



Designation: E290 – 22

Standard Test Methods for Bend Testing of Material for Ductility¹

This standard is issued under the fixed designation E290; 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 U.S. Department of Defense.

1. Scope*

1.1 These test methods cover bend testing for ductility of materials. Included in the procedures are four conditions of constraint on the bent portion of the specimen; a guided-bend test using a mandrel or plunger of defined dimensions to force the mid-length of the specimen between two supports separated by a defined space; a semi-guided bend test in which the specimen is bent, while in contact with a mandrel, through a specified angle of bend or to a specified inside radius of bend (r) measured while under the bending force; a free-bend test in which the ends of the specimen are brought toward each other, but in which no transverse force is applied to the bend itself and there is no contact of the concave inside surface of the bend with other material; a bend-and-flatten test, in which a transverse force is applied to the bend such that the legs make contact with each other over the length of the specimen.

1.2 After bending, the convex surface of the bend is examined for evidence of a crack or surface irregularities. If the specimen fractures, the material has failed the test. When complete fracture does not occur, the criterion for failure is the number and size of cracks or surface irregularities visible to the unaided eye occurring on the convex surface of the specimen after bending, as specified by the product specification. Any cracks within one thickness of the edge of the specimen are not considered a bend test failure. Cracks occurring in the corners of the bent portion shall not be considered significant unless they exceed the size specified for corner cracks in the product specification.

1.3 The values stated in SI units are to be regarded as standard. Inch-pound values given in parentheses were used in establishing test parameters and 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 appro-*

priate 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

E6 Terminology Relating to Methods of Mechanical Testing
E8/E8M Test Methods for Tension Testing of Metallic Materials

E190 Test Method for Guided Bend Test for Ductility of Welds

3. Terminology

3.1 *Definitions*—Refer to Terminology **E6** for the definitions of bend test, ductility and springback.

3.1.1 *guided bend, n*—the bend obtained by using a mandrel to guide and force the portion of the specimen being bent between two faces of a die.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *angle of bend, n*—the change in the angle between the two legs of the specimen during a bend test, measured before release of the bending forces, unless otherwise specified.

3.2.2 *bend-and-flatten bend, n*—the bend obtained by compressing the legs of a 180° bend between platens until the legs of the bend contact.

3.2.3 *crack, n*—a nominally two-dimensional defect caused by the bend test that extends primarily from the surface of the test specimen to its interior.

3.2.3.1 *Discussion*—Different disciplines characterize and describe cracks using different, specific terminology. The terminology of a specification that cites E290 shall always be followed instead of any crack terminology defined here.

¹ This test method is under the jurisdiction of ASTM Committee **E28** on Mechanical Testing and is the direct responsibility of Subcommittee **E28.02** on Ductility and Formability.

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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 Summary of Changes section appears at the end of this standard