



Designation: D 3166 – 99

Standard Test Method for Fatigue Properties of Adhesives in Shear by Tension Loading (Metal/Metal)¹

This standard is issued under the fixed designation D 3166; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the measurement of fatigue strength in shear by tension loading of adhesives on a standard specimen and under specified conditions of preparation, loading, and testing.

1.2 *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 907 Terminology of Adhesives²

D 1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)²

3. Terminology

3.1 *Definitions*—Many terms in this test method are defined in Terminology D 907.

4. Significance and Use

4.1 While this test method is intended for use in metal-to-metal applications it may be used for measuring the fatigue properties of adhesives using plastic adherends, provided consideration is given to the thickness of the plastic adherends. Doublers may be required for plastic adherends to prevent bearing failure in the adherends.

4.2 A variation in the thickness of the adherends can influence the test results. For this reason, the thickness of the sheets used to make the test specimens should be specified in

the material specification. When no thickness is specified, metal adherends 1.63 mm (0.064 in.) thick are recommended.

5. Apparatus

5.1 *Testing Machine*, capable of applying a sinusoidal cyclic axial load. The cyclic rate and type of equipment (constant load or constant displacement) can influence test results. For this reason, the cyclic rate and equipment should be specified in the material specification. When no cyclic rate is specified 1800 cycles/min is recommended. Employ suitable grips and jaws so that the specimen can be gripped tightly and held in alignment as the load, accurate within $\pm 2\%$, is applied.

6. Test Specimens

6.1 Use test specimens conforming to the shape and dimensions shown in Fig. 1, having grip ends suitable for use in the particular testing machine. These specimens are similar to the tension lap-shear specimens described in Test Method D 1002.

6.2 Test at least 25 specimens shall be tested, representing at least 4 different panels.

6.3 Prepare, cut, finish, and condition the specimens in the same manner as for Test Method D 1002. Employ an overlap of 9.5 mm (0.38 in.) for 1.63-mm (0.064-in.) aluminum alloys. Ensure that the dimensions of other materials are such that failures occur in the bond. (An overlap of 12.7 mm (0.50 in.) for 6.4-mm (0.25-in.) thick nonmetals should be used if possible.)

7. Procedure

7.1 Unless otherwise specified, test the specimens in an atmosphere maintained at $50 \pm 4\%$ relative humidity and $23 \pm 1.1^\circ\text{C}$ ($73.5 \pm 2^\circ\text{F}$). Precondition the specimens for at least 16 h.

7.2 Place the specimen in the jaws of the testing machine and grip tightly so that the specimen and the jaws are perfectly aligned in such a position that an imaginary vertical line would pass through the center of the bonded area and through the points of suspension (Fig. 1). Ensure that the edge of the lap is 25.4 mm (1 in.) from the edge of the grip. Apply the cyclic

¹ This test method is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives.

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² *Annual Book of ASTM Standards*, Vol 15.06.