



Standard Test Method for Indentation Softening Temperature by Thermomechanical Analysis¹

This standard is issued under the fixed designation E2347; 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 is applicable to materials that soften upon heating to a modulus less than 6.0 MPa. This test method describes the determination of the temperature at which the specific modulus of either 6.65 (Method A) or 33.3 MPa (Method B) (equivalent to Test Method D1525) of a test specimen is realized by indentation measurement using a thermomechanical analyzer as the test specimen is heated. This temperature is identified as the indentation softening temperature. The test may be performed over the temperature range of ambient to 300°C.

NOTE 1—This test method is intended to provide results similar to those of Test Method D1525 but is performed on a thermomechanical analyzer using a smaller diameter indenting probe. Equivalence of results to those obtained by Test Method D1525 has been demonstrated on a limited number of materials. Until the user demonstrates equivalence, the results of this Test Method shall be considered to be independent and unrelated to those of Test Method D1525.

1.2 This test method is not recommended for ethyl cellulose, poly (vinyl chloride), poly (vinylidene chloride) and other materials having a large measurement imprecision (see Test Method D1525 and 5.3 and Section 14).

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 There is no ISO standard equivalent to this test method.

1.5 *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.*

¹ This test method is under the jurisdiction of ASTM Committee E37 on Thermal Measurements and is the direct responsibility of Subcommittee E37.10 on Fundamental, Statistical and Mechanical Properties.

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2. Referenced Documents

2.1 *ASTM Standards*:²

D1525 Test Method for Vicat Softening Temperature of Plastics

E473 Terminology Relating to Thermal Analysis and Rheology

E1142 Terminology Relating to Thermophysical Properties

E1363 Test Method for Temperature Calibration of Thermomechanical Analyzers

E2113 Test Method for Length Change Calibration of Thermomechanical Analyzers

E2206 Test Method for Force Calibration of Thermomechanical Analyzers

3. Terminology

3.1 *Definitions*:

3.1.1 Specific technical terms used in this test method are defined in Terminologies E473 and E1142 including *Celsius*, *complex modulus*, *modulus*, *strain*, *stress*, *storage modulus*, *thermal analysis*, and *thermomechanical analysis*.

3.1.2 *penetration softening temperature*, [°C], *n*—the temperature at which a test specimen has a modulus of either 6.65 or 33.3 MPa as measured in penetration.

4. Summary of Test Method

4.1 The modulus of a material may be determined by the indentation (penetration) of a circular, flat tipped probe. The relationship between modulus of a material (stress divided by strain) and penetration depth is given by:

$$E = 3 F / (4 D d) \quad (1)$$

where:

E = modulus, MPa,

F = force, N,

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 standards Document Summary page on the ASTM website.