RESINTECH INC
INNOVATIONS IN ION EXCHANGE

TECHNICAL DATA SHEET

SPLIT STREAM SOFTENING AND DEALKALIZATION

The cation split stream softening and dealkalization system consists of a brine regenerated sodium cycle softeners and a hydrogen cycle cation exchangers followed by a degasifier. The same strong cation resin is used in both sodium and hydrogen units. Water passes through the sodium softener and hydrogen cation units in parallel. When the two effluents are blended together in the optimum ratio, the bicarbonates and carbonates (commonly known as alkalinity) are converted to carbon dioxide, which is removed by the degasifier. The resultant treated water contains little or no hardness, greatly reduced alkalinity, and somewhat lower total dissolved solids content.

The sodium cycle softener removes divalent cations such as calcium and magnesium (commonly known as hardness) by exchanging them for sodium. The hydrogen cycle cation unit removes all cations (including sodium) by exchanging them for hydrogen. The exchange for hydrogen increases the acidity of the water and lowers the pH. The pH of the final treated water is still slightly acidic (pH less than 7.0), so it is common practice to add sodium hydroxide to the treated water in order to neutralize the acidity and raise the pH.

The approximate percentages of softened and decationized water required for a blend can be predicted from these factors:

1. The alkalinity of the influent (Ai) A
2. The free mineral acidity (FMA) of the hydrogen cation effluent, which depends on the sulfate, nitrate, and chloride concentrations in the influent
3. The desired alkalinity in the mixed effluent (Am) A

With the above information, the proper proportion can be calculated: $\text{Percent hydrogen zeolite} = \frac{A_i - A_m}{A_i + \text{FMA}} \times 100$

For example, given a water with:

	ppm as $CaCO_3$
Calcium	24
Magnesium	12
Alkalinity	34
Sulfate	6.3
Nitrate	2
Chloride	6
Carbon Dioxide	15e

Assume an alkalinity of 15 ppm as calcium carbonate is required in the blended effluent, given Ai of 34 ppm as $CaCO_3$, and the desired Am of 15 ppm as $CaCO_3$.

The FMA is the only additional value needed to apply the formula and calculate the percentage of water treated by the hydrogen zeolite unit. The FMA value is equal to the sum of the acids of the sulfates, nitrates, and chlorides present in the water.

Substituting in the formula: $\text{Percent hydrogen zeolite} = \frac{34 - 15}{34 + 14.3} \times 100 = 39$

Note: When a water contains high levels of sodium, there is considerable sodium capacity for hardness removal remaining in the hydrogen cycle unit upon exhaustion. In these situations it is possible that both units can be regenerated to the hydrogen form alternately. While one is running in the hydrogen cycle the other unit would be running in the sodium breakthrough portion of what was previously the hydrogen cycle.

In other words, while one unit is operated as a softener, the other unit is dealkalizing and the only regeneration necessary would be using acid. In this case, both units must be of suitable construction to withstand acid regeneration.

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