~~Designation:E436–91(Reapproved 1997)~~ Designation: E 436 – 03 (Reapproved 2008)

Standard Test Method for Drop-Weight Tear Tests of Ferritic Steels[1]

This standard is issued under the fixed designation E 436; 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 drop-weight tear tests (DWTT) on ferritic steels with thicknesses between 3.18 and 19.1 ~~mm (0.125 and 0.750 in.).~~ mm.

1.2 The values stated in SI ~~(metric)~~ units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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]

E 208 ~~Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels~~ Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels

E 1823 Terminology Relating to Fatigue and Fracture Testing

3. ~~Significance and Use~~

~~3.1This test method can be used to determine the appearance of propagating fractures in plain carbon or low-alloy pipe steels (yield strengths less than 825 MPa or 120000 psi) over the temperature range where the fracture mode changes from brittle (cleavage or flat) to ductile (shear or oblique).~~

~~3.2This test method can serve the following purposes:~~

~~3.2.1For research and development, to study the effect of metallurgical variables such as composition or heat treatment, or of fabricating operations such as welding or forming on the mode of fracture propagation.~~

~~3.2.2For evaluation of materials for service to indicate the suitability of a material for specific applications by indicating fracture propagation behavior at the service temperature(s).~~

~~3.2.3For information or specification purposes, to provide a manufacturing quality control only when suitable correlations have been established with service behavior.~~ Terminology

3.1 Terminology E 1823 is applicable to this test method.

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[1] This method is under the jurisdiction of ASTM Committee ~~E-8~~E08 on Fatigue and Fracture and is the direct responsibility of Subcommittee E08.02 on Standards and Terminology.

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~~[2] Annual Book of ASTM Standards, Vol 03.01.~~

[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.

5. Apparatus

~~4.1The~~5.1 The testing machine shall be either a pendulum type or a vertical-dropped-weight (Note 1) type. The machine shall provide sufficient energy to completely fracture a specimen in one impact.

~~4.1.1As~~5.1.1 As a guide in the design of the equipment it has been found that up to 2712 J ~~(2000 ft-lbf)~~ of energy may be required to completely fracture specimens of steel up to 12.7 mm ~~(½ in.)~~ in thickness with tensile strengths to 690 ~~MPa (100000 psi).~~MPa.

NOTE 1—Equipment of the vertical-dropped-weight variety that can be readily modified to conduct the drop-weight tear test is described in Test Method E 208.

~~4.2The specimen shall be supported in a suitable manner to prevent sidewise rotation of the specimen.~~
~~4.3The velocity of the hammer (in either type of testing machine) shall be not less than 4.88 m/s (16 ft/s).~~

~~5.~~

NOTE 2—Current pipeline grade steels take more thn 4kJ at design temperature of -5°C

5.2 The specimen shall be supported in a suitable manner to prevent sidewise rotation of the specimen.

5.3 The velocity of the hammer (in either type of testing machine) shall be not less than 4.88 m/s.

6. Test Specimen

~~5.1The~~6.1 The test specimen shall be a 76.2 by 305-mm ~~(3 by 12-in.)~~ by full-plate-thickness edge-notch bend specimen employing a pressed notch. Fig. 1 presents the dimensions and tolerances of the specimens. The specimens shall be removed from the material under test by sawing, shearing, or flame cutting, with or without machining.

NOTE~~2—If~~ 3—If the specimen is flame cut it is usually difficult to press in the notch unless the heat-affected zone is removed by machining.

~~5.2The~~6.2 The notch shall be pressed to the depth shown in Fig. 1 with a sharp tool-steel chisel with an included angle of 45 ± 2°. Machined notches are prohibited.

NOTE~~3—The~~ 4—The notch radius obtained with a sharp tool-steel chisel is normally between 0.013 to 0.025 ~~mm (0.0005 to 0.001 in.).~~ mm. When many specimens are to be tested, it is helpful to use a jig that will guide the chisel and stop it at the proper depth.

~~6.~~7. Procedure

~~6.1~~7.1 In the temperature range from – 73 to 100°C ~~(–100 to+212°F)~~ employ the procedure described in ~~6.1.1~~7.1.1 and ~~6.1.2~~7.1.2.

~~6.1.1~~7.1.1 Completely immerse the specimens in a bath of suitable liquid at a temperature within ±1°C ~~(±2°F)~~ of the desired test temperature for a minimum time of 15 min prior to testing. Separate the specimens by a distance at least equal to the thickness of the specimen. Make provision for circulation of the bath to assure uniform bath temperature.

NOTE ~~4~~5—Alternatively, other methods of heating and cooling may be used, provided they produce equivalent time at temperature of the specimens.

~~6.1.2~~7.1.2 Remove the specimens from the bath and break as described herein within a time period of 10 s. If the specimens are held out of the bath longer than 10 s return them unbroken to the bath for a minimum of 10 min. Do not handle the specimen in the vicinity of the notch by devices the temperature of which is appreciably different from the test temperature.

~~6.2For~~7.2 For temperatures outside of the range specified in ~~6.1~~7.1 maintain the specimen temperature at the time of impact ~~within ± 2°F~~within 4°C of the desired test temperature.

~~6~~7.3 Insert the specimen in the testing machine so that the notch in the specimen lines up with the centerline of the tup on the hammer within 1.59 ~~mm (1/16 in.).~~ mm. Also, center the notch in the specimen between the supports on the anvil.

~~6~~7.4 Consider tests invalid if the specimen buckles during impact.

NOTE~~5—Buckling has been experienced with specimen thicknesses less than 4.75 mm (0.187 in.).~~

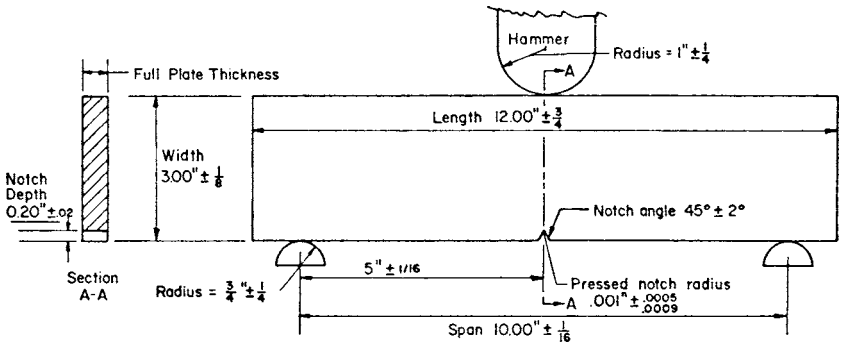

FIG. 1 Drop-Weight Tear Test Specimens and Support Dimensions and Tolerances (for Specimens ⅛ to ¾ in. in Thickness)