measuring machine (type D) 5
5.2 Reference calibrated templates for machine verification 5
6 Sampling and conditioning 5
7 General measurement criteria 6
7.1 General requirement 6
7.2 Leather orientation during measurement 6
7.2.1 General 6
7.2.2 Measuring whole leather pieces 6
7.2.3 Measuring half-leather pieces 6
7.2.4 Measuring leather cut pieces 7
7.3 Measurement operations 7
7.3.1 Roller machines 7
7.3.2 Conveyor machines 7
7.3.3 Flatbed scanner machines and bi-dimensional static measuring devices 8
8 Measurement procedure 8
9 Calculation and expression of results 9
10 Test report 9
Annex A (normative) **Manufacturing characteristics of calibrated templates for the verification of electronic measuring machines** 11
Annex B (normative) **Procedure for the verification of a measuring machine by calibrated templates** 13
Annex C (normative) **Laboratory record of calibrated templates** 15
Annex D (informative) **Repeatability and reproducibility** 16
Annex E (informative) **Pickled and wet leather conditioning before testing** 18
Bibliography 19

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 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*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19076:2016), which has been technically revised.

The main changes are as follows:

— the Scope, Clauses 3 to 9 and Annex A have been editorially and technically modified;

— a new Annex E for pickled and wet leather conditioning before testing has been inserted.

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

Leather surface measuring equipment used within the European Union (EU) for legal metrology applications is also subject to the EU Directive 2014/32/EU[4] on measuring instruments.

Leather — Measurement of leather surface — Electronic techniques

1 Scope

This document provides a method for the measurement of the surface of leather or leather parts by the use of electronic measuring machines.

It applies to the measurement of leather (or leather parts) fulfilling the following requirements:

— flexible leather, finished or unfinished dry leather;

— flexible wet leather (see Annex E);

— flexibility, such as to allow full distension on the measuring line or surface.

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

EN 15987, *Leather — Terminology — Key definitions for the leather trade*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15987 and the following 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/

3.1
longitudinal advancement sensing system
<measuring machines with linear sensor array> feeding movement sensing system to detect the longitudinal advancement of the leather with respect to the linear sensor array

3.2
measuring line
<measuring machines with linear sensor array> physical line where the leather presence is detected by the sensor array

3.3
relative feed
<non-static measuring machines> movement of relative translation between leather and the system detecting its presence

3.4
testing
setting and assessment of metrological compliance of the device

4 Principle

The leather surface is measured by means of a measuring system provided with a linear or a two-dimensional array of uniformly-spaced opto-electronic sensors capable of detecting leather presence.

There are two operating principles for sensors: the first based on the presence of an object between the beam of a source and a receiver, the second based on the image captured by a digital camera.

In both cases the digital data signals are processed by a computer to generate elementary surface units that contribute to calculate the surface of the sample. The calculation can be displayed, saved or printed. The leather surface measure is displayed in metric units, having a scale interval of 1 dm^2. For testing purposes, a scale interval shall be at least 0,1 dm^2. For other units of measurement, a suitable conversion factor shall be used.

5 Apparatus and materials

5.1 Measuring machines

5.1.1 General

The measuring machines are currently built and classified in some basic types, in relation to the different solutions adopted for the sensor array and for the relative feed.

Measuring machine types with linear sensor array:

— Type A Roller measuring machines: with transport roller (type A1) and with transport conveyor (type A2);

— Type B Conveyor measuring machines: standard conveyor machine (type B1) and vacuum conveyor machine (type B2);

— Type C Flatbed scanning machines.

Measuring machine types with two-dimensional sensor array:

— Type D Type D

5.1.2 Measuring machine types with linear sensor array (types A, B and C)

These measuring machines consist at least of the following:

— A base frame.

— A relative feed system between leather and measuring system.

— A set of sensors (sensor array) uniformly spaced along a direction normal to the feeding movement, to detect leather presence.

— A longitudinal advancement sensing system.

