INTERNATIONAL STANDARD

ISO 14087
IULTCS IUP 54

Second edition
2022-06

Leather — Physical and mechanical tests — Determination of bending force

Cuir — Essais physiques et mécaniques — Détermination de la force de flexion

Reference numbers
ISO 14087:2022(E)
IULTCS/IUP 54:2022(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

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 Tests 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 (ISO 14087:2011), which has been technically revised.

The main changes are as follows:

— 5.1.1, 5.1.2 and 5.1.3 have been revised to improve the clarity of the clamping device and its dimensions;

— Figures 1 and 2 have been revised;

— a new Figure 3 has been included;

— Clauses 6 and 7.1 have been revised to give a better understanding;

— Clause 8 has been revised and rearranged.

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.

Leather — Physical and mechanical tests — Determination of bending force

1 Scope

This document specifies a test method for the determination of the bending force of leather.

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 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 7500-1:2018, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
bending force
force exerted by the specimen on the measuring bar at a specified *bending angle* (3.2), *bending length* (3.3) and *bending rate* (3.4)

3.2
bending angle
angle at which the *bending force* (3.1) is measured

3.3
bending length
length around which the specimen is bent

Note 1 to entry: The bending length is the distance between the clamping device of the specimen and the bar onto which the force of the specimen is transferred.

3.4
bending rate
rate of bending of the specimen

Note 1 to entry: The bending rate is expressed in degrees per second (°/s).

3.5
compression bending
compression of the grain side or coating layer of the leather during bending

3.6
extension bending
extension of the grain side or coating layer of the leather during bending

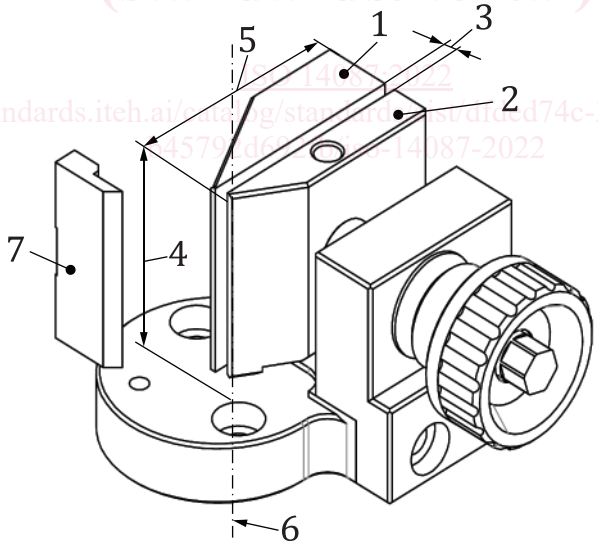
4 Principle

The bending force is determined based on the bar method (two-point bending method). In this method, the specimen is clamped in a rotating fixture. During the rotation, the specimen exerts a force onto a bar. The force acting at a specified bending angle is measured.

5 Apparatus

5.1 Device for determining the bending force according to the bar method (two-point bending method) comprising the following:

5.1.1 Clamping mechanism, in which the specimen shall be able to be clamped vertically. The clamping jaws shall have a depth of (35 ± 1) mm and a minimum width of at least 30 mm (see Figure 1). The clamping device shall enable parallel clamping with an even pressure distribution on the specimen. It shall move smoothly and allow tightening at a known clamping pressure, i.e. by a torque wrench or any other adapted method. The clamping device shall allow for affixing the specimen without it touching the bar in its initial position.



