Designation: D 2214 – 00

Standard Test Method for Estimating the Thermal Conductivity of Leather with the Cenco-Fitch Apparatus[1]

This standard is issued under the fixed designation D 2214; 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 quantitative determination of the thermal conductivity of leather. The measured parameters are the area, the thickness, and the temperature difference between the two sides of a leather specimen. This test method is not limited to leather, but may be used for any poorly conductive material such as rubber, textiles, and cork associated with the construction of shoes. Specimens up to 0.5 in. (13 mm) thick may be run. This test method does not apply to wet blue.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are provided 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.*

NOTE 1—Thermal conductivity must be measured under steady-state conditions; however, this transient test method can be used to estimate the thermal conductivity of leather.

2. Referenced Documents

2.1 *ASTM Standards:*

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

3. Terminology

3.1 *Definitions:*

3.1.1 *thermal conductivity*—the quantity of heat conducted per unit time through unit area of a slab of unit thickness having unit temperature difference between its faces.

4. Summary of Test Method

4.1 A conditioned specimen of leather is placed between two plates at different temperatures. The upper plate is at a constant temperature while the temperature of the lower plate is slowly changing. The temperature difference is measured by thermocouples. The rate of flow of heat through the specimen is proportional to the area and the temperature difference of the faces of the specimen, and inversely proportional to the thickness. Assuming no heat loss, the amount of heat flowing through the specimen per unit time is equal to the amount of heat received by the lower plate (copper block receiver) per unit time.

5. Significance and Use

5.1 Part of the function of a shoe is to assist the foot in maintaining body temperature and to guard against large heat changes. The insulating property of a material used in shoe construction is dependent on porosity or the amount of air spaces present. A good insulating material has a low thermal conductivity value, *k*. The thermal conductivity value increases with an increase in moisture content since the *k* value for water is high, 14 by 10^4cal·cm/s·cm^4 · °C (0.59 W/m·K).

6. Apparatus

6.1 *Cenco-Fitch Conductivity Apparatus*— The apparatus shall consist of two parts, the source and the receiver. The source shall be a copper vessel, heat insulated on the sides. The base of the source shall be a heavy copper plate which shall be face ground and nickel plated. The receiver shall contain an insulated copper plug which shall also be face ground. A copper-constantan junction shall be embedded in the base of the source and leads connected to a binding post in the side of the vessel. A second copper-constantan junction shall be embedded in the copper receiver and leads connected to a binding post on the side of the receiver. The mass of the copper plug shall be stamped on the receiver.

6.2 *Galvanometer*—A galvanometer with a linear scale shall be used to record the current or deflections. If the galvanometer is so sensitive that the readings are off scale, a shunt or fixed resistor may be connected between the galvanometer and receiver.

6.3 *Immersion Heater*—A knife-shaped heater shall be used to maintain a constant temperature of the liquid water at the boiling point.

6.4 *Mass, 5-kg*—A mass of about 5 kg shall be placed around the collar of the vessel to ensure close contact between the surfaces of the apparatus and the specimen.

6.5 *Micrometer*—A micrometer shall be used to measure the

[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. (Standard Method E 60 – 1965).

Current edition approved Sept. 10, 2000. Published October 2000. Originally published as D 2214 – 63T. Last previous edition D 2214 - 70 (1997).

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