— A numerical indicator (display) of the leather surface measure, in metric units, having a scale interval of 1 dm^2. For testing purposes, the scale interval shall be at least 0,1 dm^2.

As an option, the machine may be equipped with a stamping or printing system to record the surface measured value onto leather or onto a label or paper. The distance *i* between the centre of two adjacent sensors for the detection of leather presence shall not be greater than 27 mm across the feeding direction.

The length of the measuring line defines the detecting width of the machine and shall be indicated in the test report.

Let p be the step of the leather presence detection along the feeding direction: the values of i and p shall be such that their product $i \times p$ is not greater than 1/400 of the minimum measurable surface.

The feeding speed shall allow leather to spread out adequately during measurement. If necessary, the machine is equipped with a feeding speed adjustment device to aid the fulfilment of this condition.

5.1.3 Type A roller measuring machine

In this type of machine there is a coincidence between the elements that make up the feeding system and the optical detection system.

A horizontal introduction bench is present before the feeding system to facilitate the hide feeding of the machine by the operator, and the feeding system is composed of two main sections, one section above and one section below the introduction plane.

The section above is composed of one set of transparent free-running rollers of equal width, each one including a sub-array of opto-electronic devices (emitters or sensors) and one encoder that detect the roller rotation, giving the roller the independent ability to detect the longitudinal advancement of the leather for the underlying portion. All the encoders of all the measuring rollers make up the longitudinal advancement sensing system.

The section below is composed of one transport system that incorporates one array of uniformly spaced opto-electronic devices (sensors or emitters), working in axis with the opto-electronic devices inside the above measuring rollers and making up with them the optical detection system.

The points where the two sections come into contact indicate the measuring line of the machine.

5.1.4 Roller measuring machine with transport roller (type A1)

In this type of measuring machine, the transport system consists of one motorized roller that incorporates the opto-electronic devices that define the measuring line. The introduction bench is placed just before the measuring line. This means that the sensor array and the set of free-rotating measuring rollers are part of the feeding system itself.

Once the hide has been inserted between the measuring rollers and the transport system, the movement continues (autonomously) as a result of the friction generated by the light pressure of the rollers on the hide (skin, leather). The feeding speed can affect the spreading out of the leather.

The movement of leather pieces under the rollers is controlled by their (relative) encoders, which are independent from each other.

During feeding, leather pieces can be spread laterally (perpendicularly to feeding direction), slowed down or stopped on the introduction bench by the operator.

If the machine allows a temporary feeding stop during measurement (e.g. by manual holding), this shall not significantly alter the measuring value.

Any feeding inversion, even partial and/or temporary, shall automatically cancel the measure, unless the measuring system allows for the inversion in the area calculation. Such information shall be checked in the instruction manual provided by the machine manufacturer.

5.1.5 Roller measuring machine with transport conveyor (type A2)

In this type of measuring machine, the introduction bench consists of a transport conveyor with (transparent) belts that incorporates the opto-electronic sensors and that defines the measuring line.

This machine is generally used for measurement of an area before or after mechanical operations (e.g. roller press) in the tanning process. It shall not be used for the verification of surface between seller and customer.

The functional description of the device is the same as type A1. In comparison with transport roller devices, the conveyor transport minimizes the dragging effect of the leather but can cause a lower spreading of leather in the edges.

The feeding speed can affect the spreading out of the leather.

5.1.6 Conveyor measuring machine (type B)

In this type of machine, the feeding system is independent (separated) from the (linear) sensor array and no mechanical work is applied on leather during the transport.

The linear sensor array generally consists of an optical detecting bar and a light source bar; the two bars generally work in a transmissive-receptive way but, under certain conditions, reflective is also possible.

The transport system consists of a conveyor tape that carries the leather through the measuring line by means of cords or belts (e.g. nylon cords, transparent belts, strip belts) without any interference with the optical detection system.

