KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Leather Engineering

Sample Sessional Report

1.0 Abstract/Introduction: Here summarize four essential aspects of the report:

- The purpose of the experiment (sometimes expressed as the purpose of the report),
- Key findings,
- Significance and
- Major conclusions.

The abstract often also includes a brief reference to theory or methodology. The information should clearly enable readers to decide whether they need to read your whole report. The abstract should be one paragraph of 100-200 words. The Abstract is a miniature version of the lab report.
Using any type of figures or tables or equations here is prohibited.

2.0 Objectives: Write down the objectives of the experiment point by point as

(i)
(ii)
(iii)

3.0 Materials & Equipment: It can usually be a simple list, but make sure it is accurate and complete. Write down all the equipment's and specimen/raw materials that is used to perform the experiment.

3.1 Materials:

(i)
(ii)

3.2 Equipment:

(i)
(ii)

4.0 Methodology:

4.1 Theory: It includes all theories and hypothesis that are used in the experiment. Rules and laws that is used to get the result. All figures should be named specifically beneath the figure as Figure 1, Figure 2, and Figure 3.

Equations must be referenced as

$$hL = (V1 - V2)22g \text{ --- (1)}$$

(N.B: The name of the book/Paper/Journal/Internet from where the equation is cited here should be provided in the reference section as 1.)

5.0 Experimental Data:

5.1 Data: All experimental data should be provided here with sufficient tables. Tables should be specified by their relevant name in the top of the table. (Such as Table 1; Table 2.)

5.2 Calculation: All calculations should be given here with necessary laws that already have been provided in the methodology section.

6.0 Result Interpretation & Discussion:

6.1 Result Interpretation: These are usually dominated by calculations, tables and figures; however, you still need to state all significant results explicitly in verbal form, for example:

Using the calculated lattice parameter gives, then, R = 0.1244nm.

Graphics need to be clear, easily read, and well labeled (e.g. Figure 1: Input Frequency and Capacitor Value). An important strategy for making your results effective is to draw the reader's attention to them with a sentence or two, so the reader has a focus when reading the graph. In most cases, providing a sample calculation is sufficient in the report.

6.2 Discussion: It is the most important part of your report, because here, you show that you understand the experiment beyond the simple level of completing it. Explain. Analyze. Interpret. Some people like to think of this as the "subjective" part of the report. By that, they mean this is what is not readily observable.

More particularly, focus your discussion with strategies like these:

- Compare expected results with those obtained.
- Analyze experimental error.
- Explain your results in terms of theoretical issues.
- Relate results to your experimental objective(s).
- Compare your results to similar investigations.
- Analyze the strengths and limitations of your experimental design.

7.0 Conclusion:

It can be very short in most undergraduate laboratories. Simply state what you know now for sure, as a result of the lab. Generally, this is enough; however, the conclusion might also be a place to discuss weaknesses of experimental design, what future work needs to be done to extend your conclusions or what the implications of your conclusion are.

8.0 Reference:

This is a list of the references that were cited in the lab report, including the lab manual, any handouts accompanying the lab, the textbook, and sources from the scientific literature. The format for references differs in different fields and even within the same field. It's important that you check with you teacher or lab manual to find out what is expected of you.

As in order: Author name, Book name, Publication name, Place of publication, year of publication

Example:

1. Modi, Dr. P.N. and Seth, Dr. S.K., "Hydraulics and Fluid Mechanics Including Hydraulic Machines (In SI Units)", Standard Book House, Nai Sarak, Delhi-110006 (India), New Edition, 2005-2006.

2. Bentley, J., "Principles of Measurement Systems", NewYork, Longman: Scientific and Technical (1988).

(e.g.: So the equation $hL=(V1-V2)22g$ is available in the book of P.N Modi)

Testing of leather & Allied Materials

LE 4214

1. Determination of sampling location of hides & skins for chemical, physical and fastness test

International Standard: ISO 2418 IULTCS/IUP2 and IUC2

1. Scope

This International Standard specifies the location of a laboratory sample within a piece of leather and the method of labeling and marking the laboratory samples for future identification.

It is applicable to all types of leather derived from mammals irrespective of the tanning used.

It is not applicable to leathers derived from birds, fish or reptiles.

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.

3. Terms and definitions

For the purposes of this document, the terms and definitions given in the "International Glossary of Leather Terms" apply together with the following definition.

3.1 Laboratory sample:

Sample taken from the areas specified in clause 4 of this International Standard

4. Location of laboratory samples

4.1 General

4.1.1 Selection of samples

4.1.1.1 Areas selected for laboratory samples shall be free from all obvious defects such as scratches and flay cuts.

4.1.1.2 The sampling procedures described are designed to allow concurrent physical, color fastness and chemical testing.

4.1.2 Sampling for physical and colour fastness testing

For physical and colour fastness testing take leather samples from the non-shaded areas specified in Figures 1 to 4 as appropriate.

4.1.3 Sampling for chemical testing

4.1.3.1 For chemical testing take leather samples from the shaded area specified in Figures 1 to 4 as appropriate.

4.1.3.2 If the minimum mass required for chemical testing is not attained, sample from the corresponding area on the other side of the backbone. If this is impossible, take additional material from the area immediately adjacent to the sampling position.

4.1.3.3 Uncontaminated trimmings from physical test pieces may be used for chemical testing except in arbitration analysis. In arbitration analysis, only leather samples taken from the appropriate shaded areas shall be used as the chemical test sample.

4.2 Whole hides, skins and sides

Take the non-shaded square piece GJKH and/or the shaded square piece HLMN shown in Figure 1. In small skins the distances EF and JK can be shorter than the length required for a single sample. When sampling small skins modify the method of sampling using the minimum deviation from this procedure.

