Designation: E1820 – 25a

Standard Test Method for Measurement of Fracture Toughness[1]

This standard is issued under the fixed designation E1820; 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 procedures and guidelines for the determination of fracture toughness of metallic materials using the following parameters: *K, J*, and *CTOD* (δ). Toughness can be measured in the *R*-curve format or as a point value. The fracture toughness determined in accordance with this test method is for the opening mode (Mode I) of loading.

NOTE 1—Until this version, K_{Ic} could be evaluated using this test method as well as by using Test Method E399. To avoid duplication, the evaluation of K_{Ic} has been removed from this test method and the user is referred to Test Method E399.

1.2 The recommended specimens are single-edge bend, [SE(B)], compact, [C(T)], and disk-shaped compact, [DC(T)]. All specimens contain notches that are sharpened with fatigue cracks.

1.2.1 Specimen dimensional (size) requirements vary according to the fracture toughness analysis applied. The guidelines are established through consideration of material toughness, material flow strength, and the individual qualification requirements of the toughness value per values sought.

NOTE 2—Other standard methods for the determination of fracture toughness using the parameters *K, J*, and CTOD are contained in Test Methods E399, E1290, and E1921. This test method was developed to provide a common method for determining all applicable toughness parameters from a single test.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E4 Practices for Force Calibration and Verification of Testing Machines

E8/E8M Test Methods for Tension Testing of Metallic Materials

E21 Test Methods for Elevated Temperature Tension Tests of Metallic Materials

E23 Test Methods for Notched Bar Impact Testing of Metallic Materials

E399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness of Metallic Materials

E1290 Test Method for Crack-Tip Opening Displacement (CTOD) Fracture Toughness Measurement (Withdrawn 2013)[3]

E1823 Terminology Relating to Fatigue and Fracture Testing

E1921 Test Method for Determination of Reference Temperature, T_0, for Ferritic Steels in the Transition Range

E1942 Guide for Evaluating Data Acquisition Systems Used in Cyclic Fatigue and Fracture Mechanics Testing

E2298 Test Method for Instrumented Impact Testing of Metallic Materials

E2443 Guide for Verifying Computer-Generated Test Results Through The Use Of Standard Data Sets

2.2 *ASTM Data Sets:*[4]

E1820/1–DS1(2016) Standard data set 1 to evaluate computer algorithms for evaluation of J_{Ic} using Annex 9 of E1820

E1820/2–DS2(2020) Standard data set 2 to evaluate computer algorithms for evaluation of J_{Ic} using Annex 9 of E1820

[1] This test method is under the jurisdiction of ASTM Committee E08 on Fatigue and Fracture and is the direct responsibility of Subcommittee E08.07 on Fracture Mechanics.

Current edition approved April 1, 2025. Published April 2025. Originally approved in 1996. Last previous edition approved in 2025 as E1820 – 25. DOI: 10.1520/E1820-25A

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

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] These data sets are available for download from ASTM at https://www.astm.org/membership-participation/technical-committees/committee-e08.

***A Summary of Changes section appears at the end of this standard**