The detection of leather in the direction of feeding is generally unique for the whole measurement width of the machine and is obtained with suitable devices (e.g. an encoder applied directly on a moving part of a transport system).

If a service stop is applied, it is possible to stop the conveyor any time during the measurement without affecting the final result.

The measurement can vary if the operator applies a lateral movement or manually blocks the transport of leather under the sensors.

The feeding speed can affect the spreading out of the leather.

5.1.7 Standard conveyor measuring machine (type B1)

The length of the tape conveyor is adequate to ensure stable support of the leather during the measurement.

Once most of the leather is laid flat on the conveyor tape, it advances to the measuring line jointly to the conveyor tape and without any contact with the optical bar. The measurement occurs during the time that the hide is passing over the measuring line.

5.1.8 Vacuum tape conveyor measuring machine (type B2)

This is similar to the type B1 machine but equipped with a low-pressure conveyor with an air aspiration system that keeps the leather more adherent and firmer on the transport belt and that partially flattens eventual wrinkles over the tape conveyor.

Once the hide is laid flat on the first part of the vacuum conveyor, the hide moves through towards the measuring line attached to the belts.

The air aspiration system can affect the spreading out of the leather.

5.1.9 Flatbed scanning machines (type C)

This type of machine consists of a horizontal surface (flatbed) made with transparent glass, where leather is laid flat, and a portal-shaped frame containing the sensors. The frame is manually or mechanically moved over and parallel to the flatbed.

The optical detection system consists of a couple of optical bars: one above and one below the flatbed. An encoder is also installed to read the movement of the carriage across the flatbed.

The process of measurement is the same as for the conveyor machines, but in this case the sensor system moves while the leather is still on the flatbed.

5.1.10 Camera measuring machine (type D)

The measuring machine consists of at least:

— a base frame;

— a plane surface to spread and support the leather or a belt conveyor that stops when the hide is under the area camera field;

— an area camera with its optical axis normal to the leather surface;

— a system for image processing and leather surface calculation.

Area measuring devices are often inserted in automatic cutting systems and not generally used by tanneries for selling. Devices are equipped with an air aspiration system that allows the spreading of leather pieces and flattens eventual wrinkles over the plane surface. The air aspiration system can affect the spreading out of leather.

These devices shall not be used for the verification of surface area between seller and customer.

In this kind of device, colour difference between leather and the surface is fundamental for a suitable identification of the edge of the material and so for the measurement result. Make sure that there is as much contrast as possible between the leather colour and the colour of the plane or the conveyor where the hide is spread. If leather colour does not allow a correct identification of edges, a flat support with a colour in contrast to the leather should be placed below the leather.

For leather with long hair that protrudes over the edges, the results can be affected by the presence of hairs. These devices are not suitable, therefore, for measurement of the area of this leather type.

The leather surface corresponding to the elementary area measuring unit (pixel) shall not be greater than 1/400 of the minimum measured surface.

EXAMPLE If the image-capturing system is able to transfer a 2 m × 2 m area into a (512 × 512)-pixel array, the surface corresponding to 1 pixel (elementary area) is: (2 m/512) × (2 m/512) = 0,15 cm^2.

The minimum measurable surface is therefore: 400 × 0,15 cm^2 = 60 cm^2 = 0,60 dm^2.

Type D devices may be equipped with an air aspiration system that allows the spreading of leather and flattens eventual wrinkles over the plane surface. The air aspiration system can affect the spreading out of leather and consequently the uncertainty of the measurement. Its use shall be indicated in the test report.

5.2 Reference calibrated templates for machine verification

Calibrated templates conforming with Annex A, such that the area of the calibrated template is not less than 50 % of the area of the measured leather or 1,4 m^2, whichever is smaller. For bigger leather pieces, 50 % of the area is potentially too large. In these cases, therefore, the maximum template area is 1,4 m^2.

