Designation: D 2097 – 03

Standard Test Method for Flex Testing of Finish on Upholstery Leather[1]

This standard is issued under the fixed designation D 2097; 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.

1. Scope

1.1 This test method covers the determination of the flexibility and adhesion of a finish on upholstery leather.[2] 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 1610 Practice for Conditioning Leather and Leather Products for Testing[3]

3. Summary of Test Method

3.1 The leather is mechanically flexed alternately from a flat position into a single or double bend. At the end of a predetermined number of flexing cycles, the leather is visually inspected for finish cracks.

4. Significance and Use

4.1 This test method simulates the flexing received by upholstery leather in service, and correlation with service is believed to be good. Both the resistance of the finish to cracking and adhesion of the finish to the leather can be evaluated.

4.2 The flexing action received by the leather in this method is more severe than that given by methods for shoe upper leather. The less severe tests have little utility in the evaluation of upholstery leather finishes.

4.3 This test method is suitable, and has been useful, in research, development, and manufacturing control. It is used as a method of test for specification acceptance. Since this is a subjective test, proper correlation should be established by interlaboratory experience prior to use for specification acceptance.

5. Apparatus

5.1 *Newark Flexing Machine*—This machine,[4] illustrated in Fig. 1, consists basically of two pistons, one of which is stationary, the other capable of moving at 500 rpm with a stroke of 1¼ in. (32 mm). The movable piston is also adjustable on its shaft in order to vary the distance between the two pistons.

6. Test Specimen

6.1 The test specimen shall be 3 by 4½ in. (76 by 114 mm) in size.

7. Conditioning

7.1 Bring all test specimens to equilibrium as described in Practice D 1610. Usually, maintaining the specimen for 24 h under these conditions will adequately satisfy the equilibrium conditions.

7.2 The test shall also be conducted under the above conditions, described in Practice D 1610.

8. Procedure

8.1 Measure the thickness of the specimen to be tested.

8.2 While in the closed position, adjust the pistons to fifteen times the thickness of the specimen (see Fig. 2).

8.3 Turn the pulley by hand until the pistons are the maximum distance apart. Clamp the specimen around the two pistons without stretching the specimen.

8.4 Complete the first cycle by turning the pulley by hand and forcing the specimen into its flexing pattern (Fig. 3 and Note 1).

NOTE 1—The flexing pattern is achieved as follows: Facing the center

[1] This test method is under the jurisdiction of ASTM Committee D31 on Leather and is the direct responsibility of Subcommittee D31.04 on Apparel and Upholstery. This test method was developed in cooperation with the American Leather Chemists Assn.

Current edition approved May 10, 2003. Published July 2003. Originally approved in 1962. Last previous edition approved in 2000 as D 2097–00.

[2] Several methods of evaluating the resistance of an upholstery leather finish to flexing have been investigated. The method, as described here, has been adopted as standard by the Upholstery Leather Group, Tanners' Council of America.

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

[4] A machine meeting the requirements of this method is available commercially from the Aim Tool & Die Co., 14324 172nd St., Grand Haven, MI 49417. Two versions of this machine are made by Aim Tool & Die Co. Only the standard flexotest machine meets the requirements of this method.

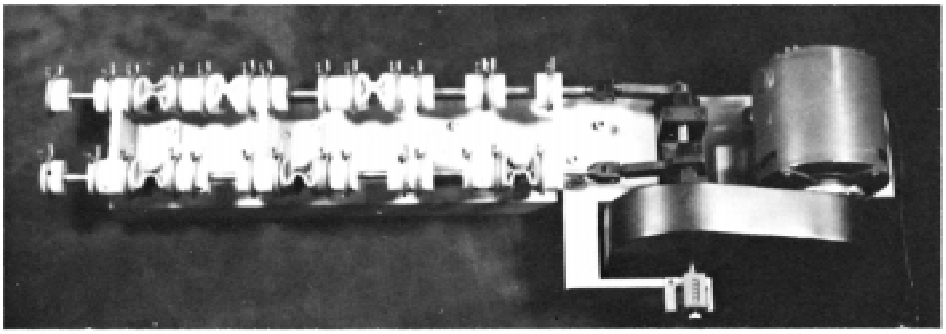
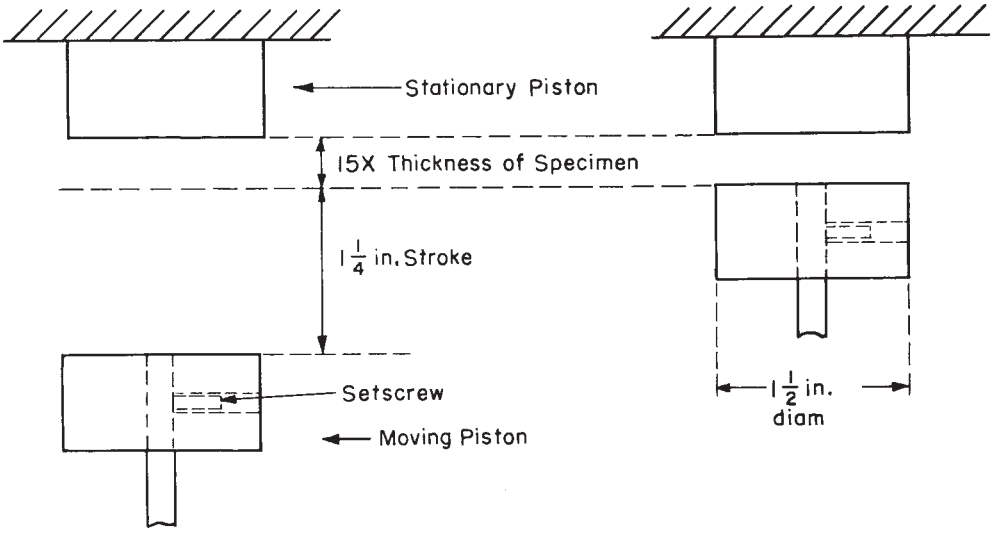


