



Designation: G 103 – 97

Standard Practice for Evaluating Stress-Corrosion Cracking Resistance of Low Copper 7XXX Series Al-Zn-Mg-Cu Alloys in Boiling 6 % Sodium Chloride Solution¹

This standard is issued under the fixed designation G 103; 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.

INTRODUCTION

Continuous immersion in boiling 6 % sodium chloride solution historically was considered to be an effective accelerated SCC testing medium for all Al-Zn-Mg-Cu alloys (1, 2),² but in more recent years, alternate immersion in 3.5 % sodium chloride solution (Practice G 44) has become the favored test medium for the high copper (1.2 to 2.6 % Cu) 7XXX series alloys (3, 4). Evidence to date shows, however, that the boiling 6 % sodium chloride medium correlates better with outdoor atmospheric exposure than Practice G 44 for the 7XXX series alloys containing little or no copper (5, 6, 7, 8).

1. Scope

1.1 This stress corrosion testing practice is intended for statically loaded smooth non-welded or welded specimens of 7XXX series Al-Zn-Mg-Cu alloys containing less than 0.26 % copper.

1.2 This practice is concerned primarily with the test medium which may be used with a variety of test specimens and methods of applying stress. Exposure times, criteria of failure, and so on, are variable and not specified.

1.3 *This standard may involve hazardous materials, operations, and equipment. 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.* See Section 8 for additional precautions.

2. Referenced Documents

2.1 ASTM Standards:

B 580 Specification for Anodic Oxide Coatings on Aluminum³

D 1193 Specifications for Reagent Water⁴

G 30 Practice for Making and Using U-Bend Stress-Corrosion Test Specimens⁵

G 38 Practice for Making and Using C-Ring Stress-Corrosion Test Specimens⁵

G 39 Practice for Preparation and Use of Bent-Beam Stress-Corrosion Test Specimens⁵

G 44 Practice for Evaluating Stress Corrosion Cracking Resistance of Metals and Alloys by Alternate Immersion in 3.5 % Sodium Chloride Solution⁵

G 49 Practice for Preparation and Use of Direct Tension Stress Corrosion Test Specimens⁵

G 58 Practice for Preparation of Stress-Corrosion Test Specimens for Weldments⁵

3. Summary of Practice

3.1 Stressed specimens are totally and continuously immersed in boiling 6 % sodium chloride solution for up to 168 h. Various types of smooth test specimens and methods of stressing may be used. Performance is based on time to visual cracking.

4. Significance and Use

4.1 This practice is normally used for stress corrosion screening for the development of Al-Zn-Mg-Cu alloys containing less than 0.26 % copper. Effects on stress corrosion resistance due to variables such as composition, thermo-mechanical processing, other fabrication variables and magnitude of applied stress may be compared.

¹ This test method is under the jurisdiction of ASTM Committee G01 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 at the end of this standard.

³ *Annual Book of ASTM Standards*, Vol 02.05.

⁴ *Annual Book of ASTM Standards*, Vol 11.01.

⁵ *Annual Book of ASTM Standards*, Vol 03.02.

4.2 For a given mechanical method of stressing, the relative stress corrosion resistance of the low copper Al-Zn-Mg-Cu alloys in atmospheric exposure correlates better with performance in boiling 6 % sodium chloride solution than with other accelerated testing media (7-9). In addition, this practice is relatively rapid.

4.3 This practice is not applicable to 2XXX (Al-Cu), 5XXX (Al-Mg), 6XXX (Al-Mg-Si), and the 7XXX (Al-Zn-Mg-Cu) series alloys containing more than 1.2 % copper.

4.3.1 For 7XXX series alloys containing between 0.26 % and 1.2 % copper, there is no general agreement as to whether this practice or Practice G 44 correlates better with stress corrosion resistance in service (5-8,10).

5. Apparatus

5.1 Fig. 1 illustrates one type of apparatus that has been used.

5.2 Materials of Construction:

5.2.1 Materials of construction that come in contact with the boiling salt solution shall be such that they are not affected by the corrodent to an extent that they can cause contamination of the solution and change its corrosiveness.

5.2.2 Use of glass or aluminum containers and condensers is recommended.

5.2.3 Metallic materials of construction should be limited to copper free aluminum alloys, which may be anodized to provide electrical contact resistance.

