



Standard Practice for Making and Using C-Ring Stress-Corrosion Test Specimens¹

This standard is issued under the fixed designation G38; 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 This practice covers the essential features of the design and machining, and procedures for stressing, exposing, and inspecting C-ring type of stress-corrosion test specimens. An analysis is given of the state and distribution of stress in the C-ring.

1.2 Specific considerations relating to the sampling process and to the selection of appropriate test environments are outside the scope of this practice.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses 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 NACE Document:

NACE TM0177–96 Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking and Stress Corrosion Cracking in H₂S Environments²

3. Summary of Practice

3.1 This practice involves the preparation of and the quantitative stressing of a C-ring stress-corrosion test specimen by application of a bending load. Characteristics of the stress system and the distribution of stresses are discussed. Guidance is given for methods of exposure and inspection.

4. Significance and Use

4.1 The C-ring is a versatile, economical specimen for quantitatively determining the susceptibility to stress-corrosion

cracking of all types of alloys in a wide variety of product forms. It is particularly suitable for making transverse tests of tubing and rod and for making short-transverse tests of various products as illustrated for plate in Fig. 1.

5. Sampling

5.1 Test specimens shall be taken from a location and with an orientation so that they adequately represent the material to be tested.

5.2 In testing thick sections that have a directional grain structure, it is essential that the C-ring be oriented in the section so that the direction of principal stress (parallel to the stressing bolt) is in the direction of minimum resistance to stress-corrosion cracking. For example, in the case of aluminum alloys (1),³ this is the short-transverse direction relative to the grain structure. If the ring is not so oriented it will tend to crack off-center at a location where the stress is unknown.

6. Specimen Design

6.1 Sizes for C-rings may be varied over a wide range, but C-rings with an outside diameter less than about 16 mm (5/8 in.) are not recommended because of increased difficulties in machining and decreased precision in stressing. The dimensions of the ring can affect the stress state, and these considerations are discussed in Section 7. A typical shop drawing for the manufacture of a C-ring is shown in Fig. 2.

7. Stress Considerations

7.1 The stress of principal interest in the C-ring specimen is the circumferential stress. It should be recognized that this stress is not uniform (2, 3). First, there is a gradient through the thickness, varying from a maximum tension on one surface to a maximum compression on the opposite surface. Secondly, the stress varies around the circumference of the C-ring from zero at each bolt hole to a maximum at the middle of the arc opposite the stressing bolt; the nominal stress is present only along a line across the ring at the middle of the arc. Thus, when the specimen is stressed by measuring the strain on the tension surface of the C-ring, the strain gage should be positioned at

¹ This practice is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.06 on Environmentally Assisted Cracking.

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² Available from National Association of Corrosion Engineers (NACE), P.O. Box 218340, Houston, TX 77218–8340.

³ The boldface numbers in parentheses refer to the list of references at the end of this practice.