



Standard Practice for Preparation and Use of Bent-Beam Stress-Corrosion Test Specimens¹

This standard is issued under the fixed designation G 39; 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 practice covers procedures for designing, preparing, and using bent-beam stress-corrosion specimens.

1.2 Different specimen configurations are given for use with different product forms, such as sheet or plate. This practice applicable to specimens of any metal that are stressed to levels less than the elastic limit of the material, and therefore, the applied stress can be accurately calculated or measured (see Note 1). Stress calculations by this practice are not applicable to plastically stressed specimens.

NOTE 1—It is the nature of these practices that only the applied stress can be calculated. Since stress-corrosion cracking is a function of the total stress, for critical applications and proper interpretation of results, the residual stress (before applying external stress) or the total elastic stress (after applying external stress) should be determined by appropriate nondestructive methods, such as X ray diffraction (1).²

1.3 Test procedures are given for stress-corrosion testing by exposure to gaseous and liquid environments.

1.4 The bent-beam test is best suited for flat product forms, such as sheet, strip, and plate. For plate material the bent-beam specimen is more difficult to use because more rugged specimen holders must be built to accommodate the specimens. A double-beam modification of a four-point loaded specimen to utilize heavier materials is described in 10.5.

1.5 The exposure of specimens in a corrosive environment is treated only briefly since other practices deal with this aspect, for example, Specification D 1141, and Practices G 30, G 36, G 44, G 50, and G 85. The experimenter is referred to ASTM Special Technical Publication 425 (2).

1.6 The bent-beam practice generally constitutes a constant strain (deflection) test. Once cracking has initiated, the state of stress at the tip of the crack as well as in uncracked areas has changed, and therefore, the known or calculated stress or strain values discussed in this practice apply *only* to the state of stress existing *before* initiation of cracks.

1.7 The values stated in SI units are to be regarded as standard. The inch-pound equivalents in parentheses are pro-

vided for information.

1.8 *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.* (For more specific safety hazard information see Section 7 and 12.1.)

2. Referenced Documents

2.1 ASTM Standards:

D 1141 Specification for Substitute Ocean Water³

G 30 Practice for Making and Using U-Bend Stress Corrosion Test Specimens⁴

G 36 Practice for Performing Stress-Corrosion Cracking Tests in a Boiling Magnesium Chloride Solution⁴

G 44 Practice for Evaluating Stress Corrosion Cracking Resistance of Metals and Alloys by Alternate Immersion in 3.5 % Sodium Chloride Solution⁴

G 50 Practice for Conducting Atmospheric Corrosion Tests on Metals⁴

G 85 Practice for Modified Salt Spray (Fog) Testing⁴

2.2 NACE Documents:⁵

NACE TM0177-96 Laboratory Testing of Metals for Resistance to Specific Forms of Environmental Cracking in H₂S Environments

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *stress-corrosion cracking*—a cracking process requiring the simultaneous action of a corrodent and sustained tensile stress. This excludes corrosion-reduced sections that fail by fast fracture. It also excludes intercrystalline or transcrystalline corrosion which can disintegrate an alloy without either applied or residual stress.

3.1.2 *cracking time*—the time elapsed from the inception of test until the appearance of cracking.

3.1.2.1 *Discussion*—1 The test begins when the stress is applied and the stressed specimen is exposed to the corrosive environment, whichever occurs later.

3.1.2.2 *Discussion*—2 The specimen is considered to have

¹ This practice is under the jurisdiction of ASTM Committee G-1 on Corrosion of Metals, and is the direct responsibility of Subcommittee G01.06 on Stress Corrosion Cracking and Corrosion Fatigue.

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² The boldface numbers in parentheses refer to the list of references appended to this practice.

³ *Annual Book of ASTM Standards*, Vol 11.02.

⁴ *Annual Book of ASTM Standards*, Vol 03.02.

⁵ Available from National Association of Corrosion Engineers, Inc., P. O. Box 218340, Houston, TX 77218–8340.

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