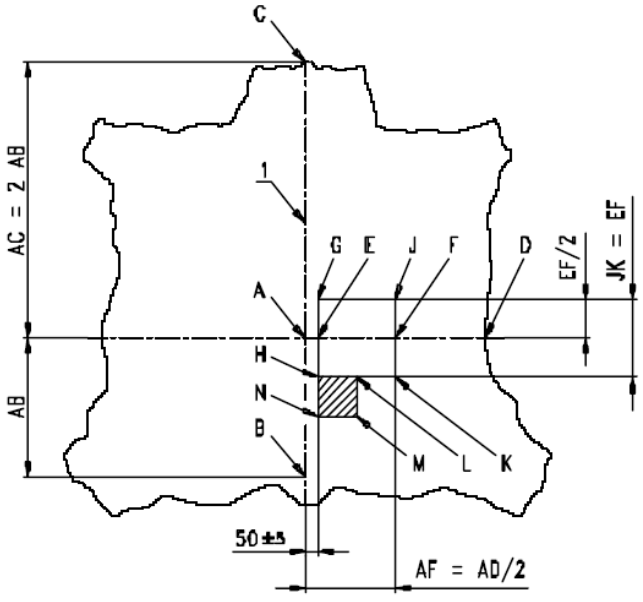


Fig.1 Representation of a hide or skin with the head removed showing sampling location for whole hides, skins and sides

Key Guideline

1 Backbone

B is the root of the tail

AD is a line perpendicular to BC

The lines GH and JK are parallel to BC

$$AC = 2AB$$
$$AF = FD$$
$$JK = EF$$
$$GE = EH$$
$$HL = LK = HN$$
$$AE = 50 \text{ mm} \pm 5 \text{ mm}$$

4.3 Bends and butts

Take the non-shaded square piece GJKH and/or the shaded square piece HLMN shown in Figure 2.

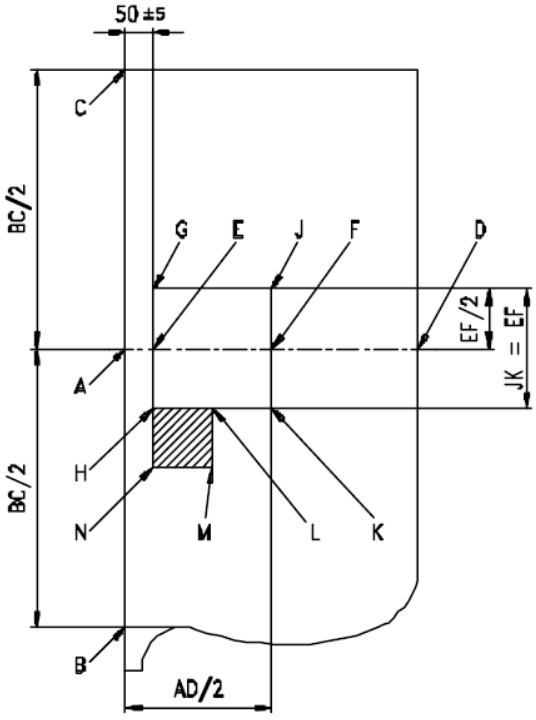


Fig.2 Representation of a bend showing sampling location for bends (or butts)

Key Guideline

B is the root of the tail

AD is a line perpendicular to BC

The lines GH and JK are parallel to BC

$$CA = AB$$

AF = FD

JK = EF

GE = EH

HL = LK = HN

AE = 50 mm ±5 mm

4.4 Shoulders

Take the non-shaded rectangular piece ABCD and/or the shaded square piece AEFG shown in Figure 3.

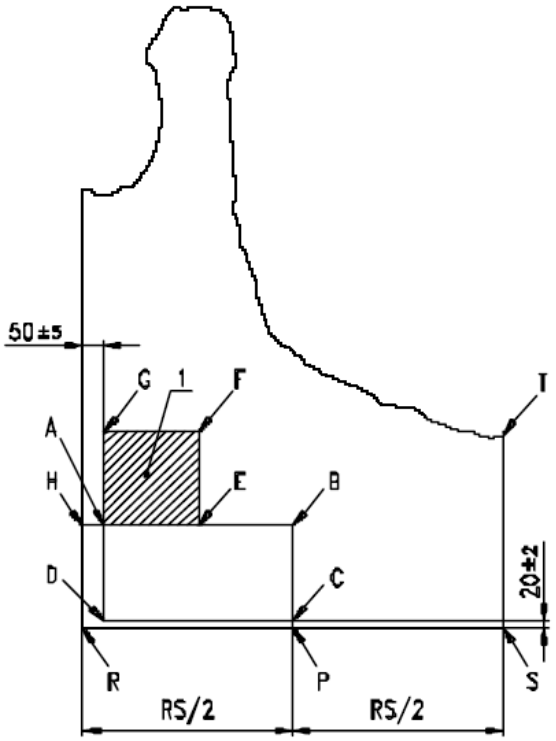


Fig.3 Representation of a shoulder showing sampling location for shoulders

Key Guideline

1 Shoulder

DC is a line parallel to RS

BCP is a line parallel to the backbone

AB is parallel to DC

RP = PS

DC = 2AD

AE = EB = AG

CP = 20 mm ±2 mm

AH = 50 mm ±5 mm

4.5 Bellies

Take the non-shaded rectangular piece GJKH and/or the shaded square pieces LMNG and HPQR shown in Figure 4.

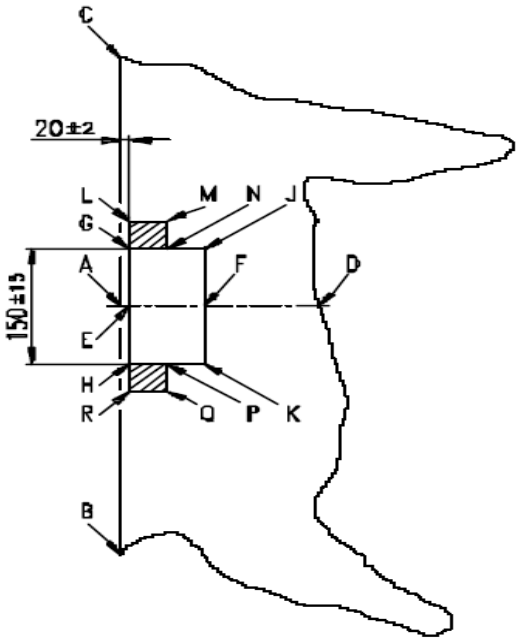


Fig.4 Representation of a belly showing sampling location for bellies

Key Guideline

AD is a line perpendicular to BC

CA = AB

GE = EH = EF

LG = HR = GH/4

LG = GN = HP

GH = 150 mm±15 mm

AE = 20 mm±2 mm

5. Storage of laboratory samples

Store laboratory samples in such a way as to avoid contamination and the effects of localized heating.

