Designation: D 2209 – 00

Standard Test Method for Tensile Strength of Leather[1]

This standard is issued under the fixed designation D 2209; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of the load required to rupture a leather test specimen having a ½-in. (12.7-mm) width. The load to rupture divided by the original unstretched cross-sectional area gives the tensile strength. It may be used for all types of leather that are smooth and firm enough to permit accurate thickness measurements. This test method does not apply to wet blue.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1517 Terminology Relating to Leather[2]

D 1610 Practice for Conditioning Leather and Leather Products for Testing[2]

D 1813 Test Method for Measuring Thickness of Leather Test Specimens[2]

D 2211 Test Method for Elongation of Leather[2]

3. Terminology

3.1 For definitions of leather terms used in this standard refer to Terminology D 1517.

4. Summary of Test Method

4.1 The width and thickness are measured in the center of the narrow area of the leather specimen. The specimen is clamped in the testing machine as described in 9.3. The force required to rupture the leather at a jaw separation of 10 ± 2 in./min. is measured. The tensile strength is calculated in psi or in kPa by dividing the force by the area of the original cross section of its narrow section. The percent elongation at rupture is also measured.

5. Significance and Use

5.1 The tensile strength test gives a reliable indication of the quality of the leather. Improperly lubricated and partially degraded leathers give low values for tensile strength. The orientation of the specimen in relation to the backbone and the location of the specimen on the hide influence the results significantly. This test method is excellent for development, control, specification acceptance, and service evaluation of leather. This test method may not apply when the conditions of test employed differ widely from those specified in the test method.

6. Apparatus

6.1 *Testing Machine, Power-Driven*— The applied load shall be indicated on a dial, scale, or chart. The load indicator shall record or indicate the maximum load at the time of rupture of the specimen. The machine shall be equipped with a set of grips for clamping the specimens. The faces of the grips should be knurled or otherwise roughened to prevent slipping of the specimen. The gripping surfaces shall be at least 1 by 1½ in. (25.4 by 38 mm). The grips shall be mounted with the longer dimension perpendicular to the direction of the application of the load. The speed of the power-activated grip shall be uniform speed of 10 ± 2 in./ min (254 ± 50 mm/min) when running free. The error of the machine up to a load of 50 lbf (222 N) shall not exceed 2 %; at loads of more than 50 lbf the error shall not exceed 1 %.

6.2 *Thickness Gage*—A dead-mass type of thickness gage as described in Test Method D 1813.

6.3 *Steel Scale*, graduated to read in 0.02 in. (0.5 mm).

6.4 *Steel Die*, to cut test specimens designed as shown in Fig. 1.

6.5 *Cutting Block*, which shall consist of a flat hardwood support upon which is placed a flat, smooth sheet of firm material that will not injure the cutting edge of the die.

7. Test Specimen

7.1 The specimen shall be dumbbell in shape, cut from the test unit of leather by means of a die as shown in Fig. 1. The direction of the long dimension in relation to the backbone shall be noted.

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[1] This test method is under the jurisdiction of ASTM Committee D31 on Leather and is the direct responsibility of Subcommittee D31.07 on Physical Properties-General. This test method was developed in cooperation with the American Leather Chemists Assn. (Standard Method E 15 – 1965).

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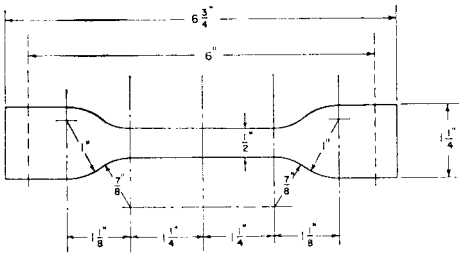
[2] *Annual Book of ASTM Standards*, Vol 15.04.



in.	mm	in.	mm
½	12.7	1¼	31.8
⅞	22	6	152
1	25.4	6¾	171
1⅛	28.6		

NOTE—The cutting edges shall be beveled on the outside and straight on the inside. The die shall be kept sharp and free of nicks to give clean, even edges on the specimen.

FIG. 1 Shape and Dimensions of Die for Cutting Test Specimens

8. Conditioning

8.1 All specimens shall be conditioned in accordance with Practice D 1610. Conditioning other than that prescribed shall be noted in the results.

9. Procedure

9.1 Measure the thickness of the specimen to the nearest 0.001 in. (0.025 mm) at one point, the mid-point of the narrow section.

9.2 Measure the width of the narrow section of the spectrum to the nearest 0.02 in. (0.5 mm) at one place on the grain side, at the mid-point. Measure heavy leathers such as belting and soling, on both flesh and grain sides at the mid-point.

9.3 Mount the specimen symmetrically with the distance between the jaws 4 ± ⅛in. (102 ± 3.2 mm).

9.4 Determine the elongation of the specimen in accordance with Test Method D 2211.

9.5 Record the load in pounds-force (or newtons) to rupture the specimen.

9.6 Reject any specimen that slips or breaks within ¾ to 1 in. (19 to 25.4 mm) of the jaws and test a similar specimen.

10. Report

10.1 Report the following information:

10.1.1 Thickness to the nearest 0.001 in. (0.025 mm) reported for each specimen or averaged and reported as the thickness of the sample.

10.1.2 Cross-sectional area of each specimen,

NOTE 1—Calculate the original cross-sectional area of the specimen from one thickness measurement and one width measurement. For heavy leathers average two width measurements.

10.1.3 Breaking load to the nearest 1 lbf (4.4 N), reported for each specimen or averaged and reported as the breaking load of the sample,

10.1.4 Tensile strength to the nearest 10 psi (69 kPa), reported for each specimen or averaged and reported as the tensile strength of the sample, and

NOTE 2—Calculate the tensile strength by dividing the load in pounds-force (or newtons) required to rupture the specimen by the area in square inches (or square millimetres) of the original cross section of its narrow section.

10.1.5 Direction of the long axis of the specimen relative to the backbone.

11. Precision and Bias

11.1 The following criteria may be used to judge the acceptability of the results if at least 15 units have been tested:

11.1.1 *One Operator, Duplicate Specimens, Same Skin*—Results by the same operator on duplicate adjacent specimens from a skin taken from the official sampling location should not be considered suspect unless the coefficient of variation exceeds:

Shoe upper	11 %
Calfskin[A]	8 %

[A] 3 ± 1 oz (85 ± 28 g), 0.0468 ± 0.0156 in. (1.189 ± 0.396 mm).

11.1.2 *Two Laboratories, Duplicate Specimens, Same Skin*—Results submitted on leathers of the type mentioned in 11.1.1 by each of two laboratories on duplicate adjacent specimens from the same skin taken from the official sampling position should not be considered suspect unless the average of the two results differ by more than 5 %.

NOTE 3—The reproducibility reported in 11.1.2 is based on data obtained at two laboratories, each with a different type of testing machine and a different operator. One machine is a load-cell type and the other a pendulum type. The results show very close correlation between laboratories.

NOTE 4—The precision data for between skins are not given because the results were based on different skins from several production lots. The variables in leather for between skins will give a higher variation of the results, but this factor should not affect the precision of the test method.

12. Keywords

12.1 leather; strength; tensile strength