



Standard Test Method for Conducting Cyclic Potentiodynamic Polarization Measurements for Localized Corrosion Susceptibility of Iron-, Nickel-, or Cobalt-Based Alloys¹

This standard is issued under the fixed designation G61; 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 test method covers a procedure for conducting cyclic potentiodynamic polarization measurements to determine relative susceptibility to localized corrosion (pitting and crevice corrosion) for iron-, nickel-, or cobalt-based alloys in a chloride environment. This test method also describes an experimental procedure which can be used to check one's experimental technique and instrumentation.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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:²

D1193 Specification for Reagent Water

G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing

G5 Reference Test Method for Making Potentiodynamic Anodic Polarization Measurements

2.2 ASTM Adjuncts:

Standard Samples (set of two)³

3. Significance and Use

3.1 An indication of the susceptibility to initiation of localized corrosion in this test method is given by the potential at

which the anodic current increases rapidly. The more noble this potential, obtained at a fixed scan rate in this test, the less susceptible is the alloy to initiation of localized corrosion. The results of this test are not intended to correlate in a quantitative manner with the rate of propagation that one might observe in service when localized corrosion occurs.

3.2 In general, once initiated, localized corrosion can propagate at some potential more electropositive than that at which the hysteresis loop is completed. In this test method, the potential at which the hysteresis loop is completed is determined at a fixed scan rate. In these cases, the more electropositive the potential at which the hysteresis loop is completed the less likely it is that localized corrosion will occur.

3.3 If followed, this test method will provide cyclic potentiodynamic anodic polarization measurements that will reproduce data developed at other times in other laboratories using this test method for the two specified alloys discussed in 3.4. The procedure is used for iron-, nickel-, or cobalt-based alloys in a chloride environment.

3.4 A standard potentiodynamic polarization plot is included. These reference data are based on the results from five different laboratories that followed the standard procedure, using specific alloys of Type 304 stainless steel, UNS S30400 and Alloy C-276, UNS N10276.³ Curves are included which have been constructed using statistical analysis to indicate the acceptable range of polarization curves.

3.5 The availability of a standard test method, standard material, and standard plots should make it easy for an investigator to check his techniques to evaluate susceptibility to localized corrosion.

4. Apparatus

4.1 The polarization cell should be similar to the one described in Reference Test Method **G5**. Other polarization cells may be equally suitable.

4.1.1 The cell should have a capacity of about 1 L and should have suitable necks or seals to permit the introduction of electrodes, gas inlet and outlet tubes, and a thermometer. The Luggin probe-salt bridge separates the bulk solution from the saturated calomel reference electrode. The probe tip should

¹ This test method is under the jurisdiction of ASTM Committee **G01** on Corrosion of Metals and is the direct responsibility of Subcommittee **G01.11** on Electrochemical Measurements in Corrosion Testing.

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² 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 Available from ASTM International Headquarters. Order Adjunct No. **ADJG0061**. Original adjunct produced before 1995.