6. Identification of laboratory samples

6.1 Marking of the direction of the backbone

Mark the direction of the backbone by an arrow pointing towards the head positioned along the edge of the sample nearest to the backbone.

6.2 Marking

Mark the laboratory sample with the following information:

1. Reference number of the batch of leather;
2. Date of sampling;
3. Reference number of the sample (if any);
4. The number and the date of this International Standard, i.e. ISO 2418 : 2002;
5. Any deviation from the sampling procedure specified in this International Standard (see 4.2).

2. Sample preparation & conditioning of leather for physical and mechanical test (Part-2.1)

International Standard: ISO 2419:2002

1. Scope

This International Standard specifies the preparation of leather test pieces for physical and mechanical testing together with two standard atmospheres for conditioning and testing. It is applicable to all types of dry leather.

2. Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1 Atmosphere

Ambient conditions defined by the parameters temperature and relative humidity

2.2 Standard atmospheres

Atmosphere maintained within prescribed tolerances, in which a test piece is kept for a given period of time before being subjected to testing

2.3 Conditioning

Operation designed to bring a test piece into a specified condition in relation to temperature and relative humidity by keeping it for a given period of time in the standard atmosphere with free access of moving air to all surfaces

3. Standard atmospheres

The standard atmospheres and tolerances shall be as given in Table 1.

Table 1 Standard atmospheres and tolerances

Designation	Temperature °C	Relative humidity %
23/50	23 ± 2	50 ± 5
An alternative, but not equivalent, set of conditions may be used.		
20/65	20 ± 2	65 ± 5

4. Design of press knives

The design of press knives is shown in Figure 1. The internal surfaces shall be perpendicular to the plane which contains the cutting edge. The angle formed between the internal and

external surfaces of the press knife at the cutting edge shall be 20° ± 1°, and the wedge of this angle shall be of a depth (d) exceeding the thickness of the leather.

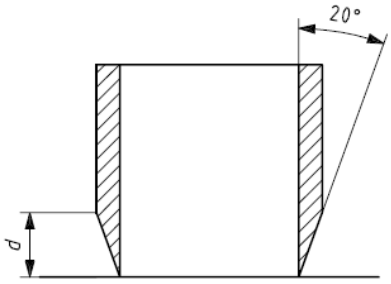


Fig.1 Design of press knives

5. Preparation of test pieces

Prepare test pieces by applying the press knife to the grain surface (or simulated grain surface) if present. If no grain or simulated grain is present, apply the press knife to either surface. If preferred, leather may be conditioned (see Clause 6) before test pieces are prepared.

6. Conditioning

Condition the test piece by keeping it in one of the standard atmospheres specified in Table 1. Support the test piece to allow free access of air to all surfaces, keeping the air in motion around the test piece (see 2.3). Condition the test pieces for a minimum of 24 h prior to testing.

7. Testing

Carry out the testing in the same standard atmosphere as that in which the test piece was conditioned unless otherwise specified in the individual test method.

8. Test report

The test report shall include the following:
a) Reference to this International Standard; i.e. ISO 2419:2006;
b) If the alternative atmosphere is used for conditioning and testing, as given in this International Standard, i.e. 20 °C/65 % relative humidity;
c) Any deviations from the method specified in this International Standard;
d) Full details for identification of the sample and any deviations from ISO 2418 with respect to sampling.

2. Determination of thickness of leather for physical and mechanical tests(Part-2.2)

International Standard: ISO 2589:2002

1. Scope

This International Standard specifies a method for determining the thickness of leather. The method is applicable to all types of leather of any tannage. The measurement is valid for both the whole leather and a test sample.

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

3. Principle

The leather is placed in a gauge under a specified load for a specified time and the thickness read directly.

4. Apparatus

4.1 Test machine, including the following:

4.1.1 Gauge, graduated to read to 0.01 mm directly with an accuracy of + 0.02 mm over the whole scale length.

4.1.2 Anvil, comprising the flat horizontal surface of a cylinder of diameter 10.00 mm ±0.05 mm projecting 3.0mm±0.1 mm above the surface of a concentric flat circular platform of diameter 50.0 mm±0.2 mm.

NOTE: The circular platform of 50 mm diameter helps to support medium weight leathers which might otherwise present a convex surface to the presser foot. The anvil is raised 3 mm above the platform so that errors are avoided in measurements on heavy leathers which are not flat.

4.1.3 Pressure foot, having a flat circular surface of diameter 10.0 mm±0.05 mm, coaxial with the anvil and capable of movement normal to the face of the anvil. The contacting surfaces of

the anvil and presser foot shall be dead weight loaded with 393g±10g. Movements of the pressure foot shall give a direct reading of the movement on the gauge (4.1.1).

4.1.4 Rigid stand, to hold the gauge (4.1.1), anvil (4.1.2) and presser foot (4.1.3).

5. Sampling and sample preparation

5.1 Official sample in accordance with ISO 2418. 5 measurements to be taken, distributed across the sample.

5.2 Sample prepared for other tests. 3 measurements to be taken, distributed across the sample.

5.3 Sample of unknown origin. 5 measurements to be taken, distributed across the sample.

5.4 For very heavy, firm leathers, a smaller sample is recommended to avoid curvature. 3 measurements to be taken, distributed across the sample.

5.5 For whole hides, 5 measurements for each location should be taken.

Condition all samples in accordance with ISO 2419.

6. Procedure

Place the apparatus on a flat, horizontal surface. Place the sample in the gauge grain side up if this can be identified. If the grain cannot be identified place the sample in the gauge with either surface upwards. Apply the load gently and record the thickness 5s±1s after full loading is reached.

7. Expression of results

The results shall be expressed as the arithmetic mean and range to the nearest 0.01 mm.

8. Test report

The test report shall include the following:

a) Reference to this International Standard, i.e. ISO 2589:2002;

b) The results obtained expressed to the nearest 0,01 mm;

c) The standard atmosphere used for conditioning and testing as given in ISO 2419 (i.e. 20ºC/65 % rh, or 23ºC/50 % rh);

d) Any deviations from the method specified in this International Standard;

e) Full details for identification of the sample.

3. Determination of tensile strength and percentage of elongation at break of leather

International Standard: ISO 3376:2002

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.