5.3 *Specimen Holders*—The specimen holders should be designed to electrically insulate the specimens from each other and from other bare metal. An anodized aluminum holder has been found to be appropriate. (Satisfactory anodic coating may be Type A or B, Specification B 580.) Periodic ohmmeter checks may be made to confirm electrical isolation of specimen and anodized holder.

5.4 Heater for Solution:

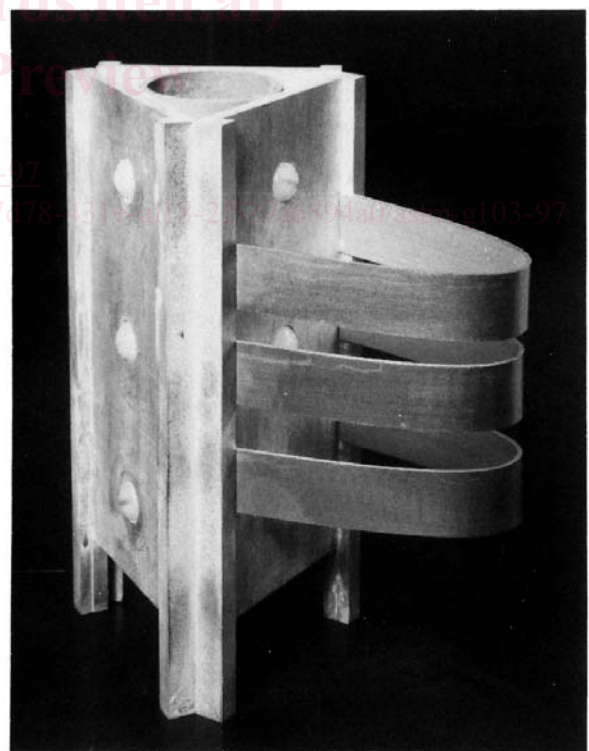
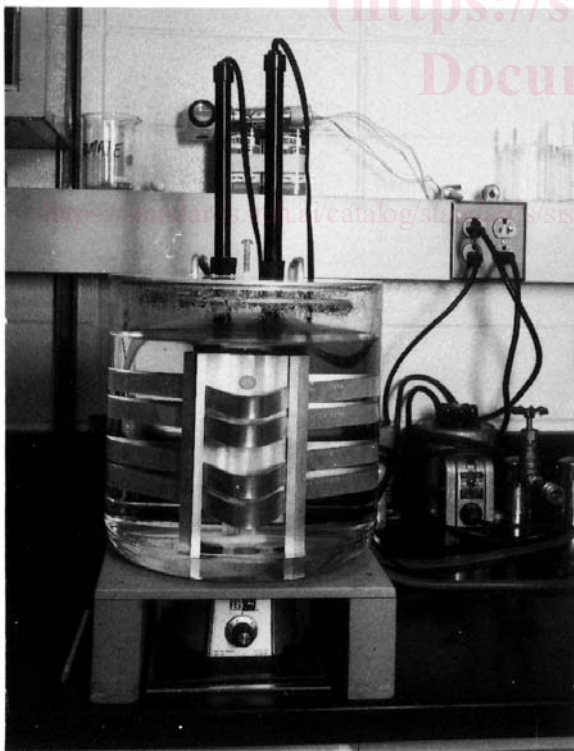
5.4.1 Heaters must be of sufficient capacity that boiling temperature can be maintained and solution can be brought back up to a boil within 10 min after the introduction of test specimens.

5.4.1.1 Quartz immersion heaters may be used.

5.4.1.2 Hot plate resistance heaters may be used.

6. Reagents and Solution Conditions

6.1 Reagent grade sodium chloride (NaCl) shall be used. It shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are applicable.



U bend specimens (Practice G 39) stressed in an anodized aluminum fixture (right photo) are placed in a pyrex battery jar (left photo), which is placed over a magnetic stirrer. The 6 % salt solution is heated to boiling by means of two quartz immersion heaters. A powerstat controls the heat output of the quartz heaters. A cold water circulating aluminum condenser tube is placed just below the aluminum cover to prevent evaporation losses. Stressed specimens are placed in the jar after the solution comes to a boil. Specimens are examined in place for visual evidence of cracking.

FIG. 1 Boiling 6 % NaCl—Stress Corrosion Testing Practice