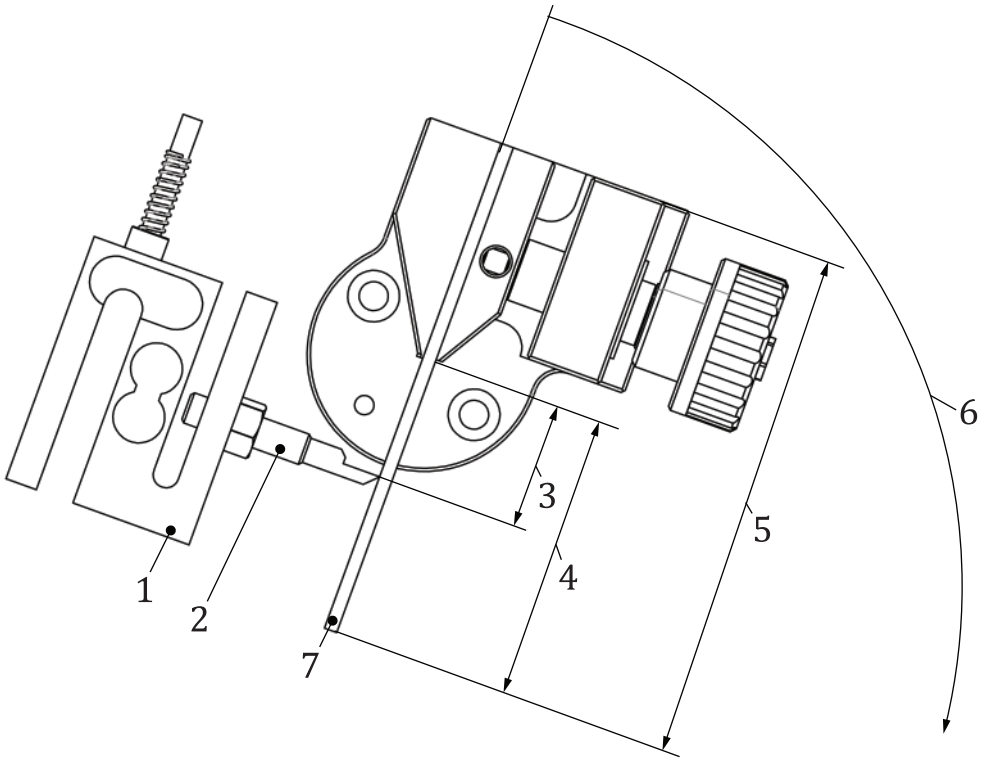
Key
1 fixed clamping jaws
2 moving clamping jaws
3 aperture > 6 mm
4 jaw width > 30 mm
5 jaw depth (35 ± 1) mm
6 pivot axis
7 vertical metering bar

Figure 1 — Clamping jaws

5.1.2 Means for rotating the clamping device about the pivot axis. The pivot axis is located exactly at the front edge of the fixed clamp (deviation of ± 0,1 mm; see Figure 1). Rotation shall be possible within the range of 1° to 91° with a maximum deviation of 1,5 %. The rotational speed shall be able to be adjusted up to 10°/s with an accuracy of 0,1°/s. At maximum load, the maximum deviation of the rotational speed allowed is 1 %.

5.1.3 Means of measuring the bending force (see Figures 2 and 3). The rotation of the specimen causes it to be pressed against a vertical metering bar. The bar is connected to a load cell that allows measurement of forces up to 10 N (optionally, 1 N for very flexible materials) with an accuracy as specified by class 2 of ISO 7500-1:2018. The bar design shall exhibit a sharp edge (R = 0,05 ± 0,01 mm) and a width of at least 30 mm. The weight of the bar shall not influence the measured value by more than 1 % of its reading.

The distance between the bar and the pivot point shall be adjustable in a range from 0,1 mm to 50 mm with an accuracy of 0,1 mm. At the start of the measurement, the specimen is moved towards the bar until contact is made and a defined preliminary force is reached. This preliminary force shall be able to be adjusted with an accuracy of 1 mN. When the preliminary force is reached, the measurement shall start, i.e. angle = 0° and force = preliminary force setting. The evaluation unit shall ensure measurement of the force at one or more previously defined angles. These angles shall not be identical to the maximum angle of rotation. The measuring apparatus shall ensure that all significant parameters (force, length, speed) can be checked, calibrated and restored. It is recommended that the measured data (raw data and parameter settings) are able to be electronically archived.