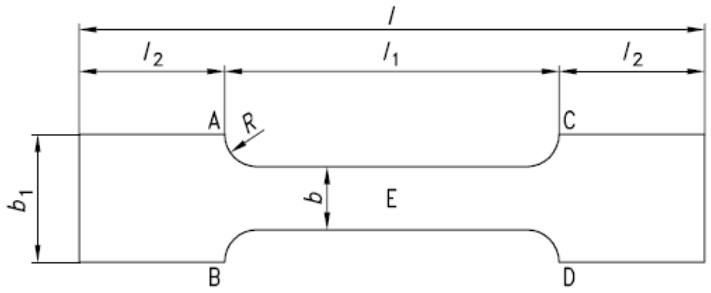


Fig.1 Shape of test piece

Table 1 Dimensions of test pieces

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 calipers, 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 lay 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, L1. 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, L2.

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, Tn, in Newton's per square millimeter shall be calculated using the equation:

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

Where,

F is the highest force recorded in Newton's;

w is the mean width of the test piece in millimeter's;

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

7.2 Percentage elongation caused by a specified load

The percentage elongation caused by a specified load, El, 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, Tn, in Newtons per square millimeter;
c. the mean percentage elongation at a specified load, El;
d. the mean percentage elongation at break, Eb;
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.

4. Determination of single tear load of leather

International Standard: ISO 3377-1:2002

1. Scope

This part of ISO 3377 specifies a method for determining the tear strength of leather using a single edged tear. The method is sometimes described as a trouser tear. 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 rectangular test specimen partially slit from one short edge is pulled so that a tear is propagated from the end of the slit. The mean force exerted during separation of the test piece is recorded.

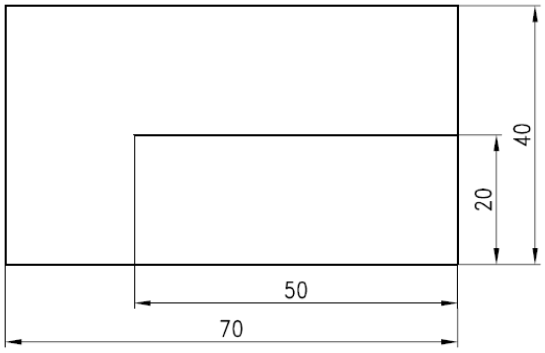
4. Apparatus

4.1 Tensile testing machine, with:

- A force range appropriate to the specimen under test;
- A means of recording the force to an accuracy of at least 2 % as specified by Class 2 of ISO 7500-1;
- A uniform speed of separation of the jaws of 100 mm/min ± 20 mm/min;
- A means of recording the force - e.g. as an extension curve;
- Jaws, minimum width 50 mm ±2 mm.

4.2 Thickness gauge, as specified in ISO 2589.

4.3 Press knife, as specified in ISO 2419, capable of cutting a test piece as shown in figure 1 in one operation. All parts of the press knife shall lie in the same plane.



(All dimensions in millimeters ±1 mm)

Fig.1 Test piece for single edge tear

5. Sampling and sample preparation

5.1 Sample in accordance with ISO 2418. From the sample, cut 6 test pieces in accordance with ISO 2419, 3 test pieces with the longer sides parallel to the backbone and 3 test pieces with the longer sides perpendicular to the backbone.

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.

5.2 Condition the test pieces in accordance with ISO 2419.

5.3 Measure the thickness of the test pieces in accordance with ISO 2589.

6. Procedure

6.1 Set the jaws of the tensile testing machine (4.1) 50 mm apart.

6.2 Clamp approximately 20 mm of one leg of the test piece in the lower jaw of the tensile test machine. Fold the other leg through 180º and clamp in the upper jaw. Ensure that the long edges of the test piece are parallel to the direction of traverse of the machine.

6.3 Run the tensile test machine until the test piece is torn apart and record the force-extension plot.

6.4 To determine the arithmetic mean of the forces, divide the peak trace, beginning with the first peak and ending with the last peak, into four equal parts. The first and last parts shall not be used for the calculation of the mean value. From each of the two remaining subsections,

select and note the two highest and two lowest peaks. A peak suitable for calculation is characterized by a 10 % minimum rising and falling of force.

6.5 For each test piece, calculate the arithmetic mean in Newtons of the peak values obtained according to 6.4. For electronic calculations, each individual peak will be analyzed. Consequently the results may differ from the manual method.

6.6 Repeat 6.2 to 6.5 for other test pieces.

7. Test report

The test report shall include the following:

a. Reference to this part of ISO 3377, i.e. ISO 3377-1 : 2002;
b. The thickness of the leather in mm;
c. The mean tear load in Newtons (N) with the long edge of the test piece cut parallel to the backbone;
d. The mean tear load in Newtons (N) with the long edge of the test piece cut perpendicular to the backbone;
e. The average tear load (i.e., the arithmetic mean of c and d);
f. The standard atmosphere used for conditioning and testing, as given in ISO 2419 (i.e. 20ºC/65 % relative humidity, or 23ºC/50 % relative humidity);
g. Any deviations from the method specified in this part of ISO 3377;
h. Full details for identification of the sample and any deviations from ISO 2418 with respect to sampling.

5. Determination of wet and dry rub fastness of finished leather by circular rub fastness tester

International standard: SATRA PM8

1. Scope

This method is intended to assess the degree of damage (marring) and transfer of a materials surface color during mild dry or wet abrasion.
The method is mainly applicable to footwear upper materials but can be used to assess any colored material such as leather, plastics and textiles.

2. Normative references

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 105-A01, Textiles — Tests for colour fastness — Part A01: General principles of testing
ISO 105-A03, Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining
ISO 105-A04, Textiles — Tests for colour fastness — Part A04: Method for the instrumental assessment of the degree of staining of adjacent fabrics
ISO 105-F09, Textiles — Tests for colour fastness — Part F09: Specification for cotton rubbing cloth
ISO 2418, Leather — Chemical, physical and mechanical and fastness tests — Sampling location
ISO 2419, Leather — Physical and mechanical tests — Sample preparation and conditioning

3. Principle

The specimen of the material is rubbed by a rotating dry or wet circular wool felt pad under a constant contact force. The test is stopped after a predetermined number of revolutions and the damage to, or transfer of; color is assessed subjectively using a geometric grey scale.

