Calculations for Elution Study

Area of Vessels Cross Section:

$$A = \pi r^2$$

Where: A = area of the vessel in square feet
π = 3.1415
r = radius of vessel in feet

Example: $A = 3.1415 \times 2^2 = 12.6\ ft^2$

Volume of Resin:

$$V = A \times D$$

Where: V = volume of resin in cubic feet
A = area of vessel in square feet
D = depth of resin bed in feet

Example: $V = 12.6 \times 3 = 37.8\ ft^3$

Maximum Flow Rate of Backwash:

$$\text{Max } BW_{flow} = 6.0 \times A$$

Where: $\text{Max } BW_{flow}$ = max flow of backwash in GPM
A = area of vessel in square feet

Example: $\text{Max } BW_{flow} = 6.0 \times 12.6 = 75$ GPM

Total Flow of Brine and Dilution Water During Brine Draw:

$$\text{Total } BD_{flow} = 1.9 \times A_{softener}$$

Where: $\text{Total } BD_{flow}$ = total flow of brine and dilution water in GPM
A = area of vessel in square feet

Example $\text{Total } BD_{flow} = 1.9 \times 12.6 = 24$ GPM

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Flow of Brine During Brine Draw:

$$\mathbf{BD_{flow} = 0.385 \text{ X Total } BD_{flow}}$$

Where: BD_{flow} = flow of brine in GPM
Total BD_{flow} = total flow of brine and dilution water in GPM

Note: The eductor drive water ideally dilutes the brine in a 1.6 to 1.0 ratio (1/2.6 = 0.385)

Example BD_{flow} = 0.385 X 24.0 = 9.2 GPM

Amount of Brine Needed:

$$\mathbf{Brine = Total\ Salt / 2.6}$$

Where Brine = amount of 100% saturated brine in gallons
Total Salt = total salt needed
2.6 = lbs of salt in one gallon of 100% saturated brine at 70 ^{o}F

Note: Total salt is determined by Dosdage X Volume of Resin. Dosages range from 6 to 15 lbs per cubic foot of resin. For this example, use 10 lb dosage per cubic foot of resin.

Example Brine = (37.8 X 10) / 2.6 = 145.4 gallons

Time For Brining:

$$\mathbf{Time = Brine / BD_{flow}}$$

Where Time = time for brining in minutes
Brine = amount of 100% saturated brine in gallons
BD_{flow} = flow of brine in GPM

Example Time = 145.4 / 9.2 = 15.8 minutes

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Flow of Dilution Water in Slow Rinse:

$$\mathbf{DW_{flow} = Total\ BD_{flow} - BD_{flow}}$$

Where DW_{flow} = flow of dilution water in GPM
Total BD_{flow} = total flow of brine and dilution water in GPM
BD_{flow} = flow of brine in GPM

Example $DW_{flow} = 24.0 \text{ X } 9.2 = 14.8$ GPM

Run Length of Softener:

$$\mathbf{Run\ Length = (SCap\ X\ V) / Hardness}$$

Where Run Length = run length of softener in gallons
SCap = softening capacity of resin for the salt dosage used in brine draw in kilograins per cubic foot resin
V = volume of resin in cubic feet
Hardness = hardness of raw water in grains per gallon

Note: 17.1 ppm = 1 grain per gallon

Example Run Length = (30,000 X 37.8) / 10.0 = 113,400 gallons