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ISO 5403-2

IULTCS/IUP 10-2

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Leather — Determination of water resistance of flexible leather —

Part 2: Repeated angular compression (Maeser)

Cuir — Détermination de l'imperméabilité à l'eau des cuirs souples —

Partie 2: Compression angulaire répétée (Maeser)

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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 5403-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 289, *Leather*, in collaboration with the Physical Test Commission of the International Union of Leather Technologists and Chemists Societies (IUP Commission, IULTCS), in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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.

ISO 5403 consists of the following parts, under the general title *Leather — Determination of water resistance of flexible leather*:

— *Part 1: Repeated linear compression (penetrometer)*

— *Part 2: Repeated angular compression (Maeser)*

Leather — Determination of water resistance of flexible leather —

Part 2:
Repeated angular compression (Maeser)

1 Scope

This part of ISO 5403 specifies a method for determining the dynamic water resistance of leather by means of repeated angular compression. It is applicable to all flexible leathers but is particularly suitable for leathers intended for footwear applications. It uses a Maeser-type machine and includes an option for electronic detection.

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 3696:1987, *Water for analytical laboratory use — Specification and test methods*

3 Principle

A square test specimen is folded and secured in two V-shaped clamps which have closed ends so as to form a trough. The trough is then immersed in water and the clamp at one end oscillates at a constant speed so that the specimen is repeatedly flexed. The test is stopped at the first sign of water penetration through the test specimen or by means of electronic detection.

NOTE This test method uses folding-type flexing, whereas the test method of ISO 5403-1 for water resistance imparts compression-type flexing on the leather specimens. Given the two completely different flexing actions, it is not possible to compare the results obtained from the two test methods.

4 Apparatus, reagents and materials

Usual laboratory apparatus is required and, in particular, the following.

4.1 Maeser-type machine, whith one or more pairs of V-shaped clamps, which are set 63 mm ± 3 mm apart in the same horizontal plane, into which the test specimen can be clamped.

4.1.1 Each clamp shall have two parts as described in 4.1.1.1 and 4.1.1.2.

4.1.1.1 An outer part comprising a “V” form with an internal angle of 31° ± 1°, an internal tip radius of 7,5 mm ± 0,5 mm and a closed back to the “V” which is impermeable to water.

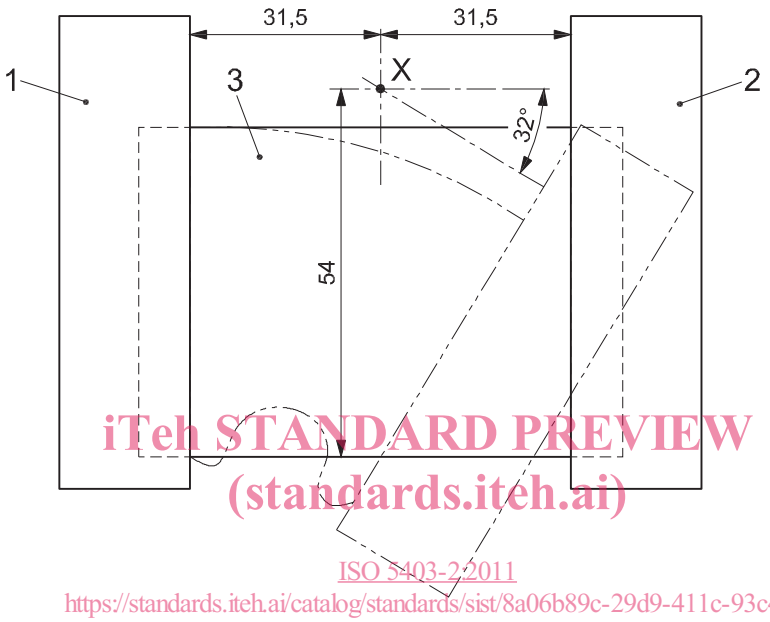
4.1.1.2 An inner part having the shape and size that shall complement the outer part.

4.1.2 One clamp is stationary.

4.1.3 One clamp shall pivot about a point X which is midway (31,5 mm ± 1,5 mm) between the clamps such that the lower end of the clamps move together (see Figure 1).

4.1.4 The pivot point X (see Figure 1) shall be 54,0 mm ± 0,5 mm above the internal face of the clamp at the tip of the "V" and the flexing angle through which the clamp moves shall be 32° ± 2°.

