

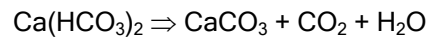
## Water Softening Through Ion Exchange

### The Process

Water Softening through ion exchange utilising a strong base cation resin in the sodium form. This process is also commonly known as Base Exchange (BX).

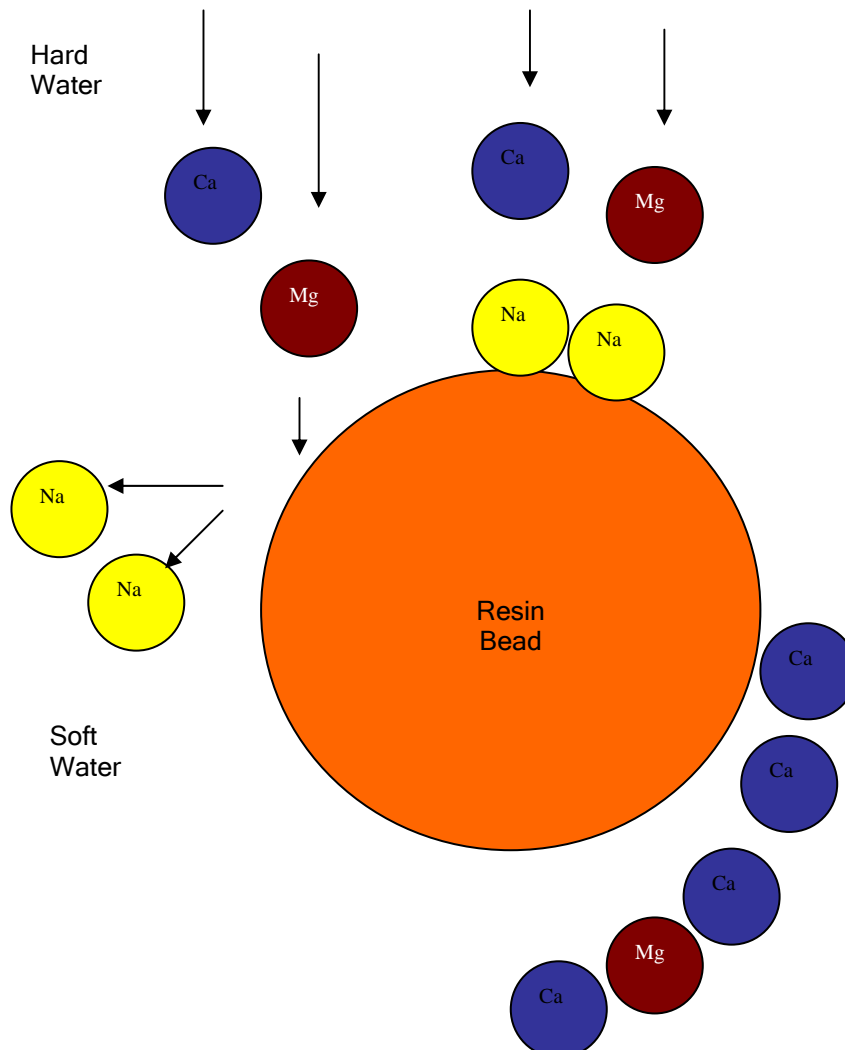
Hardness in water is associated with the presence of Calcium and Magnesium salts. The most common of these is Calcium Carbonate ( $\text{CaCO}_3$ ), which is formed as water passes through natural limestone during the water cycle. When  $\text{CaCO}_3$  precipitates out of solution it forms a hard scale commonly referred to as lime scale.

Calcium Carbonate actually exists in ambient water as Calcium Bicarbonate ( $\text{Ca}(\text{HCO}_3)_2$ ). The bicarbonate salt is unstable and at increased temperature will revert to its carbonate form.

