



Standard Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing¹

This standard is issued under the fixed designation G 3; 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 practice is intended to provide conventions for reporting and displaying electrochemical corrosion data. Conventions for potential, current density, electrochemical impedance and admittance, as well as conventions for graphical presentation of such data are included.

1.2 *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:

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI) (the Modern Metric System)²

3. Significance and Use

3.1 This practice provides guidance for reporting, displaying, and plotting electrochemical corrosion data and includes recommendations on signs and conventions. Use of this practice will result in the reporting of electrochemical corrosion data in a standard format, facilitating comparison between data developed at different laboratories or at different times. The recommendations outlined in this standard may be utilized when recording and reporting corrosion data obtained from electrochemical tests such as potentiostatic and potentiodynamic polarization, polarization resistance, electrochemical impedance and admittance measurements, galvanic corrosion, and open circuit potential measurements.

4. Sign Convention for Electrode Potential

4.1 The Stockholm sign invariant convention is recommended for use in reporting the results of specimen potential measurements in corrosion testing. In this convention, the positive direction of electrode potential implies an increasingly oxidizing condition at the electrode in question. The positive direction has also been denoted as the noble direction because

the corrosion potentials of most noble metals, such as gold, are more positive than the nonpassive base metals. On the other hand, the negative direction, often called the active direction, is associated with reduction and consequently the corrosion potentials of active metals, such as magnesium. This convention was adopted unanimously by the 1953 International Union of Pure and Applied Chemistry as the standard for electrode potential (1).³

4.2 In the context of a specimen electrode of unknown potential in an aqueous electrolyte, consider the circuit shown in Fig. 1 with a reference electrode connected to the ground terminal of an electrometer. If the electrometer reads on scale when the polarity switch is negative, the specimen electrode potential is negative (relative to the reference electrode). Conversely, if the electrometer reads on scale when polarity is positive, the specimen potential is positive. On the other hand, if the specimen electrode is connected to the ground terminal, the potential will be positive if the meter is on scale when the polarity switch is negative, and vice versa.

NOTE 1—In cases where the polarity of a measuring instrument is in doubt, a simple verification test can be performed as follows: connect the measuring instrument to a dry cell with the lead previously on the reference electrode to the negative battery terminal and the lead previously on the specimen electrode to the positive battery terminal. Set the range switch to accommodate the dry cell voltage. The meter deflection will now show the direction of positive potential.

Also, the corrosion potential of magnesium or zinc should be negative in a 1 N NaCl solution if measured against a saturated standard calomel electrode (SCE).

5. Sign Convention for Electrode Potential Temperature Coefficients

5.1 There are two types of temperature coefficients of electrode potential: isothermal temperature coefficients and the thermal coefficients. The sign convention recommended for both types of temperature coefficients is that the temperature coefficient is positive when an increase in temperature produces an increase (that is, it becomes more positive) in the electrode potential. Likewise, the second temperature coefficient is positive when an increase in temperature produces an increase (that is, it becomes more positive) in the first temperature coefficient.

¹ This practice is under the jurisdiction of ASTM Committee G-1 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.11 on Electrochemical Measurements in Corrosion Testing.

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² *Annual Book of ASTM Standards*, Vol 14.02 (excerpts in Vol 03.02).

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