



Pure Water: The Basics

Laboratory Ultrapure Water

Ultrapure water is essential to every laboratory and Barnstead manufactures a complete line of laboratory water purification systems including carbon adsorption, distillation, reverse osmosis, deionization, microfiltration, ultrafiltration, ultraviolet oxidation and the combination of ultrafiltration/ultraviolet oxidation. These systems were designed first and foremost to provide ultrapure water that can be used with confidence for your most critical needs.

Laboratory Applications for Ultrapure Water

In addition to general preparation of reagents and washing of plasticware and glassware, ultrapure water is essential in specific biotechnology applications for the preparation of media and electrophoresis gels. Tissue and cell culture, and DNA research also require ultrapure water that is both biologically pure and free of trace metals and dissolved organics. Ultra-sensitive analytical instruments including HPLC, GFAA, ICP/MS, IC, AAS and GC/MS are capable of detecting elements and compounds in nanograms per liter (ng/L) or parts per trillion (ppt). These instruments require water that is absolutely pure.

STANDARD CAP*/NCCLS*

	Type I	Type II	Type III
Specific Conductance ⁴ (Microhm, Max.)	<0.1	<0.2	<0.5
Specific Resistance ⁴ (Megohm, Min.)	>10.0	>2.0	>1.0
Total Matter (mg/liter, Max.)	—	—	—
Silicate (mg/liter, Max.)	<0.5	<0.1	<1.0
Potassium Permanganate Reduction (Minutes, Min.)	—	—	—
Culture/Colony Count (Colony Forming Units/ml)	<10.0	10	NA
pH	NA	NA	NA

* CAP - The College of American Pathologist
* NCCLS - The National Committee for Clinical Laboratory Standards

ASTM¹

	Type I	Type II	Type III	Type IV
Electrical Conductivity, Max. ⁴ µS/CM AT 298 K (25°C)	0.056	1.0	0.25	5.0
Electrical Resistivity, Min. ⁴ MΩ • CM AT 298 K (25°C)	18.0	1.0	4.0	0.2
pH AT 298 K (25°C)	*	*	*	5.8-8.0
Total Organic Carbon (TOC), MAX., µG/L	100	50	200	no limit
Sodium, Max., µG/L	1	5	10	50
Chlorides, Max., µG/L	1	5	10	50
Total Silica, Max., µG/L	3	3	500	no limit
	Type I ²	Type II ²	Type III ²	
Maximum Heterotrophic Bacterial Count	10/1000 ml	10/100ml	10	
Endotoxin, EU ³	<0.03	0.25	NA	

* The measurement of pH in Type I, II and III reagent water has been eliminated from this specification because these grades of water do not contain constituents in sufficient quantity to significantly alter the pH.
¹ ASTM The American Society for Testing and Material, Volume 11.01, Section DH93-91 Dated 1992.
² Microbiological contamination: when bacterial levels need to be controlled, reagent grade types should be further classified.
³ Endotoxin Units.
⁴ Based on in-line measurement.