



Designation: ~~D2098~~—13 D2098 – 21

Standard Test Method for Dynamic Water Resistance of Shoe Upper Leather by the Dow Corning Leather Tester¹

This standard is issued under the fixed designation D2098; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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

1. Scope

1.1 This test method covers the determination of the dynamic water resistance of shoe upper leather by means of the Dow Corning Tester. It ~~has been revised to show the state of the art in the equipment used in testing. It is applicable to all types of shoe upper leather. This test method does not apply to wet blue, blue or wet white.~~

1.2 Initial water penetration and water absorption can be measured.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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~~ safety, health, and ~~health~~ environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D1610 Practice for Conditioning Leather and Leather Products for Testing](#)

[D2099 Test Method for Dynamic Water Resistance of Shoe Upper Leather by the Maeser Water Penetration Tester](#)

3. Significance and Use

3.1 This test method is intended to estimate the water resistance of shoe upper leather. The flex imparted to the leather is a magnification of the flex given the vamp of the shoe in actual wear.

NOTE 1—There is an indication that this test method *cannot be used interchangeably* for specification purposes with Test Method [D2099](#).

¹ This test method is under the jurisdiction of ASTM Committee [D31](#) on Leather and is the direct responsibility of Subcommittee [D31.03](#) on Footwear. This test method was developed in cooperation with the American Leather Chemists Assn.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Apparatus

4.1 *Balance*, sensitive to 0.01 g.

4.2 *Dow Corning Leather Tester*, as shown in **Fig. 1**, or its equivalent. The essential features of the machine are as follows:

4.2.1 A specimen holder made of two vertical clamps. Each clamp shall have two stainless steel arms (~~7.5~~(7.5 in. by 0.50.5 in. by 0.5 in. (~~190.5~~(190.5 mm by ~~12.7~~12.7 mm by 12.7 mm)), one arm fixed, the other moveable. One clamp shall be mounted on a horizontal reciprocating shaft, that is, attached by a connecting link to a motor driven eccentric, which turns at ~~60~~60 r ~~/min~~/min. The bottom of the clamps shall be in the same horizontal plane. In one rotation of the eccentric, the minimum distance between clamps shall be ~~1.50 ± 0.01 in. (38.1 ± 0.25 mm)~~1.50 in. ± 0.01 in. (38.1 mm ± 0.25 mm) (inside measurement) and the maximum distance between clamps ~~2.50 ± 0.01 in. (63.5 ± 0.25 mm)~~2.50 in. ± 0.01 in. (63.5 mm ± 0.25 mm) (inside measurement).

4.2.2 *Water Tank* made of stainless steel or other noncorrosive material. It shall be of such a size that it can be placed around the clamps, and of such a depth that when in position for use, the top of the pan is at least 2.5 in. (63.5 mm) above the bottom of the clamps, and the bottom of the pan is at least 0.5 in. (~~12.7 mm~~)(12.7 mm) below the bottom of the clamps.

4.2.3 Two systems shall be used to record the number of cycles through which the specimen is flexed. One shall be a mechanical reset counter connected to the movable clamp. The other system shall be ~~electrical~~ (see ~~electrical~~ **Fig. 2**). The resistance across the electrodes shall be ~~7500~~7500 ohms ± 500 ohms. The sensing electrode shown is inside a leather specimen filled with stainless-steel balls. The common electrode is in a salt solution which is in continuous contact with the specimen during flexing. Switch S when manually closed starts an electrical impulse counter actuated by a micro switch, *EC*, which makes contact once on each flex. This records the total number of flexes until initial water penetration. Initial water penetration is detected by a current leakage from the high electrode through the specimen to the common electrode in the conducting solution. This causes the induction relay to operate, stopping the counter. (**Warning**—~~Warning~~—It is essential that the electrical circuit be converted to ~~110 volts~~, 110 volts, not to exceed ~~28 volts~~ 28 volts across the electrode. Specimen should be put in position or removed only when the electrode circuit is not energized.) For newer testing machines please use manufacturers' operating directions.

5. Reagents and Materials

5.1 *Magnetic Balls*, stainless steel, diameter 1/8 in. (~~3 mm~~(3 mm optional) 400 series. The steel balls must be clean and free of grease, oil, silicone, or rust and have a resistance less than ~~7500 ohms~~7500 ohms before using.

5.1.1 To clean, immerse stainless steel balls in mild acid, 5 % Nitric. Rinse in running tap water for ~~33 min~~ to 5 min and allow to air dry.

