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Foreword

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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