



Standard Method of Test for THERMAL CONDUCTIVITY OF CELLULAR PLASTICS BY MEANS OF A PROBE¹

This Standard is issued under the fixed designation D 2326; 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.

The committee responsible for this standard has voted its withdrawal. In the absence of substantial reasons that it should be continued, the Society will approve withdrawal from publication in April 1977.

1. Scope

1.1 This method covers the determination, by means of a probe, of the thermal conductivity of cellular plastics having thermal conductivities that are not in excess of 0.058 W/m · K (0.4 Btu · in./h · ft² · deg F). The test may be run over a range of temperatures within the temperature limits of the material being tested.

1.2 The probe method is a transient method for determining thermal conductivity. Heat is applied at a constant rate along a line. The temperature rise of the line source is proportional to the logarithm of time and inversely proportional to the thermal conductivity of the surrounding medium.

NOTE 1—The values stated in SI units are to be regarded as the standard.

2. Significance

2.1 The probe method is an absolute method for determination of k values directly, so that no calibration based on a specimen of known thermal conductivity is required. Low cost and simplicity of operation makes the method especially useful for screening purposes in laboratory and in plant use. In cases of dispute ASTM Method C 177, Test for Thermal Conductivity of Materials by Means of the Guarded Hot Plate,² shall be used.

3. Symbols and Definitions

3.1 For symbols and definitions, see Method C 177.

4. Apparatus

4.1 The general features of a suitable probe

for this method are shown in Fig. 1. It consists of a heater and thermocouple in a protective sheath that terminates in a plastic handle. The layout and electrical schematic drawing for the probe is shown in Fig. 2. In addition, a constant-temperature enclosure as specified in 4.6 is required.

4.2 The heating element shall be made in the form of a bifilar coil. This construction eliminates inductive effects and makes possible high resistance which greatly simplifies the problem of supplying a constant voltage for the power source. At the same time, it places the heater nearer the surface of the probe and decreases the axial heat flow along the heater wire.

4.3 The probe need not be of specified length or diameter and need not have a specified length-to-diameter ratio; however, in practice it has been found that a protective sheath 0.51 mm (0.020 in.) in diameter, a length of approximately 200 mm (8 in.), and a heater resistance of approximately 1800 Ω has proved satisfactory for cellular plastics. The resistance and length of the heater coil (ohms per unit length) must be known with an accuracy of at least ± 0.5 percent.³

4.4 The power source (see Fig. 2) shall consist of a battery and variable series resistor, a precision milliammeter, and a resistance

¹ This method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D-20.22 on Cellular Plastics.

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² Annual Book of ASTM Standards, Part 35.

³ A commercially available probe which has proven to be satisfactory for cellular plastics is available from Custom Scientific Instruments, Inc., P.O. Box A, Whippany, N. J.