Key

1 load cell
2 vertical metering bar
3 bending length – adjustable
4 free sample length
5 sample length
6 rotating direction
7 sample

Figure 2 — Clamping jaws with specimen, load cell and bar with sharp edge

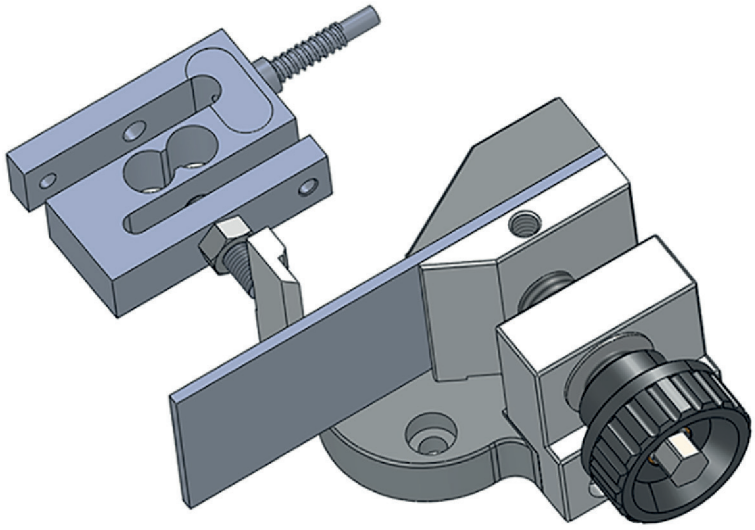


Figure 3 — 3D drawing of clamping jaws with specimen, load cell and bar

NOTE An example of a commercial source for suitable devices is FRANK-PTI GmbH, Auf der Aue 1, D-69488 Birkenau, Germany, www.frank-pti.com. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

5.2 Torque wrench, suitable for a range from 0,05 Nm to 0,2 Nm with an accuracy of 0,01 Nm.

5.3 Press knife, as specified in ISO 2419 for the corresponding specimen size.

6 Sampling and sample preparation

Sampling shall be carried out according to ISO 2418, if possible, and conditioning shall be carried out according to ISO 2419. The dimensions of the specimens shall be taken from the relevant parameter sets (see Table 1). Other dimensions are permissible but shall be indicated in the test report. Cut at least three test specimens parallel with and perpendicular to the backbone. Other sampling angles (e.g. diagonal) are also permissible and details shall be given in the test report. If the orientation of the backbone is unknown, each specimen shall be taken in two directions running perpendicular to each other.

Define and mark clearly the side which is extended during the test. This side is pressed by the bar during the test.

If both the compression and extension bending tests are to be conducted on the leather sample, an additional three specimens shall be used for each sampling direction.

7 Test procedure

7.1 Each specimen shall be tested only once and shall then be discarded. The specimen shall be carefully clamped into the test device such that the free-standing part of the specimen corresponds to the clamping length specified in Table 1. The marked side shall be pressed by the bar during the test. A torque wrench (5.2) with a setting of 0,08 Nm shall be used to tighten the clamping jaws. Then the test shall be started with one of the specified parameter sets as specified in Table 1. If no set is specified, use set A as the standard set. The measurement starts at 0° when the specified preliminary force is reached. The measured forces shall be recorded at the required bending angle.

Both extension and compression bending of the grain or coated layer side is possible. For the extension bending test, the leather specimen shall be inserted so that the bar will press on the grain or coated layer side. For the compression bending test, the leather specimen shall be inserted so that the bar will press on the flesh or back side.

Table 1 — Set of parameters

	Set of parameters		
	A (standard)	**B**	**C**
Bending length (mm)	5	10	15
Free clamping length (mm)	15	20	25
Measurement in bending angle of (°)	60	60	60
Bending up to an angle of (°)	63	63	63
Bending rate (°/s)	1,5	1,5	1,5
Bending rate up to preliminary force (°/s)	1,5	1,5	1,5
Dimensions of sample (width × length) (mm)	30 × 50	30 × 55	30 × 60
Preliminary force (mN)	3	3	3

Unless otherwise specified, express the bending force in millinewtons (mN) with three significant digits and calculate the mean value for all sampling directions (using all individual values). For measurements

testing both bending parameters of the material (compression and extension), mean values for each bending parameter shall be calculated separately. The mean values shall be given in the test report.

7.2 Measure the thickness of the leather in accordance with ISO 2589. The same specimens used for the measurement of flexural properties can be used. In this case, the thickness shall be measured after the measurement of flexural properties.

8 Test report

The test report shall include the following:

a) reference to this document (i.e. ISO 14087:2022);

b) a description of the test specimen(s);

c) the mean value of the thickness;

d) the parameter set used for measurement;

e) the indication of which side was measured under compression and/or extension;

f) the mean value of bending force in mN with three significant digits for the test with compression and/or for the test with extension;

g) any deviations from this document;

h) the date of the test.