



Standard Test Method for Fracture Strength in Cleavage of Adhesives in Bonded Metal Joints¹

This standard is issued under the fixed designation D3433; 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 (**1, 2, 3, 4, 5**)² covers the determination of fracture strength in cleavage of adhesives when tested on standard specimens and under specified conditions of preparation and testing (**Note 1**).

1.2 This test method is useful in that it can be used to develop design parameters for bonded assemblies.

NOTE 1—While this test method is intended for use in metal-to-metal applications it may be used for measuring fracture properties of adhesives using plastic adherends, provided consideration is given to the thickness and rigidity of the plastic adherends.

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

1.4 *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:³

A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)⁴

A366/A366M Specification for Commercial Steel (CS) Sheet, Carbon, (0.15 Maximum Percent) Cold-Rolled (Withdrawn 2000)⁴

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 The boldface numbers in parentheses refer to the references at the end of this test method.

³ 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.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar

B152/B152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar

B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate

B265 Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate

D907 Terminology of Adhesives

E4 Practices for Force Verification of Testing Machines

E399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials

3. Terminology

3.1 **Definitions:** Many of the terms used in this test method are defined in Terminology D907.

3.2 **Definitions of Terms Specific to This Standard:**

3.2.1 **crack-extension force, G** —the system isolated (fixed load-displacement) loss of stress field energy for an infinitesimal increase, dA , of separational area. In equation form,

$$GdA = -dU_T \quad (1)$$

where U_T = total elastic energy in the system (component or test specimen). In the test specimens of this method, the crack front is nearly straight through the specimen thickness, B , so that $dA = B da$, where da is an infinitesimal forward motion of the leading edge of the crack. Completely linear-elastic behavior is assumed in the calculations (See **Annex A1**) of G used in this method, an allowable assumption when the zone of nonlinear deformation in the adhesive is small relative to specimen dimensions and crack size.

3.2.1.1 When the shear stress on the plane of crack and forward to its leading edge is zero, the stress state is termed “opening mode.” The symbol for an opening mode G is G_I for plane-strain and G_I when the connotation of plane-strain is not wanted.

3.2.2 **opening mode fracture toughness, G_{Ic}** —the value of G just prior to onset of rapid fracturing when G is increasing with time.

3.2.3 **opening mode crack arrest toughness, G_{Ia}** —the value of G just after arrest of a run-arrest segment of crack extension.

3.2.3.1 It is assumed that the dimensions of the part containing the crack are large compared to the run-arrest segment