



Designation: D5544 – 16 (Reapproved 2023)

Standard Test Method for On-Line Measurement of Residue After Evaporation of High-Purity Water¹

This standard is issued under the fixed designation D5544; 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 dissolved organic and inorganic matter and colloidal material found in high-purity water used in the semiconductor, and related industries. This material is referred to as residue after evaporation (RAE). The range of the test method is from 0.001 $\mu\text{g/L}$ (ppb) to 60 $\mu\text{g/L}$ (ppb).

1.2 This test method uses a continuous, real time monitoring technique to measure the concentration of RAE. A pressurized sample of high-purity water is supplied to the test method's apparatus continuously through ultra-clean fittings and tubing. Contaminants from the atmosphere are therefore prevented from entering the sample. General information on the test method and a literature review on the continuous measurement of RAE has been published.²

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that 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.* For specific hazards statements, see Section 8.

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.*

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 Nov. 1, 2023. Published December 2023. Originally approved in 1994. Last previous edition approved in 2016 as D5544 – 16. DOI: 10.1520/D5544-16R23.

² Blackford, D. B., "Use of Nonvolatile Residue Monitoring in Semiconductor Water Applications" *Ultrapure Water Journal*, Tall Oaks Publishing, November 2008, pp. 16–23.

2. Referenced Documents

2.1 ASTM Standards:³

- D1129 Terminology Relating to Water
- D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water
- D3370 Practices for Sampling Water from Flowing Process Streams
- D3864 Guide for On-Line Monitoring Systems for Water Analysis
- D3919 Practice for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry
- D5127 Guide for Ultra-Pure Water Used in the Electronics and Semiconductor Industries
- E1184 Practice for Determination of Elements by Graphite Furnace Atomic Absorption Spectrometry

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D1129.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *aerosol, n*—any solid or liquid particles, with a nominal size range from 10 nm to 100 μm , suspended in a gas (usually air).

3.2.2 *colloidal suspension, n*—any material in suspension (for example, silica) with a nominal particle size less than 100 nm.

3.2.3 *water-based condensation particle counter (WCPC), n*—instrument for detecting very small aerosol particles in a size range from approximately 7 nm to 2 μm to 3 μm .

3.2.3.1 *Discussion*—The WCPC cannot differentiate among particles of varying size within this size range; the counter reports the number of particles with a size greater than that defined by the detection-efficiency curve. Detection is independent of particle composition.

3.2.4 *detection efficiency, n—in this test method*, detection efficiency represents a curve relating particle size to a counter's ability to detect that size.

³ 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.