6 Sampling and conditioning

6.1 Each leather piece making up the sample from the batch shall be identified and labelled. In the case of third-party area checking, the minimum number of leather pieces from the batch is 12 for leather pieces up to 150 dm^2 and six for larger leather pieces, unless there is a different agreement between the parties. The value to be compared shall be the total area of the batch sample and not the individual values.

6.2 For dry leather, spread out or hang leather pieces in a standard atmosphere in accordance with ISO 2419, so that air may freely flow on both leather sides; whenever possible use continuous and fast air circulation. The minimum duration of conditioning is 24 hours. The stacking of leather pieces on top of each other is permitted. In this case the duration of conditioning shall be 48 hours and the total number of stacked leather pieces shall be a maximum of six for smaller leather pieces and three for larger leather pieces.

In the case of haired leather, care is needed to avoid hair protruding over the leather edge, since with these types of machines hair presence can influence the measurement result significantly for camera measuring machines (type D).

7 General measurement criteria

7.1 General requirement

The results obtained for the leather surface area can vary depending on the type of machine (see Annex D). Therefore, the parties involved in a commercial transaction intending to refer to this document shall agree on the specific instrument to be adopted among type A, B, C and D machines.

In the case of area checking between the customer and the supplier of leather, the comparison of values shall be carried out using the same device and in the same operative conditions.

NOTE The specific device agreed is reported in References [6] and [7]. This is important in the case of third-party area checking.

7.2 Leather orientation during measurement

7.2.1 General

Place the leather in the measuring machine in such a way that the leather surface is completely spread out and flattened, as creases or folds can modify the optical projection onto the measuring line. Leather pieces shall be fed into the measuring machine with the external side (e.g. grain side, finished side, buffed side for suede and nubuk) upward.

NOTE In some measuring machines (e.g. type A roller machines), the side of feeding can affect the results of surface measurement.

7.2.2 Measuring whole leather pieces

In order to ease spreading out, the leather shall be fed into the measuring machine with its backbone aligned with the feeding direction. The leather shall be fed in such a way that its wider part is measured first; this usually corresponds to feeding the leather from the animal's back part (rump).

This subclause does not apply to type C or type D machines.

7.2.3 Measuring half-leather pieces

Since these leather pieces have a straight edge, it is important that the edge is not parallel to the feeding direction. To avoid significant measuring errors, half-leather pieces with a straight edge shall be fed in such a way that they form an angle of 10° to 20° to the feeding direction or, in type D machines, to the sensor line.

For type A devices, the feeding of half-leather pieces at an angle can determine force in the direction of feeding and the consequent slippage of leather over the base frame that can affect the measurement. For this kind of leather an angle of 0° shall be applied.

7.2.4 Measuring leather cut pieces

Leather pieces shall be fed in from the longer edge. Ensure that any straight edge forms an angle of at least 10° to 20° with the feeding direction or, in type D machines, with the sensor (pixel) line.

7.3 Measurement operations

7.3.1 Roller machines

Select the roller rotation speed. The roller speed influences the measurement and shall be indicated in the test report.

NOTE 1 The roller speed depends on the combined action of dragging the material between the rollers and on the mechanical actions applied by the operator during the measurement. For flexible materials, this effect can be significant.

NOTE 2 Typical roller speeds used for measurements are between 23 m/min and 35 m/min.

Lay and spread out the forward part of the leather (or the calibrated template) on the front bench, leaving the remaining part to hang down with the external side upward.

Move the leather front edge towards the rollers until the leather begins to be dragged in. This movement shall be applied in the direction of feeding without any lateral or oblique force.

While the leather is dragged in, keep it spread out towards the lateral edges, preventing creases and folds. In the case of folding, the leather can be temporarily stopped in its central part on the outer edge of the feeding bench in order to help crease removal. However, this operation shall come to an end as soon as possible.

If the leather fed under the rollers is not adequately spread out, the measurement shall be cancelled and repeated.