Dimensions in millimetres



Key

1 stationary clamp
2 moveable clamp
3 test piece
X pivot point

Figure 1 — Side view of test specimen in V-shaped clamps
(tolerances on dimensions given in the text)

4.1.5 A method of applying a simple harmonic motion to the moveable clamp (4.1.3) so that it pivots toward the stationary clamp (4.1.2) and back to its original position at a rate of (90 ± 5) cycles/min.

4.1.6 A means of counting the number of cycles of the moveable clamp (4.1.3).

4.1.7 A method of containing a fixed quantity of water or electrolyte (4.3) around the two clamps (4.1.2 and 4.1.3) so that the water level can be adjusted to the recommended height.

4.2 Press knife, conforming to the requirements of ISO 2419, or other cutting device, capable of cutting square test specimens at least 100 mm × 100 mm so that they fit correctly into the V-clamps and can be fixed so no water penetrates at the edge during the flexing.

4.3 Distilled or **deionized water** at (20 ± 5) °C, of grade 3 in accordance with ISO 3696, or, if electronic detection is used, an electrolyte comprising **1 g/l sodium chloride solution** at (20 ± 5) °C.

4.4 Thin strips of compressible impermeable material, such as soft rubber or plasticine, of width approximately 10 mm and thickness approximately 1 mm, may be necessary to prevent water seeping between the test specimen and the clamps (4.1.2 and 4.1.3).

4.5 Rubber solution, or a similar type of compound, which may be necessary for sealing the edges of the test specimens.

4.6 Electronic detection, if used.

4.6.1 Electrical system, using a high-potential electrode and a common electrode, and which shall stop the test when water penetration is detected as a fall in resistance between the electrodes to below 50 000 Ω. An electrolyte (4.3) in contact with the leather specimen shall form the common electrode. The high-potential electrode shall be in electrical contact with the steel balls (4.6.2).

4.6.2 Magnetic stainless steel balls, approximately 3 mm in diameter, to be maintained free of grease, oil, silicone and rust. Keep the balls clean by treating them with a suitable chemical, followed, by rinsing them with water and allowing them to air-dry.

NOTE Suitable cleaning chemicals are 5 % nitric acid or acetone.

4.7 Abrasive paper, grade P180, as defined in the P-series grit-size standard published by the Federation of European Producers of Abrasive Products, cut into rectangles of 65 mm ± 5 mm × 45 mm ± 5 mm, fixed to a flat, rigid base of the same size and weighted to give a total mass of 1,0 kg ± 0,1 kg. A fresh piece of abrasive paper shall be used for each test.

4.8 Magnet, used to remove steel balls from sample.

4.9 Balance, with an accuracy of 0,01 g if water absorption required.

5 Sampling and sample preparation

5.1 Sample in accordance with ISO 2418. Use the press knife (4.2) to cut two square test specimens of at least 100 mm × 100 mm so that one side of each specimen is parallel to the principal direction of the material.

5.2 Mark the principal direction of the material on each test specimen.

5.3 If it is considered that the test specimens are virtually impermeable through their thickness, but may be prone to wicking along their length, seal all four edges of both test specimens with the rubber solution (4.5).

5.4 Store the test specimens in a standard controlled environment according to ISO 2419 for at least 48 h. It is not necessary to carry out the test in this atmosphere.

6 Pre-treatments to simulate wear

If considered appropriate, samples can also be tested after light buffing with an abrasive paper using the following technique.

Lightly buff the grain (or the outer surface when worn) by placing the test piece grain (or the outer surface when worn) upwards on a flat surface. Place the weighted abrasive paper (4.7) on the test piece and move the abrasive paper ten times backwards and forwards along the full length of the test piece without applying any more downward force than is applied by the weighted abrasive.

NOTE In some situations, it might be more appropriate to flex a sample for 20 000 cycles using the method and apparatus specified in ISO 5402-1.

Many leathers have a surface coat on the grain or on the outer surface when worn. This surface coat greatly increases the water resistance of the leather. If microcracks develop rapidly in this coat as a result of flexing during wear or if the coat is damaged by abrasion, then measurements made on the leather as received can be misleading. The abrasion and flexing treatments described above are intended to simulate the abrasion which the leather would receive while being worn and the test piece should therefore be abraded or flexed before the test. The purpose of this abrasion is not to remove the surface coat but merely to scratch it lightly.