4. Apparatus and Materials

4.1 A machine with:

4.1.1 A rigid horizontal platform (preferably metal) capable of clamping the test specimen.

4.1.2 A vertical rotating spindle capable of holding the circular felt pad.

4.1.3 A means of rotating the felt pad at a speed of 150±10 rev/min.

4.1.4 A method of loading the rotating felt pad with a force of either 24.5±0.5 N or 7.1±0.2N.

4.1.5 A method of counting the number of revolution of the felt pad.

4.2 Circular pads of scoured pure wool felt with central holes, as specified below:

4.2.1 Outside diameter 25±1mm bore diameter 3±0.5mm.

4.2.2 Thickness 6.5±0.5mm

4.2.3 Density 190±20 kg/m^3.

4.3 Gray scales with half step ratings for assessing the change in color and degree of staining.

4.4 Distilled or de-mineralized water for the wet rub test.

5. Test specimens

5.1 Test specimens should be of a sufficient size to allow them to be fixed firmly to the test platform.

5.2 When using a SATRA rubfastness tester conveniently sized samples can be either square of 60 mm × 60 mm, or circle 60 mm diameter; alternatively a 60 mm wide stripcan be used for several tests.

6. Procedure

6.1 All Tests

Tests described in sections 6.2 to 6.3 should be repeated at least once to confirm the results.

6.2 Dry Rub Test

6.2.1 Secure the test specimen onto the horizontal platform of the test machine and configure the machine to operate with a fixed force of 24.5 N

6.2.2 Secure a dry felt pad onto the spindle of the test machine.

6.2.3 Bring the felt pad and the test specimen into contact and run the machine for the required number of revolutions.

6.2.4 Lift the felt pad clear of the test specimen surface

6.3 Wet Rub Test

6.3.1 Secure the test specimen onto the horizontal platform of the test machine and configure the machine to operate with a fixed force of 7.1N.

6.3.2 Immerse the felt pads in cool distilled water and bring to the boil, continue to boil for 60 seconds and allow cooling to room temperature. Remove the pads from the water immediately before use but reject any that are excessively swollen or soft. Pads should not be kept in water for more than 24 hrs. Unused wet pads should be discarded after 24hrs and fresh wet pads prepared as necessary.

6.3.3 Adjust the amount of liquid in the pad by gently squeezing the excess from it so that when it is fixed to the spindle and lowered onto the test piece a little liquid is squeezed out to form a rim round the pad.

6.3.4 Bring the felt pad and the test specimen into contact and run the machine for the required number of revolutions.

6.3.5 Lift the pad clear of the test specimen surface, dry the felt pad and test specimen (it is usually sufficient to leave the material overnight to dry at standard room temperature but if speed is important then accelerated drying of the pads is allowed by placing them in an oven at max temperature 60ºC. however leather samples should only be dried naturally at room temperature and proceed to section 6.4.

6.4 All Test Assessment of Results

6.4.1 To make the assessment of color transfer easier it is recommended that each pad is cut in half and is placed against half of an unused pad.

6.4.2 Under artificial lighting conditions specified compare the contrast between tested and non-tested areas with the ratings on the relevant geometric grey scale. If the assessment falls between two ratings on the grey scale then quote the lowest number of the two grey scale ratings.

7. Data Collection

Dry Test					
	Number of revolutions				
	32	64	128	256	512
Gray scale to assess color change for leather					
Gray scale to assess staining for fabric					

Wet Test					
	Number of revolutions				
	8	16	32	64	128
Gray scale to assess color change for leather					
Gray scale to assess staining for fabric					

6. Determination of water vapor permeability of upper leather

International standard: ISO 14268:2012; SATRA PM 172

1. Scope

This International Standard describes a method for determining the water vapor permeability of leather and provides alternative methods of sample preparation.

This method is intended to determine the amount of water vapor a material will transmit through its structure in a specified time.

The method is mainly applicable to leathers and textiles used in footwear uppers and clothing. It is also applicable to leather and textiles used as lining.

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 5402-1, Leather — Determination of flex resistance- Part 1: Flexo-meter method

3. Principle

The test piece is clamped over the opening of a container which contains a solid desiccant and is placed in a strong current of air in a standard atmosphere. The air inside the container is constantly agitated by the desiccant which is kept in motion by the rotation of the container. The container is weighed at the start and the end of the test and the mass of moisture which has been absorbed by the desiccant is determined from the difference.

4. Apparatus and Materials

4.1 Cylindrical test pots each with:

4.1.1 One circular open end with an internal diameter D = 30±10 mm and is known to the nearest o.1 mm.

4.1.2 An internal height of 80±10 mm.

4.1.3 A clamping ring with an internal diameter D.

4.1.4 A means of tightly clamping a test specimen between the clamping ring and the open end.

4.2 A test machine with:

4.2.1 A vertically mounted turn table, which is capable of holding at least 3 test stations, so that its axis is parallel and 67±2 mm from the axis of rotation and which is rotated at a speed of 75±5 rev/min.

4.3 A paddle type fan:

4.3.1 has three flat bodies inclined at 120º to one another. The blades should be flat with approximate dimensions of 90 mm × 75 mm.

4.3.2 is mounted so that its axis is coaxially aligned with the axis of the turntable and the blades pass with at a distance of 10±5 mm of the open ends of test pots, mounted on the turntable.

4.3.3 Rotated at a speed of 1400±100 rev/min in a direction opposite to the direction of rotation of the turntable.

4.4 An analytical balance capable of measuring up to 200g to the nearest 1mg

4.5 Silica gel:

3.5.1 Particle size greater than 2 mm.

3.5.2 Freshly dried in a ventilated oven at 125±5ºC for at least 16 hrs. and cooled in a sealed container. Typically the color of self-indicating silica gel will turn from blue when dry to pink or colored when saturated.

4.6 A press knife or similar cutting device, capable of cutting test specimens with a diameter which is sufficiently larger than D to be made the open end of the pot.

4.7 Abrasive emery paper 180 grade/in^2

5. Test specimens

5.1 For footwear upper materials, unless otherwise specified, abrasive paper was used to lightly buff the surface of the uncut sheet material.

5.2 Each test specimen was marked with a unique reference code.

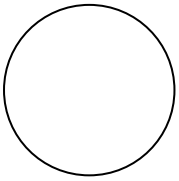


Figure 1: Test specimen

5.3 Three test specimens were cut in accordance with ISO 2418 as shown in figure 1.

6. Procedure

6.1 Pour the freshly dried silica gel into one of the pots weighted until is half full.

6.2 Place the test specimen centrally over the open end of the pot so that the surface which covers to the source of water vapor in the final product is uppermost.

