

INTERNATIONAL
STANDARD

ISO
22288

IULTCS/IUP
39

First edition
2006-09-15

**Leather — Physical and mechanical
tests — Determination of flex resistance
by the vamp flex method**

*Cuir — Essais physiques et mécaniques — Détermination de la
résistance à la flexion à l'aide de la méthode de flexion d'empeigne*

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Reference number
ISO 22288:2006(E)
IULTCS/IUP 39:2006(E)

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Published in Switzerland

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 22288 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. It was published as EN 13335. It is based on IUP 39 published in *J. Soc. Leather Tech. Chem.*, **84** (7), p. 381, 2000, and declared an official method of the IULTCS in March 2001.

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.

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Leather — Physical and mechanical tests — Determination of flex resistance by the vamp flex method

1 Scope

This International Standard specifies a method for determining the wet or dry flex resistance of leather and finishes applied to leather. It is applicable to all types of leather below 3,0 mm in thickness.

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 3696, *Water for analytical laboratory use — Specification and test methods*

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3 Principle

A test piece is folded grain outwards over two inverted “V” shaped clamps. Relative movement of the clamps flexes the sample producing one downward crease surrounded by four upward creases. The test piece is examined periodically for damage.

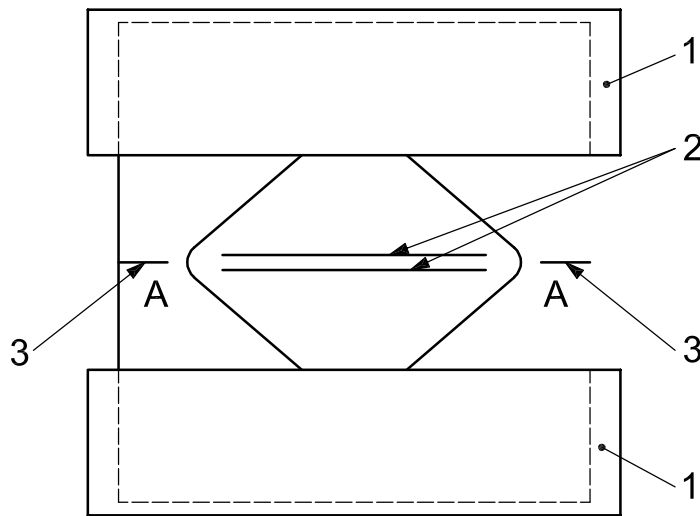
4 Apparatus

4.1 Test machine, including the parts described in 4.1.1 to 4.1.3 and the crease patterns formed by flexing as shown in Figure 1.

4.1.1 A pair of inverted “V” shaped blocks and clamps, with the axis mounted in a straight line with an angle of $40^\circ \pm 1^\circ$ and a tip radius of $6,4 \text{ mm} \pm 0,5 \text{ mm}$ and with a minimum distance between the clamps of $9,5 \text{ mm} \pm 1,0 \text{ mm}$.

4.1.2 A means of applying a simple harmonic reciprocating motion to the clamps, to move them apart by $19,0 \text{ mm} \pm 1,5 \text{ mm}$ and return them to the minimum separation at a rate of oscillation of $300 \text{ cycles/min} \pm 30 \text{ cycles/min}$.

4.1.3 Counter, to indicate the number of cycles.



Key

- 1 clamp
- 2 folds with outer surface inwards
- 3 folds with outer surface outwards

Figure 1 — Plan view — Crease pattern formed by flexing

- 4.2 **Press knife**, conforming to the requirements of ISO 2419, the inner wall of which is a square of side 64 mm ± 1 mm.
- 4.3 **Magnifier**, with a magnification of 4 to 6 times.
- 4.4 **Distilled or deionized water**, conforming to the requirements of grade 3 of ISO 3696.

5 Sampling and sample preparation

5.1 Sample in accordance with ISO 2418. Cut four test pieces parallel to the backbone and four test pieces perpendicular to the backbone by applying the press knife (4.2) to the grain surface. Use two test pieces parallel to and two test pieces perpendicular to the backbone for dry tests, and two test pieces parallel to and two test pieces perpendicular to the backbone for wet tests.

