



Designation: D 2776 – 79^{ε1}

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103

Reprinted from the Annual Book of ASTM Standards, Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Test Methods for Corrosivity of Water in the Absence of Heat Transfer (Electrical Methods)¹

This standard is issued under the fixed designation D 2776; 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.

^{ε1} NOTE—1.5 was added editorially in February 1989.

1. Scope

1.1 These test methods cover the determination of the corrosivity of water by electrical methods. The rate of corrosion of a metal immersed in water is a function of the tendency for the metal to corrode and is also a function of the tendency for water and the materials it contains to promote (or inhibit) corrosion. The following test methods are included:

	Sections
Test Method A—Electrical Resistance	5 to 12
Test Method B—Polarization Resistance	13 to 20

1.2 The electrical resistance test method (Test Method A) measures the corrosion rate of a metal sample, mounted on a probe, by periodically determining its change in electrical resistance as the cross-sectional area of the metal sample decreases due to corrosion. The observed measurement is the change in resistance ratio between a measuring element exposed to water and a reference element in proximity to, but protected from, the corrosive environment. A corrosion rate measurement requires two or more successive readings over a period of time which is governed by actual rate of metal loss and measuring element sensitivity (that is, cross-sectional area).

1.3 The polarization resistance (PR) test method (Test Method B) operates on the principle that when a prescribed voltage (usually 5 to 30 mV in water) is impressed across the interface boundary between a metal electrode surface and a conductive liquid, the resulting current flow will be directly proportional to the corrosion occurring on the metal electrode surface, if the current measurement includes both anodic and cathodic polarization characteristics.

1.3.1 There are two types of PR measurements. One employs two identical electrodes and one employs three electrodes. In the vast majority of measurements in water-based systems, both the two-electrode and the three-electrode techniques will provide data with equal accuracy. Correction of data for either test method is only necessary when the product of corrosion rate reading and solution resistivity exceed certain maximum limits. These limits are almost

never reached when corrosion rate measurements are being made in water.

1.4 Correlation of corrosion rates obtained by these test methods with the performance of an actual system is necessary if the service life of metals in a given water is to be predicted.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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:

- D 1125 Test Methods for Electrical Conductivity and Resistivity of Water²
- D 1129 Definitions of Terms Relating to Water²
- D 2688 Test Methods for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods)²
- G 59 Practice for Conducting Potentiodynamic Polarization Resistance Measurements³

3. Definitions

3.1 For definitions of terms used in these test methods, refer to Definitions D 1129.

4. Significance and Use

4.1 Since the two tendencies are inseparable for a metal to corrode and for water and the materials it contains to promote or (inhibit) corrosion, the corrosiveness of a material or the corrosivity of water must be determined in relative, rather than absolute, terms. The tendency for a material to corrode is normally determined by measuring its rate of corrosion and comparing it with the corrosion rates of other materials in the same water environment. Conversely, the relative corrosivity of water may be determined by comparing the corrosion rate of a material in the water with the corrosion rates of the same material in other waters. Such tests are useful, for example, for evaluating the effects of corrosion inhibitors on the corrosivity of water. Although these methods are intended to determine the corrosivity of

¹ These test methods are under the jurisdiction of ASTM Committee G-1 on Corrosion of Metals and are the direct responsibility of Subcommittee G01.12 on In-Plant Corrosion Tests.

Current edition approved Nov. 30, 1979. Published March 1980. Originally published as D 2776 – 69 T. Last previous edition D 2776 – 76.

² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 03.02.