Designation: C876 – 22a

Standard Test Method for Corrosion Potentials of Uncoated Reinforcing Steel in Concrete[1]

This standard is issued under the fixed designation C876; 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 the estimation of the electrical corrosion potential of uncoated reinforcing steel in field and laboratory concrete, for the purpose of determining the corrosion activity of the reinforcing steel.

1.2 This test method is limited by electrical circuitry. Concrete surface in building interiors and desert environments lose sufficient moisture so that the concrete resistivity becomes so high that special testing techniques not covered in this test method may be required (see 5.1.4.1). Concrete surfaces that are coated or treated with sealers may not provide an acceptable electrical circuit. The basic configuration of the electrical circuit is shown in Fig. 1.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered 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]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing

G193 Terminology and Acronyms Relating to Corrosion

G16 Guide for Applying Statistics to Analysis of Corrosion Data

3. Terminology

3.1 For definitions of terms used in this test method, refer to Terminology G193.

4. Significance and Use

4.1 This test method is suitable for in-service evaluation and for use in research and development work.

4.2 This test method is applicable to members regardless of their size or the depth of concrete cover over the reinforcing steel. Concrete cover in excess of 75 mm (3 in.) can result in an averaging of adjacent reinforcement corrosion potentials that can result in a loss of the ability to discriminate variation in relative corrosion activity.

4.3 This test method is not applicable to reinforced concrete structures with epoxy-coated reinforcement.

4.4 This test method is not applicable to reinforced concrete structures in which waterproofing membranes are located between the reinforcement cage and the concrete surface as they can prevent the conduction of electricity and result in erroneous readings.

4.5 This test method may be used at any time during the life of a concrete member after the concrete has set, although it is generally most useful for evaluating mature reinforced concrete that is suspected to be susceptible to corrosion.

4.6 The results obtained by the use of this test method shall not be considered as a means for estimating the structural properties of the steel or of the reinforced concrete member.

[1] This test method is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.14 on Corrosion of Metals in Construction Materials.

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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.

