Designation: ~~G51 – 95 (Reapproved 2012)~~ G51 – 18

Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing[1]

This standard is issued under the fixed designation G51; 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 determining the pH of a soil in corrosion testing. The principle use of the test is to supplement soil resistivity measurements and thereby identify conditions under which the corrosion of metals in soil may be accentuated (see G57~~-78(1984)).~~ – 78 (2012)).

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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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:*[2]

D1193 Specification for Reagent Water
E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
G57 Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
NACE/ASTM G193 Terminology and Acronyms Relating to Corrosion
G215 Guide for Electrode Potential Measurement

3. Terminology

3.1 *Definitions:*

3.1.1 *calibration solution, n*—a commercially available solution with a stable pH used for calibrating a pH measuring system (meter and probe).

3.1.2 *calomel electrode, n*—an electrode that develops a standard electric potential and is used to provide a reference voltage in the circuit for sensing electrodes. It is composed of an amalgam of mercury and mercury (I) chloride.

3.1.2.1 *Discussion—*

Due to shipping restrictions on mercury containing materials, calomel electrodes have been replaced by silver/silver chloride electrodes in newer pH meters.

3.1.3 *combination electrode, n*—an electrochemical apparatus that incorporates an ion-selective electrode and a reference electrode in a single assembly thereby avoiding the need for a separate reference electrode.

3.1.4 *pH, n*—the negative logarithm of the hydrogen ion activity written as $pH = -\log_{10}(a_H^+)$ where a_H^+ = Hydrogen ion activity = the molar concentration of hydrogen ions multiplied by the mean ion-activity coefficient.

[1] This test method is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.10 on Corrosion in Soils.

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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.

3.1.5 *pH meter, n*—an instrument with a display of pH units. For field use, it is portable and battery-powered.

3.1.6 *purified water, n*—water that meets Specification D1193, Type IV requirements.

3.1.7 *silver/silver chloride electrode, n*—an electrode that develops a standard electric potential and is used to provide a reference voltage. The electrode functions as a redox electrode and the equilibrium is between the silver metal (Ag) and it salt – Silver Chloride (AgCl).

3.1.7.1 *Discussion*—

Refer to detailed description and discussion in Guide G215.

3.2 The terminology used herein, if not specifically defined otherwise, shall be in accordance with NACE/ASTM G193. Definitions provided herein and not given in NACE/ASTM G193 are limited only to this standard.

4. Significance and Use

4.1 Information on pH of soil is used as an aid in evaluating the corrosivity of a soil environment. Some metals are more sensitive to the pH of their environment than others, and information on the stability of a metal as a function of pH and potential is available in the literature.[3]

5. Apparatus

5.1 *pH ~~Meters~~ Meter*—A portable, battery-powered pH meter that reads or attaches the electrodes is necessary for field measurements. ~~Most instruments can also function as a high-impedance voltmeter. An LCD display~~ An LCD (liquid-crystal display) is preferred for its readability in a bright, outdoor environment.

5.2 ~~*Calomel and Glass Electrodes:*~~

5.2.1 *Silver/Silver Chloride Electrode*—~~Use a saturated calomel~~ A saturated silver/silver chloride reference electrode or its equivalent is used in the pH determination. ~~A few crystals of solid potassium chloride should always be present within the chamber surrounding the calomel to assure that the solution is saturated under the conditions of use. The design of the electrode must permit the formation of a fresh liquid junction between the solution of potassium chloride and the buffer or test soil for each test and allow traces of soil to be readily removed by washing.~~

NOTE 1—A few crystals of solid potassium chloride should always be present within the chamber surrounding the silver to assure that the solution is saturated under the conditions of use. The design of the electrode must permit the formation of a fresh liquid junction between the solution of potassium chloride and the buffer or test soil for each test and allow traces of soil to be readily removed by washing.

5.2.2 *Glass Electrode*—A glass electrode of rugged construction is required. The performance of the glass electrode is satisfactory if it furnishes the correct pH value (±0.1 pH unit) for standard buffered solutions.

5.2.3 *Combination Electrode*—A combination electrode consisting of a ~~saturated calomel~~ reference electrode and a glass electrode (~~4.2.1~~5.2.1 and ~~4.2.2~~5.2.2) combined as a single electrode is acceptable. However, the requirements outlined above are equally applicable to the electrodes used in this combination unit.

5.3 *Subsurface Probe*—When pH measurements below the surface of the soil are required, it is necessary to use a probe of suitable length which will allow measurements to be made at the depth of interest. This probe consists of a glass electrode or a combination electrode in a rubber housing at the end of a plastic tube. One type of probe is illustrated in Fig. 1.

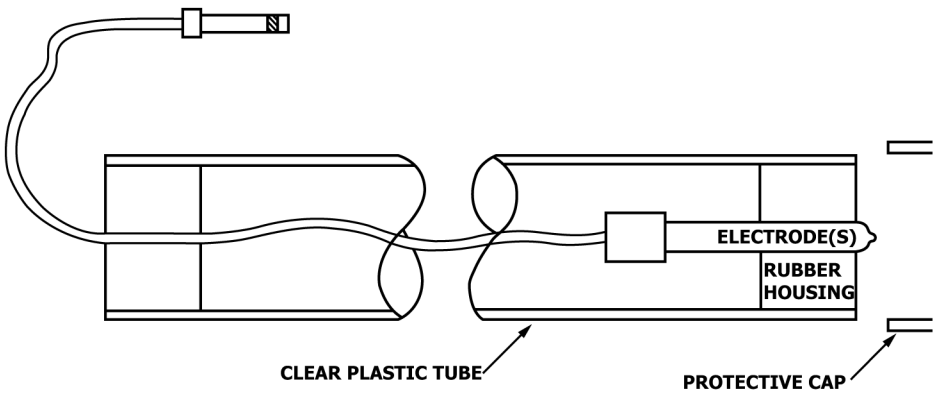

FIG. 1 Subsurface Probe

[3] Pourbaix, M., *Atlas of Electrochemical Equilibria in Aqueous Solutions*, Pergamon Press, 1966.