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.

Designation: G162 – 18

Standard Practice for Conducting and Evaluating Laboratory Corrosion Tests in Soils[1]

This standard is issued under the fixed designation G162; 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 covers procedures for conducting laboratory corrosion tests in soils to evaluate the corrosive attack on engineering materials. The test is conducted under laboratory ambient temperature unless the effect of temperature is being evaluated. This practice does not include provisions for microbiological influenced corrosion (MIC) testing, nor its influence on results.

1.2 This practice covers specimen selection and preparation, test environments, evaluation, and reporting of test results.

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

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:*[2]

D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D1193 Specification for Reagent Water
D1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
D2570 Test Method for Simulated Service Corrosion Testing of Engine Coolants
G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens
G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing
G4 Guide for Conducting Corrosion Tests in Field Applications
G16 Guide for Applying Statistics to Analysis of Corrosion Data
G31 Guide for Laboratory Immersion Corrosion Testing of Metals
G46 Guide for Examination and Evaluation of Pitting Corrosion
G51 Test Method for Measuring pH of Soil for Use in Corrosion Testing
G57 Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
G71 Guide for Conducting and Evaluating Galvanic Corrosion Tests in Electrolytes
G102 Practice for Calculation of Corrosion Rates and Related Information from Electrochemical Measurements
G187 Test Method for Measurement of Soil Resistivity Using the Two-Electrode Soil Box Method
G193 Terminology and Acronyms Relating to Corrosion
G200 Test Method for Measurement of Oxidation-Reduction Potential (ORP) of Soil
G215 Guide for Electrode Potential Measurement

3. Terminology

3.1 *Definitions:*

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

3.2 For other definitions of terms used in this guide, refer to NACE/ASTM G193 (Standard Terminology and Acronyms Relating to Corrosion).

4. Significance and Use

4.1 This practice provides a controlled corrosive environment that has been utilized to produce relative corrosion information.

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[1] This practice 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.

4.2 The primary application of the data from this practice is to evaluate metallic materials for use in soil environments.

4.3 This practice may not duplicate all field conditions and variables such as stray currents, microbiologically influenced corrosion, non-homogeneous conditions, and long cell corrosion. The reproducibility of results in the practice is highly dependent on the type of specimen tested and the evaluation criteria selected as well as the control of the operating variables. In any testing program, sufficient replicates should be included to establish the variability of the results.

4.4 Structures and components may be made of several different metals; therefore, the practice may be used to evaluate galvanic corrosion effects in soils (see Guide G71).

4.5 Structures and components may be coated with sacrificial or noble metal coatings, which may be scratched or otherwise rendered discontinuous (for example, no coating on the edges of metal strips cut from a wide sheet). This test is useful to evaluate the effect of defective metallic coatings.

4.6 Structures and components may be coated or jacketed with organic materials (for example, paints and plastics), and these coatings and jackets may be rendered discontinuous. The test is useful to evaluate the effect of defective or incompletely covering coatings and jackets.

4.7 The corrosivity of soils strongly depends on soluble salt content (related parameters are chemistry and soil resistivity, see Test Methods G57 and G187), acidity or alkalinity (measured by soil pH, see Test Method G51), and oxygen content (loose, for example, sand, or compact, for example, clay, soils are extreme examples, see Test Method G200 – oxidation-reduction potential). The manufacturer, supplier, or user, or combination thereof, should establish the nature of the expected soil environment(s) and select the test environment(s) accordingly. Multiple types of soil can be used to determine the effect of this variable.

5. Test Apparatus and Conditions

5.1 *Container*—The container for the soil shall be made from a material that is not affected by the soil environment and that does not affect the soil. Container materials, such as glass, plastic, or corrosion-resistant metal or alloy, can be used; however, electrically conductive containers must be electrochemically isolated from the specimens. The size of the container is determined by the volume of soil required for the test. A minimum of 40 cm^3 should be used for each 1 cm^2 of exposed metal surface area (see Fig. 1).

5.2 *Soil Environment*—The container is filled with a soil sample of choice. A soil sample from a specific outdoor location may be retrieved for the test, or a soil sample may be prepared with a specific property and chemistry. If necessary, physical and chemical characteristics of the soil may be determined.

5.2.1 A field soil sample may be utilized for purposes of conducting a soil corrosion test in a specific environment.

5.2.2 Laboratory soil samples may be prepared by using washed sand, (that is, No. 2 silica sand) clean clay (that is, bentonite) or other uniform known media.

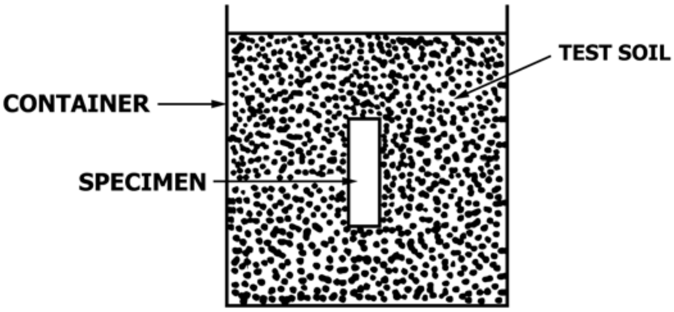

FIG. 1 Apparatus for Conducting Laboratory Corrosion Tests in Soils

5.2.3 *Soil Chemistry*—The field soil sample and the laboratory soil sample are saturated with a known electrolyte chosen for the test. Typically, the electrolyte is added to the soil of choice in the container. A typical electrolyte for use with washed sand is ASTM corrosive water (see Test Method D2570). With field soil samples, purified water is commonly used to saturate the soil and is added periodically to maintain the soil in a saturated condition. A non-saturated condition can be maintained if desired.

5.2.4 *Temperature*—The test is conducted under laboratory ambient temperature unless the effect of temperature is being evaluated.

5.2.5 *Test Specimen*—The test specimen is buried in the soil within the container and is prepared as discussed in Section 6.

5.2.6 *Scales*—Scales or balances are needed to determine mass loss of exposed samples. The capacity and accuracy of the scales will be determined by the configuration, size, and weight of the test specimen, and by the amount of mass loss needing to be measured based on the exposure period. In general, the more accurate the scale or balance, the lower the total capacity of the device.

5.2.7 *High Impedance Voltmeter (Guide G215)*—In general, devices with input impedances greater than 10^7 ohms have been found to be acceptable in most corrosion related measurements.

5.2.8 *Current Measuring Device*—Capability and accuracy of the device needed will vary depending on the amount of current generated by the specific type of galvanic couple being evaluated.

5.2.9 *Camera*—For photographically documenting the test specimen before and after exposure, prior to cleaning, type and extent of corrosion, etc.

6. Test Specimen

6.1 *Material*—Prepare the test specimens from the same material as that used in the structures or components being studied. Alternatively, use test specimens from the actual products.

6.2 *Size and Shape:*

6.2.1 The size and shape of test specimens are dependent on several factors and cannot be rigidly defined. When determining corrosion behavior of metals in the laboratory, it is advisable to use the largest specimens permissible within the constraints of the test equipment. In general, the ratio of surface area to metal volume should be large in order to obtain