In order to ensure the correct spreading out of large pieces of leather (i.e. with an area greater than 2,5 m^2 or a width greater than 1,5 m), two operators are required, one on the right side and one on the left side of the feeding bench. Once the leather is fed in, the operators use one hand to spread the leather and remove the creases, while the other hand, if necessary, can temporarily brake or stop the leather feed.

7.3.2 Conveyor machines

Select the conveyor speed. The conveyor speed shall be indicated in the test report.

If available, switch on the vacuum system to distend the wrinkles and the folds of leather pieces.

NOTE For long half-leather pieces the air aspiration can be a suitable support to a correct feeding of samples, i.e. without movement below the sensor line.

Lay the leather (or the calibrated template) on the feeding conveyor and spread it out before the conveyor drives it towards the measuring sensor array.

Should creases be observed, the conveyor can be temporarily stopped to help crease removal before the leather arrives under the measuring sensors.

During this operation, care shall be taken not to induce movements in the leather part already under the sensor line while the rest of the leather is spread, unless the machine is equipped with a low-pressure conveyor system which is in operation.

If the leather fed under the measuring sensors is not adequately spread out, the measurement shall be cancelled and repeated.

On type B2 conveyor machines with an air aspiration system, first lay the leather on the insertion table, smoothing it out to reduce undulation and folds as much as possible. Then bring it forward, keeping it against the conveyor, until the leather advances by the action of the low-pressure zone. If necessary, the belt conveyor can be stopped by pressing the service pedal.

In order to ensure correct spreading out of large pieces of leather (i.e. with an area greater than 2,5 m^2 or a width greater than 1,5 m), two operators are recommended, one on the right side and one on the left side of the conveyor frame. In these cases the use of the air aspiration is recommended.

7.3.3 Flatbed scanner machines and bi-dimensional static measuring devices

These measuring machines are not recommended for area checking between seller and customer for large leather pieces (e.g. 4 m^2 to 5 m^2 bovine leather) due to the difficulties of keeping the leather surface completely flat.

Lay and spread out the leather (or the calibrated template) on the machine plane, removing any creases or folds.

For flatbed scanner machines, let the sensor line array translate over the whole surface of the leather at a constant speed included within the range suggested by the machine manufacturer.

In the case of leather pieces that are not perfectly flat or with evident wrinkles at the edges, some transparent glass plates can be placed on the sample to flatten folds and wrinkles. The use of glass plates shall be indicated in the test report.

This measuring machine is not suitable for leather pieces with hair that protrudes over the edge.

For bi-dimensional measuring devices, start the measuring process according to the machine manufacturer's instructions.

NOTE Bi-dimensional measuring devices are often inserted in automatic cutting systems, where the leather-supporting surface is provided with a porous or perforated cover (e.g. fabric cover, drilled plane) and with a vacuum system to keep the leather in position while being cut. The friction between the supporting surface and the leather, especially for fabric-covered surfaces, influences the measurement result significantly, particularly in cases of very elastic leather or leather pieces with large dimensions.

8 Measurement procedure

8.1 Switch the surface measuring machine on and let it run for the time specified by the machine manufacturer before the measuring operations.

8.2 Choose the calibrated template with an area similar to that of the leather to be measured, according to the requirements specified in 5.2.

8.3 Measure the area of the chosen calibrated template 10 times and record the obtained values, rounded to 0,1 dm^2. A resolution down to 0,1 dm^2 is permitted.

In roller and conveyor machines, the 10 measures shall be distributed in such a way that four of them are in the central third of the measuring sensor line and three are in each of the right and left third of the line itself.

In flatbed scanner and/or camera machines, measure the area of the calibrated template in 10 positions uniformly spaced all over the scanner or device surface.

8.4 Calculate the arithmetic average (A_{MM}) of the 10 area measures of the calibrated template obtained as specified in 8.3, rounded to 0,1 dm^2 (see Annex A and Annex B).

