INTERNATIONAL STANDARD

ISO 3376

IULTCS/IUP 6

Second edition
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Leather — Physical and mechanical tests — Determination of tensile strength and percentage extension

Cuir — Essais physiques et mécaniques — Détermination de la résistance à la traction et du pourcentage d'allongement

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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 3376 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). It is based on IUP 6 originally published in *J. Soc. Leather Trades Chemists* **42**, p. 389, (1958) and declared an official method of the IULTCS in 1959. This updated version was published in *J. Soc. Leather Tech. Chem.* **84**, p. 317, (2000) and reconfirmed as an official method in March 2001. The same principle is used but the text has been updated and includes the number of test pieces to be taken.

This second edition cancels and replaces the first edition (ISO 3376:1976), which has been technically revised.

Leather — Physical and mechanical tests — Determination of tensile strength and percentage extension

1 Scope

This International Standard specifies a method for determining the tensile strength, elongation at a specified load and elongation at break of leather. 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*

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

ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system*

3 Principle

A test piece is extended at a specified rate until the forces reach a predetermined value or until the test piece breaks.

4 Apparatus

4.1 Tensile testing machine, with:

— a force range appropriate to the specimen under test;

— a means of recording the force as specified by Class 2 of ISO 7500-1;

— a uniform speed of separation of the jaws of 100 mm/min ± 20 mm/min;

— jaws, minimum length 45 mm in the direction of the applied load, designed to apply constant clamping by mechanical or pneumatic means. The texture and design of the inside faces of the jaws shall be such that at the maximum load attained in the test the specimen does not slip at either jaw by an amount exceeding 1 % of the original jaw separation.

4.2 A means of determining the extension of the test piece, either by monitoring the separation of the jaws or by sensors which monitor the separation of two fixed points on the test piece.

4.3 Thickness gauge, as specified in ISO 2589.

4.4 Press knives, as specified in ISO 2419 capable of cutting a test piece as shown in Figure 1 with dimensions as given in Table 1.

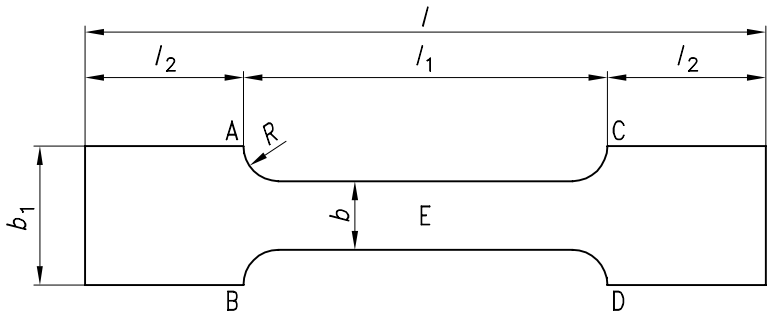

Figure 1 — Shape of test piece

Table 1 — Dimensions of test pieces

All dimensions in millimetres

Designation	l	l_1	l_2	b	b_1	R
Standard	110	50	30	10	25	5
Large	190	100	45	20	40	10

4.5 **Vernier callipers**, reading to 0,1 mm.

5 Sampling and sample preparation

5.1 Sample in accordance with ISO 2418.

5.2 From the sample, cut six test pieces in accordance with ISO 2419 by applying a press knife (4.4) to the grain surface, three test pieces with the longer sides parallel to the backbone and three test pieces with the longer sides perpendicular to the backbone. If previous testing has shown that there is slippage of the test piece in the jaws, use the large press knife (4.4).

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

5.3 Condition the test pieces in accordance with ISO 2419.

6 Procedure

6.1 Determination of dimensions

6.1.1 Using vernier callipers (4.5) measure the width of each test piece to the nearest 0,1 mm at three positions on the grain side and three on the flesh side. In each group of three measurements make one at the mid-point E (as shown in Figure 1) and the other two at positions approximately mid-way between the mid-point E and the lines AB and CD. Take the arithmetic mean of the six measurements as the width of the test piece, *w*.

NOTE For soft leathers, the width may be taken as the width of the press knife.

6.1.2 Measure the thickness of each test piece in accordance with ISO 2589. Make the measurements at three positions namely the mid-point E and at positions approximately mid-way between the mid-point E and the lines AB and CD. Take the arithmetic mean of the three measurements as the thickness of the test piece, *t*.

6.2 Determination of tensile strength

6.2.1 Set the jaws of the tensile strength testing apparatus (4.1) 50 mm apart if using the standard test piece or 100 mm if using the large test piece. Clamp the test piece in the jaws so that the edges of the jaws lie along the lines AB and CD. When the test piece is clamped, ensure its grain surface lies in one plane.

6.2.2 Run the machine until the test piece breaks and record the highest force exerted as the breaking force, *F*.

6.3 Determination of the percentage elongation caused by a specified load

6.3.1 Clamp the test piece between the jaws of the apparatus as described in 6.2.1. Measure the distance between the jaws to the nearest 0,5 mm and record this distance, L_0, as the initial length of the test piece for the purpose of the test.

6.3.2 Start the apparatus. Unless the apparatus automatically draws a force/extension curve with the necessary accuracy (see 4.2), follow the distance between the pairs of jaws or the sensors as the force increases.

6.3.3 Note the distance between the pair of jaws or sensors at the instant when the force first reaches the specified value. Record this distance as the length of the test piece at this force, L_1. Do not stop the apparatus if results from the procedures described in 6.2 or 6.4 are also required.

6.4 Determination of the percentage elongation at break

6.4.1 Carry out the steps given in 6.3.1.

6.4.2 Run the tensile test machine until the test piece breaks.

6.4.3 Record the distance between the jaws or sensors at the instant when rupture of the test piece occurs. Record this distance as the length of the test piece at break, L_2.

6.5 Slippage

If there is slippage of the test piece at either jaw when tested according to 6.2, 6.3 or 6.4, and the slippage is greater than 1 % of the initial jaw separation, reject the result and repeat the determination with a new test piece cut using the large press knife (4.4).

7 Expression of results

7.1 Tensile strength

The tensile strength, T_n, in Newtons per square millimetre shall be calculated using the equation:

$$T_n = \frac{F}{w \cdot t}$$

where

F is the highest force recorded in Newtons;

w is the mean width of the test piece in millimetres;

t is the mean thickness of the test piece in millimetres.

7.2 Percentage elongation caused by a specified load

The percentage elongation caused by a specified load, E_l, shall be calculated using the equation:

$$E_l = \frac{L_1 - L_0}{L_0} \times 100$$

where

L_1 is the separation of the jaws or sensors at the specified load;

L_o is the initial separation of the jaws or sensors.

7.3 Percentage elongation at break

The percentage elongation at break, E_b, shall be calculated using the equation:

$$E_b = \frac{L_2 - L_0}{L_0} \times 100$$

where

L_2 is the separation of the jaws or sensors at break;

L_0 is the initial separation of the jaws or sensors.

8 Test report

The test report shall include the following:

a) reference to this International Standard, i.e. ISO 3376:2002;

b) the mean tensile strength, T_n, in Newtons per square millimetre;

c) the mean percentage elongation at a specified load, E_l;

d) the mean percentage elongation at break, E_b;

e) details of the test piece;

f) the standard atmosphere used for conditioning and testing as given in ISO 2419 (i.e., 20 °C/65 % relative humidity or 23 °C/50 % relative humidity);

g) any deviations 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.