Designation: E290 – 14

Standard Test Methods for Bend Testing of Material for Ductility[1]

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 or to a specified inside radius (r) of curvature, 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 standard. 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 standard.

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 appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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

E18 Test Methods for Rockwell Hardness of Metallic Materials

E190 Test Method for Guided Bend Test for Ductility of Welds

3. Summary of Test Methods

3.1 Four methods for ductility testing employing bending are included in these test methods. Three methods have subgroups with specific procedures.

3.1.1 *Guided Bend:*

3.1.1.1 Guided Bend, No Die,

3.1.1.2 Guided Bend, U-Bend,

3.1.1.3 Guided Bend, V-Bend,

3.1.1.4 Guided Bend, V-Bend for cold rolled sheet,

3.1.2 *Semi-guided Bend:*

3.1.2.1 *Arrangement A,* specimen held at one end.

3.1.2.2 *Arrangement B,* for thin material.

3.1.2.3 *Arrangement C,* mandrel contact force in the bend.

3.1.3 *Free-Bend:*

3.1.3.1 *Type 1,* 180° bend.

3.1.3.2 *Type 2,* bend flat on itself.

3.1.4 *Bend and Flatten:*

3.2 A guided-bend test for ductility of welds is described in Method E190 and may be used for flat-rolled materials when specified by the product standard. The essential features of this bending method are employed in 3.1.1.2, Guided Bend, U-Bend.

3.3 Bend tests are made in one of two directions relative to the principal working direction employed in production processing of the material.

[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**

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