

## Water Purification

Tech Tip #29 ©2000

### Methods of Purification

**Deionization:** The removal of ions and minerals by synthetic ion exchange resins. Cation resins remove positively charged ions; anion resins remove negatively charged ions.

**Adsorption:** Activated carbon bonds with the chlorine and organic materials in feedwater to immobilize and remove these impurities.

**Filtration:** Use as a pretreatment or a stand-alone treatment. Water passes through a filter of specified porosity at normal line pressures. The filter retains most particulates, with water passing through.

**Ultrafiltration:** Use for removing pyrogens and bacteria. Under pressure, water is forced through a membrane with a pore size smaller than 0.005 µm. Particulates are retained, with only pure water passing through.

**Reverse osmosis:** Use primarily as a pretreatment. Equal amounts of pure water and saline solution are separated in a U-tube by a semipermeable membrane. When external pressure is applied to the saline side, the semipermeable membrane allows water to pass through while salts are concentrated and flushed down a drain.

**Distillation:** The process in which water is heated to a gaseous state and recondensed in a separate vessel.

**Ultraviolet (UV) oxidation:** UV light (at <280 nm) passes through the water destroying bacteria, viruses, and trace organics.

### Methods of Purification

E = Excellent    G = Good    P = Poor

	Dissolved ionized solids	Dissolved organics	Dissolved ionized gases	Particulates	Bacteria	Pyrogens
Deionization	E	P	E	P	P	P
Adsorption	P	E	P	P	P	P
Filtration	P	P	P	E	E	P
Ultrafiltration	P	G	P	E	E	E
Reverse Osmosis	G	G	P	E	E	E
Distillation	E/G	G	P	E	E	E
UV oxidation	P	G	P	P	G	P

## ASTM Water Grade Standards

	Resistivity (M $\Omega$ -cm, min)	Conductivity ( $\mu$ S/cm, max)	Organic carbon ( $\mu$ g/L, max)	Silica ( $\mu$ g/L, max)	Chlorides ( $\mu$ g/L, max)	Sodium ( $\mu$ g/L, max)
<b>Type I</b>	18.0	0.056	100	3	1	1
<b>Type II</b>	1.0	1.0	50	3	5	5
<b>Type III</b>	4.0	0.25	200	500	10	10
<b>Type IV</b>	0.2	5.0	No limit	No limit	50	50