FIG. 1 Newark Flexing Machine



in.	*mm*
1¼	32
1½	38

(*a*) Open Position (*b*) Closed Position

FIG. 2 Adjustment of Pistons

front of the specimen, squeeze the sides of the cylindrical specimen with the thumb and middle finger and then force the center inward with the index finger, while the pistons are closed.

8.5 Turn on the power and the specimen will follow this pattern during the whole flexing time.

8.6 At the completion of the test, remove the specimens for evaluation.

NOTE 2—If an evaluation is required before the test is complete, the probe shown in Fig. 4 can be used without removing the specimens.

8.7 Use a 4× magnifying glass to examine specimens for cracks in or through the finish.

9. Report

9.1 The report shall include the following:

9.1.1 Number of total cycles flexed, and

9.1.2 Ratings of the specimen, as follows:

9.1.2.1 No cracks.

9.1.2.2 Fine cracks, with no russet showing.

9.1.2.3 Fine cracks, none larger than ⅛ in. (3.2 mm) through to the russet, and no evidence of the finish peeling or

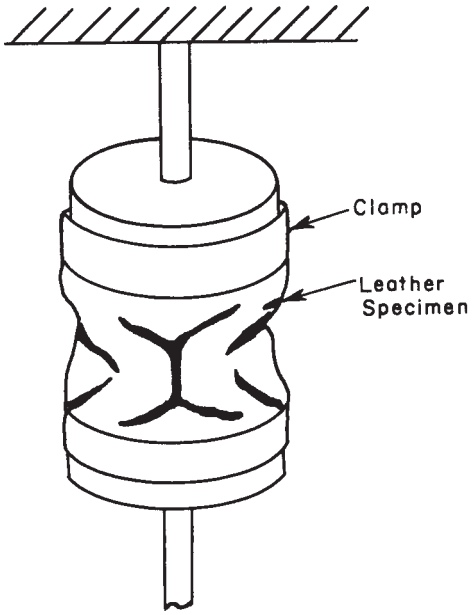
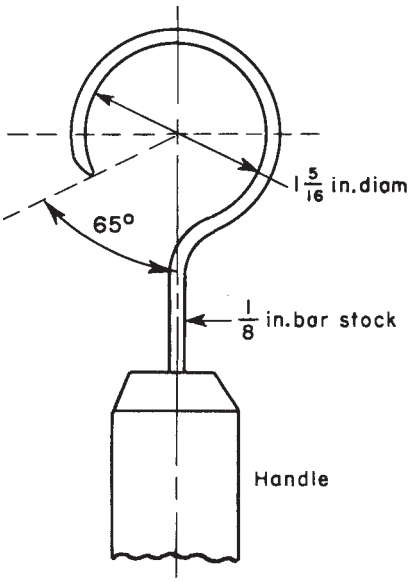


FIG. 3 Flexing Pattern



in.	*mm*
⅛	3.2
1⁵⁄₁₆	33

FIG. 4 Probe for Evaluating Specimens

rolling back. There shall be no group of ⅛ in. cracks; only single cracks are permitted.

9.1.2.4 Extreme cracks to russet or peeling of finish.

10. Reproducibility

10.1 For full grain and hand buff hides, the Chi Square Rank value and the probability obtained from a controlled experiment indicate that the results obtained by different laboratories should not be significantly different. Deep buff hides, however, may show significantly different results between laboratories, if great care is not taken to ensure interlaboratory agreement on describing the condition of the tested specimen.

NOTE 3—The data used for a basis for this reproducibility statement were taken from a series of round-robin tests run by the Upholstery Leather Group, Tanners Council, from December 14, 1956 to April 18, 1957. Six adjacent samples, from the official sampling area, were taken from each hide tested. These samples were distributed to six different laboratories for test. Three types of upholstery leather were used: full grain, hand buff, and deep buff. In the data examined, 57 hand buff hides, 62 full grain hides, and 61 deep buff hides were represented. The Friedman two-way analysis of variance by ranks[5,6] was used to compare the results obtained by the different laboratories. The Chi Square Rank value for the hand buff was 5.1, a probability of 0.4, whereas the Chi Square Rank value for full grain was 2.3, a probability of 0.82. That is, based on these two sets of results, there was no significant difference in the test results from the different laboratories. The deep buff results however, showed a Chi Square Rank value of 44.2, probability less than 0.001. The deep buff tests, however, were run at 60 000 cycles. Common specifications within the industry call for only 30 000 cycles on deep buff leathers. It is recommended that greater care be used in establishing interlaboratory correlation prior to use of this method on deep buff leathers, or reduce the cycles for the test to 30 000.

11. Keywords

11.1 finish; flex; leather

[5] Milton Friedman, "The Use of Ranks to Avoid the Assumption of Normality," General American Statistical Assn., Vol 32, 1937, pp. 675–701.

[6] Sidney Siegel, "Non-parametric Statistics for the Behavioral Sciences," McGraw-Hill Publishing Co., New York, NY 1956, pp. 166–173.