Designation: G103 – 97 (Reapproved 2023)ε1

Standard Practice for Evaluating Stress-Corrosion Cracking Resistance of Low Copper 7XXX Series Al-Zn-Mg-Cu Alloys in Boiling 6 % Sodium Chloride Solution[1]

This standard is issued under the fixed designation G103; 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.

ε[1] NOTE—Ref (9) was updated editorially, and other editorial changes were made throughout in January 2023.

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 G44) 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 G44 for the 7XXX series alloys containing little or no copper (**5, 6, 7, 8**).

1. Scope

1.1 This practice primarily covers 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.

1.2 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.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* See Section 8 for additional precautions.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

B580 Specification for Anodic Oxide Coatings on Aluminum

D1193 Specification for Reagent Water

G30 Practice for Making and Using U-Bend Stress-Corrosion Test Specimens

G38 Practice for Making and Using C-Ring Stress-Corrosion Test Specimens

G39 Practice for Preparation and Use of Bent-Beam Stress-Corrosion Test Specimens

G44 Practice for Exposure of Metals and Alloys by Alternate Immersion in Neutral 3.5 % Sodium Chloride Solution

G49 Practice for Preparation and Use of Direct Tension Stress-Corrosion Test Specimens

G58 Practice for Preparation of Stress-Corrosion Test Specimens for Weldments

[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] The boldface numbers in parentheses refer to the list of references at the end of this standard.

[3] 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.

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.

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 G44 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.

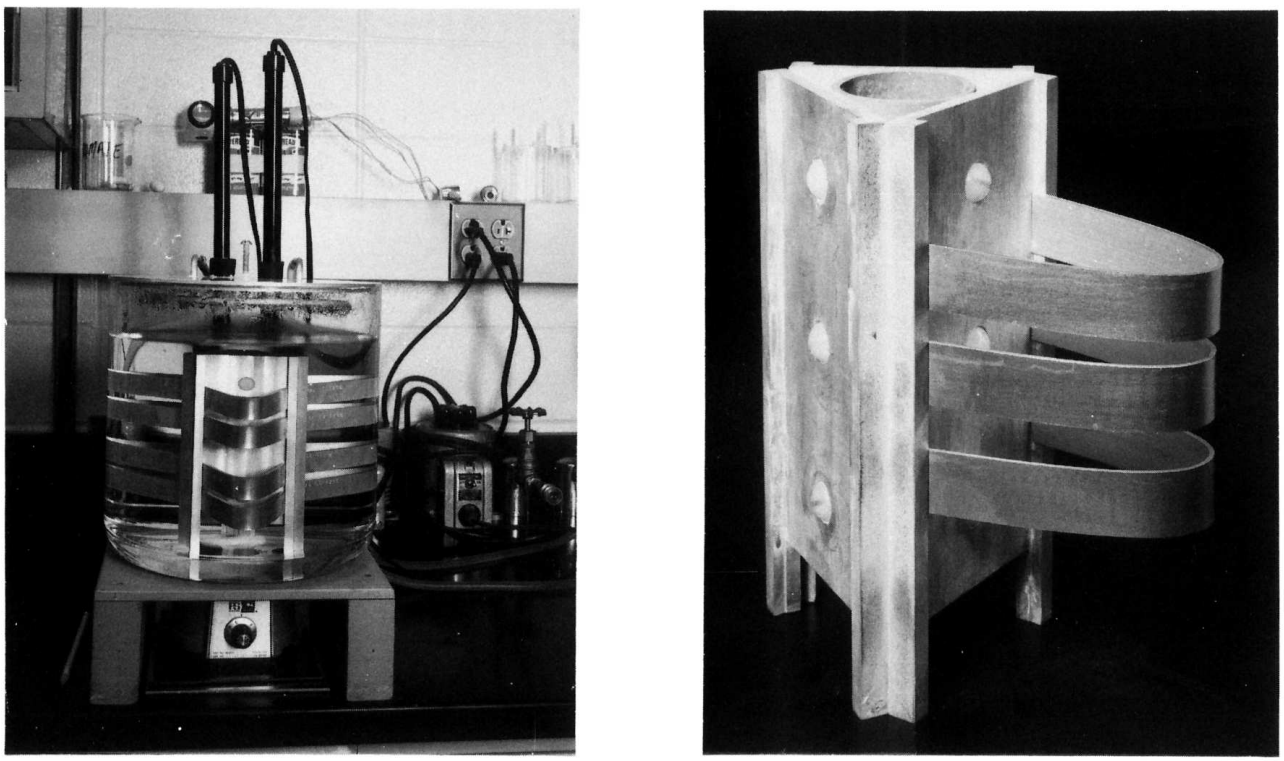
5.2 *Materials of Construction:*

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



U bend specimens (Practice G39) 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