D.M. Plants

There are two basic kinds of demineralizer systems, separate-bed and mixed-bed. In a separate-bed system, cation resins and anion resins and anion resins are loaded into separate pressure vessels. During the service cycle, water passes through the cation bed first, where undesirable positive ions (cations) such as sodium (Na+), calcium (Ca+2), and magnesium (Mg+2) are exchanged for hydrogen (H+) ions. The water next passes through the anion bed, where a similar process removes undesirable negative ions (anions) such as chloride (Cl-), sulfate (SO4-2), and bicarbonate (HCO3-), replacing them with hydroxyl (OH-). Pure water is produced from the combination of hydrogen and hydroxyl ions. In a mixed-bed system, also referred to as a polisher, the cation and anion resins are loaded into the same vessel.

Where they are in contact with each other. This allows the hydrogen and hydroxyl ions to combine instantaneously to produce water of the highest possible purity. In any demineralizer, the capacity of the resins to exchange ions is finite. As the capacity becomes stressed, ion leakage occurs in the effluent. This is called the breakthrough point. When the breakthrough point is detected, the bed is switched from a service cycle to a regeneration cycle. During the regeneration cycle, the beds are backwashed to flush out particulate matter, then chemically regenerated with acid and caustic. Finally, the beds are rinsed thoroughly to yield a service cycle ready condition.

The breakthrough point of a demineralization bed is impacted by its ion exchange capacity, which is affected by water flow rate, ion contaminant concentration, and feed water composition. Regeneration of a bed is costly, due to the need for chemicals and rinse water, pretreatment, regeneration waste treatment, and labor. Thus the goal is to maintain the service

cycle of the bed as long as possible, while ensuring that the system continues to deliver water of the required purity.

Conductivity sensors are successfully employed on demineralizers to monitor the operation of the bed and to predict and signal the all-important breakthrough Point. In a cation bed, salt impurities are converted to an acid form, typically hydrochloric acid (HCl). When this happens, the conductivity of the water increases dramatically, because the hydrogen ion is far more conductive than the mineral ion it has replace.