8.5 Determine the percentage maximum permitted error (A_{MPE}) using Formula (1). The A_{MPE} shall not be greater than 0,5 %.

$$A_{MPE} = \frac{A_{MM} - A_{MC}}{A_{MC}} \times 100 \tag{1}$$

where

A_{MC} is the area value, rounded to 0,1 dm^2, of the calibrated template used, obtained from the calibration procedure as specified in Annex A;

A_{MM} is the average value, rounded to 0,1 dm^2, of the same calibrated template, obtained as specified in 8.4.

8.6 The difference between maximum and minimum measured values shall not be greater than 1,5 % of the average measured value, according to Formula (2). This value shall be indicated in the report.

$$\frac{A_{max} - A_{min}}{A_{MM}} \times 100 \leq 1,5 \tag{2}$$

8.7 Measure the area of the first leather of the batch 10 times and define the average value (A_{SM}) and the standard deviation. Calculate the percentage coefficient of variation (C_V). Round the value to 0,1 % and record the C_V %.

NOTE A C_V % exceeding 1 % indicates a certain variability of measuring for the specific system defined by leather article and device used.

8.8 Measure the leather pieces of the batch once according to Clause 7.

9 Calculation and expression of results

9.1 Record each leather piece area measurement, rounding its value to 1 dm^2.

9.2 Calculate the correction factor *F*, rounded to 0,001, according to Formula (3).

$$F = \frac{A_{MC}}{A_{MM}} \tag{3}$$

where

A_{MC} is the area value, rounded to 0,1 dm^2, of the calibrated template used, obtained from the calibration procedure as specified in Annex A;

A_{MM} is the average value, rounded to 0,1 dm^2, of the same calibrated template, obtained as specified in 8.4.

9.3 Multiply the area of each piece of leather (or the total value for the batch) by the correction factor *F* calculated in 9.2 to obtain the actual area of each piece of leather.

The correction can be omitted if $|F - 1| < 0,005$, i.e. if it is less than 0,5 %.

10 Test report

The test report shall include at least the following:

a) a reference to document, i.e. ISO 19076:2023;

b) the date of the measurement;

c) the type of measuring machine used (see 5.1.2 and 7.1), including the operative test conditions (e.g. for roller machines, the rotation speed; for scanners, the use of a glass plate; for conveyor machines, the use of a vacuum system);

d) complete identification of the leather sample;

e) conditioning mode;

f) correction factor *F*, as specified in 9.2;

g) leather area values obtained for each leather piece, as specified in 9.3;

h) details of any deviations from the test method specified in this document;

i) if requested, coefficient of variation, as specified in 8.7.

Annex A
(normative)

Manufacturing characteristics of calibrated templates for the verification of electronic measuring machines

A.1 Material

The calibrated templates shall be made of opaque material, 0,5 mm to 3 mm thick, with high flexibility but practically inextensible during use (this feature can be obtained, for example, by using a polymeric material with internal textile reinforcement).

The material elasticity shall be such that when a strip 20 mm wide and with 200 mm free length is subjected to 200 N tensile strength, it shows an elongation not exceeding 5 mm.

In the temperature range between 10 °C and 40 °C, the material of the calibrated template shall not show a linear thermal extension exceeding 1 mm/m (0,1 %).

A.2 Shape and dimensions

Calibrated templates are typically circular.

The set of calibrated templates for the verification of a measuring machine consists of at least three templates with different increasing areas, depending on the application field.

NOTE Examples of template areas are: 20 dm^2, 30 dm^2, 50 dm^2, 65 dm^2, 70 dm^2, 80 dm^2, 100 dm^2, 130 dm^2 and 140 dm^2.

In any case, the calibrated template dimensions shall fulfil the requirements of 5.2.

A.3 Storage of calibrated templates

The calibrated templates shall be kept in normalized environmental conditions, protected from any object, substance or condition that might cause them damage or modification, and stored either in a cabinet or on a shelf in a flat, horizontal position.

As an alternative, and exclusively for the roller machine (Type A), the calibrated template should be stored in a rigid cylindrical container with an internal diameter of at least 30 times the template thickness.

