



Standard Test Method for Tear Testing of Aluminum Alloy Products¹

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1. Scope

1.1 This test method covers the static tear test of aluminum alloy products using specimens that are 0.040 in. (1 mm) to 0.250 in. (6.35 mm) thick.

1.2 This test method is applicable to aluminum alloy products having a minimum thickness of 0.040 in. (1 mm).

1.3 This test method provides a measure of both notch toughness and resistance to crack propagation with the primary use as a screening or merit rank test.

1.4 The reliability of the tear test has been established in various research programs by reasonably good correlations between data from the tear tests and fracture toughness tests.^{2,3}

NOTE 1—Direct measurement of fracture toughness may be made in accordance with Practices B645, B646 and Test Method E399.

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

1.6 *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:⁴

B557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

B645 Practice for Linear-Elastic Plane-Strain Fracture Toughness Testing of Aluminum Alloys

¹ This test method is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.05 on Testing.

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² Kaufman, J. G., and Holt, Marshall, "Fracture Characteristics of Aluminum Alloys," Alcoa Research Laboratories Technical Paper No. 18.

³ Kaufman, J. G., and Knoll, A. H., "Kahn-Type Tear Tests and Crack Toughness of Aluminum Sheet," Metals Research and Standards, April 1964, pp. 151–155.

⁴ 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.

B646 Practice for Fracture Toughness Testing of Aluminum Alloys

E4 Practices for Force Verification of Testing Machines

E83 Practice for Verification and Classification of Extensometer Systems

E338 Test Method of Sharp-Notch Tension Testing of High-Strength Sheet Materials (Withdrawn 2010)⁵

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

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *initiation energy, IE (FL)*—the amount of energy required to initiate a crack in a tear specimen. Initiation energy is determined by integrating the area under the force-displacement curve from the beginning of the test to the point of maximum force.

3.1.2 *propagation energy, PE (FL)*—the amount of energy required to propagate a crack in a tear specimen. Propagation energy is determined by integrating the area under the force-displacement curve from the point of maximum force to the point of complete fracture.

3.1.3 *tear resistance*—a general term describing the resistance of a material to crack propagation under static loading, either in an elastic or plastic stress field.

3.1.4 *tear strength, TS (FL⁻²)*—the maximum nominal direct and bending stress that the tear specimen is capable of sustaining.

3.1.5 *tear strength to tensile yield strength ratio (TYR)*—the ratio of the tear strength to tensile yield strength of the material determined in accordance with Test Methods B557.

3.1.6 *unit propagation energy, UPE (FL⁻¹)*—the amount of energy required to propagate a crack across a tear specimen divided by the original net area of the specimen.

4. Summary of Test Method

4.1 The tear test involves a single edge notched specimen that is statically loaded through pin loading holes. The force and displacement required to fracture the specimen are recorded for analysis.

⁵ The last approved version of this historical standard is referenced on www.astm.org.