Measurement of Surface Friction

1   Scope

This IULTCS standard specifies a method for determining the coefficient of friction of the surface of leather. It is applicable to all types of leather.

2.   Normative References

The following standards contain provisions which through reference in the text constitute provisions of this IULTCS Standard. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this IULTCS Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

IUP 1   General Remarks

IUP 2   Sampling

IUP 3   Conditioning

EN 7500-1 : 1999   Metallic materials - Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines

EN ISO 13000-1 : 1997 Plastics, polytetrafluoroethylene (PTFE) semi-finished product. Requirements and designation

3   Principle

A leather sample is attached to a smooth surface of a sledge. This is placed on the level surface of a specified reference material. The static coefficient of friction between the two surfaces is determined from a measurement of the force required to initiate movement of the mass. The dynamic coefficient of friction is determined from the average force required to maintain movement.

4   Apparatus

4.1 *Material testing machine,* capable of producing a uniform speed of 480 mm/min ± 20 mm/min. The force range should be appropriate to the specimen under test (maximum 50 N is suggested). A means of recording the force to an accuracy of at least 2 % as specified by class 2 of EN ISO 7500-1 and a means of recording the force-extension curve is also required.

4.2 *A horizontal fixed test platform* of approximately 500 mm ± 2 mm by 100 mm ± 2 mm, with a means of securing the reference material **(4.3)** at all edges. The platform should be equipped with a low friction pulley to allow the application of a horizontal force to the test sledge **(4.4)** on the platform. A phenolic-type pulley mounted in hardened steel cone bearings on a metal fork, or a ball-bearing type pulley may be used.

> Note: Any frictional forces resulting from a pulley system must be minimal and not in excess of ± 2 % of the measured force.

4.3 *A reference material consisting of a100% virgin polytetrafluoroethylene (PTFE)* sheet, manufactured to the specification of EN ISO 13000-1, placed on top of the platform **(4.2)**. A thickness of approximately 1 mm or greater shall be used to avoid any creases. Other materials may be used and they must be specified in the test report **(8)**, as they will significantly affect the test results.

4.4 *A rectangular test sledge* which exerts a normal force of 15 N ± 0,3 N. The sledge should have a means of securing a leather test piece lengthways at both ends, ensuring the sample is held flat, and should result in the leather having a contact area of 150 mm ± 2 mm by 40 mm ± 2 mm with the reference material **(4.3)**. For heavier leathers an alternative means of securing the leather to the sledge may be required (e.g. adhesive). A means of attaching a connecting line **(4.5)** to the motional cross head of the materials testing machine **(4.1)** is also required.

4.5 *A light, inextensible line,* (e.g. fishing line) to attach the sledge **(4.4)** to the materials testing machine **(4.1)**. The extension of the line and any connections shall be less than 2 % at 50 N.

4.6 *Press knife,* the inner wall of which is a rectangle of width 40 mm ± 1 mm and approximately 250 mm as specified in IUP 1.

> Note: The longest dimension will depend upon the method of securing the sample.

5 Sampling and sample preparation

5.1 Sample in accordance with IUP 2. Cut 6 test pieces by applying the press knife **(4.6)** to the grain surface. Cut three test pieces with the longer sides parallel to the backbone and three with the longer sides perpendicular to the backbone.

> NOTE 1: In the case of small skins, the number of test pieces may have to be reduced because of the size of the test piece.

> NOTE 2: If there is a requirement for more than two hides or skins to be tested in one batch, then only one sample 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.

5.2 Condition the test pieces in accordance with IUP 3.

6 Procedure

6.1 All testing should be carried out in a standard atmosphere as specified in IUP 3.

6.2 Attach the test platform **(4.2)** to the materials testing machine ensuring it is level.

6.3 Secure the PTFE reference material **(4.3)** to the test platform. This also must be level.

6.4 Connect the test sledge **(4.4)** to the motional cross head of the materials testing machine **(4.1)** using a line **(4.5)** via the pulley system. The line should be adjusted to be taut when the sledge is placed at the furthest end of the test platform.

6.5 Secure a test piece to the test sledge **(4.4)** with the surface to be tested remaining exposed.

6.6 Place the test sledge **(4.4)** at the furthest end of the test platform **(4.2)** with the test piece in contact with the reference material. Ensuring that the line **(4.5)** is initially taut, move the sledge towards the pulley by approximately 3 mm thus allowing the line to go slack.

6.7 The materials testing machine **(4.1)** should run to give a total displacement of 100 mm whilst recording the force/displacement curve.

6.8 From the force/displacement plot determine the maximum initial force required to move the sledge **(4.4)**.

6.9 From the force/displacement plot determine the mean force between 20 mm and 90 mm displacement, i.e. the force required to maintain the sledge movement.

7   Expression of results

7.1 Static Coefficient of Friction

The static coefficient of friction (μ_s) shall be calculated using the formula:

$$\mu_s = \frac{F}{N}$$

where:

μ_s is the static coefficient of friction.
F   is the force required to initiate movement in the sledge in Newtons (as determined in **6.8**).
N   is the normal force of the sledge (i.e. 15 N).

7.2   Dynamic Coefficient of Friction

The dynamic coefficient of friction (μ_d) shall be calculated using the formula:

$$\mu_d = \frac{F}{N}$$

where:

μ_d is the static coefficient of friction.
F   is the force required to maintain movement of the sledge in Newtons (as determined in **6.9**).
N   is the normal force of the sledge (i.e. 15 N).

8   Test report

This procedure allows the determination of both static and dynamic coefficients of friction. It should however be noted that experimental evidence has shown the dynamic coefficient of friction (as measured by this method) to be a less variable parameter than the static coefficient. The dynamic coefficient of friction should therefore be reported in preference.

The test report shall include the following

a) reference to this IULTCS standard;
b) the dynamic coefficient of friction (μ_d) (mean value) and/or the static coefficient of fiction (μ_s) (mean value);
c) the standard atmosphere used for conditioning and testing, as given in IUP 3; (i.e. 20 °C/65 % rh, or 23 °C/50 % rh);
d) any deviations from the method specified in this IULTCS standard;
e) full details for identification of the sample and any deviations from IUP 2 with respect to sampling.