6.3 Fit a clamping ring centrally over the top of the test specimen and tightens the ring so that the test specimen securely hold around its edges and seal the pot.

6.4 Repeat the procedure in (i)-(iii) for remaining two specimen.

6.5 Place each of filled test specimens on to the turntable and operate the test machine for 20±4 hrs.

6.6R the each test pots from the turntable.

6.7 Remove the clamping ring and also the test specimen from the pot.

6.8 Weight each of the pot as quickly as possible.

6.9 Pour away the silica gel from the inside of the pot.

6.10 Refill the pot with a similar amount of silica gel which was freshly dried.

6.11 Repeat the procedure for another two specimens.

6.12 Use the balance to ensure measure the combined mass of each test pot, silica gel and test specimen assembly and record these values with the minimum of delay.

6.13 Replace the test specimens on the turntable and start the machine.

6.14 After 11.5±45 hrs. stop the test machine and remove the test pots from turntable.

6.15 Use the balance to measure the combined mass of each of test pot, silica gel and test specimen assembly and record the values with the minimum of delay.

6.16 Calculate the water vapor permeability of the test specimen for each test.

6.17 Calculate the arithmetic mean of WVP values.

6 Data collection & Result

$$\text{WVP} = \frac{\text{M1}-\text{M0}}{\text{A}\times(\text{T1}-\text{T0})}$$

Where,

Initial mass of the test pot, M_0

Final mass of the test pot, M_1

Initial time, T_0

Final time, T_1

Surface area, $A = \pi \times \frac{D^2}{4}$

7. Determination of adhesion of finish film of …… skin

International standard: EN ISO 11644:2009; SATRA TM 408

1. Scope

This International Standard specifies a method for measuring the adhesion of the finish to leather or the adhesion between two adjacent layers of the finish.

The method is valid for all finished leathers with a smooth surface that can be bonded to an adherent-plate without the adhesive penetrating into the finish. Preliminary experiments might be necessary to determine whether these conditions are met.

This test method is valid for finished leathers with a finish-coat thickness of at least 15 μm.

This method can also be applied to synthetic with a finish layer on its surface.

2. Normative references

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 105-A02, Textiles- Tests for color fastness - Part A02: Grey scale for assessing change in color

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

2. Principle

The finished side of part of a strip of leather is bonded to an adherent-plate by means of an adhesive film. Force is applied to the free end of the strip to peel the leather from the finish over a given distance, the finish layer remaining on the adherent-plate together with the film of adhesive. The force required is measured and reported as the adhesion value of the finish.

The test is usually carried out on specimens conditioned in a standard atmosphere before testing. If required, the test may additionally be carried out on wetted specimens or on specimens that have previously been subjected to other treatments.

3. Apparatus and Materials

3.1 A test apparatus consisting of:

3.1.1 A clamp which is capable of holding one of the rigid strips together with the attached test specimen at its end. A clamp capable to withstand a force of 15N applied normally free end of the strip.

3.1.2 A method of firmly gripping the end of the test specimen furthest from the clamp. A hole punched through the thickness of the test specimen is suitable.

3.1.3 A means of applying a force in a direction normal to the surface of the strip in the clamp. The increase of force by 0.25±0.05N, increments up to 5N, and then by 0.5±0.1N increments up to 15N. The force known to an accuracy of 2% at all times.

3.2 Six rectangular rigid PVC of width of 10.0±0.5 mm, length approximately 75 mm and thickness of 3.0±0.5 mm.

3.3 A suitable adhesive for bonding the finish of the test specimen to the rigid strip, such as-

3.3.1 PVC strips-polyurethane adhesive

3.4 Petroleum spirit, general purpose laboratory grade, boiling range 40-60ºC.

3.5 When use PVC strips the following are also required-

3.5.1 A heat reactivators, capable of raising the surface temperature of adhesive coated strips by sufficient amount of reactivate the adhesive within a few seconds. Typically a surface temperature of the adhesive between 80ºC and 90ºC.

3.5.2 A bonding press, with a platen size greater than 130 mm × 65 mm and capable of applying a pressure of 500±10KPa to consolidate the adhesive bond. A suitable device is available from SATRA STD 451.

3.6 Heat sensitive crayon, such as tempilstick, with a melting temperature of 83±2ºC.

3.7 100 part PU adhesive, and cross-linker 5 part of PU adhesive.

4. Test specimens

4.1 Cut four square pieces of material with dimensions 65±2 mm. (as shown in figure 1).

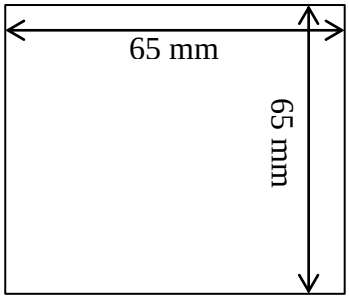


Figure 1: Test Specimen

4.2 Cut the samples from two directions which are at right angles to each other.

4.3 After cutting the samples mark the directions as parallel and perpendicular to backbone to identify at later stage.

5. Procedure

5.1 Preparation of bonded assemblies:

5.1.1 PVC strips & polyurethane adhesive is most commonly used as the preparation time much shorter and reliable bonds are produced with nearly all finishes, and it is followed in the lab during experiment.

5.2 Use PVC strips with polyurethane adhesive:

5.2.1 Wipe the surface of the PVC strips with grease free cotton wool dampened with the petroleum spirit.

5.2.2 Use a small brush to evenly spread a fairly generous coating of polyurethane adhesive on the cleaned surface of the strips and allow them to dry for at least one hour. Isocyanate hardener haven't the capability to use the coating many weeks with proper bonding ability. But without isocyanate it is usable after some weeks.

5.2.3 Wipe the finish surface of four pieces with grease free cotton wool wetted with petroleum spirit to remove grease and wax and allow them to dry with finish side upper most and don't touch the finish.