7 Procedure

7.1 Adjust the test machine (4.1) so that a pair of clamps (4.1.2 and 4.1.3) have their tips at maximum separation and in the same horizontal plane.

7.2 If it is considered that the test specimens are virtually impermeable through their thickness, but may be prone to wicking along their length, place a thin strip of compressible impermeable material (4.4) in each of the clamps (7.1) in the area where the test specimen will be bedded down. This will help to prevent water seeping between the test specimen and the clamps (4.1.2 and 4.1.3) during the test.

7.3 Weigh the test specimens if water absorption is required.

7.4 Fold, without creasing, one test specimen in half so that the outer surface is facing outwards and the fold is parallel to the principal direction of the material.

7.5 Place the folded test specimen (7.4) between the pair of clamps (7.1) so that the fold runs between the tips of the Vs.

7.6 Fully tighten one of clamps, ensure that the test specimen is not slack, and then fully tighten the other clamp.

7.7 Slowly move the clamps together and watch the specimen to ensure that the centre section folds upwards. If this is not the case, gently apply pressure to the underside at the centre of the fold as the clamps move together to form an upward fold.

7.8 If the test machine (4.1) has a second pair of clamps, repeat the procedure in 7.1 to 7.7 for the other test specimen, but this time fold the specimen at 90° to the principal direction of the material.

7.9 If electronic detection is used, place a sufficient quantity (approximately 140 g) of steel balls (4.6.2) inside the V formed by the test specimen and insert the high-potential electrode ensuring that electrical contact is made with the steel balls.

7.10 Fill the container (4.1.7) with water or electrolyte (4.3) and adjust the level so that it is above the centre of the upward fold (see 7.7). During this stage, it is recommended that a wad of absorbent tissue be put in the trough formed by the clamped test specimen as a precaution against accidentally splashing water onto the reverse surface of the specimen. This wad should be removed from the specimen after the water level has been adjusted.

7.11 Immediately zero the counter, activate the electronic detection system (if used) and start the test machine (4.1).

7.12 If electronic detection is used, go to 7.13; otherwise observe the test piece continuously for the first 15 min, then at intervals of 15 min until water is seen to penetrate through the test piece. If the material continues to resist penetration, the inspection intervals may be increased. Do not stop the machine when making the inspections. If water penetrates between the test piece and the clamps, reject the result and repeat the determination using a fresh test piece.

NOTE Penetration usually occurs initially at the two ends of the centre fold and might be seen as a damp patch or as a droplet (or droplets) of water formed on the surface. The droplets are often easier to see using a suitable light source.

7.13 At the first sign of valid water penetration through the test specimen, record the number of cycles completed by the movable clamp. When penetration occurs during a period of intermittent inspections, record both the number of cycles of the last inspection stage before penetration and the first inspection stage after penetration.

7.14 Continue the test until penetration of all test specimens has occurred and record the number of cycles to penetration for each specimen. If no penetration has occurred after 24 h, stop the test.

7.15 If the test machine has only one pair of clamps, repeat the procedure in 7.1 to 7.14 with the second test specimen folded in 7.4, this time at 90° to the principal direction of the material.

7.16 The water or electrolyte (4.3) shall be changed after each test.

7.17 To determine water absorption, remove the test specimens from the machine, blot with absorbent paper, and weigh to the nearest 0,01 g.

8 Calculation and expression of results

8.1 Water absorption

If water absorption is required, calculate the percentage water absorption, w_a, as follows.

$$w_a = \frac{(m_1 - m_0) \times 100}{m_0}$$

where

m_1 is the mass of specimen after flexing, in grams;

m_0 is the mass of specimen before flexing, in grams.

8.2 Water penetration

The penetration of water is expressed as the number of cycles after which the water penetration is visually or electronically noted.

9 Test report

The test report shall include the following information:

a) a reference to this part of ISO 5403, i.e. ISO 5403-2:2011;

b) a description of the type of leather used;

c) the conditions in ISO 2419 used to condition the test specimens, if different from reference standard conditions;

d) details of any pre-treatment;

e) the method of detection of water penetration: visual or electronic;

f) for each test specimen:

   1) the test direction;

   2) the number of cycles after which water penetration first occurred or, when penetration occurs during a period of intermittent inspections, record both the number of cycles of the last inspection stage before penetration and the first inspection stage after penetration (7.13);

g) details of any deviations from the procedure, or special circumstances which may have affected the results;

h) mass, or percentage of water absorbed, if requested.