



Standard Specification for Reagent Water¹

This standard is issued under the fixed designation D 1193; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers requirements for water suitable for use in methods of chemical analysis and physical testing. Four grades are specified:

	Type I	Type II	Type III	Type IV
Electrical conductivity, max, $\mu\text{S}/\text{cm}$ at 298 K (25°C)	0.056	1.0	0.25	5.0
Electrical resistivity, min, $\text{M}\Omega\text{-cm}$ at 298 K (25°C)	18	1.0	4.0	0.2
pH at 298 K (25°C)	A	A	A	5.0 to 8.0
Total organic carbon (TOC), max, $\mu\text{g}/\text{L}$	100	50	200	no limit
Sodium, max, $\mu\text{g}/\text{L}$	1	5	10	50
Chlorides, max, $\mu\text{g}/\text{L}$	1	5	10	50
Total silica, max, $\mu\text{g}/\text{L}$	3	3	500	no limit
Microbiological contamination—When bacterial levels need to be controlled, reagent grade types should be further classified as follows:				
		Type A	Type B	Type C
Maximum heterotrophic bacteria count		10/1000 mL	10/100 mL	100/10 mL
Endotoxin, EU/ml ^B		<0.03	0.25	not applicable

^A The measurement of pH in Type I, II, and III reagent waters has been eliminated from this specification because these grades of water do not contain constituents in sufficient quantity to significantly alter the pH.

^B EU = Endotoxin Units.

1.2 The method of preparation of the various grades of reagent water determines the limits of impurities and shall be as follows:

1.2.1 Type I grade of reagent water shall be prepared by distillation or other equal process, followed by polishing with a mixed bed of ion exchange materials and a 0.2- μm membrane filter. Feedwater to the final polishing step must have a maximum conductivity of 20 $\mu\text{S}/\text{cm}$ at 298K (25°C).

1.2.2 Type II grade of reagent water shall be prepared by distillation using a still designed to produce a distillate having a conductivity of less than 1.0 $\mu\text{S}/\text{cm}$ at 298 K (25°C). Ion exchange, distillation, or reverse osmosis and organic adsorption may be required prior to distillation if the purity cannot be attained by single distillation.

NOTE 1—Because distillation is a process commonly relied upon to produce high purity water, the levels specified for Type II reagent water

were selected to represent the minimum quality of water that a distillation process should produce.

1.2.3 Type III grade of reagent water shall be prepared by distillation, ion exchange, continuous electrodeionization reverse osmosis, or a combination thereof, followed by polishing with a 0.45- μm membrane filter.

1.2.4 Type IV grade of reagent water may be prepared by distillation, ion exchange, continuous electrodeionization reverse osmosis, electrodialysis, or a combination thereof.

1.3 The choice of one of the various grades may be designated by the method or by the investigator.

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 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 Terminology Relating to Water²
- D 1293 Test Methods for pH of Water²
- D 4453 Practice for Handling of Ultra-Pure Water Samples²
- D 4517 Test Method for Low-Level Total Silica in High-Purity Water by Flameless Atomic Absorption Spectroscopy^{3, 4}
- D 4779 Test Method for Total, Organic, and Inorganic Carbon in High Purity Water by Ultraviolet (UV) or Persulfate Oxidation, or Both, and Infrared Detection⁴
- D 5391 Test Method for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample²
- D 5542 Test Method for Trace Anions in High Purity Water by Ion Chromatography²
- D 5997 Test Method for On-Line Monitoring of Total Carbon, Inorganic Carbon in Water by Ultraviolet, Persulfate Oxidation and Membrane Conductivity Detection²
- D 6071 Test Method for Low Level Sodium in High Purity

¹ This specification is under the jurisdiction of ASTM Committee D-19 on Water and is the responsibility of Subcommittee D19.02 on General Specifications, Technical Resources, and Statistical Methods.

Current edition approved Feb. 10, 1999. Published March 1999. Originally issued as D 1193 – 51 T. Last previous edition D 1193 – 91.

² *Annual Book of ASTM Standards*, Vol 11.01.

³ Determination of Trace Silica in Industrial Process Waters by Flameless Atomic Absorption Spectrometry, Judith Rawa and Earl Henn, Analytical Chemistry, Vol 51, No 3, March 1979.

⁴ *Annual Book of ASTM Standards*, Vol 11.02.