NOTE If there is a requirement for more than two hides or skins to be tested in one batch, then only two samples in each direction need be taken from each hide or skin, giving one sample in each direction for both dry and wet, provided that the overall total is not less than four test pieces in each direction.

5.2 For dry flex testing, condition the test pieces in accordance with ISO 2419 and perform the test in the conditioned atmosphere.

5.3 For wet flex testing, the test pieces can be wetted by rubbing 1 ml of distilled or deionized water into the flesh surface of the leather. The wetting should be repeated every 25,000 flexes during the test. Carry out wet flexing without delay.

6 Procedure

6.1 Remove the upper parts of the clamps (4.1.1) and adjust the test machine so that the clamps are at their maximum separation.

6.2 Fold the test piece evenly over the “V” shaped clamps and hold in place by replacing the upper parts of the clamps, ensuring that there is no slack in the test piece. Position two test pieces so that the direction of the backbone is along the axis of movement of the clamps and two so that it is perpendicular to the axis.

6.3 Slowly move the clamps together and observe the test pieces to ensure that the centre of each test piece folds downwards. If this is not the case, apply gentle pressure to the centre of the ridge as the clamps move together to make a downward fold form.

6.4 Run the machine for the required number of flex cycles selected from the following list:

— Dry flex: 50 000; 100 000; 250 000; 500 000; 1 000 000 cycles;

— Wet flex: 50 000; 100 000 cycles.

In addition to the above inspection points, remove the wet test pieces from the machine every 25 000 cycles and examine them for spue before re-wetting and replacing in the test machine.

6.5 Stop the test machine and remove the test piece. Examine visually in good light using the naked eye and with the magnifier (4.3). Examine the test piece with it both lying flat and folded. Record any damage in the flexed area, ignoring damage in the clamped area. Cut through the flexed area if required to assist identification of loose leather structure.

NOTE Cutting through the test piece damages it too severely to allow further testing and may only be carried out after the final inspection.

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The damage may include the following:

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- a) creasing in the central inward fold;
- b) cracking in the central inward fold, (the number of cracks and the depth may be reported if it is feasible);
- c) cracking in the outward folds, (the number of cracks and the depth may be reported if it is feasible);
- d) delamination or flaking of the surface finish;
- e) cracking extending to the edge of the test piece;
- f) salt spue (wet flex only), judging as “light”, “medium” or “heavy” by eye.

6.6 If required, replace the test piece in the clamps using the marks produced by the clamps as a guide to ensure that the test piece is returned to its original position in the clamps.

6.7 Restart the machine and continue to the next required number of cycles. Repeat the inspection given in 6.5.

6.8 Repeat steps 6.6 and 6.7 if required for other numbers of flex cycles.

NOTE The actual number of cycles chosen will depend on the specification, the end use of the leather and the expected performance.

7 Test report

The test report shall include the following:

- a) a reference to this International Standard; i.e. ISO 22288:2006;
- b) whether the leather was tested wet or dry;
- c) the number of flex cycles and damage at each inspection stage;
- d) the standard atmosphere used for conditioning and testing as given in ISO 2419 (i.e. 20 °C/65 % RH or 23 °C/50 % RH);
- e) any deviations from the method specified in this International Standard;
- f) full details for identification of the sample and any deviation from ISO 2418 with respect to sampling.

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Annex A (informative)

Sources of apparatus

Examples of suitable products available commercially are given below.

The recommended apparatus is the vamp flexer manufactured, for example, by:

SATRA Footwear Technology Centre ¹⁾, Rockingham Road, Kettering, Northamptonshire, NN16 9JH, United Kingdom.

Muver - Francisco Muñoz Irlles¹⁾, Avda Hispanoamerica 42, E-03610 Petrer (Alicante), Spain.

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1) SATRA Footwear Technology Centre and Muver - Francisco Muñoz Irlles are examples of suppliers of suitable products available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of their products.