



Standard Test Method for Repassivation Potential of Aluminum and Its Alloys by Galvanostatic Measurement¹

This standard is issued under the fixed designation D6208; 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 A procedure to determine the repassivation potential of aluminum alloy 3003-H14 (UNS A93003) (**1**)² as a measure of relative susceptibility to pitting corrosion by conducting a galvanostatic polarization is described. A procedure that can be used to check experimental technique and instrumentation is described, as well.

1.2 The test method serves as a guide for similar measurement on other aluminum alloys and metals (**2-5**).

1.3 The values stated in SI units are to be regarded as the standard. 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 *ASTM Standards:*³

D1193 Specification for Reagent Water

D3585 Specification for ASTM Reference Fluid for Coolant Tests

G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing

G15 Terminology Relating to Corrosion and Corrosion Testing (Withdrawn 2010)⁴

G46 Guide for Examination and Evaluation of Pitting Corrosion

G107 Guide for Formats for Collection and Compilation of Corrosion Data for Metals for Computerized Database Input

3. Terminology

3.1 *Definitions:* Terms used in this test method can be found in Practice G3 and Terminology G15.

3.2 *Symbols:*

3.2.1 E_B —break potential, potential at which the passive aluminum oxide layer breaks down.

3.2.2 E_G —protection potential as measured in this galvanostatic method, potential at which oxide layer repassivates.

3.2.3 J —current density, in A/m²

4. Summary of Test Method

4.1 The test method described is an adaptation of the method described in FORD Motor Company standards (**6**).

4.2 An aluminum alloy specimen is polarized at fixed current density for 20 min. in a solution of coolant and corrosive water containing chloride. The potential as a function of time is recorded.

4.3 The maximum potential, E_B reached upon polarization is determined, as is the minimum potential following the maximum potential, E_G .

4.4 Visual examination of the specimen may be made using Guide G46 as a guide after disassembly and rinsing.

5. Significance and Use

5.1 This test method is designed to measure the relative effectiveness of inhibitors to mitigate pitting corrosion of aluminum and its alloys, in particular AA3003-H14, rapidly and reproducibly. The measurements are not intended to correlate quantitatively with other test method values or with susceptibility to localized corrosion of aluminum observed in service. Qualitative correlation of the measurements and susceptibility in service has been established (**1**).

5.2 The maximum potential reached upon initial polarization, E_B , is a measure of the resistance to breakdown of the aluminum oxide film. Lower susceptibility to initiation of pitting corrosion is indicated by a more noble potential (See

¹ This test method is under the jurisdiction of ASTM Committee D15 on Engine Coolants and Related Fluids and is the direct responsibility of Subcommittee D15.06 on Glassware Performance Tests.

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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.

⁴ The last approved version of this historical standard is referenced on www.astm.org.