5.2.4 Then dry the cleaned pieces of material and place two of them edge to edge as shown in figure 2.

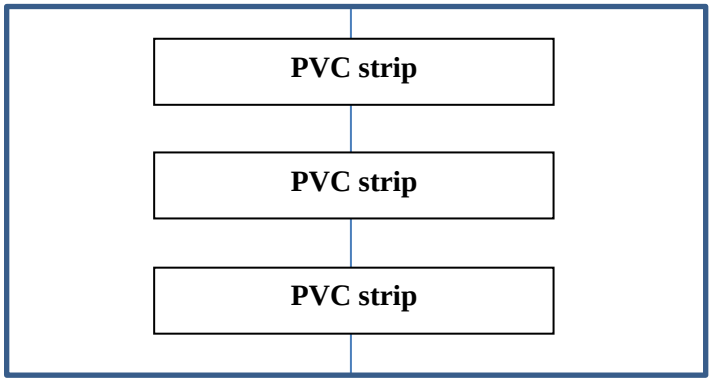


Figure 2: Leather with PVC strip

5.2.5 Check the efficiency of the heat reactivator using the heat sensitive crayon. Scrap a small amount of the crayon onto knife blade so that it covers about a 100 square millimeters. Measure the time for the power crayon to melt and use it for the specimen.

5.2.6 Place the three PVC strips on the reactivator until reactivate the adhesive.

5.2.7 Then remove the strips from reactivator and place on the finish with the adhesive side down.

5.2.8 Then place the assembly in the press and apply a pressure of 500±100 kPa to the strips for 15±1 seconds.

5.2.9 Repeat the procedure for the remaining pieces of material.

5.2.10 Then allows the bonds to cure for single part polyurethane adhesive-at least 2.0 hrs. Add adhesive with isocyanate hardener at least 16 hrs.

5.3 Cutting of test specimens:

5.3.1 Carefully cutout the test specimens of the test assemblies using a sharp knife.

5.3.2 Make a small punch/hole for the scale pan hook near the edge of the test specimen at the center of its width using SATRA test apparatus.

5.3.3 Check the width of the test specimens with a steel rule.

5.4 Peeling the test specimen:

5.4.1 Dry test

5.4.1.1 Take the six prepared specimens for dry peeling test, but not take from the same original test assembly.

5.4.1.2 Mount one of the test specimens horizontally in the tester, so that one end of the test specimen protrudes allowing attachment to the tab.

5.4.1.3 Attach the gripping device to the tab of the test specimen.

Then place the hook of the scale pan through the hole punched in the tab of the test specimen and support the pan on the platform so that no load is applied to the adhesive joint.

5.4.1.4 In a separation of the finish and the substance of the test specimen by peeling the two apart by hand for a few millimeters with leathers which usually have a thick finish which itself has considerable film strength, such as patent leather or other coated leather at the end of rigid plate cut with knife.

5.4.1.5 Applied a force of 0.50±0.05 N to the tab of the test specimen gently.

5.4.1.6 Then raise the test head of the peel tester gradually so that the weight of the scale pan pulls on the tab of the test specimen.

5.4.1.7 Repeat the procedure until the test specimen started to peel steadily away from the strip.

5.4.1.8 Allow the test specimen to peel for two third of its length.

5.4.1.9 Stop the peeling before two third of length and then –

Removed the force, carefully peel the test specimen by hand for millimeter and then apply the same force.

5.4.1.10 Record the force when two thirds of the test joint has been peeled. Joint the weight and mass of the pan.

5.1.4.11 Then remove the test specimen from the holder. Examine and record the type of bond separation corresponding to the maximum peeling load.

5.4.1.12 Repeat the procedure for remaining test specimen.

5.4.2 Wet test

5.4.2.1 Immerse the test specimens in distilled or deionized water in a beaker. Other suitable vessel also available.

5.4.2.2 In a vacuum chamber- immerse the test assemblies into the chamber and reduce the pressure inside the chamber to below 3kPa. Return the pressure into atmospheric pressure and leave the test specimen in the water for 15 minutes.

5.4.2.3 As the vacuum chamber is not available so the specimens are immersed for 30 minutes, with rubbing reverse side of the material for several minutes at the start of the period to facilitate penetration.

5.4.2.4 Removed the sample after wetting from water and blot excess of water.

5.4.2.5 Then do the peeling test as described in dry test method.

9.4.2.6 Record the force of two third of peel of the length.

6. Data collection

a) For dry test:

$$\text{Adhesion strength} = \frac{\text{Applied Weight}}{\text{Peeling Width}}$$

b) For wet test:

$$\text{Adhesion strength} = \frac{\text{Applied Weight}}{\text{Peeling Width}}$$

8. Determination of flexing endurance for shoe upper leather of … skin

International standard: ISO 17694:2016

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.

Also applicable for lining, patent and synthetic upper materials.

2. Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 5402-1:2011, Leather — Determination of flex resistance — Part 1: Flexometer method

ISO 177091, Footwear — Sampling location, preparation and duration of conditioning of samples and test pieces

ISO 184542, Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear

2. Principle

A test piece is folded with the surface to be tested inwards and clamped in an upper moveable clamp and with the surface to be tested outwards in a lower fixed clamp. Movement of the upper clamp causes a fold in the test piece to run along it. The test piece is examined periodically for damage.

3. Apparatus and Materials

3.1 Leather

3.2 Gray scale

3.3 Break pipiness scale

3.4 Bally flexing endurance tester

3.4.1 Test machine, including the parts described in 3.4.1.1 to 3.4.1.3.

3.4.1.1 Upper clamp, consisting of a pivoting pair of flat plates as shown in Figure 1. One plate has the shape of a trapezium ABCD but with the corner D rounded to a radius of 2 mm. It has a ledge EF to support the folded test piece. The other plate has the shape EGHCF. The screw K draws the plates together and also acts as a stop to prevent the test piece from being positioned closer to AB than the vertical through C. A stop near the edge AB and approximately mid-way between A and B ensures that the plates clamp more effectively near the point F. The upper clamp can be reciprocated by a motor about a horizontal axle J, descending through an angle of 22° 30' ± 0° 30' at a frequency of 100 cycles/min ± 5 cycles/min.

3.4.1.2 Lower clamp, fixed and lying directly beneath (planar to) the upper clamp and consisting of a pair of flat plates to hold the test piece. The position of the lower clamp is such that the distance between the ledge EF and the upper edge of the fixed lower clamp, when the ledge EF is horizontal, is 25.0 mm ± 0.5 mm.

