



Standard Test Method for Creep and Time to Failure of Adhesives in Static Shear by Compression Loading (Wood-to-Wood)¹

This standard is issued under the fixed designation D 4680; 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 time-dependent properties of structural adhesives in wood-to-wood bonds when specimens are subjected to shearing stresses at various levels of static load, constant temperature, and relative humidity. Apparatus and procedures are provided for direct measurement of time-dependent shear deformation (creep) and time to failure of adhesive bonds under static load. Guidelines for selecting test conditions, methods for calculating creep rate, creep strain, creep modulus, and extrapolation of time to failure, are given along with methods of presenting these data.

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

1.3 *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:²

D 143 Test Methods for Small Clear Specimens of Timber
D 905 Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading
D 907 Terminology of Adhesives
D 2016 Test Methods for Moisture Content of Wood

2.2 ASTM Adjuncts:

Compression-Shear Creep Test Apparatus³

3. Terminology

3.1 **Definitions**—Many terms in these test methods are defined in Terminology D 907.

¹ This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.30 on Wood Adhesives.

Current edition approved April 1, 2004. Published April 2004. Originally approved in 1987. Last previous edition approved in 1998 as D 4680 – 98.

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 standard's Document Summary page on the ASTM website.

³ Available from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. Request No. ADJD4680.

3.1.1 **creep**—the dimensional change with time of a material under load, following the initial instantaneous elastic or rapid deformation. Creep at room temperature is sometimes called cold flow.

3.1.2 **creep modulus**—the ratio of initial applied stress to creep strain.

3.1.3 **creep strain**—the total strain, at any given time, produced by the applied stress during a creep test.

3.1.3.1 **Discussion**—In this test method, creep strain is calculated by dividing displacement at any given time by the estimated apparent thickness of the adhesive bondline.

3.1.4 **rate of creep**—the slope of the creep-time curve at a given time.

3.1.5 **shear stress**—the stress component tangential to the plane on which the forces act, that is, in the plane of the bond line.

3.1.6 **strain**—the unit change, due to stress, in the size or shape of a body referred to its original size or shape.

3.1.7 **stress, *n***—the force exerted per unit area at a point within the plane.

4. Significance and Use

4.1 Creep data that are obtained over a relatively short period of time in this test method can provide a measure of an adhesive bond's ability to withstand static loading in shear over a relatively long period of time. Creep measurements are made over a range of expected service conditions, including level of stress, temperature, relative humidity, and duration of load. Creep rate, creep strain, and creep modulus are calculated at the various service conditions.

4.2 Creep data can be used to (1) predict performance of an adhesive under long-term loading, (2) characterize an adhesive, (3) compare adhesives with each other and against specifications, and (4) design structural members fabricated with an adhesive.

4.3 Time-to-failure data provide a measure of the ultimate load-carrying ability of an adhesive bond as a function of time at various levels of stress, temperature, and relative humidity.

4.4 With proper caution, time-to-failure data derived from relatively short loading periods can be extrapolated to estimate the useful service life of an adhesive at working levels of static stress. This property may also be used with creep data to accomplish purposes listed in 4.2.