



Standard Test Method for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample¹

This standard is issued under the fixed designation D5391; 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 determination of electrical conductivity and resistivity of high purity water samples below 10 $\mu\text{S}/\text{cm}$ (above 0.1 Mohm-cm). It is applicable to both continuous and periodic measurements but in all cases, the water must be flowing in order to provide representative sampling. Static *grab* sampling cannot be used for such high purity water. Continuous measurements are made directly in pure water process lines, or in side stream sample lines to enable measurements on high temperature or high pressure samples, or both.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D1066 Practice for Sampling Steam

D1125 Test Methods for Electrical Conductivity and Resistivity of Water

D1129 Terminology Relating to Water

D1192 Guide for Equipment for Sampling Water and Steam in Closed Conduits (Withdrawn 2003)³

D1193 Specification for Reagent Water

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.03 on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

Current edition approved Feb. 1, 2014. Published February 2014. Originally approved in 1993. Last previous edition approved in 2009 as D5391 – 99 (2009). DOI: 10.1520/D5391-14.

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 The last approved version of this historical standard is referenced on www.astm.org.

D2186 Test Methods for Deposit-Forming Impurities in Steam

D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water

D3370 Practices for Sampling Water from Closed Conduits

D3864 Guide for On-Line Monitoring Systems for Water Analysis

D4519 Test Method for On-Line Determination of Anions and Carbon Dioxide in High Purity Water by Cation Exchange and Degassed Cation Conductivity

3. Terminology

3.1 *Definitions*—For definitions of other terms used in these test methods, refer to Terminology D1129.

3.1.1 *electrical conductivity*—refer to Test Methods D1125.

3.1.2 *electrical resistivity*—refer to Test Methods D1125.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cell constant, n* —the ratio of the length of the path, L (cm), and the cross-sectional area of the solution, A (cm^2), between the electrodes of a conductivity/resistivity cell, with units of cm^{-1} .

3.2.1.1 *Discussion*—In high purity water measurements, the cell constant is normally between 0.001 and 0.1 cm^{-1} to prevent electrical interference. This is lower than the 1 cm^{-1} of the standard centimetre cube and is taken into account by direct reading instrument ranges that are matched with specific cell constants.

4. Summary of Test Method

4.1 Conductivity or resistivity is measured with a cell and temperature sensor or compensator in a flowing, closed system to prevent trace contamination from wetted surfaces and from the atmosphere. Specialized temperature compensation corrects the measurement to 25°C, taking into account the temperature effects on the ionization of water, the contaminants, and interactions between the two. In the absence of specialized temperature compensation, the sample temperature is controlled to 25 $\pm$ 0.2°C.

4.2 To determine the cell constant of a high purity conductivity cell with an instrument capable of accurate measurement over the range of pure water to 150 $\mu\text{S}/\text{cm}$ with a single cell