3.4.1.3 Counter, to indicate the number of cycles.

3.5 Antic-utter

3.6 Scale

4. Test specimens

4.1 Take two rectangular test specimens of 75 mm × 45 mm size (SATRA)

4.2 Among two specimens take one parallel to backbone and one perpendicular to backbone.

5. Procedure

5.1 Fold the specimens in one end grain side out and other end fold in flesh side out.

5.2 Place the specimens into bally flexing endurance tester as one end of specimen in fixed clamp another into the movable clamp.

5.3 Move the movable clamps forward and backward to cause the fold in specimens.

5.4 Examine the specimens with gray scale and break pipiness scale to asses change in color and for the number of crease.

5.5 Examine the specimens after 10000, 20000, and 30000 cycles.

6. Data collection

For specimen no. 1			
Cycles	10000	20000	30000
Color migration			
Crease formation			

For specimen no. 2			
Cycles	10000	20000	30000
Color migration			
Crease formation			

9. Determination of sole adhesion of footwear

International standard: ISO 17708:2003(en)

1. Scope

This standard describes a test method for the determination of the resistance to separation of the upper from the outsole or to separate adjacent layers of the outsole or to cause tear failure of the upper or the sole is measured. It also defines conditions of ageing that can be used for production control.

It applies to all types of footwear (cementing, vulcanization, injection moulding, etc.) where the evaluation of sole adhesion on the upper is needed and where the upper is continuously assembled (closed shoe).

Note 1: In all cases the objective should be to test the bond strength nearest to the edge of the assembly.

Note 2: The test need not be carried out when the bond has been made by grindery (using, for example, nails or screws) or stitching.

2. Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12222, Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear.

EN ISO 7500-1, Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension / compression testing machines

2. Principle

3. Apparatus and Materials

3.1 SATRA sole adhesion tester (STD 185) with:

3.1.1 A range of detachable horizontally mounted top pieces each:

3.1.1.1 Constructed from mild steel of thickness 10±1 mm.

3.1.1.2 With the profile of the arc shape approximately the same as the toe or heel. The total arc length of the cut out will fit over the extended edge of the footwear sole.

3.1.1.3 With the arc shape approximately 45º to the upper surface to produce almost a knife. This help to be inserted to as far as possible over the extended edge.

3.1.2 A means of measuring the force applied normally to the metal plate in an upwards direction to an accuracy of ±5%. The force range:

Toe adhesion test 0 to 450N

Heel adhesion test 0 to 900N

6.3.1 A horizontally fulcrum to support the lower surface of the footwear outsole which has:

3.1.3.1 The form:

Toe adhesion: An anvil of width greater than 75mm.

Heel adhesion: A strip of width greater than the footwear heel.

3.1.3.2 The center of the fulcrum approximately 45mm from the center of the arc of the toe piece.

3.1.3.3 The fulcrum height in relation to toe piece is adjustable.

3.1.3.4 The fulcrum rigidity connected to the force measuring.

3.2 A last

3.3 A shoe

4. Test specimens

4.1 A suitable last (suitable with the footwear taken) inserted into the footwear carefully.

4.2 A properly inserted last was made the joining edge of the upper and sole more visible.

5. Procedure

5.1 After the preparation of sample set the measuring indicator into zero.

5.2 Then inserted the prepared footwear (sample) into the machine.

5.3 Toe adhesion:

5.3.1 Select the pressure block and top piece to conform the shape of the toe of the specimen footwear.

5.3.2 Inserted toe piece in the feather line groove between the sole and upper at the toe.

5.3.3 Resting the wearing surface of the forepart of the sole on the anvil.

5.3.4 Apply a downward force and record the force when the sole has separated from the upper by approximately 3mm from the feather edge.

5.4 Girth adhesion:

5.4.1 After toe adhesion test the girth adhesion.

5.4.2 At the outside ball point insert the top piece of the machine in the feather line groove between the sole and upper.

5.4.3 Apply a downward force and record when the sole has separated from the upper by approximately 3 mm from the feather edge.

5.4.4 Do the same procedure (5.4.2 & 5.4.3) on the inside ball point and complete the girth/ball point adhesion.

5.5 Heel adhesion:

5.5.1 Select the pressure block and top piece, which conform the shape of the heel of the specimen footwear.

5.5.2 Insert top piece in the feather-line in groove between the sole and upper at the heel.

5.5.3 Rest the wearing surface of the back part of the sole on the anvil.

5.5.4 Apply a downward force & repeat when the sole has separated from the upper by approximately 3mm from the feather edge.

6. Data collection

S.N.	Sample	Toe portion (kg)	Heel portion (kg)	Inside ball point, (kg)	Outside ball point, (kg)
01					
02					

10. Whole sole flexing of a sole

1. Scope

This Method is intended to determine the resistance of materials to cut growth during repeated flexing.
This method is applied to outsoles that have a maximum longitudinal rigidity of 30N.
It is especially applicable to outsoles of footwear that can be used for other flexible components such as rubbery type materials.

2. Normative references

2. Principle

3. Apparatus and Materials

3.1 Bennewart sole flexer (STM 465) with three workstations presented horizontally ease
3.2 The jig (STD 465J)
3.3 The chisel (STD 465C)
3.4 Measuring scale

4. Test specimens

Test Piece Size: full sole / forepart of the sole
No. of test pieces: at least one sole
Bond at 2mm taxon insole board on to the reverse side of the sole
After bonding store sole at room temperature over night before testing

5. Procedure

5.1 Pierce the specimen at three points at equal distance with 2mm width along the flexing line of the sole where maximum bonding stress required.
5.2 Insert and secure the sole in the clamps.
5.3 Turn the motor wheel by hand until the sole is extended.
5.4 Repeatedly flex the sole with a flexing cycle at a rate of 140 flexes minute with 90 bending action and 1000 cycles split.

5.5 Inspect and check the sample after a determine split time to measure the enlargement of the holes.

5.6 Carryout the process for 1000, 2000 and 3000 cycles

5.7 Measure the cut growth of bended sole.

Inspection stage:

1st stage:

2nd stage:

3rd stage:

Units: average growth in mm/30000 cycles. Should sole failure earlier.

6. Data collection & Result

Holes	After 10000 cycles	After 20000 cycles	After 30000 cycles
First hole			
Second hole			
Third hole			