



Standard Test Method for COEFFICIENT OF CUBICAL THERMAL EXPANSION OF PLASTICS¹

This Standard is issued under the fixed designation D 864; 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.

1. Scope

1.1 This method covers the determination of the coefficient of cubical thermal expansion of both rigid and nonrigid plastics.

1.2 The thermal expansion of a plastic is composed of a reversible component on which are superimposed changes in volume due to changes in moisture content, curing (degree of polymerization), loss of plasticizer or solvents, release of stresses, and other factors. This method covers determination of the reversible cubical thermal expansion under exclusion of these spurious factors. Some plastics show more or less abrupt changes in the coefficient of cubical thermal expansion in narrow temperature intervals, which indicate changes in molecular structure or second-order transition points. They can be investigated by careful measurements in the critical temperature range.

2. Applicable Documents

2.1 ASTM Standards:

D 1898 Recommended Practice for Sampling of Plastics²

D 618 Conditioning Plastic and Electrical Insulation Material for Testing²

3. Significance and Use

3.1 The coefficient of cubical thermal expansion is important to predict the dimensional changes that may occur to fabricated parts during service.

3.2 Data from this method may be used to compare materials, or material specifications.

3.3 For data to be published in tables of

properties of plastics, it is recommended that the coefficient of cubical thermal expansion as derived from reading at -30° and $+30^{\circ}\text{C}$ be given.

4. Apparatus

4.1 *Dilatometer*—A glass dilatometer as shown in Fig. 1 (Note 1). It shall consist of two pieces of borosilicate glass tubing sealed together as shown in Fig. 1(a). The lower or bulb member shall be approximately 200 mm in length, 10 mm in outside diameter, and 1 mm in wall thickness. The capillary part shall be approximately 1 m in length, 6 mm in outside diameter, and about 0.7 mm in inside diameter. The inside diameter shall be tested for uniformity and, if necessary corrections shall be made for irregularities in diameter.³ A suitable scale shall be attached to the dilatometer as shown in Fig. 1(b). The scale shall extend from the top of the capillary to within a short distance of the stem mark and shall be graduated so that readings can be made to the nearest 0.5 mm.

NOTE 1—Glass dilatometers as described in this method have been used successfully. Dilatometer bulbs made from a metal with low thermal expansion may also be used, provided the expansion characteristics of the metal are known and are taken fully into consideration when calculating the

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² *Annual Book of ASTM Standards*, Part 35.

³ For method of calibrating capillary see Joseph Reilly and W. N. Rae, *Physico-Chemical Methods*, Vol I, Van Nostrand, 1943, p. 362.