Water Quality Standards

Technical reference sheet

PURETEC Industrial Water

Technical standards on water quality have been established by a number of organizations including the American Society for Testing and Materials (ASTM), International Organization for Standardization (ISO), the Clinical Laboratory Standards Institute (CLSI), and United States Pharmacopoeia (USP). CLSI outlines Clinical Laboratory Reagent Water (CLRW) guidelines.

Standards at a Glance

Standard	Used for	Highest grade	Top grade limit
ASTM D1193	Laboratory reagent water	Type I	> 18 MΩ·cm resistivity
ISO 3696	Analytical laboratory water	Grade 1	< 0.1 µS/cm conductivity
ASTM D5127	Semiconductor/electronics UPW	Type E-1.3	18.2 MΩ·cm, TOC ≤ 1 µg/L
CLSI CLRW	Clinical laboratory water	CLRW	> 10 MΩ·cm resistivity
USP	Pharmaceutical water	Water for Injection	≤ 1.3 µS/cm, < 0.25 EU/mL

ASTM D1193-99: Laboratory Reagent Water

Measurement (unit)	Type I	Type II	Type III	Type IV
Resistivity (MΩ·cm, min)	> 18	> 1	> 4	> 0.2
Conductivity (µS/cm)	< 0.056	< 1	< 0.25	< 5.0
pH at 25°C	n/a	n/a	n/a	5.0–8.0
TOC (µg/L)	< 50	< 50	< 200	n/a
Sodium (µg/L)	< 1	< 5	< 10	< 50
Chloride (µg/L)	< 1	< 5	< 10	< 50
Silica (µg/L)	< 3	< 3	< 500	n/a

ASTM D1193 Sub-Types for Bacteria and Endotoxin

Measurement	A	B	C
Heterotrophic bacteria (CFU/mL)	< 1	< 10	< 1000
Endotoxin (EU/mL)	< 0.03	< 0.25	n/a

ISO 3696: Analytical Laboratory Water

Parameter (unit)	Grade 1	Grade 2	Grade 3
Conductivity at 25°C (µS/cm)	< 0.1	< 1.0	< 5.0
pH at 25°C	n/a	n/a	5.0–7.5
Oxidizable matter as O_2 (mg/L)	n/a	< 0.08	< 0.4
Absorbance at 254 nm, 1 cm path	< 0.001	< 0.01	n/a
Residue after evaporation at 110°C (mg/kg)	n/a	< 1	< 2
Silica as SiO_2 (mg/L)	< 0.01	< 0.02	n/a

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ASTM D5127-13: Electronics-Grade and Ultrapure Water (UPW)

ASTM D5127 defines seven types of electronics-grade water based on device line width, with limits applying at the point of distribution. All values are maximums except resistivity, which is a minimum.

Parameter	E-1	E-1.1	E-1.2	E-1.3	E-2	E-3	E-4
Line width (µm)	1.0–0.5	0.35–0.25	0.18–0.09	0.065–0.032	5.0–1.0	> 5.0	n/a
Resistivity at 25°C (MΩ·cm)	18.1	18.2	18.2	18.2	16.5	12	0.5
TOC (µg/L)	5	2	1	1	50	300	1000
Dissolved oxygen (µg/L)	25	10	3	10	n/a	n/a	n/a
Sodium (µg/L)	0.05	0.02	0.005	0.001	1	5	1000
Potassium (µg/L)	0.05	0.02	0.005	0.001	2	5	500

Only selected parameters shown.

CLSI Clinical Laboratory Reagent Water (CLRW)

Parameter (unit)	CLRW
Resistivity (MΩ·cm, min)	> 10
TOC (µg/L)	< 500
Bacteria (CFU/mL)	< 10
Particulates	0.22 µm filtration required

USP Pharmaceutical Water

Parameter (unit)	Purified Water	Water for Injection
Conductivity at 25°C (µS/cm)	≤ 1.3	≤ 1.3
TOC (µg/L)	≤ 500	≤ 500
Bacteria action limit	100 CFU/mL	10 CFU/100 mL
Endotoxin (EU/mL)	n/a	< 0.25