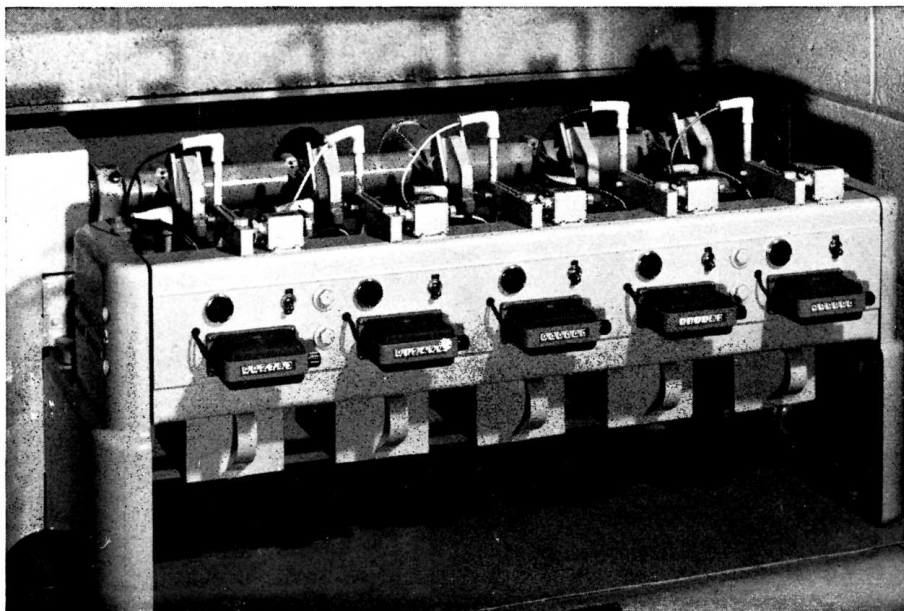


FIG. 1 Dow Corning Leather Tester

5.2 *Rubber Gaskets or Adhesives* for sealing the specimen.

5.3 *Magnet*, to facilitate removal of the stainless steel balls.

5.4 *Sodium Chloride Solution (1 g/L)*—Dissolve ~~1 g~~ 1 g of sodium chloride (NaCl) in distilled water and dilute to ~~1 L~~ 1 L.

6. Test Specimen

6.1 The test specimen shall be ~~3.94~~ 3.94 in. by ~~3.54 ± 0.01 in. (100 by 90 ± .25 mm)~~ 3.54 in. ± 0.01 in. (100 mm by 90 mm ± 0.25 mm) with the backbone direction parallel to the ~~3.54 in. (90 mm)~~ 3.54 in. (90 mm) side.

7. Preparation of Apparatus

7.1 The electrode should be inserted into the steel balls so the tip is covered at all times during flexing but does not rub on the leather fold of the specimen.

7.2 Add NaCl solution to the pan of the Dow Corning Tester until the solution level is as indicated on the pan. If equivalent apparatus is used, adjust the solution level to ~~1 7/16 ± in. ± 1/8 in. (36.5 ± 3.2 mm)~~ in. (36.5 mm ± 3.2 mm) from the bottom of the clamps when the pan is in operating position and there is no specimen in the clamps.

8. Conditioning

8.1 All specimens shall be conditioned in accordance with Practice **D1610**.

9. Procedure

NOTE 2—These instructions are for older models; for newer models refer to manufacturers' operating instructions.

9.1 *Water Penetration and Water Absorption*—Water absorption can be determined concurrently with initial water penetration, or as a separate measurement. If water absorption is to be a separate determination, follow the procedure below with **9.1.12** changed to read “engage the drive-link mechanism.” Do *not* activate the electrode circuit.

9.1.1 Weigh the specimen to the nearest 0.01 g. Optional use when trying to determine water absorption.

9.1.2 Disengage the link to the drive shaft, and place the pin on the underside of the drive-link handle in the back hole on the drive-link bearing. Newer machines do not have drive link handles.

9.1.3 Optional, only needed if the clamps do not tighten well enough to prevent leakage. Fold the specimen in half, bringing each ~~100 mm~~ 3.94 in. (100 mm) edge to itself and with the surface to be exposed to the water on the outside. Fold rubber gasket in half (hard rubber side out) and insert into the specimen. Place the gasket flush with the edge of the specimen and in contact with the bottom of the fold. For a water penetration determination only, coat the ~~100 mm~~ 3.94 in. (100 mm) edge with a film of adhesive no more than ~~12.5 mm~~ 0.49 in. (12.5 mm) wide. Press ends together and hold until cured.

9.1.4 Grasp the specimen with the left hand at the point where the gasket is in place. Place the specimen between the open jaws of a pair of clamps. Position the specimen so that the gasketed end is in the back clamp, with the bottom of the fold flush with the bottom of the clamps.

9.1.5 Grasp the back clamp firmly in the left hand (containing the gasketed end of the specimen) and tighten down the clamp with the wing nut. The specimen must be very securely clamped.

9.1.6 Position the second gasket, folded as before, in the specimen, so that it lies between the jaws of the front clamp. Grasp the clamp with the left hand and tighten the wing nut with the right hand.

9.1.7 Move the drive-link assembly forward and with the forefinger form a horizontal fold perpendicular to the path of the flex. Place the pin on the under side of drive-link handle in the front hole of the drive-link bearing.

9.1.8 Place approximately ~~100~~ 100 g ± 5 g of stainless steel balls into the specimen pocket.