Designation: D2293 – 96 (Reapproved 2016)

Standard Test Method for Creep Properties of Adhesives in Shear by Compression Loading (Metal-to-Metal)[1]

This standard is issued under the fixed designation D2293; 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 creep properties of adhesives for bonding metals when tested on a standard specimen and subjected to certain conditions of temperature and compressive stress in a spring-loaded testing apparatus.

1.2 The values stated in SI units are to be regarded as standard. The inch-pound units 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]

D907 Terminology of Adhesives

D1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

3. Terminology

3.1 *Definitions*—Many terms in this test method are defined in Terminology D907.

4. Significance and Use

4.1 This test method is useful in research and development for comparison of creep properties of adhesives, particularly as those properties are affected by changes in adhesive formulation or expected service conditions, including temperature, moisture level, and duration of loading.

4.2 The relative size and simplicity of design of the spring-loaded apparatus permits easy portability and transfer from one environment to the next without disturbing static loads.

4.3 The relative simplicity of design with inexpensive materials permits replication of creep tests at relatively low costs.

5. Apparatus

5.1 *Compression Creep Test Apparatus,* as shown in Fig. 1 and Fig. 2.

5.2 *Microscope,* calibrated, with Filar microeyepiece and 10× objective lens.

6. Test Specimens

6.1 Test specimens shall conform to the form and dimensions shown in Fig. 3. These specimens are similar to the tension lap shear specimens described in Test Method D1002, except that the length of either side of the shear area shall be 6.35 mm (¼ in.) rather than 88.9-mm (3½-in.) minimum.

6.2 A complete description of these specimens and the method of preparation is given in Sections 6, 7, and 8 of Test Method D1002.

6.3 For creep measurements, polish the edges of the bonded area of each test specimen, and scribe with three fine lines across the bondline.

7. Procedure

7.1 To conduct a creep test, center the specimen within the slot between the washer and bushing of the apparatus as shown in Fig. 1. Compress the spring between the two bushings to the desired load by tightening the nut. The correct load can be applied by deflecting the spring a given measured amount as determined from a calibration curve.

7.2 To measure total deflection, observe the average displacement of fine razor scratches across the centers of both sides of the lap joints with a calibrated microscope having a Filar microeyepiece and a 10× objective lens.

7.3 If the spring load is allowed to continue to compress the specimen, the observed initial deflection will be followed by a continued increasing deflection with time. To provide a complete history of creep behavior, measure these deflections

[1] This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives.

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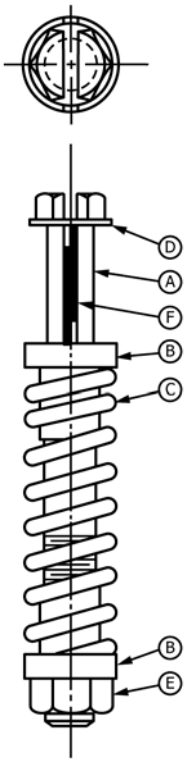
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



A—Slotted bolt
B—Bushing
C—Spring—piano wire cylindrical helical compression spring with six active coils, eight total coils, wound closed, ground square, and cadmium plated
D—Washer—22.25-mm (⅞-in.) OD, 12.7-mm (½-in.) ID, 1.6 mm (1⁄16 in.) thick
E—Nut–12.7 mm (½ in.)—20 NF
F—Test specimen

FIG. 1 Compression Creep Test Apparatus, Assembly

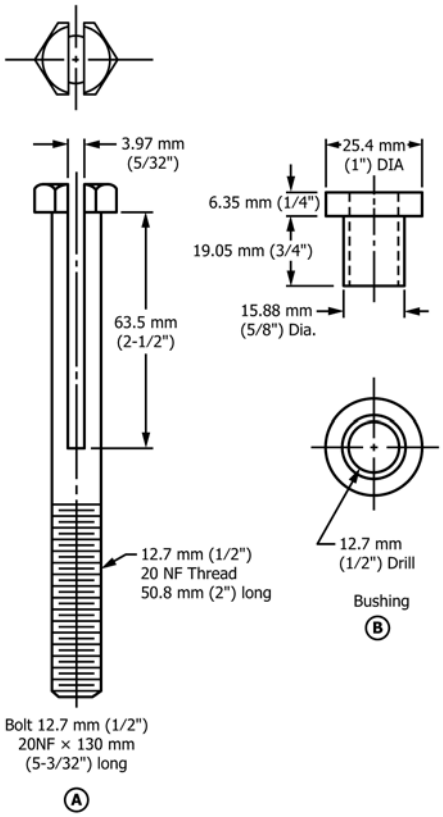


FIG. 2 Compression Creep Test Apparatus, Details

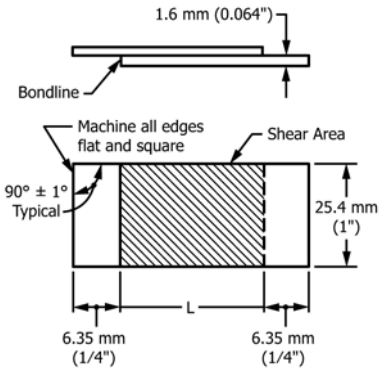


FIG. 3 Form and Dimensions of Test Specimen

periodically with the calibrated microscope for as long as the test is allowed to continue or until the adhesive joint fails.

7.4 If a creep curve at other than room temperature is required, perform both the specimen loading and its subsequent exposure while holding the specimen to the desired temperature. A suitable oven or cold box may be used for this purpose. Under these conditions, the actual creep measurements are more difficult to obtain. This can be done, however, in one of two ways. The microscopic measurements can be made quickly and the specimen and its apparatus returned to its temperature box before its test temperature has changed appreciably. Or, periodically, additional fine scribe lines can be added adjacent to the original scratches across the centers of both sides of the lap joints and all of the displacements measured and calculated in terms of differences from the original scratches at the conclusion of the test. If final scratches are made just before the specimen is removed from the temperature box, the displacement measurements can be made at room temperature and with the specimen unloaded if desired. Furthermore, relaxation of the specimen after unloading can also be measured if the displacement readings are continued.

7.5 If buckling of the specimen occurs due to compressive creep of the metal, discount the test and redesign the specimen.

7.6 Record the total observed average deflection, the magnitude and duration of the compressive stress, and the test temperature for each specimen.

8. Report

8.1 Report the following information:

8.1.1 Complete description of materials and procedures used and dimensions of the specimen,

8.1.2 Creep of specimen defined as the quotient of the total measured deflection and the bondline thickness, expressed in millimetres per millimetre (or inches per inch),

8.1.3 Magnitude and duration of the compressive stress and the test temperature, and

8.1.4 Nature of the failure if it occurs before the creep test is completed.

9. Precision and Bias

9.1 At the present time, there is no basis for a statement of precision and bias concerning the reproducibility of results among laboratories.

9.2 The precision and bias of this test method is a function of the properties of the cured bondline. Report precision as standard deviation of the data and standard error of the mean.

10. Keywords

10.1 creep; metal-to-metal bonds; shear by compression loading