Designation: D 5052 – ~~96~~00

Standard Test Method for Permeability of Leather to Water Vapor[1]

This standard is issued under the fixed designation D 5052; 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 permeability of leather to water vapor by measuring the rate at which water vapor passes through a test specimen. This test method does not apply to wet blue.

1.2 The values stated in either inch-pound or SI units are to be regarded separately as standard. The values stated in each system may not be exact equivalents, therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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:*

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[1] This test method is under the jurisdiction of ASTM Committee D-31 on Leather and is the direct responsibility of Subcommittee D31.07 on Physical Properties—General.
Current edition approved ~~Oct.~~ Sept. 10, ~~1996.~~ 2000. Published ~~December 1996.~~ November 2000. Originally published as D 5052–90. Last previous edition D 5052–~~96~~06.

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

3. Summary of Test Method

3.1 In this test method the water vapor permeability is measured after the test specimen is exposed to moist air on one side and dry air on the other side.

4. Significance and Use

4.1 This test method is intended for use on all types of leathers.

4.2 Water vapor permeability is one of several factors contributing to the relative comfort of footwear, handwear, and garments.

5. Apparatus

5.1 *Analytical Balance*, accurate to 0.001 g.

5.2 *Permeability Apparatus*, as shown in Fig. 1. It shall consist of an aluminum cup having approximately the dimensions shown in Fig. 2 and a template, ⅛ in. thick and 2.225 ± 0.025 in. in diameter ([area is 0.0025 ~~e~~ m^2~~)~~,, or 25 cm^2], made of brass or other non-corrosive metal.

5.3 *Steel Stamping Die*, 2.75 ± 0.1 in. in diameter.

5.4 *Constant Temperature and Humidity Chamber*, ~~that~~ which may be either a laboratory, a cabinet, or a chamber with circulated air maintained at standard condition (23 ± 1°C and 50 ± 4 % relative humidity).

5.5 *Fan*, capable of maintaining an air-flow over the surface of the *Permeability Apparatus* at a velocity of at least 500 ft/min ([254 m/s~~)~~].

6. Reagents and Materials

6.1 *Dessicant*, consisting of fresh 8 mesh anhydrous calcium chloride.

6.2 *Microcrystalline Wax*, with a melting point of 70°C or lower.

7. Procedure

7.1 All specimens shall be conditioned as prescribed in Practice D 1610. Conditioning other than as prescribed shall be noted in the results.

7.2 Fill the aluminum cup with the desiccant to a height between ⅛ and ¼ in. ~~(~~ [3.2 to 6.4 ~~mm)~~ mm] below the level of the rim, as shown in Fig. 1. Leave enough space so that shaking of the dish, ~~that~~ which must be done after each weighing, will mix the desiccant. Place the specimen, with the grain side downward, over the desiccant and center with the cup. Place the template flat on the specimen and center as nearly as possible with the cup. Apply a slight pressure to the template to ensure good contact between the rim of the cup, the specimen, and the template around the entire rim. Fill the groove formed by the lip of the cup and the edge of the template with melted wax that is allowed to harden before the template is removed. (The removal of the template from the hardened wax is facilitated by applying a coat of petroleum jelly to the edge and chilling the template prior to use.)

7.3 Place the complete assembly in the constant temperature and humidity chamber, specimen side up. Adjust the air flow so that the velocity over the specimen shall be at least 500 ft/min ~~(~~ [254 m/s~~)~~]. At the end of 1 h, weigh the assembly to the nearest

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

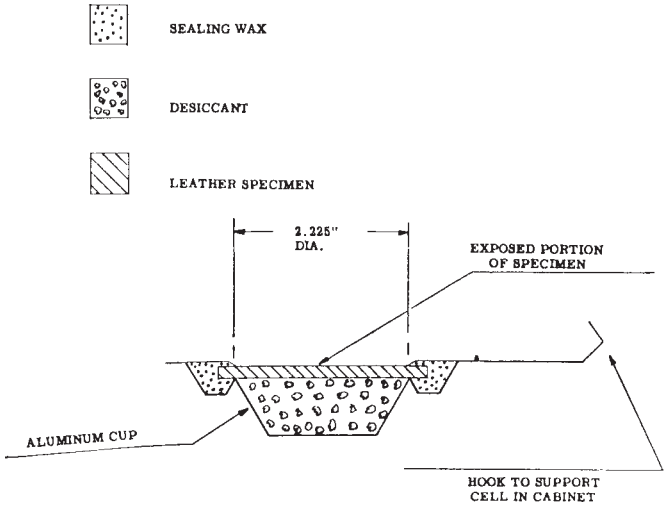

FIG. 1 Permeability Apparatus

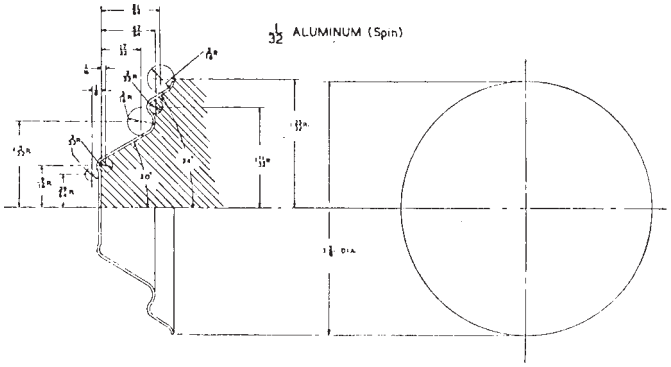

FIG. 2 Spining Stud for Water Vapor Permeability Dish

~~0.1 g shaking~~ 0.001 g. This will be considered the "initial weight." Shake the assembly after weighing to redistribute the surface of the desiccant. (The assembly shall preferably be weighed in the constant temperature and humidity chamber. If this is not possible, the assemblies can be removed and weighed one at a time, provided they are returned to the chamber in 2 min or less.) Weigh the assembly at ~~0.5 h~~ 1–h intervals shaking the assembly after each weighing until three or more successive weighings show weight increases that are equal within 0.0~~1~~2 g. (The weighing intervals can be extended ~~to 1 h or more~~ longer for specimens with low permeability.) Total time should be no less than 4 h and not more than 24 h. The last weighing will be recorded as the "final weight."

8. Calculation

8.1 Calculate the permeability to water vapor of the test specimen by one of the following ~~formula:~~ equations:

$$P = \frac{I}{AT} \tag{1}$$

where:

P = water vapor permeability in grams per square centi-metre per hour,
I = increase in weight in grams in ~~0.5 time, T,~~ total time,
A = area of the exposed specimen in square centimetres (normally 25), and
T = total time of exposure in hours ~~after equilibrium has been reached.~~ between intial and final weighings.

OR

$$P = \frac{I}{AT} \tag{2}$$

where:

P = water vapor permeability in grams per square centimetre per 24 h (day),
I = increase in weight in grams in total time multiplied by 24,
A = area of the exposed specimen in square metres (normally 0.0025), and
T = total time of exposure in hours between intial and final weighings.

9. Report

9.1 The average of the results obtained from the test specimens shall be the water vapor permeability of the sample.

10. Precision and Bias

10.1 This test method is adopted from the procedures of the American Leather Chemists Association[3] where it has long been in use and where it was approved for publication before the inclusion of precision and bias statements were mandated. The original interlaboratory test data is no longer available. The user is cautioned to verify by the use of reference materials, if available, that the precision and bias of this test method is adequate for the contemplated use.

[3] American Leather Chemists Association, Office of Secretary-Treasurer, Campus Station, Cincinnati, OH 45221.