A calibrated template stored in a cylindrical container shall be drawn and unrolled on a horizontal plane for a time interval sufficient to make it spread out before use.

A.4 Templates calibration

The reference templates shall be calibrated against measurement templates traceable to the international system of units (SI) by an accredited metrology institute.

The calibration extended uncertainty, calculated with a coverage factor $k = 2$, shall not exceed 0,2 %.

NOTE The uncertainty range allows for any reasonable uncertainty source, including the template shape, the calibration system, the measuring system and the influence of quantities.

A.5 Calibration frequency

The calibration of reference templates shall be repeated at least every 36 months. Moreover, every calibrated template shall be subjected to a new calibration whenever:

— any defects, even visual (e.g. cuts, permanent creases, deformations), are observed;

— it has undergone conditions that might have modified its area or shape;

— the date of the previous calibration is not known;

— suspicions arise about the validity of its calibration, for example as a consequence of abnormal results from the measuring machine in the routine verification with the same calibrated template.

Annex B
(normative)

Procedure for the verification of a measuring machine by calibrated templates

B.1 General

The procedure described in this annex shall be applied at least every 6 months and every time any irregular condition is detected in the measuring process with the measuring machine.

B.2 Measuring scale adjustment

B.2.1 This operation shall be carried out for the first calibration of the measuring machines and is only repeated for repair or important deviations.

B.2.2 Switch the machine on and let it run for the time specified by the manufacturer.

B.2.3 Select a suitable template size according to the measurement field. Measure the area of the calibrated template 10 times and calculate the average value (A_{MM}) of the measured area.

B.2.4 The measured averaged value (A_{MM}) shall not differ from the calibration value (A_{MC}) of the calibrated template by more than 0,5 %.

B.2.5 Should the difference exceed this value, modify the machine adjustment and repeat the procedure specified in B.2.3 until the value of the average area is as close as possible to the calibration value of the calibrated template, or at least as soon as a difference between A_{MC} and A_{MM} not exceeding 0,5 % is obtained.

B.3 Verification of measurement homogeneity among different zones in the machine measuring field

B.3.1 In flatbed scanner machines or bi-dimensional devices, a calibrated template not exceeding one third of the measuring field of the machine shall be used.

Measure the area of the calibrated template 10 times in the leftmost zone of the machine measuring field and calculate the arithmetic average.

B.3.2 Repeat the operation described in B.3.1 in the central zone and in the rightmost zone of the machine measuring field, calculating the arithmetic average of the 10 measures in each case.

B.3.3 The extreme (maximum and minimum) average values shall not differ by more than 0,5 % of their average.

B.4 Verification of machine linearity

B.4.1 Measure the area of each one of the set of calibrated templates 10 times and also the set of (80 + 30) dm^2 and (80 + 70) dm^2 templates placed tangentially 10 times. Calculate the average value for each case to the nearest 0,1 dm^2. The obtained values are designated A_{MM} measures and shall be recorded in the laboratory log as specified in Annex C, together with the machine calibration date.

B.4.2 Calculate the correction factor, F, for each calibrated template or set of calibrated templates, using Formula (B.1).

$$F = \frac{A_{MC}}{A_{MM}} \tag{B.1}$$

where

A_{MC} is the official area value of the template used, resulting from the calibration according to A.4;

A_{MM} is the average value of the calibrated template area, obtained as specified in B.4.1.

B.4.3 The extreme values of the correction factors obtained in B.4.2 shall not differ by more than 2 %.

B.5 Verification of invariability of measured area in the event of interruptions of operation during the measuring operation

B.5.1 Measure the area of the 80 dm^2 calibrated template 10 times and calculate the average value.

B.5.2 Repeat the measurement of the calibrated template area 10 times, but interrupt the template feeding operation three times during each measuring operation. Calculate the average value for the 10 measures.

B.5.3 The average measures obtained according to B.5.1 and B.5.2 shall not differ by more than 0,3 %.

