



Designation: D 671 – 93

Standard Test Method for Flexural Fatigue of Plastics by Constant-Amplitude-of-Force¹

This standard is issued under the fixed designation D 671; 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 determination of the effect of repetitions of the same magnitude of flexural stress on plastics by fixed-cantilever type testing machines, designed to produce a constant-amplitude-of-force on the test specimen each cycle.

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

1.3 *This standard does not purport to address all of the safety problems, 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 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²

D 4000 Classification System for Specifying Plastic Materials³

3. Summary of Test Method

3.1 This test method measures the ability of a material to resist deterioration from cyclic stress. The test results provide data on the number of cycles of stress to produce specimen failure by fracture, softening, or reduction in stiffness by heating as a result of internal friction (damping).

4. Significance and Use

4.1 The flexural fatigue test provides information on the ability of rigid plastics to resist the development of cracks or general mechanical deterioration of the material as a result of a relatively large number of cycles of constant amplitude of force.

4.2 This test method is useful to determine the effect of variations in material, stress, and environmental conditions on the ability of a material to resist deterioration resulting from repeated stress. It may also be used to provide data for use as a guide to design and selection of materials for service under conditions of repeated stress.

4.3 The results are suitable for direct application in design only when all design factors including magnitude and mode of stress, size and shape of part, ambient and part temperature, heat transfer conditions, cyclic frequency, and environmental conditions are comparable to the test conditions.

4.4 The results obtained from testing machines other than the type described here may not agree due to differences in specimen size and geometry, testing machine speeds, heat transfer, material fabrication, etc.

4.5 The type of machine covered in this test method is suitable for determining the fatigue strength for a range of mean stress in flexure. However, for plastic materials, which creep and stress relax, the effect of a mean stress other than zero is to cause relaxation so that the stress cycle tends to approach the condition of complete reversal of stress.

4.6 Tests of thin sheet yield results which vary with the thickness of the sheet (Note 1). Because of this fact the thickness of the sheet shall be specified when reporting results of tests of thin sheet; and all comparisons of different materials, or selection of materials on the basis of fatigue strength, shall be made from results of tests of standard specimens or tests in which the same thickness of sheet is used for all materials.

NOTE 1—For the purposes of this test a thin sheet shall be defined as a sheet less than 7.6 mm (0.3 in.) in thickness or a material for which the ratio of the modulus of elasticity to the fatigue limit is less than 100. The reason for these restrictions is that thin sheets and materials having a low modulus of elasticity are bent so much under the required loads that the fatigue specimen cannot (in the deflected position) be considered a straight beam and hence the following equation is not accurate:

$$S = Mc/I$$

where:

S = stress in outer fiber,

M = bending moment (PL),

c = distance from neutral axis to outer fiber, and

I = moment of inertia.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

Current edition approved Oct. 15, 1993. Published December 1993. Originally published as D 671 – 42 T. Last previous edition D 671 – 90.

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

³ *Annual Book of ASTM Standards*, Vol 08.03.