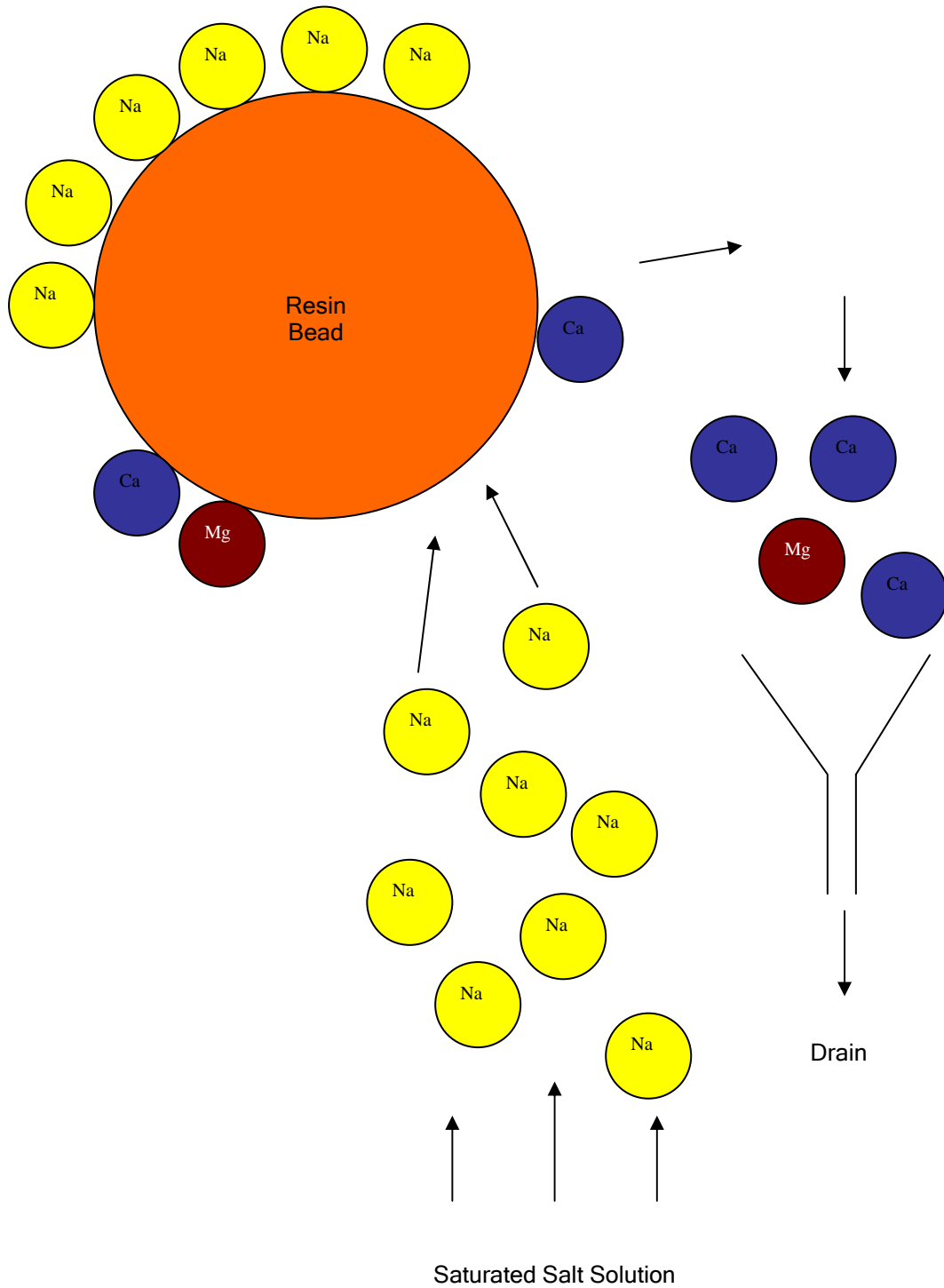


The carbonate salt is not as soluble as its bicarbonate equivalent and will, therefore, precipitate out of solution and form a scale. For this reason bicarbonate hardness is also referred to as "Temporary Hardness".

In a water softener the Calcium and Magnesium ions are exchanged for sodium, the resulting Sodium Bicarbonate salt is stable and will not precipitate out of solution as the temperature increases. The water is now deemed "soft".



The resin has only a finite capacity to exchange sodium for calcium and magnesium. When this point is reached the resin is deemed exhausted and must be "regenerated". This is achieved by rinsing the resin with a strong solution of sodium to reverse the exchange reaction and revert the resin back to its original sodium form. A saturated solution of salt (NaCl) is used for this regeneration.



Once regenerated the resin is now available again for softening. All water softeners comprise a resin tank, upon which is mounted a control valve and a brine tank with salt dissolving system. Regeneration and service cycles are controlled automatically by the softener valve. The regeneration is initiated by one of the following methods: -

- i. Electronic Timer
- ii. Volumetric Control
- iii. External Control

Methods i and ii are the ones most commonly deployed on Balba Technologies water softeners although all are capable of regenerating via external control such as a hardness monitor.

Hardness Conversion

	°Fr	°dH	°Clark	gpg	ppm - mg/l
1 °Fr	1.00	0.56	0.70	0.583	10.0
1 °dH	1.79	1.00	0.24	1.040	17.9
1 °Clark	1.43	0.80	1.00	0.833	14.3
1 gpg	1.71	0.958	1.20	1.000	17.1
1 ppm - mg/l	0.10	0.056	0.07	0.058	1.0

Table 1 - Hardness Conversion Factors