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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Guide for Describing the General Principles for Determining the Temperature of Deflection of Plastics Under Load[1]

This standard is issued under the fixed designation D 5944; 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 guide covers procedures for determination of the temperature of deflection under load (bending stress under three-point loading) of different types of material.

1.2 This guide is identical to ISO 75-1. This guide is comparable to Test Method D 648, but neither standard should be substituted for the other. The two standards may differ with respect to test specimen dimensions, test specimen conditioning, test equipment, testing conditions, etc. The two procedures may not give the same results.

1.3 The procedures specified are suitable for assessing the behavior of different types of material at elevated temperature under load at a specified rate of temperature increase. The results obtained do not necessarily represent maximum use temperatures because, in practice, essential factors such as time, loading conditions, and nominal surface stress may differ from the test conditions.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load[2]

2.2 *ISO Standards:*[3]

ISO 75-1 Determination of Temperature of Deflection Under Load—Part 1: General Test Method

ISO 291:1977 Plastics—Standard Atmospheres for Conditioning and Testing

3. Terminology

3.1 *Definitions:*

3.1.1 *deflection*—the distance, at mid-span, over which the top or bottom surface of a test specimen deviates, during flexure, from its original position. It is expressed in millimetres.

3.1.2 *flexural strain*—the nominal fractional change in length of an element at the surface of the test specimen at mid-span. It is expressed as a dimensionless quantity.

3.1.3 *flexural stress*, σ—the nominal stress at the surface of the test specimen at mid-span. It is expressed in megapascals.

3.1.4 *standard deflection*, *s*—the deflection that will result in the flexural strain, at the surface of the test specimen, which is specified in the relevant part of this guide. The standard deflection depends on the dimensions and position of the test specimen and the span between the supports. It is expressed in millimetres.

3.1.5 *temperature of deflection under load*, T_f—the temperature at which the deflection of the test specimen reaches the standard deflection as the temperature is increased. It is expressed in degrees Celsius.

4. Principle

4.1 A standard test specimen is subjected to a bending stress to produce one of the nominal surface stresses given in the relevant part of this guide. The temperature is raised at a uniform rate, and the temperature at which a specified deflection occurs is measured.

5.

6. Apparatus

6.1 *Means of Applying a Bending Stress*:

6.1.1 The apparatus shall be constructed essentially as shown in Fig. 1. It consists of a rigid metal frame in which a rod can move freely in the vertical direction. The rod is fitted with a weight-carrying plate and a loading edge. The base of the frame is fitted with test specimen supports; these and the vertical members of the frame are made of a metal having the same coefficient of linear expansion as the rod.

6.1.2 The test specimen supports consist of cylindrical metal pieces at a distance apart, defined in the relevant part of this guide, with their lines of contact with the specimen in a