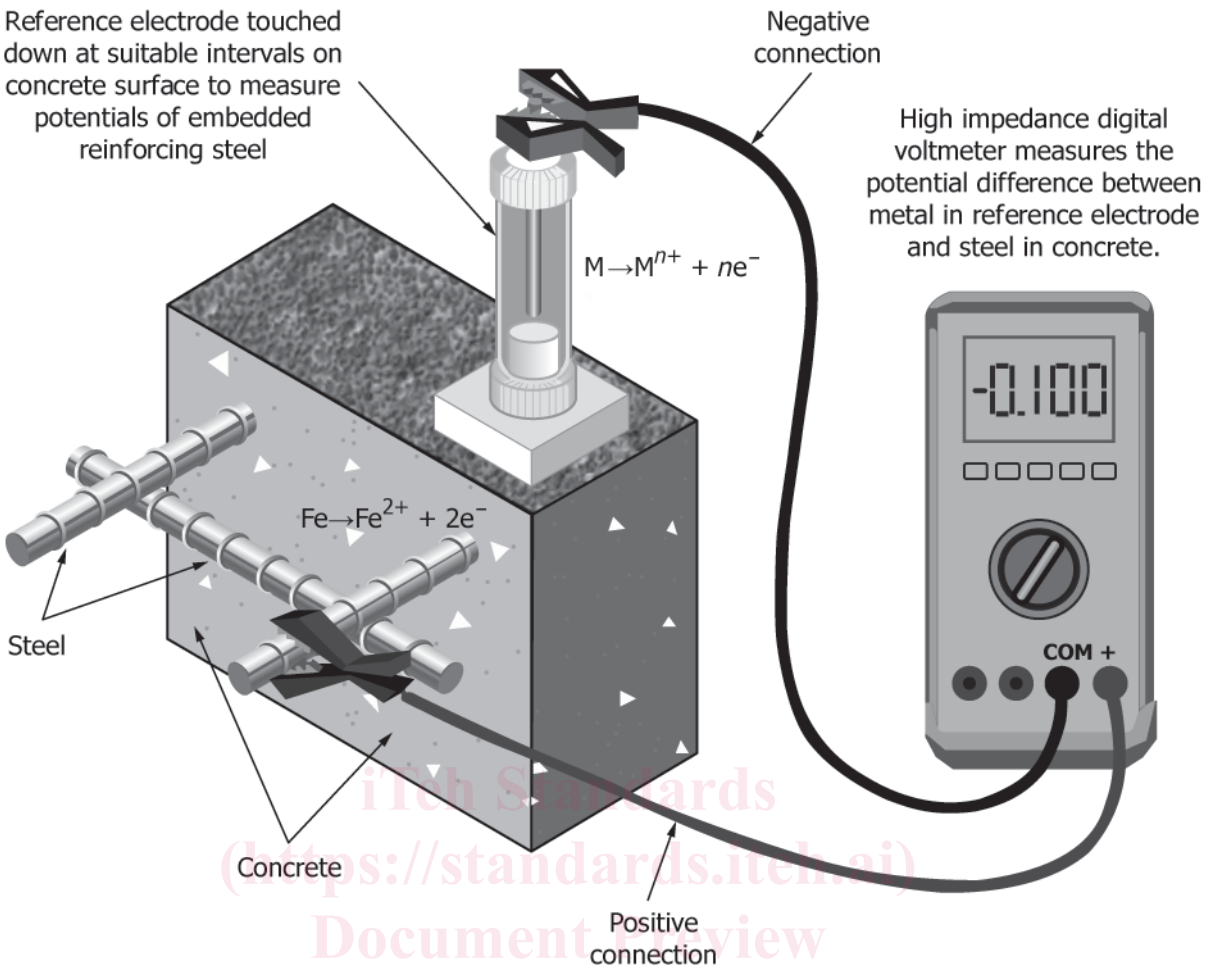

FIG. 1 Reference Electrode Circuitry

4.7 Temperature and humidity can impact potential readings. This is particularly important for periodic testing of the same test location. An increase in the temperature leads to increasing ionic mobility, which in turn affects the reference electrode's potential. The temperature influence can be neglected if the measurements are taken within the range of 22.2 °C ± 5.5 °C (72 °F ± 10 °F). Otherwise, the temperature-dependency of the measurements must be taken into account.

4.8 The potential measurements should be interpreted by engineers or technical specialists experienced in the fields of concrete materials and corrosion testing. It is often necessary to use other complementary data such as chloride contents, depth of carbonation, delamination survey, rate of corrosion, and environmental exposure conditions, in addition to corrosion potential measurements, to formulate conclusions concerning corrosion activity of embedded steel and its probable effect on the service life of a structure.

5. Apparatus

5.1 The testing apparatus consists of the following:

5.1.1 *Reference Electrode:*

5.1.1.1 The reference electrode selected shall provide a stable and reproducible potential for the measurement of the corrosion potential of reinforcing steel embedded in concrete over the temperature range from 0 °C to 49 °C (32 °F to 120 °F).

5.1.1.2 For the purposes of this test method, corrosion potentials shall be based upon the half-cell reaction Cu→ Cu++ + 2e- corresponding to the potential of the saturated copper-copper sulfate reference electrode as referenced to the hydrogen electrode being –0.30 V at 22.2 °C (72 °F) (**1**).[3] The copper-copper sulfate reference electrode has a temperature coefficient of approximately 0.0005 V more negative per °F for the temperature range from 0 °C to 49 °C (32 °F to 120 °F).

5.1.1.3 Other reference electrodes having similar measurement range, accuracy, and precision characteristics to the copper-copper sulfate electrode may also be used. Calomel reference electrodes have been used in laboratory studies. For concrete submerged in seawater, using silver-silver chloride reference electrodes avoids chloride contamination problems that may occur with copper-copper sulfate electrodes. Silver-silver chloride/potassium chloride reference electrodes are also

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