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

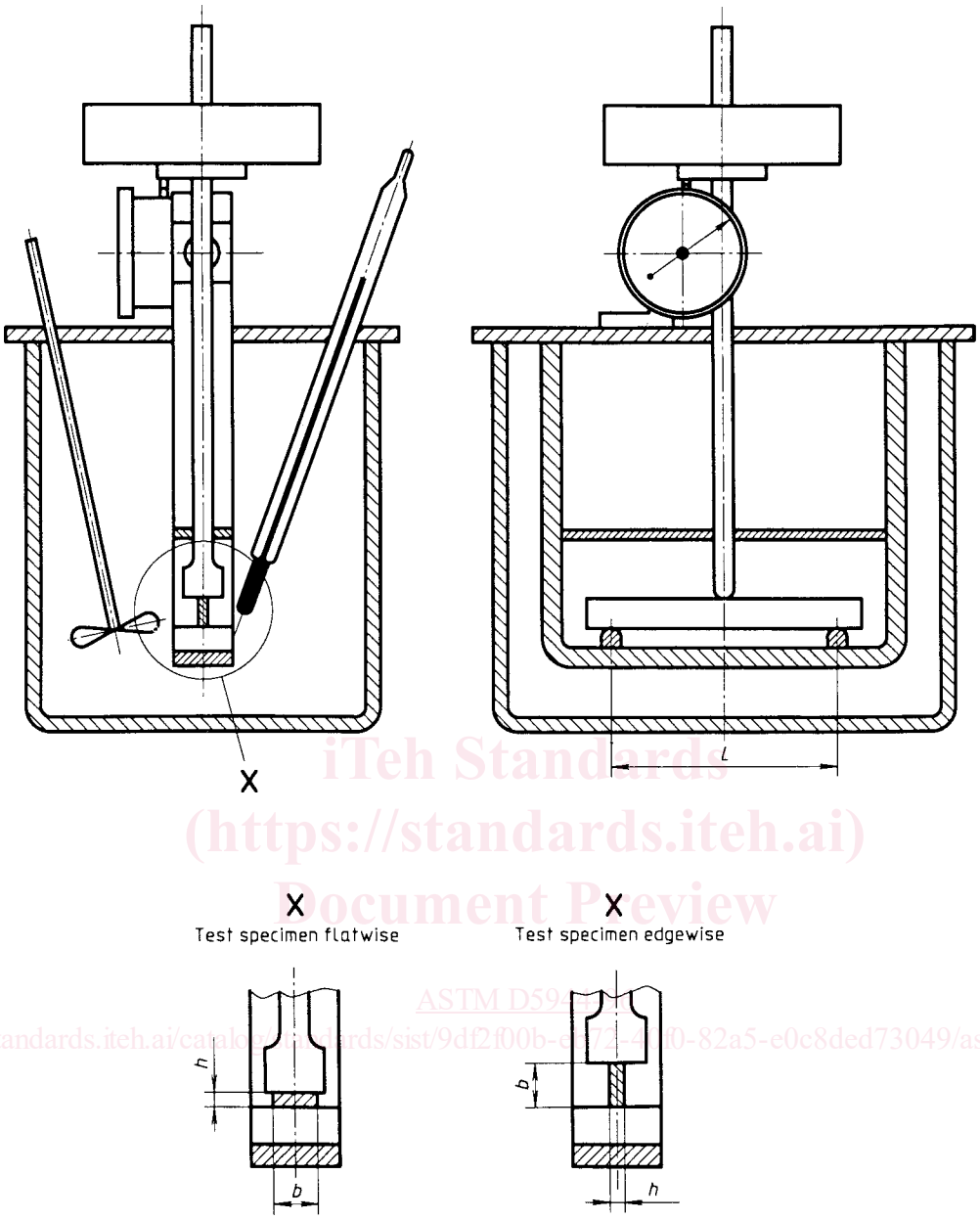

FIG. 1 Typical Apparatus for Determination of Temperature of Deflection Under Load

horizontal plane. The supports are fitted to the base of the frame in such a way that the vertical force applied to the test specimen by the loading edge is midway between them. The contact edges of the supports are parallel to the loading edge and at right angles to the length direction of a test specimen placed symmetrically across them. The contact edges of the supports and loading edge are rounded to a radius of 3.0 ± 0.2 mm and shall be longer than the width of the test specimen.

6.1.3 Unless vertical parts of the apparatus have the same coefficient of linear expansion, the differential change in the length of these parts introduces an error in the reading of the apparent deflection of the test specimen. A blank test shall be made on each apparatus using a test specimen made of rigid material having a low coefficient of expansion. The blank test shall cover the temperature ranges to be used in the actual determination, and a correction term shall be determined for each temperature. If the correction term is 0.010 mm or greater, its value and algebraic sign shall be noted and the term applied to each test by adding it algebraically to the reading of the apparent deflection of the test specimen.

NOTE 1—Invar and borosilicate glass have been found suitable as materials for the test specimen in the blank test.

6.2 *Heating Equipment*:

6.2.1 The heating equipment may be a heating bath containing a suitable liquid, a fluidized bed, or an oven with forced circulation of air or nitrogen.

6.2.2 The heating equipment shall be provided with a control unit so that the temperature can be raised at a uniform rate of 120± 10°C/h. This heating rate shall be considered to be met if, over every 6-min interval during the test, the temperature change is 12 ± 1°C.